APPROPRIATENESS OF MNEMONIC TECHNIQUES ON LEARNING OUTCOMES IN PUBLIC PRIMARY SCHOOLS IN MACHAKOS SUB-COUNTY, KENYA

PATRICIA MWIKALI MAKAU
E83-6652-2015

A Research Thesis Submitted to the School Education in Partial Fulfillment of the Requirements for the Award of the Degree of Doctor of Philosophy in Educational Psychology of Machakos University

2020

DECLARATION

I confirm that this research thesis is my original work and has not been presented in any other university/institution for consideration for award of any certificate. This thesis has been complemented by referenced works duly acknowledged. Where text, data, graphics, pictures or tables have been borrowed from other works, including the internet, books, journals and other sources have been accredited through referencing in accordance with anti-plagiarism regulations.

Sign…… Date……

PATRICIA MWIKALI MAKAU

E83-6652-2015

This thesis has been submitted for examination with our approval as University Supervisors.

Sign…… Date……

PROF. JAMES MUOLA

Department of Educational Psychology and Special Need Education

Machakos University.

Sign…… Date……

DR. WYCLIFFE AMUKOWA

Department of Educational Management and Curriculum Studies

Machakos University.

DEDICATION

I dedicate this thesis to my loving husband Jonathan who has been of great encouragement to me and source of inspiration throughout my studies. I cannot forget my dear children; Faith, Mercy and Victor for their patience.

ACKNOWLEGMENTS

This thesis was accomplished through the cooperation I received from several individuals and institutions. Unfortunately, I cannot reach out to everyone and pass my gratitude for the time and support that they extended to me. First, my special gratitude goes to my supervisors Prof. James Muola and Dr. Wycliffe Amukowa who guided me through the writing of this thesis. It was through their guidance, positive criticisms and encouragement that made the completion of this thesis possible. Special thanks also go to Dr. Ogogo and Dr. Koech of Machakos University who accepted to guide me after school and departmental defenses respectively. Special thanks also go to Dr. Mutweleli who assisted in data analysis and his guidance towards writing of this thesis.

I want also to thank the office of NACOSTI for granting me a research permit without which I wound not have conducted this study. Special thanks also go to the administration in Machakos Sub-County Educational office for providing me with necessary records and allowing me to carry out research within the area of their jurisdiction. Many thanks also go to pupils, subject teachers and Headteachers of the schools which were sampled for the study, who directly or indirectly participated in this study. I also cannot forget to thank Mr. Simon Muteti and Miss Ann Kimasyu my research assistants who tirelessly spent a lot of time in the schools administering and monitoring treatment process of the study subjects. I wish also to pass my special thanks to my husband Jonathan and our children Faith, Mercy and Victor for their patience and understanding during the trying period of writing this thesis. God bless you all.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA: Analysis of Variance

ASAL: Arid and Semi-Arid Lands

ERS: Economic Recovery Strategy

FRL: Free Recall Learning

FPE: Free Primary Education

KCPE: Kenya Certificate of Primary Education

KCSE: Kenya Certificate of Secondary Education

KICD: Kenya Institute of Curriculum Development

KLB: Kenya Literature Bureau

LSD: Least Square Difference

LTM: Long Term Memory

MDG: Millennium Development Goals

MOVA: Meaningfulness Organization Visualization and Attention

NACOSTI: National Council for Technology and Innovation

STM: Short-Term Memory

TV: Television

TOA: Type of Assessment

UPE: Universal Primary Education

ABSTRACT

Mnemonic techniques are memory strategies that help learners recall large pieces of information. They link new information to prior knowledge through the use of visual and acoustic cues. They have been proven effective with students at a wide range of abilities and grade levels. The purpose of this study was to investigate the appropriateness of Mnemonic techniques on learning outcomes in primary schools in Machakos sub-county, Kenya. To achieve this, the study sought to find out which Mnemonic techniques were appropriate for Free Recall and serial learning tasks by comparing pegword, keyword and music Mnemonic techniques and control group. Thorndike Connectionism theory and Tulving Theory of Long-Term Memory were used to ground the study. Factorial-experimental research design was used to test the appropriateness of three Mnemonic techniques on learning outcomes. Schools were first stratified into three educational zones of Machakos; Muvuti, Mutituni and Mumbuni zones. Purposeful sampling technique was used to select four schools with similar mean grades in KCPE exams from the three zones. Simple random sampling was used to assign streams experimental and control groups. A sample of 317 pupils were selected from class 7 pupils to participate in the study. The instruments of study were tests, (to measure learning outcomes); observation schedules (to monitor the treatment process) and questionnaires; (to measure level of satisfaction among learners during treatment process). Research instruments were piloted to establish their validity and reliability. The reliability of the research instruments was determined through the test-retest method. The reliability index for the instruments was; RAT Tests 0.92, CAT Tests 0.93, questionnaires 0.87 and observation schedules 0.89. The results were analyzed descriptively and inferentially. Two-way and one-way ANOVA were used to analyze the data. Post-hoc Pairwise comparison was also performed. The findings of the study showed that there are no significant differences ($F(3,318) = 2.26$, $P > 0.05$) in Free Recall learning outcomes between learners who were taught using the three Mnemonic techniques. Hence, none of the three Mnemonic techniques was found to be more appropriate for Free Recall learning tasks. Data on serial learning tasks revealed significant differences ($F(3,317) = 4.70$, $P < 0.05$) between learners using different Mnemonic techniques and serial learning outcomes. Post-hoc analysis showed that Music was the most appropriate Mnemonic technique for serial learning tasks, Pegword, keyword and control group were second, third and fourth respectively. No significant differences ($F(3,147) = 0.052$, $P < 0.05$) were found in mathematics learning outcomes between learners using the three Mnemonic techniques. Hence, none of the three Mnemonic techniques was found to be more appropriate for mathematics. In Social Studies, significant differences ($F(3,146) = 4.25$, $P < 0.05$) were found between learners using the three Mnemonic techniques. Post-hoc analysis showed Music Mnemonic was most appropriate for Social Studies, pegword, keyword and control group were second, third and fourth respectively. The conclusion of the study was that mnemonic techniques enhance learning outcomes at varying degrees; music was the most appropriate among the mnemonics used in this study. The study recommended that, KICD should in-cooperate Mnemonic techniques in teacher training colleges.

CHAPTER ONE
INTRODUCTION

This chapter presented the background to the study, statement of the problem, purpose and the objectives, hypotheses, significance of the study, delimitation and limitation the and as well as research assumptions.

1.1 Background of the Study

The origin of Mnemonic techniques is usually traced to the early Greeks from about 500 B.C. Imagery Mnemonics played a central role from the very beginning. Writing of Orator, described the procedure as follows: Persons desiring to train this faculty of memory must select places and form mental images of the things they wish to remember and store these images in those places, so that the order of the places will preserve the order of the things (Yates, 1966).

The term "mnemonic" is derived from the Greek word *mnēmonikós,* which refers to "relating to the memory" (Liddell & Scott, 1889). Researchers working within the framework of stimulus-response theory in the late 1950s and early 1960s had often noted that subjects tried to encode the materials presented in a paired-association learning task so that a verbal mediator connected the two components in each pair (Rock, 1957; Clark, Lundsford, & Dallenbach, 1960; Underwood & Schulz, 1960). The prevailing theoretical attitudes at that time indicated that these Mnemonic techniques and the presence of these cognitive encodings should not be major determinants of recall performance compared with such factors as the type of material learned, study time, number of trials, amount and kind of prior learning, and so on. Experimentation in the Ebbinghaus (1885, 1909, 2011), took pains to ensure that cognitive Mnemonic activities on the part of the learner were minimized. To ensure that rote learning

occurred, nonsense syllables were often used as the materials to be learned, and these materials were often presented at a fast rate. However, it soon became apparent that the Mnemonic strategies used by the subjects were important to learning. Processes such as categorization (Bousfield, 1953); rehearsal (Atkinson & Shiffrin, 1968); the encoding of stimuli (Underwood, 1963); subjective organization (Tulving, 1962); natural language mediation (Montague, Adams & Kiess, 1966) and visual imagery mediation (Paivio, 1971), eventually became important areas of investigation in their own right.

Theoretical and empirical foundations for the use of mnemonic strategies have been provided from the experimental learning literature. Underwood & Shultz, (1960) have reported that learning is strongly influenced by meaningfulness. That is, the more meaningful information is, the more easily it is acquired. Underwood and Schultz, (1960) described familiarity as a "natural" synonym of meaningfulness.

Concreteness plays an important role in learning, and that semantic elaboration of stimulus and response information (Rohwer, Raines, Eoff, & Wagner, 1977) is known to facilitate associative recall. These theories suggest that concrete, meaningful and elaborated information will be more easily learned. Unfortunately, many learners in school are likely to find to-be-learned content more non-meaningful, abstract and unelaborated. Ceci, (1985) and Herrmann, (1987) suggested further research to be more profitable, in investigation involving learning strategies which are aimed at more purposive information-processing strategies like elaborative, encoding, anticipation, type 2 rehearsal, chunking and so on (Ceci,1985, p. 219).

Research evidence has shown that mnemonic strategy approach has been used (Levin, 1993) to improve students' academic performance in the classroom. Mnemonic techniques are designed to enhance students' memory skills to retain specific content area and retrieve it with much ease. Mnemonic techniques are devices aimed at facilitating information recall by linking recently learned information to information already in the Long-term memory (Scruggs & Mastropieri, 1990). Various types of mnemonic techniques (Putnam, 2015) have been shown to enhance the academic skills for learning disabled students and non-disabled students in the United States (Lubin & Polloway, 2016).

Mnemonic techniques are systematic procedures for enhancing memory. They are used in developing better ways to encode information so that it will be much easier to retrieve it, Brigham, Scruggs, and Mastropieri, (1995). Mnemonic techniques are memory devices that enable students to remember information more easily and effectively. Mnemonics perform this function by connecting the new, unfamiliar information that must be learned and remembered with information that is already known by the learner by the use of visual and auditory cues (Mastropieri, Sweda, & Scruggs, 2000). Mnemonic techniques such as acrostics and acronyms have facilitated individuals to recall information by making new information more familiar, meaningful and concrete (Bakken & Simpson, 2011). These devices are effective and are used by students to recall information on various subjects. Young adult learners have used Mnemonics techniques to improve their vocabulary knowledge (Bakken & Simpson, 2011).

Mnemonic techniques accelerate the rate of acquisition of new knowledge in elementary levels and help to enhance formal reasoning (Laing, 2010). Laing added that Mnemonic techniques such as acronyms and acrostics, narratives and rhymes help

to make abstract concepts more meaningful. An acronym that students learn to recall the colours of the rainbow is ROYGBIV. This acronym helps learners to remember the order of the colours correctly as Red, Orange, Yellow, Green, Blue, Indigo and Violet (Bakken & Simpson, 2011).

Mnemonic techniques are also viewed as Mnemonic systems which aid the memory in encoding, retaining and retrieval. The term may also refer more specifically to unusual artificial memory techniques, the kinds recommended in popular memory-training books (such as stories, rhymes, acronyms, verbal mediators, visual imagery). Mnemonic techniques can be used over and over again to learn different sets of material, (Morris, 1977). Research evidence indicates that to make visual association effective, imagery must both be "visual" and involve "association" (Higbee, 1979). The emphasis should therefore be on comparison between different Mnemonic techniques and their effect on different verbal learning outcomes.

Interacting imagery are more effective than separate images in paired-associate learning (Begg & Anderson, 1976; Kerst, 1976; Nelson, Greene, Rank, Hatchett, & Igl, 1978). The advantage of interacting imagery over separate images has been well-supported by research evidence, and future efforts may be more beneficially aimed at theoretical explanations for the effect (Reese, 1977; Begg, 1978) Key strengths of Mnemonic advantages as a teaching tool stems from the fact that imagery Mnemonic techniques do not require literacy among the learners, they are easy to learn and difficult to forget. Mnemonic techniques are useful with large number of people, and they are cost effective because images are inexpensive to construct, easy to transport, they do not wear out, never rust or need no paint (Higbee, 1979). The literature on Mnemonic

techniques is very scanty in Kenya and Machakos County. Hence this formed the bedrock of this study.

Education and training of all Kenyans is fundamental to the success of the Kenya's Vision 2030 (Ministry of State for Planning National Development and Vision 2030, 2010). Education is made to equip citizens with knowledge and skills that enable them to fit in the competitive job market. The education sector is therefore required to provide the skills that are relevant to Kenyan's economic and social goals of Vision 2030. Education sector is faced with the challenge of ensuring that the education provided meets high quality standards, and that its content is relevant to the needs of the economy and society (Kenya vision 2030, 2007).

The Government introduced Free Primary Education (FPE) in 2003 in an effort to realize the Economic Recovery Strategy (ERS) and Millennium Development Goals (MDG) goals. The FPE programme has resulted into increased access to primary education by reducing the cost burden on households and providing learning and teaching materials to all public primary schools. FPE interventions have increased enrolments in public primary schools from 5.9 million in 2002 to 7.63 million in 2006 (Education Sector Report, 2008). However, while Free Primary Education has increased enrolment, it has at the same time created considerable problems such as constrained teaching and learning facilities. This is because as a result of high influx of new pupils to schools, classrooms are congested. At the same time, conditions laid down to request for concessions to institute levies are so cumbersome such that the head teachers hesitate to embark on the process (Sifuna, 2010). These negative effects of FPE have affected the learning outcomes.

The universalization of primary education has been facing a number of challenges. One such challenge has been Poverty and eventual realization of Universal Primary Education (UPE). An offshoot of the poverty problem is child labour. According to the Child Labour Survey, Kenya had 1.3 million children classified as child labourers (GoK, 1999). Poor staffing has also adversely affected the attainment of UPE. Many schools are grossly understaffed. The situation is more severe for schools in the arid and semi-arid areas, as well as those in the slums of urban areas, where the ratio could be as high as 1:100 (UNICEF, 2005). For the majority of children in Kenya, as in other African countries primary school education is terminal (Ki-Zerbo, 1990). As such, primary education should equip learners with adequate life and career skills to lead meaningful lives after school.

However, the education offered in primary schools predominantly is aimed at preparing the pupils for secondary school (Sifuna & Sawamura, 2008). Consequently, many children terminate their formal schooling after primary school level with very little life skills to enable them live a meaningful life. Low learning outcomes have been defined as failing to meet the average academic performance in test or examination scores, as determined by a set cut-off point. Pupil learning outcomes in primary schools can be compared using the Kenya Certificate of Primary Education (KCPE) examination which is standardized.

Learning involves connecting new information with existing concepts, knowledge and experience. Hence, new information is linked to existing knowledge by the learner to form new knowledge, and this process is known as constructivism. The links are stronger if they involve recent vivid, multisensory experiences that are encountered in the learning process (Petty, 2009). According to Thomson (2005), Verbal Learning is

associated with memorization and retention of lists of words, in order to describe basic elements of associative learning. The types of mental events that occur in verbal learning studies go beyond passive memorization, as learners can play an active role in manipulating experimental stimuli. There are various types of verbal learning which include; Serial Learning that involves having subjects learn a list of items according to the order in which the items appear in a list, Paired Associate learning that involves having 2 items (a stimulus and a response item) paired together as stimuli and response, (such as smoke and fire). When the item pairs are committed to memory, the presentation of the first word should evoke the second word and Free Recall learning which is very unstructured and one can recall words in any order they would like (Thomson, 2005).

1.2 Statement of the Problem

Research findings on the earlier curriculum had shown a chronic deficiency in learning outcomes across the country. It had been established that many children of primary school age, including those enrolled beyond Standard three, were not able to pass verbal learning outcome tests. On individual tests, only one in three children enrolled in Standard three can pass them. This rises to a little over 60% (or less than two in three children) in Standard four. Even in Standard seven, one in ten pupils could not pass both the English and Numeracy tests.

In the 2016 Kenya Certificate of Primary Education (KCPE) results, more than 50% of pupils did not achieve the expected learning outcomes hence were perceived to have failed the examinations. Studies further show that although the number of students taking (KCPE) at standard eight has increased, particularly the number of girls, demonstrating improved access, students fail to demonstrate progress in

learning with only 900 achieving 400 marks or above out of about 1,000,000 candidates who sat for the KCPE Examination in 2018. In Machakos Sub-County, only 15 candidates managed to score 400 marks and out of 15, nine were from public primary schools, (Machakos Sub-County Education Office). This performance is worrying. And although most of the teachers were able to complete the syllabus as required, most learners were not able to recall the content during examination. A low academic performance in final examinations at primary school level is a strong indicator that the learner will not attain the desired career in future. It is therefore important to look for strategies which can improve learning outcomes especially for CBC whose emphasis is on practical learning.

It is for these reasons that study investigated whether learning outcomes can be improved by practical use of Mnemonic techniques during teaching and learning process. The study also sought to establish which among the three Mnemonic techniques (keyword, pegword and music) was most appropriate for Free Recall and serial learning tasks as well as mathematics and Social Studies.

The study was aimed at investigating the appropriateness of keyword, pegword and music Mnemonic techniques to free and serial learning tasks. These learning tasks were selected because they tend to make use of more or less the same Mnemonic techniques and because they have been used for investigating the relative effectiveness of Mnemonics techniques more than any other paradigms in the literature. Mathematics and Social Studies were selected because they have been poorly performed in KCPE examinations in the last three years.

1.3 Purpose of the Study

The purpose of this study was to establish the appropriateness of Mnemonic techniques in Free Recall and serial learning outcomes. The study involved comparing keyword, pegword and music Mnemonic techniques with Free Recall and Serial Learning outcomes as well as mathematics and Social Studies.

1.4 Objectives of the Study

The study was guided by the following objectives:

i. To find out whether there are differences in Free Recall learning outcomes between learners taught using keyword, pegword and music Mnemonic techniques in public upper primary pupils.

ii. To find out whether there are differences in Serial learning outcomes between learners taught using keyword, pegword and music Mnemonic techniques in public upper primary pupils.

iii. To determine the appropriateness of keyword, pegword and music Mnemonic techniques on learning outcomes of mathematics and Social Studies in public upper primary pupils.

1.5 Research questions

The present study addressed the following research questions:

i) Are there any significant differences in Free Recall learning outcomes among learners using keyword, pegword and music mnemonic techniques?

ii) Are there any significant differences in serial recall learning outcomes among learners using keyword, pegword and music mnemonic techniques?

iii) Are there any significant differences in learning outcomes of mathematics and Social Studies subjects among learners using keyword, pegword and music mnemonic techniques?

1.6 Hypotheses of the Study

The present study sought to test the following hypotheses

H_{01}: There are no significant differences in Free Recall learning outcomes between learners using keyword, pegword and Music Mnemonic techniques in public upper primary pupils.

$H0_{1.a}$: There are no significant differences between main effect factor A (Mnemonic instruction treatment conditions) and Free Recall learning outcomes.

$H0_{1.b}$: There are no significant differences between main effect factor B (type of assessment) and Free Recall learning outcomes.

$H0_{1c}$: There are no significant main interaction effect between Mnemonic techniques and type of assessment on the Free Recall learning outcomes.

H_{02}: There are no significant differences in Serial learning outcomes between learners using keyword, pegword and music Mnemonic techniques in public upper primary pupils.

$H0_{2.a}$: There are no significant differences between main effect factor A (Mnemonic techniques) and Serial learning outcomes.

$H0_{2.b}$: There are no significant differences between main effect factor B (type of assessment) and Serial learning outcomes.

$H0_{2.c}$: There are no significant main interaction effect between mnemonic techniques and type of assessment on Serial learning outcomes.

H_{03}: There are no significant differences in learning outcomes of mathematics and Social Studies subjects between learners using keyword, pegword and Music Mnemonic techniques in public upper primary pupils.

$H0_{3.a}$: There are no significant differences in learning outcomes of Mathematics between learners using Keyword, Pegword and Music Mnemonic techniques

$H0_{3.b}$: There are no significant differences in learning outcomes of Social Studies between Learners using Keyword, Pegword and Music Mnemonic techniques.

1.7 Significance of the Study

Although there is a wide array of research regarding the use of the Mnemonic techniques to enhance learning outcomes. Majority of the research has been done outside Kenya and in extension Africa. There is a need for more current research regarding the impact of the Mnemonic techniques in Africa context and specifically in Kenya. The findings of this study will go a long way in assisting both teachers and pupils to be able to select the Mnemonic techniques which are appropriate for Free Recall and Serial learning tasks as it has been established in the study so as to improve retention and retrieval of information. The findings of the study will also help learners to improve learning outcomes of mathematics and Social Studies.

The findings of the study will also help educators to improve performance in national examinations and help to reduce exam irregularities since learners will be able to choose

the appropriate Mnemonic techniques to store and retrieve content from the Long-Term memory hence improving learning outcomes. The findings of this study also will assist students, parents, teachers and other education stakeholders in promoting proper methods of learning and revision so as to improve learning outcomes. The findings of the study will be an eye opener to the Kenya Institute Curriculum Development (KICD) in providing suggestions of materials which need to be included in the syllabus, especially in support of the competency-based curriculum (CBC) syllabus.

1.8 Limitation and Delimitation of the Study

This section looked at limitations and delimitations of the study. Delimitation of the study refers to the scope or the extent in which the study has covered. Limitations of the study refers to the challenges which the researcher faced during the study, some of which were behold his /her control.

1.8.1 Limitations of the Study

The study was limited by the intervening variables such as learners' attitude towards Mnemonic techniques, learners' stress, time taken for training, ability level of learners which might have affected Free Recall and Serial learning outcomes. Some Mnemonic techniques may have been appropriate for specific age of learners hence they end up scoring very low. To minimize this limitation, the researcher used learners who were at the same class levels and ages. The learners' age range was between 12 and 15 years as shown in table 4.2 page 105.

Another limitation was gender. Some Mnemonic techniques could have been preferred more than others by either gender which may end up influencing the learning outcomes. Music Mnemonic technique seemed to be mostly favoured by girls than boys. To minimize the effect of the variable of gender on observed scores, the researcher used

equal number of boys to girls as shown in figure 4.1 page 103. The learners' ability in terms of cognitive level of development could also affect the learning outcomes. Ability level as an intervening variable, the researcher used learners who had similar ability level by choosing schools which had similar mean grade of between 279 and 281 marks in KCPE examination in 2016 as shown in table 3.1 page 77.

Another limitation was that, some pupils had challenges in interpreting individual Mnemonic techniques and linking them with the content to be remembered. This limitation was commonly experienced by learners from the schools in the rural set up. On the other hand, some teachers felt that, using Mnemonic instruction techniques was time consuming and that it was likely to slow the phase in teaching if they continued using Mnemonic instruction methods.

Another limitation of the study was attrition during the research process. Specifically, the study experienced mortality rate where by three pupils from two of four selected schools did not attend all the lessons during Mnemonic technique teaching strategy due to sickness, and this affected their scores. The effect of these very low scores was likely to affect the homogeneity and normality of the scores hence affecting the outcome of the study. However, the effect of this variable was minimized by cleaning the raw data by removing the outlier values.

Another limitation was sample size, since the researcher picked class seven and two streams from each class as intact groups for both experimental and control groups, the groups selected did not have the same class size. Some had 2 to 3 pupils more than the others. During cleaning of the data, extra numbers were removed to ensure equal number of participants in each intact groups.

1.8.2 Delimitation

The study delimited itself to effects of (keyword, pegword and music) Mnemonic techniques, Free Recall and Serial learning outcomes and two subjects (Social Studies and mathematics). The study was confined in four public primary schools in Machakos sub-county, Machakos County. At least one school was selected from each of the three Educational zones viz; Muvuti zone, Mutituni zone and Mumbuni zones in Machakos Sub-County. The study was delimited to a sample of 317 pupils, which was used to generalize to the rest of the primary schools and pupils in the Sub-County. The study was also delimited to standard seven pupils from public primary schools. There are many variables that may affect Free Recall and Serial learning outcomes. However, this study delimited itself to direct effect of Mnemonic techniques instruction methods.

1.8 Assumptions of the Study

The study was guided by three assumptions. The first assumption was that improvement of test scores or lack of it, was as a result of Mnemonics instruction method interventions. Second, it was also assumed that the training and subsequent use of Mnemonic techniques during learning and teaching process affected the learning outcomes of pupils, and not other prevailing factors. Third, the study sample selected was assumed to be sufficient representative of the entire population for results to be generalized to the target population.

1.9 Theoretical Framework

This section comprised of two sub-sections. The first sub-section discussed Connectionism Theory of Learning (Thorndike, 1949) and the second sub-section discussed Tulving's Theory of Long-Term Memory (Tulving, 1997). This section involved discussion of the two theories and how they are related to the study.

1.9.1 Connectionism Theory of Learning by Thorndike, (1949)

Connectionism Theory of Learning by Thorndike, (1949) theory holds that learning involves forming bonds or connections between stimuli and responses. According to Thorndike (1874 & 1949), most common type of learning involves a trial-and-error, and learners usually stamp in effective S-R connections and stamp out (put to an end completely) those responses which are useless. This learning consists of forming bonds or connections between stimuli and responses.

By use of Mnemonics techniques such as pegword, keyword and Music which are imaginary in nature, images are formed during Mnemonic preparation and use. The new bonds are formed in the memory between the imaginary and linked to the content to be learned, thus enabling learners to retrieve the content much easier when required. Time is required to prepare and practise any particular Mnemonics technique. This also influences learning by creating frequency, recency, intensity and vividness of the experience, mood and capacity of the subject, similarity of situations and resulting reinforcement which is basic condition in learning (Thorndike, 1949).

The Connectionism theory has proposed several laws which are necessary for learning and are applicable in this study as follows: Law of effect, Law of exercise, principle of analogy and principle of associative shifting. The Law of effect states that satisfaction serves to strengthen or reinforce S-R bonds/activity, and that dissatisfaction weakens the S-R bond which causes the organism to look for alternatives and to seek out satisfactory solutions by trial and error. The effect of Mnemonic devices no doubt has very positive results in enhancement of learning outcomes.

According to Thorndike (1949), the organism selects from a set of random responses which are followed by positive consequences. Thus, learning is a function of the

consequences: During the preparation of Mnemonic techniques, the content to-be-remembered should be made understandable and meaningful (rewarding) in terms of the child's personal life so that this serves as a reinforcement. The nonsense and abstract content are made meaningful by associating it with visual and imaginary Mnemonics which are meaningful to the learner hence making it easier to remember the content. By use Mnemonics techniques, materials to-be remembered are presented using varied approaches for the purpose of stimulus variation. Mnemonic techniques are made in such a way that they make use of various modalities of learning such as; visual, hearing, touch, smell and taste.

The Law of exercise is another law proposed in this theory (frequency, practice repetition, application). It states that bonds are strengthened simply by the same stimulus and response repeatedly occurring together. On the other hand, reduction in response weakens the S-R bond to a point of extinction (redundancy). The use of Mnemonic techniques requires a lot of practise in the initial stages which enhances proper storage and retrieval of information. The learners are required first to practice Mnemonic techniques and to link them to the to-be-remembered content. Some Mnemonic techniques actually require the learners to rehearse them over and over again before they can be used.

Other principles of this theory of learning which are applicable to the current study include Principle of analogy or assimilation which states that when an individual is faced with a new situation for which he/she has no natural or learned response, the response he makes will resemble an earlier response to a similar situation. This principle implies the importance of learning from the known to the unknown. Once the Mnemonic techniques are learned, the same Mnemonic can be used over and over again

to remember different contents or pieces of information and can also be used to learn other subjects and this will improve the overall learning outcomes hence improve grade performance.

Another principle is the Principle of associative shifting, which states that any response that a learner is capable or may be attached to any stimulant to which he/she is sensitive. In preparation and application of Mnemonic techniques, to-be-remembered content is linked/associated with things or visuals which the learner is sensitive to or knows so well. For example, in music Mnemonic technique pupils are required to listen to music lyrics which also includes both audio and video images interacting in some way. This makes the learners recall the content very easily. This makes the learners to be able to apply associative shifting. For example: by associating shopping list items with video images which they know too well such as furniture in their sitting rooms. Another example is when using pegword Mnemonic technique the learner is encouraged to select items which he knows so well and are within his/her immediate environment as the 'pegs' or 'hooks' because it is the things which learners are sensitive to and will act as cues for remembering information.

1.9.2 Tulving's Theory of Long-Term Memory (LTM)

Tulving, (1997) proposed that there are three different types of long-term memory (LTM). According to him, there are two main categories of LTM, these are procedural memory and declarative memory. Procedural memory is the memory of how to do things. It may include things like how to write, how to drive and to use knife and fork. One may retain procedural memories for example how to cook even after having forgotten being taught how to cook in the first place. Declarative memory is the memory of meaningful events.

Tulving split declarative memory into two sub-categories: Episodic memory and Semantic memory. Episodic memory is the memory of particular events and specific information: events such as wedding, funeral, circumcision and so forth. It includes memories of things that have happened to you and information like a person's address. Episodic memories seem to be perceptually encoded and linked to the five senses and that is why they can be triggered ("cued") by a sight or a sound or a smell. Semantic memory is the memory of general information, facts and meanings. Semantic memory is needed for language because words have meaning; learning words in the first place involves episodic memory but once they are learned they go into the semantic storage. Procedural and episodic memories are much easier to remember than semantic memory.

The use of Mnemonic techniques combines or/ and converts semantic contents into the other two categories of long-term memory: procedural and episodic, hence making it possible to retrieve information with much ease. This is done by first having a list of words or facts which are in semantic form for example a shopping list. The items are then hooked or pegged on the "Keywords" as used to represent the words, or better still the word can be converted to "Music". By so doing, the items are changed from semantic memory to either procedural memory or episodic memory or both. Hence, making it much easier to remember content. For example, if you visualise item one as a big burn being fried in an oven, semantic memory (facts) is changed to procedural memory (doing something, cooking) and hence making it much easier to recall.

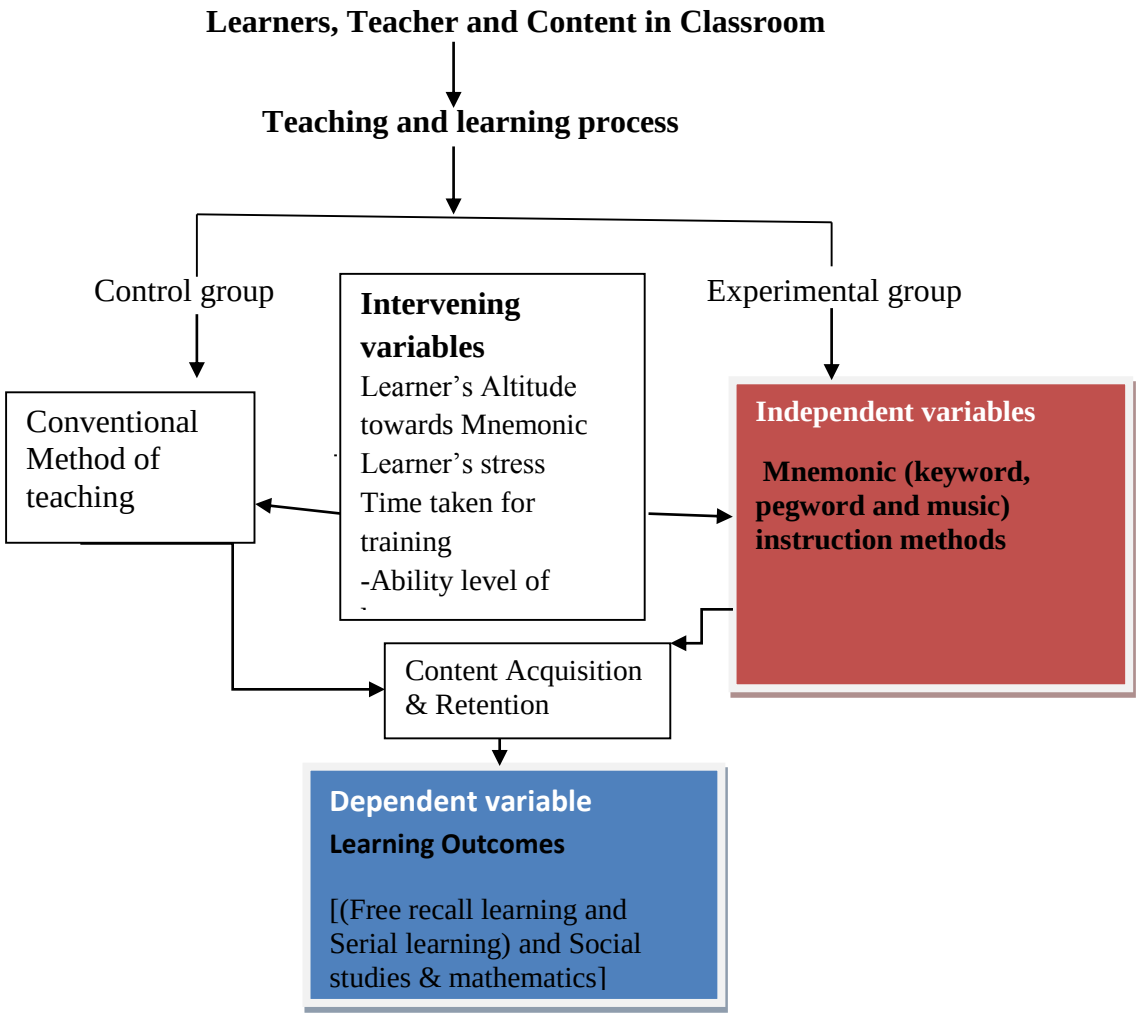
The use mnemonic techniques enhance the use several learning modalities. A study conducted by Pikulski and Templeton (2014) on the effectiveness of the method of memorizing to improve vocabulary mastery explains that learning content requires the involvement of brain activity. This is because memorization involves receiving,

encoding and storage of information which is a memory process. The combination of learning methods in learning new information is part of multimodality. Multimodality (Jewitt, 2005) is a combination of several methods of processing information in working memory. The working process of memory supported by multimodality will help new information fit into Long-Term Memory much easier.

1.10 Conceptual Framework

The conceptual framework illustrates how the three Mnemonic techniques enhance learning outcomes on two learning tasks as measured by Free Recall and Serial learning outcomes. It largely represents how the different Mnemonic instruction methods may be appropriate in enhancing Free Recall and Serial learning outcomes. The appropriateness of Mnemonic techniques instruction method may have been affected by intervening variables. The intervening variables included learners' ability level, age, grade level and their attitude towards Mnemonic techniques instruction method. Learning outcomes may have been appropriate depending on which subject is being tested.

The experimental groups were taught using Mnemonic instruction methods. Post-test were then administered to establish which Mnemonic techniques was appropriate for Free Recall and serial learning tasks. Keyword, Pegword and Music Mnemonic techniques instruction methods were used for experimental groups. The control group used conventional methods during teaching and learning process such as recitation and memorisation. Post-test results were analysed and compared in the four groups.



KEY

Variables under investigation

Independent variable

Dependent variable

Figure 1.2: A Relationship between Mnemonic Techniques, Learning Outcomes and Other Intervening Variables.

Source: Field data, 2020

1.11 Operational Definition of Terms

Appropriateness: Most effective Mnemonic technique as a memory strategy to enhance different types of learning tasks.

Declarative memory: Declarative memory is the memory of meaningful events.

Delayed recall: Retention and retrieval of information from the long-term memory after certain time has elapsed.

Episodic memory: Episodic memory is the memory of particular events and specific information. It is a category of memory which stores information about past events.

Free Recall: Free recall is an unstructured form of verbal learning It involves recalling items without following any order as long as one can recall whole list.

Keyword: Keyword Mnemonics involves making a phonetic link connecting to-be-learned word with a similar-sounding keyword, and then making an interactive image that links the keyword to the meaning of the to-be-learned word.

Immediate recall: Retaining and retrieving information in the working memory.

Learning outcomes: Pupils' content acquisition as measured by improved scores in Free Recall learning and serial learning as well as mathematics and Social Studies.

Long Term memory: Refers to the continuing storage of information in the long-Term memory which has an unlimited capacity and duration for future use.

Mnemonic techniques: Mnemonic techniques are artificial memory devices; the kinds recommended in popular memory-training books (e.g., stories, music rhymes, acronyms, verbal mediators, visual imagery, pegword, loci method, keyword etc.).

Pegword: The pegword method is an organizational Mnemonic technique that is often recommended for remembering ordered lists. Pegword Mnemonic technique is based on the famous children's poem "one- bun, two shoe, three-

tree, four for shoe, five for hive, six for sticks, seven for heaven eight for gate, nine for vine and ten-hen."

Procedural Memory: Procedural memory is the memory of how to do things. It is a category of memory which stores information of procedures of doing things e.g., how to drive, how to cook.

Semantic Memory: Semantic memory is the memory of general information, facts and meanings. It is a category of memory which stores of abstract information as opposed to procedures and events.

Serial Learning: Serial Learning involves recalling or learning content in the order in which the information appear in the content. It involves learning a process or stage and being able to recall those steps, stages, processes as they appear in the content. For example, recalling Freud's psychoanalytic stages of personality development.

Verbal learning: Verbal Learning is a type of learning which involves memorization and retention of lists of words in order to describe basic elements of associative learning. It involves the use of language, words and symbols.

CHAPTER TWO
REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter started with an overview of performance in primary schools. The researcher has also reviewed literature related to Mnemonic techniques particularly highlighting the keyword, pegword and Music Mnemonic techniques. Literature related to appropriateness of Mnemonic techniques on Free Recall and serial learning tasks have also been reviewed. Finally, literature related to appropriateness of Mnemonic techniques on Social Studies and mathematics has been reviewed.

2.2 Factors Affecting Performance in Primary Schools

Free Primary Education (FPE) interventions has increased enrolments in formal primary schools from 5.9 million in 2002 to 7.63 million in 2006 (Education Sector Report, 2008). However, while FPE has increased enrolment, it has at the same time created considerable problems such as constrained teaching and learning facilities. As a result of the high influx of new pupils, classrooms are congested. At the same time, conditions laid down to request for concessions to institute levies are so cumbersome that the parents hesitate to embark on the process (Sifuna, 2010). All these have led to low learning outcomes in public primary schools in Kenya.

The introduction of Universal Education (UPE) in primary school has brought about many challenges. Poverty is one of the leading challenges facing the implementation and realization of UPE intervention to education in primary sector in Kenya. One of the effects of poverty is the problem of child laborer. The government of Kenya in the Child Labour Survey in Kenya revealed that, 1.3 million children were classified as labourers, GoK, (1999). Poor staffing has also adversely affected the attainment of UPE in Kenya. Many schools are grossly understaffed. The situation is more severe for schools in the

Arid and Semi-Arid Lands (ASALs), as well as those in the slums of urban areas, where the ratio could be as high as 1:100 (UNICEF, 2005). For the majority of children in African countries, Kenya included primary school education is terminal (Ki-Zerbo, 1990). As such, primary education should provide competency life skills and career skills for learners to lead meaningful lives after school. In reality, however, the education offered in primary schools predominantly aims at preparing pupils for secondary school (Sifuna & Sawamura, 2008). Consequently, many children terminate their formal schooling with very little skills to enable them to lead meaningful life after school.

Low learning outcomes have been defined as failing to meet the average academic performance in test or examination scores, as determined by set cut-off points. Pupils' learning outcomes in primary schools can be compared using the KCPE examination which is standardized. Studies have indicated that in informal settlements of Nairobi, pupils perform below average compared to those outside informal dwellings. However, the performance is also affected by such factors as gender, school type and location and Socio-economic status (African Population and Health Research Center, 2008.)

Studies by Oloo (2003) and Mackenzie (1997) showed that a major problem contributing to low learning outcomes was unconducive home environment. Low learning outcomes in final examinations at primary school level is a strong indicator that the student will not attain the desired career in future. It is therefore important to be able to predict the learners who are likely to achieve below average marks and need for intervention early enough for them to improve their marks (Mgala & Mbogho, 2015). According Jagero (1999), in his research in Kisumu district suggested that lack of reading materials was a major factor affecting the performance of day primary school

pupils. According to Mbilinyi (2003), most pupils especially girls, are engaged in home chores such as caring for their siblings when their parents are away, taking care of the sick, cooking, attending to traditional rituals, funerals, and other celebrations. This was a major contributor low learning outcome. Mensch and Lloyd (1997), found that when girls have more domestic responsibilities than boys, they usually have less time for homework, but on the other hand, when girls are confined at home after school and boys allowed more freedom, girls may use some of their free time to do more homework, thus performing better than boys.

Morumbwa (2006) carried out a study to investigate factors affecting performance in KCPE in Nyamaiya Division. His findings revealed that absenteeism from school, lack of facilities, lack of motivation, understaffing, and lack of role models are some of the cause's poor of performance. In his study, Obiero (2010) explored the effect of administrative practices on KCPE performance in Maseno Division in Kisumu. The findings of his study revealed that curriculum implementation and assessment, teacher professionalism and work-related behaviour and management practices predict KCPE performance.

Effects of low learning outcomes lead to a lot of wastage in primary school education. More than 50% of pupils enrolled in standard one in the earlier curriculum fail to complete the education cycle, and yet education consumes about 55% of the government's recurrent expenditure. Wastage resulting from failure to complete primary education cost the public an estimated Kshs. 5.2 million between 1992 and 1996 (Abagi & Odipo, 1997).

Some measures have been put in place to improve learning outcomes which include the following, management committees have to devise ways of making sure that the right

candidates are registered for the KCPE, introduction of extra tuition for which further fees are charged, pupils have been forced to repeat classes or transfer to a particular school which they think that is not good enough. At the same time, pupils are generally overworked academically, and have little time left for play. Parents are forced to bear heavy burdens of paying for extra coaching, buying books, and meeting costs of transport. The fundamental issue has been the justification for this burden to the parents and Guardians (Abagi & Odipo 1997). It is in this regard the current study sought to investigate whether learning outcomes in primary school can be improved by use of Mnemonic techniques. The study sought to investigate which Mnemonic technique among keyword, pegword and music was more appropriate for improving Free Recall and serial learning outcomes as well as mathematics and Social Studies.

2.3 Mnemonic Techniques

The term Mnemonic means "aiding the memory". Thus, a Mnemonic technique is a system or technique which aids the memory. Mnemonics generally refers to methods of memory improvement (Thomson, 2005). Typically, however, the term is used to refer more specifically to artificial memory techniques, the kinds of techniques recommended in popular memory-training books. They include such techniques as visual imagery, verbal mediators, stories, rhymes, acrostics, and acronyms.

Mnemonic techniques are memory aids that assist one in remembering specific information by using a process, strategy, or technique that enables a person to improve memory (Higbee, 1979). The use of Mnemonic systems dates back more than twenty centuries ago. Their history ranges from about 500 B.C. Though the seventeenth century has been traced by Yales (1966). Mnemonic techniques are also encoding strategies used to organize and/or chunk to-be-learned material in order to make it more

meaningful and easier to remember. At a conceptual level, Mnemonics boosts memory due to at least three factors. First, they involve deliberate, or effortful learning, (Bellezza, 1996); the focused attention the learner pays to the materials while using and/or creating Mnemonics supports encoding to long-term memory. Second, they connect new knowledge with established schemes in long-term memory, a process also known as elaboration, which enhances encoding and supports successful retrieval (Balch, 2005).

Third, many Mnemonic devices require the integration of two or more information codes (like verbal, visual) which is consistent with Paivio's (1986) dual-coding theory. Hence, enhancing memory by providing multiple routes to retrieval. The use of mental imagery may be particularly important; some researchers recommend using interactive, dynamic, distinctive, and possibly even bizarre images (McDaniel & Einstein, 1986; Brady, 1995 & McDaniel, Einstein, DeLosh, May 2006) and spending at least 6 seconds on each visual association (Bugelski, 1974). Mnemonics are useful only for recall, and they are not comprehension strategies and only facilitate the recall of new knowledge (Bakken & Simpson, 2011).

Onur, Ali, Yunus and Musa (2013) conducted a study to investigate the effects of the letter/phonetic Mnemonic techniques on nurses' attainment of basic knowledge of the healthcare system and recall of their basic knowledge. Letter/phonetic involves creating a meaningful word or a sentence by using the initial letters of the items to be learned. It is commonly known as acronym. They used sample of 76 subjects. The experimental group of 39 subjects were taught using Mnemonic techniques. The control group had 37 subjects. Using t-test, the findings showed that there was a significant difference between the experimental and control groups ($t = 9.35$, $p = 0005$), in favor of the

experimental group that employed letter-phonetic Mnemonics. Three weeks after instruction, the participants were tested again; and the attainment test was given as a delayed retention test (Onur et al., 2013). Using a t-test, the researchers showed that there was a significant difference again between the experimental and control groups, in favor of the experimental group that employed letter-phonetic Mnemonics ($t = 12.73$, $p = 0.05$).

In another study Shmidman and Ehri (2010) used a sample 36 two-year-old preschoolers to investigate whether Mnemonics facilitated the learning of foreign alphabets among English-speaking preschoolers. The results showed that Mnemonics were effective to reduce confusion, accelerate learning besides enhancing long-term retention (Shmidma & Ehri, 2010). However, the study did not highlight which specific Mnemonic techniques was used, hence in the current study the researcher focused only on three Mnemonics: keyword, pegword and music Mnemonics. The researcher investigated which Mnemonic among the three is most appropriate to for Free Recall and Serial learning outcomes.

2.3.1 Role of Mnemonic Techniques

Levin and Levin (1993) summarized important factors of using Mnemonic as the "three*R*s": Recoding, Relating, and Retrieving, with a possible fourth "*R*" for Rehearsin*g*. Recoding is important because the information needs to be encoded in a form which can be easy for storage. The information to be remembered need to be related to information which is already in the Long-Term memory. After recoding and relating information, it is then stored and retrieving is made much easier. Similarly, Shimamura (1984) created an acronym Mnemonic to describe elements of Mnemonic learning: "*MOVA* your memory," with the letters referring to *Meaningfulness* (e.g.,

schema-building), *Organization* (e.g., chunking), *Visualization* (i.e., imagery), and *Attention*.

In education, Mnemonics are often used at the initial stage of knowledge acquisition. They may act in this early stage as scaffolding for more permanent schematic knowledge that develops as education advances (Bellezza, 1996). Indeed, psychology courses (especially those taken early in the curriculum, such as Introduction to Psychology) require the mastery of an entirely new area before students can study more complex concepts (Carney & Levin, 1998; Balch, 2005). The types of elaborative strategies incorporated into Mnemonics support this process.

Mnemonic techniques comprises of mental cues that are created to make information retrievable. This is done by associating a similar or dissimilar piece of information (mental cue) with the information needed to-be-remembered (Bjorklund, 2000). In the current study, the effect of three types of Mnemonic techniques; keyword Mnemonic, pegword and Music have been compared and their interaction effect also compared in relation to learning outcomes.

Ying，Guoqing, Guozhen and Yuwei (2014) suggested a technique called mind maps which has greatly enhanced the theory of memory. This technique informs the ease with which information can be recalled/retrieved with ease, and it is the contention of this study that the technique can be used to inform pedagogic practice.

A mind map is a diagram used to visually organize information. It is hierarchical and shows relationships among pieces of the whole. It is often created around a single concept, drawn as an image in the centre of a blank page, to which associated representations of ideas such as images, words and parts of words are added. The

pedagogic application could be implemented if learners were trained on how to construct meaningful mind maps in relation to specific topic areas in their subjects of study; followed by adequate and frequent guided practice on their use.

Ying，Guoqing, Guozhen and Yuwei (2014) further observed that educators and students have been drawing concept maps and mind maps on paper for many years. Visual software applications, in particular mind mapping tools, have automated this process, making it more efficient to brainstorm concepts as ideas or branches. This allows for the creation of much larger mind maps, and the ability to easily re-organized branches by dragging and dropping them around the map. Furthermore, some mind mapping software applications integrate with MS Office, allowing students to convert their ideas into other documents such as Word or PowerPoint. Mind mapping for education is perfect for: Brainstorming sessions; Visualizing concepts; Improving critical thinking; Improving reading and writing skills; Advanced research papers or graduate projects; Outlining written documents; Storyboarding presentations.

2.3.2. Mnemonics in Education: Applications

Putnam (2015) noted that Mnemonic techniques are a powerful way to learn large amounts of information, but are not used widely in education today probably because practical demands of the classroom may not be conducive to the use of mnemonics. Putnam (2015) suggested that investigations on use of mnemonics in education could focus on the following: (a) Do mnemonics contribute to more than just rote memory? (b) Do mnemonics work with educationally relevant materials? (c) How much time is required to learn and prepare a mnemonic? (d) Do mnemonics promote long-term learning? These basic questions as provided by Putnam (2015) informed the context in

which this study was carried out in testing the key elements that teachers and learners could use mnemonics to enhance learning outcomes.

Besides Putnam (2015) other researchers who investigated applications of mnemonics in education include: Levin (1993); Lorayne, (1990), who showed through empirical studies that mnemonics are highly effective in the right circumstances. This seem to be concur with many studies discussed in this chapter that support the use of mnemonic techniques in the teaching learning process.

Worthen and Hunt, (2011) and Dunlosky, Rawson, Marsh, Nathan, and Willingham, (2013) have been critical. From literature reviews, proponents of mnemonics are encouraged by the results of research done with education in mind (e.g., studies conducted in real classrooms or using educationally relevant materials), whereas detractors suggest that mnemonics have limited utility compared with other techniques that are easy to use and applicable to a wide range of materials, such as retrieval practice or spacing. This calls for further research to ascertain the place of mnemonics in the teaching and learning exercise. This is further informed by the fact that it is not uncommon to find teachers using some of the common forms of mnemonics in their classroom work, some of which are summarized in the table below:

Table 2.1: Descriptions of Popular Mnemonic Techniques and Systems

Serial Number	Mnemonic	Description
1	Link Method	Interactive visual imagery connects items in a list, making a chain. Item 1 is joined with item 2; a separate image joins item 2 with item 3 and so on. Thus, retrieving one item in the list cues the next item.
2	Method of loci	First, a memory palace—a mental map of a building or walk that you know well, such as your house—is memorized. Then, imagery is used to store list items at different locations throughout the palace. Items are retrieved by "walking" through the palace.
3	Peg system	A "peg list," or a list of concrete objects in a specific order (e.g., *one* is a bun, *two* is a shoe, *three* is a flea) is learned. Then, visual imagery combines the to-be remembered items with the peg items. Items can be retrieved by thinking of a number and the corresponding peg, which cues the target item.
4	Keyword method	First, a keyword is found that sounds like the unfamiliar word (e.g., "dentist" sounds like "la dent"). Then imagery joins the keyword with the definition of the unfamiliar word (an image of a "dentist" holding a large "tooth"). Seeing "la dent" activates dentist, which in turn should activate tooth.
5	Phonetic system	Each number corresponds to a consonant sound (1 _ *t*, 2 _ *n*, 3 _ *m* etc.). Then numbers can be remembered as words, using vowels as necessary. For example, 321 can be remembered as "manatee." Words can be decoded back into numbers.
6	Acronyms	The first letters of a list of words are used to create a new word. For example, the colors of the rainbow (red, orange, yellow, green, blue, indigo,

		violet) can be remembered as ROYGBIV. Each letter serves as a retrieval cue for the target items.
7	Acrostics	The first letters in a list of words serve as the first letters in a new sentence or phrase. For example, the colors of the rainbow can be remembered as **R**ichard **O**f **Y**ork **G**ave **B**attle **I**n **V**ain. The first letter in each word of the acrostic serves as a retrieval cue.
8	Songs, stories, and rhymes	Words in a list are joined together by being elements in a story, or by being included in a song or rhyme. Songs and rhymes can also be written to remember specific pieces of information (e.g., *i* before *e* except after *c*).

Source: Putnam (2015)

From the above summary of mnemonics used in education, the current study focused on three types namely, keyword, pegword and music. A description of each is as provided below:

2.3.3 Keyword Mnemonics

The first mnemonic device explored in this study was the Keyword Mnemonics defined by Raugh and Atkinson (1974) as associations between an acoustic similarity of an English keyword to a foreign word and the visual association of the English keyword to the English definition of the foreign word.

The keyword Mnemonic techniques involves linking new information to keywords that are already stored in the memory. Keyword works by taking unfamiliar information and making it more meaningful and concrete and hence making it much easier to remember. Scruggs and Mastropieri (1989) noted that the keyword method works best when the

information to be learned is new to students and must be remembered. Keyword Mnemonic techniques involve making a phonetic link connecting to-be-learned word with a similar-sounding keyword, and then making an interactive image that links the keyword to the meaning of the to-be-learned word (Bellezza, 1996 and Levin, 1983). Though originally studied in the context of foreign language learning, the keyword method has been recently applied to other areas in education curriculum. Educational application of the keyword method is able to facilitate students learning of information contained in factual prose passages.

According to Atkinson (1975) and Levin (1981), the keyword Mnemonic requires two stages: an acoustic link stage and an imagery link stage. First the learner is given a 'keyword' that is acoustically similar to and that can be visualized as interacting with the item to-be-remembered. For example, the word perro is Spanish for dog. An acoustically similar and visually represented word would be *pear*. In the second stage, the learner would form the visual image of the keyword *pear* and the target word perro interacting in some way. Thus, for perro, a learner might visualize a dog holding a pear in its mouth. When the learner is asked to recall the definition of *perro,* the visualization is invoked and she can then recall the definition, (Atkinson, 1975; Levin 1998; Richmond, Cummings, & Klapp, 2008).

Keyword is very effective in learning foreign languages. The first stage of the keyword method would entail acquiring a keyword, an English word that sounds like a salient part of the foreign word. For example, a suitable keyword for *carta* might be *cart.* The second stage of the method would then involve asking the learner to form a visual image that relates the keyword to the foreign word meaning (e.g., picturing a letter inside a shopping cart). Students receiving instruction in the keyword method typically recall

substantially more definitions in comparison to students left to their own devices. Although research has shown that keyword is best used in learning foreign languages, the current study used keyword Mnemonic techniques in learning Social Studies and mathematics.

Keyword Mnemonic procedure has been applied to children's learning of unfamiliar English vocabulary items (Levin, McCormick, Miller, Berry, & Pressley, 1982). In addition, the keyword method has been extended to improve students' memory for other curricular contents, such as the states and their capitals (Levin, Shriberg, Miller, & McCormick, 1980), cities and their products and the order of U.S. presidents (Levin, McCormick & Dretzke, 1981).

Educationally, application of the keyword method would be profitable in facilitating students learning of information contained in factual prose passages. The literature largely shows that keyword Mnemonic has been used to study language. In the current study keyword Mnemonics has been used to study Social Studies and mathematics. Its appropriateness on Free Recall and Serial learning tasks has been compared with other two Mnemonic techniques. The content used to study keyword and other two mnemonic techniques was from standard seven syllabuses.

2.3.4 Pegword Mnemonic Techniques

The second mnemonic device used in the study was the Pegword Mnemonic Technique. The process of using the pegword method starts with learning a set of concrete words (pegs) associated with the first 20 or so whole numbers. The sound words, pegs or hooks are such as “1 is a bun, 2 is a shoe, and 3 is a tree...” (Bower & Reitman, 1972, p. 8). In order to learn any new list of words, the individual must visualize the referent of the

respective new words in explicit interaction with the reference of the peg words being used, (Abbas, Zarei & Keysan 2016).

The pegword Mnemonic techniques is a two-stage process. In the first stage, learners are asked to learn 10 number-rhyme pairs (e.g., one is a bun, two is a shoe, and three is a tree, etc.). In the second stage, learners are given a picture or asked to visualize the to-be-remembered item linking the rhyming words. The Pegword method is an organizational Mnemonic strategy that is often recommended for remembering ordered lists, (Scruggs & Mastropieri, 2000).

The pegword Mnemonic technique is especially used for remembering an ordered list of items: It involves two stages. First, the learner memorizes a rhyming scheme for the numbers 1 to 10, which can be used multiple times: One is a bun, two is a shoe, three is a tree, four is a door, five is a hive, six is bricks, seven is heaven, eight is a plate, nine is wine, ten is a hen (Miller, Galanter & Pribram, 1960). Next, the learner creates a mental image of each item on the to-be-learned list interacting with the word that rhymes with the appropriate number. The numbers are hooks or pegs you can hang anything on them. In the second stage, learners are given a picture or asked to visualize the to-be-remembered item linking the rhyming words to the to-be-remembered item. For example, if the to-be-remembered item is Jomo Kenyatta, the image of President Kenyatta holding a bun could be shown as a picture or the learner would be instructed to create vivid mental image of this picture. When the learner must recall the first president of Kenya, this image comes to mind and he recalls Jomo Kenyatta (Scruggs & Mastropieri, 2010; Roediger, 2014).

Research evidence has shown that pegword Mnemonic technique is mostly used in recalling ordered list (Serial learning task). In the current study pegword Mnemonic has been used for both ordered list and Free Recall content. The researcher also sought to investigate whether pegword Mnemonic technique is most appropriate for Social Studies as well as mathematics.

The pegword lists are generated from words that are easy to associate with the numbers or letters. Peg lists created from letters of the alphabet or from rhymes are very simple to learn, but are limited in the number of pegs they can produce. While it is a little more complicated to learn the simple rhymes or alphabetic pegs, it is limitless in the number of pegs it can produce. Learners can also be asked to use other things as peg list, for example; their nuclear family members starting with father, mother, eldest sibling to the last born, and when the nuclear family list is exhausted, they can turn to their extended family members and make more pegs to hook the content to be learned. In the current, study the researcher used the famous pegs which were developed by Miller, Galanter and Pribram (1960). The content used was standard seven first term syllabus. To remember accurately and rapidly memorize a list of arbitrary objects, each one is associated with the appropriate peg. Pegword list only has to be memorized once and can then be used over and over every time a list of items needs to be memorized.

The pegword Mnemonic has been specifically applied to psychology learning in the case of Erikson's eight stages of psychosocial development. For example, for the *trust* stage, one could imagine "an infant lying in a perfectly, *trusting'* position while mommy powders his little behind (*buns*)" (Carney et al., 1994, Table 2, p. 173). The learning of any set of ordered items can potentially benefit from the use of pegwords.

Milleret al. (1960) rekindled the interest of psychologists in the pegword Mnemonic technique based on the children's poem "one-bun, two-shoe, three-tree,… ten-hen".

Subsequent studies by Bugelski, Kidd and Segmen, (1968) demonstrated both the efficacy of this imagery technique and the relative efficiency of such procedural variations as a function of the rate of presentation of the words to be memorized. The Bugelskiet al. (1968) technique involved requiring college students to learn a list of words paired with their ordinal position for example, 1-pencil, 2-house, 3-apple, etc. When the experimenter called out "three", the subject was to respond "apple". The experimental design called for one third of the 5s to learn the "One bun" poem until they could correctly recite the poem on five successive trials. Next they were taught to visualize the to-be-learned words interacting in some way with those peg-words. In the above instance, pencil might be visualized as interacting with one-bun as a "pencil sandwich," house might be visualized as being a "shoe house," and so on. The findings revealed significant differences between experimental group and control group in favor of the experimental group.

Earlier studies have demonstrated successful use of pegword Mnemonic using university students to study psychology courses. In the current study the researcher has demonstrated how pegword can be used at lower levels i.e. by using participants from upper primary school pupils to learn and retain mathematics and Social Studies content. Pegword has also been compared with keyword and music Mnemonic techniques to establish which one among the three is most appropriate.

2.3.5 Music Mnemonic Technique

The third technique used in this study was Music mnemonic technique. Winoto, Yudiarso and Sugoto (2017) define music mnemonic as a method of remembering information by making the information into a song. Winoto, et al. (2017) added that Music mnemonic involves composing songs as a method of adding variety to classroom teaching and learning process into any subject and for any class size. Songs are composed using popular tunes but a novel lyric is very appealing to our 21st century learners as it engages them through multiple modalities namely; auditory, kinesthetic and visual learning styles (Crowther, 2012).

Music has even been used by notable personalities such as National Institutes of Health Director Francis Collins, who occasionally sang to students at the University of Michigan "to break up the monotony" (Anonymous, 2011). Any tune can be used, as long as it is familiar to students. The music technique has been tried for students in University, Diploma programmes, and for training sessions for academic and non-Academic staff.

Music mnemonic technique has been supported by physiological, neurological and behavioral studies and it is known to reduce stress in students (Savan, 1999; Russell, 1992; Albers & Bach, 2003). Research has shown that music reduces blood pressure, heart rate and body temperature in students (Savan, 1999). Music is also known to reduce great levels of anxiety (Russell, 1992). Russell investigated, to the effectiveness of using music to reduce anxiety among 265 university students. His findings showed that using music among highly anxious students might be an effective and alternative method to reduce anxiety. There is therefore the need to be innovative in traditional teaching that can cater for our 21st century learners that have such diverse learning

styles and short attention spans. The objective of this study is to compare music mnemonic technique with keyword and pegword and to establish which mnemonic technique is most appropriate for Free Recall and Serial learning as well as Social Studies and mathematics.

Sacks (2007) described how music enhances performance of the brain. When music enters in the memory system it can easily be understood in the brain compared to other forms of content. Sacks (2007) explains that the song in which lyrics have been replaced by the content that is about to be put into memory, has a chunking effect to the memory of the learners. This is due to the repetitious process of learning songs during entering information from Short-Term to Long-Term Memory. Chunking effect is related to the grouping of melodies with the existing content in the lyrics of the songs. This causes the pupils to recall more easily with the existence of facilities such as music.

Tsin and Isabel (2015) conducted an Action Research on 95 Monash University first year (Science) students in Sunway College. Majority (83%) of the students revealed that songs added variety to teaching. About (83%) indicated that music lowered tress and boredom levels and they understood and retained key information better. A majority (88%) of the students indicated that songs were enjoyable in the classroom. Research from Wolters and Rosenthal (2000) also concurred with Tsin and Isabel (2015) that students who were unwilling to read a textbook chapter might listen to a related song repeatedly. Tsin and Isabel (2015) suggested that a music strategy can be applied to specific topics for all subjects especially those topics which appear to be challenging to students in order to supplement the rehearsal with music. This is because they could remember lyrics of songs upon listening to them repetitively.

Crowther (2012) suggested that songs make recalling of facts easier than the traditional methods of rehearsing content. They are also organizational mnemonic devices. The same method that students use to remember the lyrics of their favorite song can also be used to remember their content for long term memory retention and retrieval. However, this technique is time consuming. Hence it cannot be used for all topics. It takes a lot of time and intellectual effort for a teacher to compose songs and train the learners in class. In addition, not all complex facts can be easily incorporated in a song. Therefore, diagrams, tables and charts may need to be used instead to make certain points as clear as possible to learners.

Music Mnemonics are used to help students recall important details to main ideas and many learners have made songs out of information when a list of items must be learned. Advertising on radio and TV use music to help potential customers remember their products when shopping. Songs or jingles are made using any type of music you choose for any list of items (Congos, 2014). Music Mnemonics are appropriate for long lists. For example, it will involve putting Social Studies class six syllabus in song lyrics.

Winoto, et al (2017) in their comparative study to compare the effect of music Mnemonic and Flash Cards in fourth grade students' English vocabulary acquisition used quasi-experimental research design. They compared the pre-test values with the post-test values obtained after treatment conditions. The findings showed that music mnemonic group had the highest increase, followed by card method group and control group recorded the lowest increase.

According to Stegemöller (2014), music promotes neural plasticity in three key ways: by promoting dopamine production which is vital for the brain's ability to make new

neural connections; by enhancing the ‘‘Hebbian Theory” which is the increase in synaptic efficacy arising from the presynaptic cells and persistent stimulation of the postsynaptic cell and by ensuring a clear, structured signals in the brain. Researchers have also used songs and melodies as memory devices to aid in the encoding and decoding of semantic information (Jellison, 1976; Claussen & Thaut, 1997; Gfeller, 1983). Specifically, for Attention deficit children, music was used to promote social skills (Brownell, 2002; Pasiali, 2004; Kern, Wolery, & Aldridge, 2007; Schwartzberg & Silverman, 2013) and increase both short-term and long-term memory recall (Schwartzberg & Silverman, 2012). Previous research studies have concluded that more accurate working memory is demonstrated during primacy (i.e., the first time the information is presented) and recency (i.e., the most recent information presented) serial positions (Jellison, 1976; Miller, 1956; Schwartzberg & Silverman, 2012; Silverman & Schwartzberg 2014a, 2014b; Ward, 2002). Therefore, targeted information to-be-learned should be placed in positions of primacy and recency to increase the potential for recall and subsequent learning. Music mnemonic technique is said to promote primacy and recency.

Previous research has also shown that music can be used to boost verbal memory not only in patients with memory deficits, such as those with Alzheimer’s disease and Attention Deficit; (Simmons Stern, Budson, & Ally, 2010; Thompson, Moulin, Hayre & Jones, 2005), but also in conditions where memory is not impaired, (Sarkamo et al., 2008) and multiple sclerosis (Thaut et al., 2009). In addition, music has been widely used as a tool for therapeutic process for aphasic patients (Hillecke, Nickel, & Bolay, 2005; de l’Etoile, 2010; Thaut, 2010; Hurkmans et al., 2011; Altenmuler & Schlaug, 2013).

The use of music is well known to have a positive effect on mood and arousal (Koelsch, 2009; Sarkamo et al., 2008). Music is also known for recruiting spared language homologue areas in the right hemisphere following a left hemispheric lesion (Altenmu ¨ller and Schlaug, 2013; Stahl, Henseler, Turner, Geyer, & Kotz, 2013; Zumbansen, Peretz, & He´bert, 2014).

Music Mnemonics are used to help students excel and build their knowledge in all content areas. This method of teaching helps students to commit new information to memory and continue to use this material throughout their lives. Music is a cohesive way to teach learners the required standards in core areas as well as maintain a well-behaved classroom (Waite-McGough, Arianne, 2006). According to Mastropieri and Scruggs (1989), rhyming song lyrics act as Mnemonic techniques which tap into the power of rhythm. Music Mnemonics is the learning tool that engage learners with a song, and enhance memory recall (Cirigliano, 2013).

Yeoh (2014), in his study to investigate effect of musical Mnemonics in facilitating learning of transcription of RNA, used sample of 78 subjects. Half were assigned experimental group and half control group. The results showed that the scores of the control group were normally distributed (Shapiro-Wilk statistic = .951, p = .087>.05) but the scores of experimental group were negatively skewed (Shapiro-Wilk statistic = .233, p = .0005). The skewness = -4.233, kurtosis = 16.779). A Mann-Whitney test was carried out to evaluate the scores of the two groups. A significant effect was found: W (76) = 780, Z = -8.066, p =.0005.

Although music Mnemonic has been found effective in enhancing recall, in the current study the researcher sought to find out whether music Mnemonics was most appropriate

in recalling contents in Free Recall and serial learning tasks and whether it was appropriate for learning of Social Studies as well as mathematics.

2.4. Mnemonic Instructions Techniques in Teaching and Learning

According to Lubin and Polloway (2016), mnemonic instruction includes a variety of strategies that are applicable across multiple settings and may be used effectively with students with varying abilities. This section highlights general information about the utility of mnemonics. Amirousefi and Ketabi, (2011) pointed out that there are five classes of mnemonics that teachers may employ: linguistic, spatial, visual, physical response and verbal methods. Linguistic mnemonics, such as the pegword and keyword methods, involve associating the new concept with familiar words and/or phrases to help remember the item. Spatial mnemonics, which include the loci, spatial grouping and finger methods, involve connecting the new concept to a familiar place, pattern or finger to help in memorization of the material. Visual mnemonics make use of pictures or visualizations to create an association to the target concept (e.g., symbolics, pictographics). The verbal method uses meaning and stories to help students remember, with methods such as grouping or semantic organization and story-telling or narrative chains. Physical response methods make use of the body parts to aid in remembrance, either through movement or physical sensation. These five types of mnemonics are illustrated in figure 2.1.

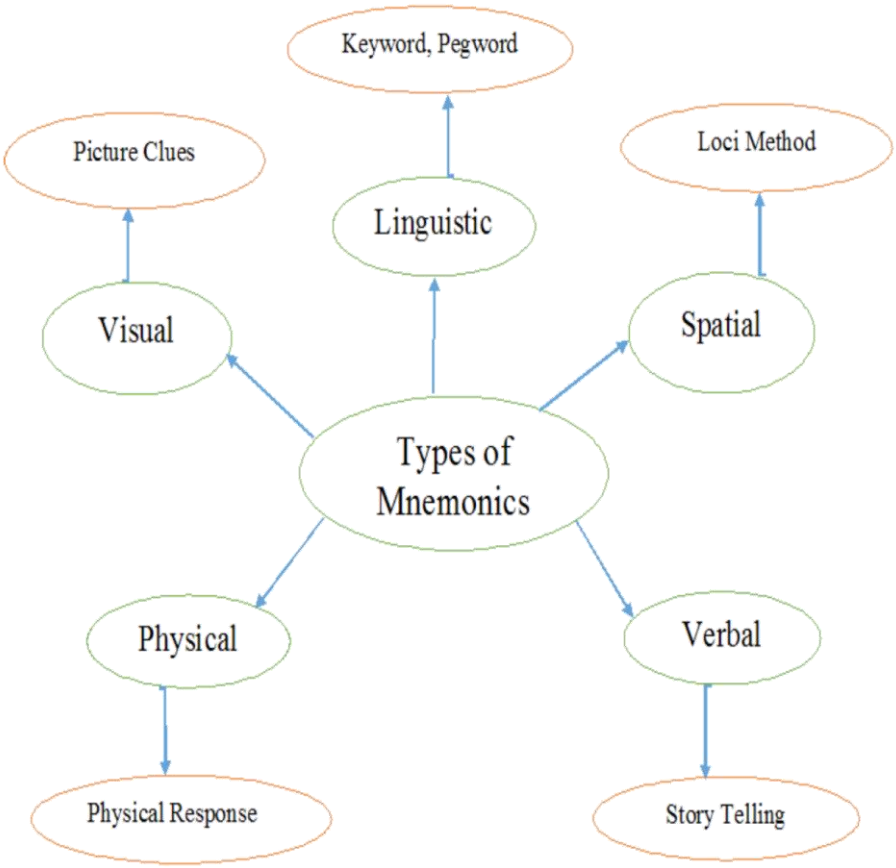


Figure 2.1: Types of Mnemonic Techniques

Source: Amirousefi and Ketabi, (2011)

Evident from the figure above is the different manner in which mnemonics have been conceptualized. In Table 2.1 Descriptions of Popular Mnemonic Techniques and Systems, Putnam (2015) gives a categorization that differs from that provided in table 2.1 by Lubin and Polloway (2016), yet in practice, the use of mnemonics is a shared practice.

Lubin and Polloway (2016) explains that mnemonic instruction uses memory devices that may help students learn a significant amount of information as well as increase long-term retention. Mastropieri and Scruggs, (1991) suggested that mnemonics may assist with both storage and retrieval of information. This way, mnemonic has been

used to promote as a way to assist especially those students who do not meet the minimum requirements with regard to their academic progress. Such learners often fail to develop the knowledge, skills, will, and self-regulation necessary to succeed in key subject areas. They could exhibit difficulties in specific areas (e.g., reading, mathematics) and would thus may be referred to as having a learning disability (LD). Or they may be identified as having a mild intellectual disability (MID) (Grünke & Morrison Cavendish, 2016). The finding that the use of mnemonic instruction could be useful in assisting learners with special needs informed the current study in investigating how learners with different learning disabilities in Machakos Sub-County could be helped to improve their learning outcomes. However, the study was not on any such specific case or form of learning disability and therefore, the findings were generally considered.

Lubin and Polloway (2016) argues that in any case, mnemonic instruction can be very effective to use for students who have problems in remembering information given that there are many subject area concepts to be learned, students are often unfamiliar with the content, and the information is often complex. Accordingly, therefore, mnemonic instruction has been proven to be a research-based method for teaching students with different kinds of disabilities (Brigham, Scruggs, & Mastropieri, 2011; Conderman, & Pedersen, 2005). It has been used in special and general education for decades as a way to convert difficult-to-remember concepts into more memorable ones.

Mnemonic instruction may be used by both general education and special education teachers. Given the degree of inclusion of students with learning problems, clearly much of the instruction for the students will occur in general education classrooms. Further, mnemonic strategies may be used broadly across subject areas in lessons where

new vocabulary, technical terms, the names of people places or things, number patterns and formulae need to be learned. In general, mnemonic instruction has utility for any academic task that requires factual recall of information and has been found to be effective in enhancing performance across subject areas (Therein, Taylor, Hosp, Kaldenberg, & Gorsh, 2011). The principal goal of mnemonic instruction is to help students remember facts and concepts and this goal is imperative to school success as there is content in every area that needs to be memorized and quickly retrieved. The proven effectiveness of mnemonic instruction makes it a valuable tool in the classroom (Lloyd et al., 1998 quoted in Lubin and Polloway, 2016).

Bakken and Simpson (2011) explains that mnemonic strategies are systematic procedures for enhancing the memory and making information more meaningful. Their particular use is in developing better ways to encode information so that it will be much easier to retrieve and remember the information. Although there are many different retrieval strategies that can be implemented to attempt to retrieve forgotten information, research has demonstrated that the way information is initially encoded facilitates memory and the recall of this information better. Bakken and Simpson (2011) further emphasizes that the fundamental aspect in developing mnemonic strategies is to find a way to relate new information to information that is already in the long-term memory of students. If this connection can be made, the memory of this information has the potential of being remembered for a very long time. This account by Bakken and Simpsons (2011) informed that current study in investigating conditions which could make the use of mnemonics in improving learning outcomes in Mathematics and Social Studies.

According to Laing (2010), mnemonics instruction with school age students is commonly implemented as an instructional strategy for teaching word recognition and vocabulary. The effectiveness of the use of these strategies is well documented. Research shows that students, including secondary and college level, remember 2 to 3 times as much factual information, maintain information over delayed recall periods, and enjoy using them. Many research findings discussed in this chapter provide evidence that instruction involving the use of mnemonic devices does enhance a student's formal reasoning skills and that this has the potential for application of knowledge to more varied tasks. The observation by Laing (2010) corroborates well with that of Higbee (1994) when he observed that the use of mnemonics with college age students might have enough potential for making learning easier and possibly more fun.

Bakken and Simpson (2011) draws our attention to the effect that mnemonic strategies do not represent a "philosophy" of education. Mnemonic strategies should be implemented for only one reason: to help people remember to-be-learned information. Mnemonic strategies are also not an overall teaching method or curricular approach. The focus of mnemonic strategies is so specific that they are intended to be implemented to enhance the recall of the components of any lesson for which memory is needed. It should be noted that students who are trained mnemonically also perform better on comprehension tests of that specific content (Mastropieri, Scruggs, & Fulk, 1990), but that is generally because the implementation of the mnemonic strategies helps them remember more information that can be applied on comprehension tests.

The above mnemonic instructions formed the bedrock upon which discussions on appropriateness of the techniques covered in this study were done as follows:

2.5 Appropriateness of Keyword, Peg word and Music Mnemonic Techniques on Free Recall Learning Outcomes

According to Lervag and Hulme (2010), Free Recall learning is an unstructured form of verbal learning, one can recall words in any order they would like. Although it is different from serial learning, Free Recall tasks will also show a serial position effect similar to that obtained with serial learning. In addition, a serial position effect similar to that obtained with serial learning, (Chazin & Neuschatz 1990)**,** Free Recall is facilitated by several factors viz; the more an item is rehearsed, the greater the likelihood that the item will be recalled. Organizing information into some type of meaningful system also enhances recall ability. Some organizational heuristics include:

i. Associative Clustering which involves putting presented stimuli together in a manner that utilizes preexisting associations.
ii. Categorical Clustering which involves breaking a large number of specific words down into several smaller groups organized by conceptual similarity, such as schools, cities, among others.
iii. Subjective Organization which involves using idiosyncratic associations that are relevant only to individuals.

In a study by Monica, Melby and Charles (2010) to investigate the interrelationships between verbal memory (as measured by Serial and Free Recall tasks) children were assigned to three groups and given training on unfamiliar words (phoneme-awareness training, rhyme training, vocabulary training and an untrained control group). Before and after training, the children performance was assessed for Serial learning and Free Recall tasks with these words, as well as their ability to define the words, manipulate phonemes in them and generate rhymes for them. The results showed that, phoneme-

awareness training improved serial recall substantially and improved recall to a lesser extent. In contrast, vocabulary training produced a substantial increase in Free recall and a lesser increase Serial recall. These effects on recall were specific and did not generalize to untrained words. Rhyme training produced in rhyming skills but no increase in either serial or free recall. The findings also showed that Serial and Free Recall learning depends on common mechanisms, but Serial Recall relies more on phonological codes and Free Recall relies more on rehearsal. In the current study, three Mnemonic techniques: Pegword, keyword and music were compared with Free Recall learning outcome at two levels viz: Immediate and delayed recall.

A study to investigate effectiveness of Mnemonic techniques in Learning by disabled and non-disabled Adolescents was done by Elliott and Gentile (1986). A sample of 60 junior high school students was studied. Half of the students had learning disability while the other half were non-disabled. Half the students were taught the peg-word rhyme, and practiced visualizing four target lists of words interacting with the rhyme words. The other half of students were used as controls; learning the list in whatever way they chose. Retention tests were conducted immediately after the last list was learned, one week later, and five months later.

In a 2 x 3 analysis of variance, all main effects in depended groups and interaction effects were significant. The peg-word Mnemonic technique increased the memorability of paired-associates learning for both groups, by a factor of 2.3 vs. 2.4 at the immediate retention interval, with differential longer-term retention slightly favoring the non-disabled. In the current study, main effect of both Mnemonic techniques and type of assessment (immediate and delayed recall) were examined

separately and conjoined. The interaction effect between mnemonic techniques and type of assessment was also examined.

Carney and Levin (1998) tested the use and impact of keyword Mnemonics for study of brain structures and functions. For example, to remember the function of the *medulla*, one could use the keyword medal, and then imagine a runner winning a race, breathing heavily and with his heart pounding, then bending over to have a medal hung around his neck. After a 2-minute delay, both the keyword and the keyword-plus-image group which were similar in performance outperformed the control group using a rote repetition strategy, on definitional and applied test items. Because Carney and Levin's (1998) results did not suggest that instructor-provided imagery added to the keyword's helpfulness, they recommended that instructors teach the keyword method and provide the specific terms and relevant keywords for the to-be-learned material, so that learners can create interactive images on their own.

In a study by Shriberg, Levin, McCormick, and Pressley (1982), eighth grade students were presented with short passages describing the names and accomplishments of fictitious people. The keyword adaptation consisted of translating the "famous" person's surname into a concrete keyword, and then creating a pictorial relationship between the keyword and the person's accomplishment. Thus, to remember that Char-McKune was famous for owning a counting cat, *McKune* could be "keyworded" as *raccoon*, and one could then picture a cat counting raccoon jumping over a fence. In the Shriberg et al. (1982) study, students who were shown actual keyword illustrations of this kind recalled over three times more name-accomplishment information than did non-strategy control subjects. Moreover, subjects who were instructed to generate their own keyword images recalled more than twice the information recalled by the controls.

In the current study, teachers were supposed to use mnemonic techniques already provided by the researcher other than asking pupils to generate their own strategies in order to ensure uniformity.

Carney and Levin (2008) investigated the Short-Term and Long-Term benefits of keyword Mnemonics, using phobia words as stimuli. For example, to remember *harpaxophobia which* refers to the fear of *robbers*, one could imagine *robbers* stealing a lovely *harp*. Three experiments showed significant advantages of the keyword Mnemonic over a repetition condition, on immediate and two-day-delayed tests of forward recall, inferential matching, categorization, and backward recall. Given that their results uniformly and strongly supported the advantages of the keyword Mnemonic in a variety of immediate and delays recall contexts, the researchers cautioned instructors against avoiding Mnemonics due to "*Mnemonophobia*."

McCabe, Osha and Roche (2013) extended the work of Carney and Levin (2008) by adding hand gestures to keyword Mnemonics using similar phobia terms and keywords. He compared a gesture condition, in which an actor read aloud the imagery sentence while incorporating iconic hand gestures to a non-gesture condition, in which the actor read the sentence aloud with no gestures. Gestures were advantageous on the 10-minute delayed test, although not at the 1-week-delayed test. Carney and Levin recommended further investigation on whether adding hand gestures to Mnemonics is helpful for long-term memory, and whether it is beneficial for learners to do the hand gestures themselves, compared to observing the gestures being performed.

Balch (2005) investigated the keyword Mnemonic using undergraduate Introduction to Psychology students. The students encoded various psychology terms (e.g.,

experimental method terms, brain terms, psychological disorders, and psychotherapies). Keyword Mnemonics, paraphrases, and twice-repeated definitions (control condition) were provided by the instructor. Results showed that performance of definitional and applied multiple choice questions were equivalent for the example and keyword Mnemonic conditions, and these levels were significantly better than the control condition. Students rated Mnemonics as very helpful, and repeated definitions as less helpful. However, as mentioned earlier, students showed a meta-cognitive disconnect in rating paraphrases higher than twice-repeated definitions, even though objective test scores showed no difference in the two conditions.

McCabe et al. (2013), in a study to explore the use of Mnemonic in studying Introduction to Psychology course unit, extended Balch's work, and conducted a study that compared three conditions when learning brain terms in Introduction to Psychology: simply reading instructor provided examples and keyword Mnemonics, self-generating examples, and self-generating keyword Mnemonics. Results indicated a learning advantage on a structure-to-function matching test at both a 10-minutes delay and a two-day delay recall for the generate-keyword condition. However, the read-only and generate-example conditions were lower and similar to each other. Thus, for keyword Mnemonics, as with acrostics, evidence suggests that self-creation is beneficial for learning.

Sears, Mercer, and Sindelar (1992) conducted a study to investigate effectiveness of keyword Mnemonics by learning disabled students in science subjects. Sears et al. (1992) used a sample of 37 students of seventh and eighth grades, which included 34 males and 3 females. Results showed that there were significant favourable results for imposed and induced keyword methods compared to systematic teaching. In the current

study, the researcher intended to compare the effectiveness of three imaginary Mnemonic techniques with Free Recall and Serial learning outcomes.

A study by Elhinney and Annett (1996) to investigate effect of music Mnemonic on recall learning outcomes material which contained no unfamiliar words over three presentations used a sample of 20 participants with an average age 21.9 year. They were randomly allocated to one of two experimental and control conditions. They were required to remember lyrics either being sung or read aloud without musical accompaniment. Analysis of both total number of words correctly recalled and the extent of chunking of recalled material showed better over-all recall in the song condition with evidence of greater chunking of material.

A study was done by Chazin and Neuschatz (1990) to investigate the effect of a music Mnemonics on the recall of unfamiliar scientific information. The sample composed of 18, 20, 26 and 28-year old, who were divided into four different groups: Older Song Group, Older Lecture Group, Younger Song Group, and Younger Lecture Group. Both the lecture and the song presented to the subjects included minerals, colors, and other related information to be recalled. The researcher used 2×2 factorial design. for test analysis. The results showed information learned in a song increased recall rate lecture.

In another study by Rainey and Larsen (2000) to determine the effect of familiar Melodies on Initial Learning and Long-term Memory for unconnected text. In their two experiments, they hypothesized that, music in the form of a familiar melody, can serve as an effective Mnemonic technique. Participants learned a list of names that they heard either spoken or sung to a familiar tune. In experiment 1, the melody was "Pop Goes the Weasel"; in experiment 2, the melody was "Yankee Doodle." They measured the

number of trials to learn the list initially and the number of trials to relearn the list a week later. In both studies, there was no advantage in initial learning for those who learned the names to the musical accompaniment. However, in both studies, participants who heard the song version required fewer trials to relearn the list of names a week later than did participants who heard the spoken version.

In the current study, pupils were given content drawn from the standard seven term one syllabus. Songs were compiled from the content and put in a CD. The pupils were asked to listen to the music lyrics until they are able to master the melody. The music mnemonic technique was compared with keyword and peg-word Mnemonic techniques and control conditions to try to establish which of the three Mnemonic technique was more appropriate for serial recall learning tasks.

Scruggs and Mastroprieri (2004), conducted a study on usefulness of Mnemonic technique on high school students with learning disabilities. Over a six-week period, students were taught the vocabulary words using either traditional instructional approach for control group where else experimental group was taught using pictorial Mnemonic keyword technique. At the end of the instructional period, post-test showed that there was significant difference between the two groups in favour of experiment group. Rummel, Levin and Woodward (2003), conducted experiment using college students to read a historical passage on aspects of human intelligence. Students were randomly assigned to two different instructional conditions, Mnemonic techniques and traditional methods. Findings showed that Mnemonic techniques are useful in improving students' memory.

Although literature existed on Mnemonic techniques enhancing and improving memory, literature reviewed did not report the appropriateness of the three Mnemonic techniques on Free Recall learning outcomes, hence the researcher sought to fill this gap by investigating the appropriateness of the three Mnemonic techniques on Free Recall learning outcomes for both immediate recall and delayed recall.

2.6 Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Serial Learning Outcomes

According to Chazin and Neuschatz (1990) Serial learning involves having subjects learn a list of items according to the order in which the items appear in the list. Thomson continues to say that early and late items may not have to compete as much for rehearsal resources as the middle items. Middle items have more of a likelihood of being interfered with by earlier and later items, while the initial and terminal items do not have to face as much interference. Ebbinghaus (1985) has argued that the serial position effect is due to the working of different memory systems. Levin and Cormick (2009), designed a study to explore issues regarding use of Mnemonic techniques in a systematic procedure for improving one's memory. Seventh and eighth grade students were presented with fictitious biographies to remember. Keyword students were instructed to use a prose-learning adaptation of the Mnemonic keyword method while and control students were left to their own devices.

In the initial experiment, each of three variations of the keyword method, differing in terms of the manner in which the Mnemonic images were organized, resulted in significantly higher levels of recall than did control instructions. Moreover, the keyword groups could be distinguished from the controls, as well as from one another, on the basis of qualitative differences in their recall patterns. The researcher in the

current study compared pegword, keyword and music Mnemonic techniques on Serial learning outcomes for both immediate and delayed recall to establish which mnemonic technique among the three is most appropriate for Serial learning tasks.

Delin (1990) used a sample of 72 male first-year psychology students aged between 18 and 22 years to investigate the effects of Mnemonic instruction and items lists on Serial learning and retention. Subjects with and without Mnemonic instructions learned lists of either 10 to 16 nouns by the anticipation method over four trials. Six weeks later they relearned the lists. Mnemonic instructions facilitated both learning and relearning, but the relearning effect may have depended on the learning effect. The longer lists were more difficult for both Mnemonic and control groups to learn, but there was no clear difference on relearning. Mnemonic instructions were associated with flattening of the serial-position error curves on both learning and relearning, and with differences in the types of error made by the groups. In the present study, the researcher compared serial learning outcomes with three Mnemonic techniques in both immediate recall and delayed recall of three weeks.

McReynolds and Acker (1959) in a study they conducted, used a sample of 50 comprising 36 men and 14 women to investigate Serial learning under conditions of rapid presentation of Stimuli; with the ratio between inter-stimulus interval and duration of exposure held constant. In the first experiment, subjects were exposed to 12 syllables for 0.082 seconds each, using intervals of 0.30, 0.69, and 1.45 seconds between their successive exposures.

The findings revealed that the amount learned increased with the length of the intervening interval. In the second experiment utilizing the paired-associates learning

had intervals of 0, 1, 2, 3, 4, and 5 seconds between the successive members of each pair. Under these conditions, they found that learning proceeded best with shorter intervals. The third experiment used a continuous belt of motion-picture film to present 10 pairs of stimuli. Each frame was exposed for 0.41 seconds, with the intervals between the members of the pairs varying in three conditions, from 2.55 to 4.93 seconds and the intervals between successive pairs being 5 seconds. The findings revealed that learning was best for the longer intervals. In the fourth experiment utilized 12 nonsense syllables under two different speeds of presentation 2 and 4 seconds and found errors to be notably less for the longer interval. In the current study, the researcher investigated the appropriateness of three Mnemonic techniques on Serial learning in two levels of immediate recall and three weeks delayed recall.

Roediger (2014), Carried out a research to investigate the effectiveness of Mnemonics in Serial learning. They used sample of 150 undergraduate students who were given instructions in using 1 of 4 Mnemonic techniques: imagery, the link method, a peg system, or the music. With a relative control, all Mnemonic groups showed an advantage in memorizing 20-word lists for Free Recall. However, the greatest differences appeared when recall was scored by a strict positional criterion (Serial learning) whereby subjects received credit for recalling a word only when it was placed in its correct position. By this scoring method, peg and loci subjects performed best on an immediate test, and the imagery and control group was worst.

Another study by Levin, Shriberg, and Berry (1983), eighth graders were presented with prose passages describing the distinguishing attributes of several fictitious towns (e.g., the town of Fostoria was noted for its abundant natural resources, advances in technology, considerable wealth, and growing population). In the Levin et al. (1983)

study was considerably more abstract because more than one attribute had to be associated with each town name. Levin et al. (1983) obtained impressive keyword illustration advantage on both attributes of matching and recall tasks in the two experiments.

Unlike the Shriberg et al. (1982) passages where a single attribute was paired with the corresponding keyword, in the Levin et al. (1983) passages several attributes had to be integrated with the corresponding keyword. Bower (1972) termed this kind of multiple attribute pairing as "grand imaginal scene." Based on the verbal learning literature concerning the benefits of multiple item elaboration (Levin & Rohwer, 1968; Bower & Clark, 1969). It was expected that keyword integrated factual passages would also facilitate students' recall, and indeed they did. In the current study, the researcher has attempted to find out whether differences exist between learners using the three Mnemonic techniques with Serial recall tasks at two levels of assessment: immediate and delayed recall. The interaction effect between Mnemonic techniques and two levels of type of assessment was also examined.

2.7 Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Mathematics

Mathematics, is an important foundational skill to perform in our everyday life. Being skilled in mathematics is very important to general academic success in school, postsecondary opportunities, and can lead to better future employment (Rivera-Batiz, 1992; National Mathematics Advisory Panel, 2008; Geary, Hoard, Nugent & Bailey, 2012).

However, a significant number of students have difficulties learning basic mathematics skills in primary school. Unfortunately, mathematics challenges often continue on into the secondary levels (Bryant, Bryant, Shin, & Pfannenstiel, 2015).

In 2017, the National Assessment of Educational Progress reported that, 40% in the fourth, 34% in the eighth, and 25% in the 12th grade scored "at or below proficient" on the mathematics assessment test (National Center for Education Statistics, 2017). For students identified with disabilities, who historically perform below their peers (Hunt, Valentine, Bryant, Pfannenstiel, & Bryant, 2016; Wagner, Newman, Cameto, Levine & Garza, 2006; Wei, Lenz & Blackorby, 2012), the data is even more disappointing. Specifically, over 90% of students with learning disabilities in the fourth and eighth grade perform below the "proficient" level in overall mathematics learning outcomes, with 56% of fourth grade students and 74% of eighth grade students with learning disabilities scoring below the minimum cut point, (Horowitz, Rawe & Whittaker, 2017).

Students with mathematics learning disabilities have difficulties in learning mathematics concepts (Jitendra, Nelson, Pulles, Kiss & Houseworth, 2016) and consistently show poor academic performance in other science related content. Deficits in attention, poor working memory and language, and inadequate acquisition and language hamper mathematics learning for these students (Geary, 2003). In order to support students with learning disabilities in mathematics instruction, several research-based interventions (e.g. individualized instruction, cognitive strategies, peer-tutoring, graphic organizers) have been identified to enhance students' mathematics learning outcomes. (Myers, Wang, Brownell & Gagnon, 2015; Watt, Watkins & Abbitt, 2016;

Marita & Hord, 2017; Jitendra, Lein, Im, Alghamdi, Hefte & Mouanoutoua, 2018; Stevens, Rogers & Powell, 2018; Cook, Collins, Morin & Riccomini, 2019).

More recently, studies have also explored innovative uses of technology to aid student learning in mathematics (Kiru, Doabler, Sorrells, & Cooc, 2018; Ok, Bryant & Bryant, 2019). However, research on appropriateness of mnemonic technique mathematics learning outcomes has been found to be scanty. It is this reason the current study sought to investigate the appropriateness of mnemonic techniques on mathematics learning outcomes.

In mathematics instruction, a commonly used letter strategy is the FOIL method, which stands for First, Outer, Inner, and Last (Betz, 1929). This is made to help students remember the sequence of multiplying two binomials in algebra in high school level. In Japan, the use of Yodai mnemonics has also shown great deal in improving mathematics instruction among Japanese students, (Higbee & Kunihira, 1985). Extensive research has been conducted in the area of mnemonic instruction for students with learning disabilities since 1980s; with most of the research studies focusing on vocabulary, Social Studies, and science instruction (Scruggs, Mastropieri, Berkeley & Marshak, 2010). In these academic areas, mnemonic techniques have been proven to be an effective research-based intervention (Mastropieri & Scruggs, 1989; Scruggs & Mastropieri, 2000; Wolgemuth, Cobb & Alwell, 2008). The purpose of this study is to fill this gap by investigating appropriateness of mnemonic technique on mathematics learning outcomes.

Greene (1999) compared the effects of a pegword mnemonic technique strategy to conventional instruction to teach multiplication facts to 23 elementary and middle

school learning disabled students. The students were assigned randomly to the two groups, both of which received conventional instruction and mnemonic technique strategy in a balanced fashion. A pre-test was administered in both groups. Seven learning trials were done and a review of the multiplication facts was also done. At the end of the sessions a post-test was administered. Participants' recall of multiplication facts was assessed after 90 seconds, 24 hours and seven days' delay period. Findings indicated that students retained more multiplication facts when they learned with the mnemonic technique strategy than with the traditional strategy at post-test, in 24 hours, and seven days delayed tests.

A multiple-baseline across participants' design was used by Irish (2002a) to evaluate the effectiveness the pegword and keyword mnemonic strategy which was computer-based in teaching multiplication facts. Three non-disabled and three learning disabled elementary students participated in the study. In the baseline stage, the students received traditional method on multiplication facts. A computer-based quiz to assess students' recall of multiplication facts was administered later. During treatment conditions students were taught multiplication facts using a software, Memory Math (Irish, 2002b) that employed pegword and keyword mnemonics techniques. After the intervention session, students completed a computer-based quiz. A review of the mnemonics was also administered three times a week during intervention.

The maintenance phase was conducted upon completion of the intervention followed by a one-week follow-up. Findings revealed that the computerized keyword and pegword mnemonic strategy was effective in increasing the recall of multiplication facts for the three students who were learning disabled. However, the largest accuracy increase from baseline to treatment condition was demonstrated by two of the students

with learning disabilities. Gains in accuracy across all students continued to increase with increase in the maintenance and follow-up phases. In addition, students in the three phases were administered paper-and-pencil tests to evaluate generalization from the computer-based format. All students, including the learning disabled improved their recall accuracy from pre-test to post-test on the paper-and-pencil probes, which were sustained during the maintenance phase.

Willott (1982) used a sample of 15 elementary students who were learning disabled. He used single-group within-subjects and single-factor repeated measures design to investigate the effects of the use of a pegword mnemonic versus recitation on the recall of multiplication facts. The first session involved six multiplication facts which were taught using numerals for both factors and products. In the first session, a total of four trials were administered. In each trial was taught the six multiplication facts. Each multiplication fact was presented for 10 seconds in a slide and stated by the teacher. A black slide was displayed for another 10 seconds as the teacher instructed the learners to mentally internalize the multiplication fact. After every trial, both an oral and a written test were administered. At the end of the first session, the students were taught the pegwords and rhymes associated to four of the products to be remembered in the second session. In the second session, the students reviewed first pegwords and rhymes until achieving 100% accuracy. Of the six multiplication facts taught in the second session: two facts displayed the factors as numerals and the product as pegwords, another pair displayed the factors as pegwords and the product as a numeral, and the remaining pair displayed both factors and product as pegwords. Four trials were conducted, each trial introduced the six multiplication facts in a random order alternating between modes.

Presentation of multiplication facts followed similar procedures to those in the first session, but the instructor used pegwords and rhymes instead of numerals to state factors, products or both accordingly. Both oral and written tests were conducted immediately after each trial. One-week delayed oral and written post-tests were administered after completing the second session. Analysis of combined oral and written responses of immediate and delayed post-tests showed that in general, multiplication facts presented with pegwords for both factors and products were recalled more effectively than multiplication facts presented in the other three modalities. However, an analysis of the delayed post-tests only was not provided, thus, lasting effects over time could not be determined. Some limitations are worth to be mentioned. First, students learned the pegwords of factors and products in the N-P and P-P conditions at the end of the first session prior to intervention, which might have facilitated their recall during intervention and at post-test. Second, the number of multiplication facts learned were inconsistent across conditions. In the N-N condition students learned six multiplication facts versus two multiplication facts in each of the other three conditions, P-N, N-P, and P-P. The smaller number of multiplication facts in these conditions might have favored memorization. In light of these limitations, the current study was carried to compare three mnemonic techniques in relation with learning mathematics concepts. The study was designed in such a way that the mathematics concepts to-be-learned were uniform across all the three mnemonic strategies.

DeLashmutt and Nebraska (2007) did a study on the role of Mnemonics in Learning Mathematics. Their findings suggest that Mnemonics helps many students, but not all of them. Some of the students would rather just learn the mathematics concepts, instead

of having to learn a form of Mnemonics to remember the concepts. The research findings revealed that some students in the lower levels used Mnemonics to help retain key mathematics concepts.

Irish's (2002) study to investigate the effective use of pegword and keyword Mnemonic techniques to study basic multiplication facts. Irish used a small sample of six students with learning and cognitive disabilities selected from five special education classrooms. Alternative for delivery of strategy instruction related to acquisition, storage, and retrieval of basic multiplication facts was used.

Research findings revealed that there was a significant difference in performance of basic multiplication facts with respect to the length of treatment. The students who remained in the treatment phase the longest experienced the greatest gains. The data also indicated that the number of sessions per week was significant to the level and rapidity of change. Those students who interacted more frequently each week demonstrated the greatest increases during the Memory intervention (Irish, 2002). Students who had Memory Mathematics computer sessions at least three times per week were more likely to experience gains in their multiplication performance than those who interacted with the software on a less frequent basis. However, these results were based on learning and cognitive disabled students and therefore there was need to investigate the relative effect of pegword and keyword and music mnemonic techniques on non-disabled learners as this is a basis for the current study.

Mastropieri and Scruggs (1998) conducted a study to determine effectiveness of Mnemonics in Social Studies instruction. They used a sample of 17 mildly handicapped elementary grade students from three special education classes who were taught information relevant to two chapters from a Social Studies textbook. All students

received Mnemonic instruction for one chapter, and on other chapter they were taught using traditional methods of instruction. Chapter order and experimental condition were counter-balanced to control for possible influences from order of presentation or chapter difficulty. Each chapter was taught daily over a period of 1 week, in each of the three classrooms.

Chapter tests were given at the end of the week (immediate), and 1 week later (delayed). Analysis of the results revealed that under Mnemonic instruction treatment conditions, students performed significantly higher on both immediate and delayed learning outcomes tests than under conventional instruction conditions. However, these results were based on elementary learning and cognitive disabled students and therefore, there was need to investigate the relative effect of pegword and keyword and music mnemonic techniques on upper primary non-disabled learners and Social Studies and mathematics instead of chapters of the one subject.

Li and Julaihi, (2013), in their study critically examined and evaluated traditional versus innovative methods of teaching mathematics. The strengths and weaknesses of each teaching methodology were identified and probable modifications especially in traditional methods were suggested. In their review, they suggested that innovation technique brought about several benefits. For example, the students are revived from their passivity of merely listening to a lecture and instead become attentive and actively engaged.

DeLashmutt (2007) in his study used three Mnemonics methods of teaching Mathematics; keyword, pegword and letter strategies. He used keyword Mnemonic to place numerator and denominator for fraction numbers while for pegword Mnemonic

was used for improper fraction. Another technique used for Mnemonic strategy in teaching mathematics was the Mnemonic chart figure 2.2 on page 67. This Mnemonic tool helped students to remember abundance of Trigonometric identities.

The technique contains a hexagonal figure with function one side and co-function on the other side and a 1 in the middle. The Mnemonic also has been used in spherical and hyperbolic trigonometric consisting of formula relating to sides and angles of a triangle (Conway & Ryba, 2016). In the current study, the researcher sought to find out which Mnemonic technique between keyword, pegword and music Mnemonic techniques is most appropriate to study and retain mathematics and Social Studies content by analyzing the three mnemonics in a 2x4 factorial design.

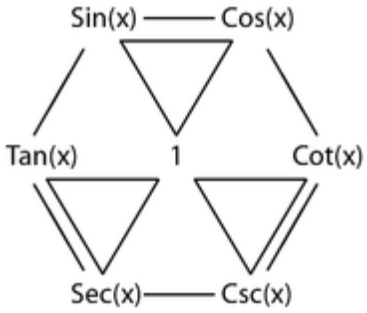


Figure 2.2: Mnemonics Chart for Trigonometric Identity (Magic Hexagon)

Everett, Harsy, Hupp and Jewell (2014) carried out a study to investigate the effects of the Look-Ask-Pick (LAP) Mnemonic on the addition and subtraction of fraction skills of 3 general education sixth graders. Subjects were taught to add and subtract fractions with like denominators, and unlike denominators where one divides evenly into the other, and unlike denominators where one does not divide evenly into the other. 'Multiple baseline across participant's design' results indicated increases in both

percent problems correct and digits correct per minute (immediate recall) for all participants during the LAP intervention. Gains were also sustained at 3-week maintenance (delayed recall).

Triana**,** Johar and Ansari (2016) conducted a study to investigate student*s'* understanding in learning trigonometry using Mnemonic technique. The researchers used quasi-experiment design with the pre-test, post-test, control and experimental group. They used sixty-four students of ninth grade 2017/2018 academic year students who divided into two classes. With class one as experiment class and class 2 as control class with each class having 32 students. The instruments in this research were achievement tests and observations sheet.

The findings of this research showed that the mean of the post-test of learning using Mnemonic technique was 79.06 while using technique of structured matter exercise was 74.22. A t-test statistical analysis indicated that Mnemonic technique learning method was more effective than conventional method from the students' learning outcomes. Therefore, Mnemonic learning method in material sum formula and difference sine and cosine trigonometry was profitable for using as mathematics learning method for ninth grade. Although literature has shown that Mnemonic techniques can be used to enhance mathematics, no literature on comparison between the three Mnemonic techniques has been identified and the researcher in the current study has tried to bridge this gap by doing a comparison between the three Mnemonic techniques to establish the most appropriate Mnemonic techniques in studying mathematics.

2.8. Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Social Studies

Fontana, Scruggs, Mastropieri (2015) carried out a research to investigate effectiveness of Mnemonic strategy instruction in inclusive secondary Social Studies classes. Fifty-nine students in an inclusive Social Studies in a suburban high school participated in a research study to compare the relative effectiveness of keyword mnemonic techniques and traditional instruction on academic performance. Regular school teachers were assigned high school classes to deliver instruction during Social Studies unit. Keywords with interactive images were alternated with traditional instruction procedures to teach 2 units of world history for 4-week period to Grades 10 and 11 students. The findings revealed that there were no significant differences between treatment and control groups on immediate recall.

However, on the cumulative delayed recall tests there were significant differences on observed scores between treatment condition and control groups. Further, there was significant interaction between students for whose English was a second and first language. Students for whom English was a second language scored significantly higher in the mnemonic condition. On the other hand, no significant differences were observed for first-language English, learning disabled and general education students. Analysis on use of strategies revealed that students used the strategies appropriately, and time on task was higher in the mnemonic treatment condition than traditional instruction strategy.

An investigation was carried out by Scruggs and Mastropieri (1989b) to examine the effects of mnemonic instruction on the Social Studies learning of learning-disabled high school students. In that study, students with learning disability were taught content of

World War I in a single session using either mnemonic strategies or traditional instruction strategy. The results revealed significance difference between mnemonic instruction strategy and traditional instruction. They provided limited insight on the effects of mnemonic strategies applied in inclusive high school history classes using regularly assigned units of content.

Most studies done previously on the effects of mnemonic strategies instruction on Social Studies were conducted with middle level school students (Bulgren, Schumaker & Deshler, 1994; Hockenbury, 1999; Mastropieri & Scruggs, 1988). Very few studies were conducted with primary school pupils (Copperth; Waite, Essig, Hill, & Randal,1999; Mastropieri & Scruggs, 1989; Mastropieri, Sweda & Scruggs, 2000). The purpose of the present investigation, was therefore to determine whether mnemonic strategy instruction would facilitate learning in primary school by the use of three mnemonic strategies and control group in learning Social Studies.

2.9 Summary of Related Literature

The researcher through the review of related literature has established that there is a problem of low learning outcomes especially in primary schools. Through the related literature the researcher has also established some measures which have been put in place to improve learning outcomes (Abagi & Odipo, 1997).

The researcher through the review of related literature has established that pegword, keyword and music Mnemonic techniques have been used to enhance learning outcomes in both Free Recall and Serial recall learning tasks. Through the related literature the researcher has identified how pegword Mnemonic technique is especially used for remembering an ordered list of items (Scruggs & Mastropieri, 2000). Regarding related literature on pegword Mnemonic technique, the researcher has

established that pegword increased the memorability of learning for both immediate recall and delayed retention.

Through related literature the researcher has established that rhyming song lyrics act as Mnemonic technique which tap into the power of rhyme and enable learners to remember large amount of information (Mastropieri & Scruggs, 1998). Through the related literature reviewed, the researcher has discussed how the pegword, keyword and music Mnemonic techniques have been used extensively to improve mathematics subject. Through related literature the researcher has also discussed how the pegword, keyword and music Mnemonic techniques have been used to enhance learning outcomes in Social Studies.

In conclusion, literature reviewed shows how the three Mnemonic techniques (pegword, keyword and music) can be used to enhance Free Recall and Serial recall learning as well as mathematics and Social Studies learning outcomes. However, the researcher has identified the following research gaps:

i. In the literature reviewed there is no research done on appropriateness of Mnemonic techniques on Free Recall and Serial learning outcomes.
ii. There are no research studies which have been identified in the reviewed literature comparing appropriateness of three Mnemonic techniques with Social Studies and mathematics subjects.
iii. From the literature reviewed little literature exist on the subject of Mnemonics from Africa continent and especially in Kenya.

It is these gaps that the current study sought to address as stated in the statement of the problem in chapter one.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents a description of the research methodology. More specifically, the chapter discusses the research design, research variables, location of the study, target population, sampling techniques and sample size, research instruments, pilot study validity and reliability, data, collection, logistical and ethical considerations and finally, data analysis.

3.2 Research Methodology and Design

3.2.1 Research Methodology

The methodology adopted for this study was the Quantitative Research Method. This was adopted due to the exploration of quantitative relationships between the mnemonic devices and the quality of free recall and Serial learning in Social Studies and Mathematics.

3.2.2 Research Design

Research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure (Kothari, 2004). Research Design is necessary because it facilitates smooth sailing of various research operations hence making research as efficient as possible. The study adopted Quasi-experimental research design to carry out this research. This research design is useful when investigating cause-effect relationships between independent and dependent variables in situations which do not permit randomization. The participants were selected from two streams from standard seven in three primary schools. The intact groups (streams) were assigned experimental and control groups.

Under Quasi-experimental research design, factorial-experimental design was adopted. Factorial design involves having more than one independent variable in a study. Factorial designs allow the researcher to look at how multiple factors affect a dependent variable, both independently and together.

A factorial-experimental setup consists of multiple factors and their separate and conjoined influence on the participants in the experiment. According to Trochim, (2004) a main effect in factorial - experimental design is an outcome that is a consistent difference between levels of a factor. An interaction effect exists when differences on one factor depend on the level you are on another factor. In the current study, three independent variables were under investigation. The three Mnemonic technique instructions methods (Pegword, Keyword and Music Mnemonic techniques) and control group were examined simultaneous and their effects was investigated at two levels (immediate and delayed recall Learning outcomes).

This ensures investigation of the effects of treatment between the groups and also within the groups. The control group was also studied and its learning outcomes compared with the treatment groups. The control group included pupils who did not use any form of Mnemonic techniques during intervention process. Teachers employed the conventional teaching strategies to teach the contents. The study conducted post-test for all the three treatment groups and control group. Variations of these groups were analysed using 2x4 analysis of variance.

3.3 Research Variables

According to Kothari (2004), if one variable depends upon or is a consequence of the other variable it is termed as a dependent variable. The variable that does not depend on another variable is termed as independent variable.

In the current study, the main independent/predictor variables were three mnemonic techniques (pegword, keyword and music). These three mnemonic techniques were treatment conditions which involved teaching three different groups using mnemonic strategies in three different schools. Post-tests were taken immediately after intervention teaching strategy and after 3 weeks for delayed recall. The dependent/response variable was learning outcomes which was measured by post-test mean scores obtained from achievement tests administered to the pupils immediately and after 3 weeks' intervention period. The mean score of each intact group was then calculated and given as learning outcomes for each specific group.

3.4 Location of the Study

The study was carried out in Machakos Sub-County, Machakos County, Kenya. Machakos County borders Nairobi county to the west, Embu to the north, Kitui to the east, Makueni to the south, Kajiado to the south west and Murang'a and Kiambu to the north west. The head-quarters of Machakos County is Machakos Town which is about 64km South East of Kenya's capital Nairobi. Machakos town is a 30 minutes' drive from the Jomo Kenyatta International Airport. Machakos County connects Nairobi County to the Konza Techno City, a Kenya Vision 2030 flagship project that is set to be Africa's first Silicon Savannah and an oasis of modern living and class. The County stretches from latitudes 0º 45' South to 1º 31' South and longitudes 36° 45°' East to 37° 45°' East. The county has an altitude of 1000 - 1600 meters above sea level, (www.machakoscounty.ac.ke).

At the time the study was done, Machakos County had 998 primary schools, 346 secondary schools, one public university and over 30 post-secondary institutions. Machakos Sub-County is divided into three educational zones: Muvuti zone which had

36 primary schools, Mumbuni zone which had 31 primary schools and Mutituni zone which had 26 primary schools. Pupils in public upper primary schools were sampled for the study. Machakos County was chosen because after reviewing literature it was discovered that, there is no research study carried out on application of Mnemonic techniques done in Machakos Sub-County. Machakos Sub-County was chosen because it did not perform very well in KCPE national examinations. According to Machakos Sub-county education office only nine candidates managed to score 400 marks from public schools in the year 2016.

3.5 Target Population

The target population comprised of all public primary schools in Machakos Sub-County. The accessible population was class seven pupils from 75 public primary schools. The choice of the schools was based on the fact that they had presented class eight candidates in the past two years in the national examinations (2016 and 2017), which was one of the criteria for inclusion in the study. These schools also had similar mean grade in KCPE examinations in 2016 and 2017. According to statistics obtained from Machakos Sub-County Education office in January 2018, there were a total of 92 primary schools in Machakos Sub-County with an estimated population of 25,966 pupils. There were 13,932 boys and 12,034 girls.

Machakos Sub-County is divided into three educational zones. The study was carried out within these three educational zones. There were 92 primary schools in Machakos Sub-County with an estimated population of 25,966 pupils. There were 13,932 boys and 12,034 girls respectively. The distribution of schools in the Sub-County is shown on table 3.1 on page 77. The Information in table shows that there were 36 primary schools in Muvuti zone, of which 32 were public and 4 private. In Mutituni zone, there

were 26 primary schools. Of these 19 were public and seven were privately owned. In Mumbuni zone, there were 30 primary schools, and while 23 were public primary schools, seven were privately owned.

From the table 3.1 on page 77, public primary schools were the majority with 75 schools out of 92 while private schools are the minority with only 18 primary schools. The study was carried out in public primary schools because they comprise the largest number of schools and pupils. In addition, although the public primary schools comprised the largest number of schools as well as largest the number of pupils, they recorded poorest performance compared to privately owned schools as shown in in table 3.1 on page 77. It is therefore, for this reasons that the researcher chose the public schools over private schools in Machakos Sub-County. Standard seven pupils were selected because they were more than ever before expected to be getting more serious with their studies in preparation for national examinations at standard eight. Three schools were used for treatment groups for the three Mnemonic instruction treatment conditions while the fourth school was used as the control group.

Table 3.1: Primary Schools in Machakos Sub-County and Kenya Certificate of Primary Education Grade Summary for 2016 and 2017

Muvuti Zone	**2016 Mean**	**2017 Mean**	**Mutituni Zone**	**2016 Mean**	**2017 Mean**	**Mumbuni Zone**	**2016 Mean**	**2017 Mean**
1.One hill Academic	349.4	353	Baraka Academy	303.5	312.9	Early Bird	NEW	371.7
2.Premise	342.3	369.9	Emanuel	293.3	336	Machakos Academy	319.1	337.1
3.Machakos	336.5	342	***Kyasila***	270.4	**281.7**	St. Ann Joster	293.8	306.8
4.Malili hills	327.8		Mitaboni royal	269.3	226.9	Vision Academy	307.6	301.5
5.Katumani	324.4	323.5	Kiteini	267.9	262.8	Kathese	241	295.2
6.St. Marys girls	306	278	St. James	266.8	277	***Mumbuni***	250.1	**281.1**
7.Machakos Baptist	313.5	290.8	St. Johns Academy	278.4	264	Rehema	290.7	273.5
8.St. marys boys	282.7	305.5	Yakamete	262	261.2	Kwa Katheke	NEW	268.1
9. Township Muslim	280	271.2	Kivutuini	261.6	230.8	Springs of Glory	275.5	267.9
10. Kamweleni	279.2	256.3	Mua Hills	257.2	195.2	Ivumbuni	227.9	266.6
11. ***Muthini***	278.9	**281.3**	Kyanda	256.5	262	***Kiangini***	258.7	**279.2**
12.Katumani	2783.1	290.9	Metuma	254.1	233.4	Kimua	220.3	257.1
13. Kwa kavoo	271.3	290.9	Ngomeni	251.4	272.3	Kyumba	255.7	254.4
14.MSPD	271.1	276.9	Kasaini	234	265.7	Mikuyu	237.6	250.9
15.Harizon peak	261.8	263.4	Mbukoni	299.7	261.4	Ikokani	235.1	246.7
16. Kyeni	260.6	240.2	Kwa kitaa	225.1	241.9	Manza	255.6	246.9
17.Katoloni	245.9	248.5	Kyaani	224.4	212.3	Abc academy	302.4	245.8
18. Kimutwa	243.4	249.1	Mutituni	223.9	219.1	Misakwani	238.2	244
19.Mbembani	243.3	225.8	Makyau	209.5	228.3	Kusyomuomo	235.8	243
20. Love	234.6	248.7	Kithima	205.7	248	Miwongini	190.1	237.8
21. Kyanzasu	234.2	262.5	Ngelani	205.1	202.4	Kyanguli	219.9	236.9
22.Konza	231	260.1	KEAA	199.1	255.4	Kitanga	222.5	224.3
23. Iluvya	228.3	259.1	Mua farm	194	237.4	Vota	229.9	223.4
24. Kathaayoni	225.4	238.8	Kamuthanga	189	196.1	Kathekakai	214.9	219.2
25. Makakoi	225	223.5	St. Charles mixed	NEW	211.6	Kyambuko	208.1	218.1
26. Kaathi	223.8	212.8	Mutituni Baraka Academy.	NEW	276.2	Kathimani	214.3	210.7
27. Mikuini	221.2	225				Mung'ala	207.1	208.7
28. Mwanyani	218.4	252.5				Katelembo	226.1	206.9
29. Kivandini	204.7	213.6				kyemutheke	240	205.1
30. Kitulu	204	224.8				Kasinga	200.9	182.6
31. Moi	203.7	220.3						
32. Kiima Kimwe	203	249.7						
33. Mang'auni	201.1	247.3						
34. Machakos Sch. for deaf	200.4	214.6						
35.Kaseve	193.2	235.8						
36.Kakinduni	190.4	230.2						

Source: Machakos Sub-County Education Office, 2017

The ability level of pupils in the schools selected for the study shows that schools had performed more or less the same in 2017 KCPE national examination with a mean grade ranging between 279 and 281. The researcher felt this would minimize variations due to ability levels of the learners.

With an exception of Machakos primary school, the first top four schools in every zone were private schools yet in terms of population they were the majority. All the public primary schools in the Machakos Sub-County were day schools. According to the Machakos Sub-County education office, public primary schools in Machakos sub-county were adequately staffed. Other resources were also adequate and most of the teachers had more than five years teaching experience. Yet the performance was still poor and below the average. It is therefore for these reasons the researcher selected public primary schools over private primary schools in order to investigate whether learning outcomes could be improved by use of mnemonic techniques.

3.6 Sampling Techniques and Sample Size

According to Kombo and Tromp (2006), sampling is done to select a number of individuals from a population. The selected group contains elements which are representative of the characteristics found in the entire population.

3.6.1 Sampling Techniques

Table 3.1 on page 77, was constructed from records obtained from Machakos Sub-County Education Office. The table comprised of all primary schools in Machakos Sub-County as at January 2017 and KCPE performance for years 2016 and 2017. Stratified sampling, purposeful sampling and random sampling techniques were used in the current study to select Muthini, Mumbuni, Kiangini and Kyasila to take part in the study. Stratified sampling was used to ensure that certain sub-groups in the population

were represented in the sample (Kumar, 2011). It also ensured that key characteristics of individuals in the population are included with the same proportion (Jaccard & Becker, 2010). A sample of 317 pupils were selected from standard seven to participate in the study in the four selected schools.

The schools were first stratified into three educational zones: Muvuti, Mumbuni and Mutituni zones. At least one school was selected from each of the three zones, this ensured that the three zones were represented in the study. Purposeful sampling technique was used to select four schools with similar mean grades in the KCPE examination. The schools purposefully selected had mean grades between 279 and 281 marks in KCPE examination in 2017 as shown in table 3.1 on page 77. This ensured that performance of the pupils during the study did not differ as a result of ability level but the performance during the study differed as a result of the Mnemonic technique treatment or lack of it. Purposeful sampling technique was also used to select two schools from the township and two schools from the rural set up. Random sampling was used to assign three mnemonic instruction treatment conditions and control groups to the four schools. Random sampling technique was also used to assign the two streams from each school Social Studies and mathematics subjects. Random sampling ensured participants had an equal chance to be assigned to any of the four groups and two streams.

3.6.2 Sample Size Determination

A study sample was selected from the list of 75 public primary schools in Machakos Sub-County. The distribution of schools' sample size for the study is shown in the Table 3.2.

Table 3.2: Sampling Frame

Zones	Schools	Streams		Total
Muvuti	Muthini Mean Score 281	A(41)	B (44)	85
Mutituni	Kyasila Mean Score 280	A (34)	B (36)	70
Mumbuni	Mumbuni Mean Score 280	A (45)	B(43)	88
Mumbuni	Kiangini Mean Score 279	A (37)	B(37)	74
Total		**157**	**160**	**317**

Key: Figures in parentheses is the total number of pupils in each stream

The sample of this study was divided into three strata comprising Muvuti zone, Mumbuni zone and Mutituni zone. The study was also divided into two strata comprising two streams, each stream (intact group) which had different number of pupils ranging from 35 – 46 pupils as shown in the table 3.2. The total sample was 317 pupils. According to Kothari (2004), a sample of 10% is sufficient for the experimental research design. In the current study there were four groups in every test: three treatment exposure to Mnemonic instruction methods and the control group.

3.7 Research Instruments

Having obtained research permit from NACOSTI, the researcher started by first training the teachers on how to use Mnemonics instruction treatment condition. This training was done for two sessions. The teachers then used the Mnemonic techniques instruction methods during teaching and learning process. After intervention process of using Mnemonic techniques instruction method, pupils were then tested using

achievement tests for both Social Studies and mathematics subjects. Learners were tested at two levels. First, they were tested immediately after the lesson for immediate recall using Random Assessment Tests (RATs). After 3 weeks, the pupils were tested for delayed recall using end of month Continuous Assessment Tests (CATs).

The researcher used three Mnemonic techniques i.e. Keyword, Pegword and Music Mnemonic techniques instruction method during teaching. Two learning tasks (Free Recall learning outcomes) for objective one and (Serial learning outcomes) for objective two. Mathematic and Social Studies subjects learning outcomes were also for three Mnemonic techniques for the objective three. Contents and the tests were specifically tailored for each learning task and subject to determine which Mnemonic technique is most appropriate. Achievement tests were used to measure learning outcomes. The following are the instruments used in this study.

3.7.1 Observation Schedules

The researcher used observation schedules to observe how teachers were teaching using Mnemonics techniques instruction methods to teach Social Studies and mathematics in class. The researcher participated in half of the lessons during the three Mnemonics instruction methods. The researcher used two assistants to observe and guide teaching process in the rest of the lessons. The observation schedule had seven items. The items in the observation schedule were used as checklist to guide and ensure that teachers did what they were required to do. The observation schedules were used as monitoring tools during treatment process to ascertain whether Mnemonic instruction treatment conditions were properly administered during teaching and learning process.

The researcher also attended and used the observation schedule for the control group where no Mnemonic instruction methods were used to ascertain that no form of Mnemonic instruction methods were used during teaching and learning process. Observation schedule also ensured that no contamination occurred, that is; a situation whereby a treatment group could be influenced by another group which is receiving a different treatment hence interfering with treatment process. This did not happen because the researcher with the help of assistants monitored the treatment very closely using observation schedules. The researcher and the research assistants held briefs with the teachers after the lessons to iron out any difficulties and make clarifications whenever necessary in order to improve Mnemonic instruction methods.

The researcher used two graduates as research assistants to carry out observations during treatment process. The research assistants were trained by the researcher one week before the intervention process commenced. The research assistants were supposed to ensure that teachers followed strictly the mnemonic strategy assigned to particular school. They were also supposed to give clarification whenever possible.

3.7.2 Pupils Satisfaction Survey Questionnaires

At the end of the treatment period the participants in all the experimental groups were asked to fill Pupils satisfaction survey questionnaires. Pupils' satisfaction survey questionnaires were used to determine reported enjoyment and effectiveness of the Mnemonic instruction treatment conditions during teaching and learning process. The teacher guided the pupils on how to fill the questionnaires. Pupils' satisfaction survey questionnaires had a total of 12 items. The type of questions used required "yes" or "no" answers. Others required participants to tick the correct answer where applicable and others required to fill in blank spaces.

The pupils' satisfaction survey questionnaires consisted of two sections: Section A, had six items. The items in this section required the participants to give their demographic information such as age gender, subject and name of school, which were necessary in determining learning outcome variations as a result of age and gender. Section B had six items also, pupils were required to answer questions regarding their level of enjoyment and preference of Mnemonic instruction treatment conditions.

The researcher used survey questionnaires to gather information from pupils on challenges and areas of improvement on Mnemonic techniques as an instruction method.

3.7.3 Achievement Tests

Achievement tests were used to measure learning outcomes in the three objectives**.**

Two types of Achievement tests were used for this study, that is, Random Assessment Tests (RATs) and Continuous Assessment Tests (CATs).

3.7.3.1 Random Assessment Test (RATS)

Random Assessment Tests (RATs) were used for measuring immediate recall learning outcomes for both Free Recall and Serial learning tasks. RATs were administered to pupils immediately after the lesson. They were then scored to establish how well the learners were able to remember the content using Mnemonic techniques. RATs contained five multiple choice items. The pupils were required to take 10 minutes for Social Studies and 20 minutes for mathematics to answer all the items. The pupils were required to circle or tick the correct answer from the multiple choices given.

3.7.2.2 Continuous Assessment Tests (CATs)

Continuous Assessment Tests (CATs) were used for measuring delayed recall learning outcomes for both Free Recall and Serial learning tasks. CATs were administered to pupils after three weeks of intervention process. Learners were continuously taught using Mnemonic instruction strategies for three weeks. Learners were encouraged and followed up to ensure that they were using the three Mnemonic techniques for each specific group to rehearse the contents taught. After three weeks, CATs were administered to the participants. The CATs contained eight multiple choice items, the learners were required to circle or tick the correct answer from the multiple choices given. The pupils were required to take 40 minutes for Social Studies and one hour for mathematic subjects to answer all the items.

3.8 Pilot Study

A pilot study was conducted in order to ascertain the validity and reliability of the observation schedule and questionnaires. For the purpose of the pilot study, an equivalent of ten per cent of the total sample size was used for the pilot study. The sample for the study had been established as totalling to 317 class seven pupils. A 10% of sample (317) yielded approximately 32 pupils. The pilot study was carried out in September 2018, approximately one month before the onset of the KCPE national examinations. Data collection for the pilot study was conducted on 32 Standard seven pupils at Lumbwa primary school in the neighbouring Kathiani sub-county. The researcher visited this school, created rapport and was eventually allowed to carry out the pilot study. Stratified and simple random sampling technique was used respectively to select 16 boys and 16 girls from standard seven classes for the pilot study.

In a simple random sampling procedure, and with the help of the class teacher, the standard seven pupils were divided into two groups based on their gender. They were then given pieces of papers to indicate their two names, folded them and returned the papers to the researcher. The researcher churned the papers separately in their respective groupings, and randomly picked up to 16 papers from each group. The researcher called out the names of those papers which had been picked to remain for the pilot study purpose. The researcher then explained the purpose of the study to the pupils. This activity took about three weeks. The researcher urged the respondents to point out areas that were not clear and precise, as the researcher supervised the exercise. The pupils' satisfaction survey Questionnaires, Observation Schedules and achievement tests were then later subjected to statistical analysis for the purpose of ascertaining validity and reliability of these research instruments respectively.

After the pilot study Satisfaction Survey Questionnaires items were reduced from 15 items to 12 items. Two items were removed because they were ambiguous and did not add any value to the research. Achievement test items were analysed. Items which were too difficult and too easy for learners were also removed and replaced with items which had an average difficult index. The modified research instruments were then used to collect data for the study.

3.9 Validity

Validity refers to whether an instrument is really measuring what it is intended to measure (Orodho, 2009). Face validity is a subjective and cursory judgment of a concept, assessment of instrument, or any other conceptualization to ascertain whether or not its face appears valid (Belly, 1993). Face, content and construct types of validity had earlier on been confirmed through professional guidance from university

supervisors and other researchers especially from the school of education. Feedback given by the supervisors and experts was analysed and incorporated in the study.

3.10 Reliability

Reliability refers to whether an instrument is measuring consistently in different situations but comparable occasions. There are several forms of reliability test: test re-test, alternate form and split-half reliability (Kothari, 2004).

The reliability of the three instruments, that is Pupils Satisfaction Survey Questionnaires, Observation Schedules and Achievement tests were checked using test-retest method of reliability testing. Pearson Product Moment Correlation test was used to calculate the correlation coefficients of these sub-scales which were then corrected using Spearman-Brown prophecy formula. The following steps in the test of reliability were observed:

i) The teachers were trained how to use mnemonic techniques in teaching the second week after opening third term for two sessions.
ii) During intervention process two of the observation schedules used for monitoring purpose were scored and correlated using Pearson Product Moment Correlation Test.
iii) After intervention process pupils were guided on how to fill satisfaction survey questionnaires in two sessions. The questionnaires were scored and their marks correlated.
iv) For the RAT tests two sets of marks were obtained after testing pupils in two lessons. The two set of scores were correlated using Pearson Product Moment Correlation Test. The same process was repeated for the CAT scores.

v) The Spearman-Brown prophecy formula was used to correct the realized coefficient.

$$rs = \frac{2rh}{rh + 1}$$

Whereby, rs = split-half reliability

rh = correlation between the two halves of the test.

Table 3.3: Reliability Coefficients for research instruments

Instruments	**Pearson Correlation Coefficients**	**Corrected coefficients**
Questionnaires	0.694	0.87
Observation schedule	0.706	0.89
Achievement tests (RAT)	0.709	0.92
Achievement tests (CAT)	0.710	0.93

All the research instruments gave reliable coefficient indexes of above 0.7. According to Gay (1992), any instrument with a split-half estimate of between 0.7 and 1.0 is readily acceptable as reliable enough.

3.11 Logistical and Ethical Considerations

As part of logistics and ethical considerations the following was done:

i) Research authorization: In order to be able to collect data from the sampled schools, the researcher obtained research authorization letter and research permit from the National Council for Science and Technology (NACOSTI).

ii) After obtaining research authorization letter and research permit from NACOSTI, the researcher visited Machakos Sub-County office who issued her with an introduction letter to the respective schools.

iii) Familiarization Meeting: With the aid of the introduction letter, the researcher visited the sampled schools and conducted familiarization meeting with each school's Head teachers. The purpose of the study and the anticipated benefits of the research to the school were explained to the head teachers. The Head teachers arranged another meeting for the researcher to meet with the Social Studies and mathematics subject teachers. In the second meeting with teachers and assistants, the purpose of the study and intervention procedures were explained to the teachers and assistants and an appropriate time to commence the training sessions was agreed on. The teachers were trained for two sessions in each school involved in intervention process. Before the actual intervention process commenced, the following ethical considerations were made:

i. The purpose of the research was thoroughly explained to the participants and their consent to participate in the study was sought See appendix I on page 164.
ii. The researcher assured the participants that the scores obtained were to be used for research purpose only and not any other purposes.
iii. Anonymity teachers and pupils was assured by the researcher. To ensure anonymity, pupils were not supposed to write their names in the questionnaires. Research assistants were also not supposed to write the name of the teacher in the observation schedules.

3.12 Data Collection

Data collection refers to gathering specific information aimed at providing or refuting some facts (Kombo, 2006). Upon acquiring a research permit from NACOSTI, the researcher further had to seek permission from Machakos Sub-County Education

office. The researcher obtained a letter of introduction to the selected schools for data collection.

Two stages were adopted as procedure of data collection and experiment. These stages were:

i. Selecting sample
ii. Conducting the experiment

3.12.1 Stage 1: Selecting the Sample

Sample selection was done at two levels; school sample and student sample. At school samples selection, pupils were selected from the four strata which included three educational zones and the 4th school was selected randomly from one of the zones. To select the school, the researcher used the records from Machakos Sub-County Education office on Kenya Certificate of primary education (KCPE) performance for the years 2016 and 2017 as shown in table 3.1 on page 77.

The following schools were selected for study: Muthini had mean Score of 281, Kyasila had mean Score of 280, Mumbuni had mean Score 280 and Kiangini had a mean Score of 279. The selection criteria for inclusion in the study was national exam performance. The schools which scored mean grade between 279 and 281 marks in 2017 KCPE examinations. The four schools were purposively selected to participate in the study. Purposive sampling was also used to ensure that the four schools selected two were from township and two were from the rural area. Further the researcher used random sampling to allocate three treatment groups and one control groups to the four schools.

On pupils' sample intact groups (streams) of class seven, 317 pupils were randomly selected and allocated Social Studies and mathematics subjects. To ensure there was no

bias, great care was taken while assigning three treatment groups and control group to the four primary schools. Four groups were written down in four separate sheets of papers of equal sizes. The papers were folded into six symmetrical parts and put into an enclosed box measuring 30cm x 30cm x15cm. The box was then shaken many times for shuffling to take place. In a separate piece of paper, the researcher had written the name of the schools; 1. Muthini primary, 2. Mumbuni primary 3. Kingini primary and 4. Kyasila primary school. The investigator personally drew out the first, second, third and fourth paper accordingly. The first paper she picked gave to school number one, then the second paper she gave to school number two, third paper she gave to school number three, then the last paper to school number four.

For the intact groups (streams), the researcher took two pieces of papers one paper was written Social Studies and the other was written mathematics. The papers were then folded and dropped in an enclosed box and shaken several times. The two assistants representing two streams for each class were asked to pick one of the papers. This process was repeated to the other three primary schools.

3.12.2 Stage 2: Conducting the Experiment

The experiment was conducted in four phases as stated below.

3.12.2.1 Phase One: Initial Mnemonic Training

As part of the study, the researcher started by first training teachers on how to use the three Mnemonic techniques instruction method in teaching. This training lasted for two sessions in each of the three schools which participated in the intervention process.

Due to the nature of treatment process, the researcher contracted the services of two assistants who were to be used during monitoring process because teaching and learning

was done simultaneously in the three schools. Hence there was need for assistants. During this phase, the researcher also trained the assistants who were to be used in the next phase. The teachers were given pamphlets with examples of Mnemonics instructions.

The Social Studies content that was used to initially train teachers was drawn from Social Studies syllabus for class seven, "Primary Social Studies" textbooks pupils' book 7 by Kenya Literature Bureau (KLB). Mathematics materials that were used initially for training teachers and teaching was drawn from primary mathematics syllabus for class seven and "Lets learn Mathematics" pupils' book 7 by (KLB).

3.12.2.2 Phase Two: Mnemonic Instruction Phase

In the Mnemonic Instruction Phase, two main methods of instruction were used in this study: The Mnemonic instruction method for the Keyword, Pegword and Music treatment conditions and conventional method of instruction for control group. The Mnemonic instruction phase involved intervention process where pupils in the three treatment conditions were using Keyword, Pegword and Music Mnemonic instruction strategies in their respective learning tasks and subjects. Three schools were used for treatment conditions; Mumbuni Primary School was used for Keyword Mnemonic instruction condition. Kyasila Primary School was used for Pegword Mnemonic instruction condition and Muthini Primary School was used for Music Mnemonic instruction condition. Kiangini Primary School was used as the control group. In this school the teachers used conventional and traditional methods of teaching the pupils.

Instructional materials for Pegword Mnemonic instruction method was developed based on the methods used in studies done by Scruggs et al. (1993). For the keyword Mnemonic instruction method, the procedure was developed based on the methods used

in studies done by Carney and Levin (1994). For music condition initial Mnemonic instructional materials used was developed by Digitec media services Mnemonic music compiled by Waweru and Kiwia (2008). The researcher sought permission from the authors to use the materials for the study. The authors agreed and the materials was therefore adopted.

During phase 2 process, the researcher and the research assistants used observation schedule to monitor how teachers were teaching using Mnemonics instruction strategies. Treatment procedures involved the following processes:

3.12.2.2.1 The Keyword Mnemonic Instruction Method

The keyword Mnemonic instruction method involved two stages: an acoustic link stage and an imagery link stage. First, the pupils were given a 'keyword' that is acoustically similar to and very familiar to the learner, and that can be visualized as interacting with the item to-be- remembered. In the second stage, the pupils were required to form the visual image of the keyword and the target word interacting in some way.

When using the Mnemonic keyword instruction method, the teacher introduced keyword Mnemonic to the learners by defining and explaining how the keyword is used. For example when you want to remember *mountain vegetation* which is Serial learning task content (Savanna grassland, Rainforest, Bamboo forest, Heath and moorland and Snow and bare rock) the term savanna is acoustically or sounds similar to service, when the learners pronounce service they are able remember savanna grassland, rain sounds similar to rainfall this will help learners to remember rainforest, bamboo sounds similar to *Babu* Kiswahili word for grand-father, learners were able to remember bamboo forest. Heath sounds similar to health, and moorland is sounds similar to moonlight, this helps the learners to remember heath and moorland. And

finally snow sounds similar to snoring and bear sounds similar to bare rock, this helps learners to remember Snow and bare rock. A full description of the keyword instruction procedure is given in Appendix ii on page 165.

3.12.2.2.2 The Pegword Mnemonic Instruction Method

The Pegword Mnemonic instruction treatment condition involved two stages. First, the pupils were supposed to memorize rhyming pegs for the numbers 1 to 10, and 11 to 20 as necessary. The pegs have sounds of numbers they represent. Once the pegs have been memorised, they were used multiple times for different contents. The pegs are as follows: one is a bun, two is a shoe, three is a tree, four is a door, five is a hive, six is a sticks, seven is a heaven, eight is a gate, nine is a vine, ten is a hen, eleven is a leaven, twelve is a shelve, thirteen is a bird queen, fourteen is a floor clean, sixteen is a fix screen, seventeen is a seven green, eighteen is an ate bean, nineteen is a swine clean and twenty is a plenty Tea.

In the second stage, the learners were expected to create a mental image or visualize each item of the to-be-learned list interacting with the word that rhymes with the appropriate number. These numbers act as hooks or pegs where learners can hang anything on them. The teacher first introduced the ten or twenty pegs depending on length of the list, the learners with the help of the teacher committed the pegs into the memory b memorizing the pegs to the point of mastery.

The teacher then instructed the learners how to use pegs to learn and remember every content they learnt. This was done by creating an image of the pegs word like *shoe* interacting with the word to-be- remembered item in some way. For example, the nine planets which is Serial learning task for class six content (*Mars, Venus, Earth, Mercury, Jupiter, Satan and Pluto)* Peg number one is *Burn;* visualise a big bun with a M shape,

peg number two is *shoe*, visualise V shaped shoe, Peg number three is *tree*, visualise tall tree planted on earth, Peg number four is *door*; visualise door with M shaped handle. peg number five is *hive*, visualise bees coming out of hive forming letter J. peg number six is *sticks*; visualise ugly Satan made of sticks, peg number seven is *heaven*; visualise heavenly angels worshiping forming letter U, peg number *eight* is gate; visualise two gates with shiny handles resembling letter N. And peg number nine is *vine*; visualise vine tree with hung P shaped ripe fruits. Teachers will repeat this instruction procedure several times for all the lists until the learners are able to correctly link Mnemonics with the items in lists. A full description of the pegword instruction procedure is given in appendix iii page 173.

3.12.2.2.3 Music Mnemonic Instruction Method

Music Mnemonic instruction treatment condition was used to help learners recall details of to-be-learned content. Rhyming music lyrics were used to compose songs which cover the content of interest. Songs were compiled and put in CD containing the content to be learned.

The teacher explained to learners that the content to be learned has been compiled music format. The teacher then played the music using a TV screen while the pupils listened. The learners were also provided with extra copies of CDs so that they can listen to the music at home. The learners were encouraged to practise the songs during break and lunch time as a way of rehearsing the content. The CD contained several songs depending on the topic i.e. different topics have different tunes. When the pupils had mastered the songs then they were able to remember the content as long as they could remember to sing the songs. Full description of the keyword instruction procedure is given in appendix iv page 180.

3.12.2.2.4 Pupils' Satisfaction Survey Questionnaires

At the end of intervention process the participants in each treatment group were given the satisfaction survey questionnaires to fill. The questionnaires were used to determine pupils' reported enjoyment and effectiveness of the Mnemonic techniques instruction method. The questionnaires were also used to collect demographic information from the learners. The researcher and teachers guided the pupils on how to use the Likert scale, and supervised them to fill the questionnaires as accurate, as possible. The pupils were given five minutes to fill the questionnaires.

3.12.2.2.5 Observation Schedule

During the phase 2 process, the researcher used observation schedule to monitor how teachers were teaching using Mnemonics instruction methods. The researcher and the assistants attended all the lessons during the teaching process using Mnemonic instruction methods. The observation schedules were used as monitoring tool to check how effective Mnemonic instruction methods were to both teachers and pupils during teaching process. The researcher and the trained assistants guided the teachers on how to use Mnemonic instruction methods. Corrections were given to the teachers whenever necessary.

3.12.2.3 Phase Three; Measurement of Learning Outcomes.

Post-test achievement tests for different learning tasks were administered after intervention process of Mnemonic instruction method to all treatment groups and one control group. Achievement tests were administered at two levels: Immediate Recall and delayed recall.

3.12.2.3.1 Immediate Recall

The first level, tests were administered immediately after lesson as Random assessment tests (RATs) these tests were indented to measure immediate recall. The tests were then scored using a key. A total of ten sets of scores were gathered end at of the three weeks. A mean score for pupil from each set was obtained as a final score for immediate recall test (RAT).

3.12.2.3.2 Delayed Recall

After three weeks of teaching using Mnemonic instruction strategies, Continuous Assessment Tests (CATs) were administered to measure delayed recall. Four sets of scores were obtained one for each category. Free Recall learning outcomes scores were obtained for objective one, Serial recall learning outcomes scores were obtained for objective two, mathematics scores were also obtained and finally Social Studies scores were obtained.

3.13 Data Analysis

The purpose of analysis is to reduce data to intelligible and interpretable form so that the relations of research objective can be studied and tested. Data analysis is important because it assists the researcher to come up with findings of the study and as a result the researcher is able to identify the areas of gaps for further study (Kombo & Tromp, 2011).

The quantitative data obtained from the test scores were coded for statistical analysis using the Statistical Package for Social Sciences (SPSS) version 24. After completion of data entry, data cleaning was done in order to ensure that there were no outliers or improper entries which may affect the results. Descriptive and inferential statistical methods of data analysis were used in the presentation of the findings.

A 2 X 4 Two-way ANOVA was used to analyse data for objective 1 and 2, at confidence level of 0.05 with degrees of freedom as follows: *dfT*=N-1=317-1=316, *dfb=(K×M)-1=4×2-1=7, dfA=K-1=4-1=3, dfB=M-1=2-1=1, dfAB= dfA × dfB=3×1=3.*

Relevant inferential statistical procedures were used to test each hypothesis. Two-way ANOVA was used because of the following reasons: First, it is best suited for data analysis method when there is more than one independent variable being tested at different levels. Secondly it allows the interaction between the main factors. Thirdly it ensures the increased power of statistical test. Finally, it allows the use of less number of subjects. Illustrations of 2x4 two-way analysis of variance is shown in tables 3.4 and 3.5 on page 98. One-way ANOVA illustrations of 1x4 analysis is also shown in table 3.6 on page 99.

One-way ANOVA was used to test data for objective 3 at confidence level of 0.05. This analysis was best suited because it allowed testing several independent variables (three Mnemonic technique strategy and control group) on one dependent variable (Social Studies and/or Mathematics learning outcomes. Post-hoc Pairwise comparison by Least Square Difference (LSD) was performed to determine which group(s) the differences were significant. The following were the specific null hypotheses tested together and the statistical tests used:

H_{01}: There are no significant differences in Free Recall learning outcomes between learners using Keyword, Pegword and Music Mnemonic techniques. Statistical test: two-way ANOVA

H_{02}: There are no significant differences in Serial learning outcomes between learners using Keyword, Pegword and Music Mnemonic techniques. Statistical test: two-way ANOVA

H_{03}: There are no significant differences in learning outcomes of mathematics and Social Studies subjects between learners using keyword, pegword and Music Mnemonic techniques.

Table: 3.4: Illustration of Two-way ANOVA 2 X 4 Data analysis for Objective1, Mnemonic Techniques on Free Recall Learning Outcomes

Experimental group Control group

Learning outcome	Keyword Mnemonic	Pegword Mnemonic	Music Mnemonic	Control group convectional method
Immediate recall	**X**1	**X**2	**X**3	**X**4
Delayed recall	**Y**1	**Y**2	**Y**3	**Y**4

Table: 3.5: Illustration of Two-way ANOVA 2 X 4 Data Analysis for Objective 2, Mnemonic Techniques on Serial Learning Outcomes

Experimental group Control group

Learning outcome	Keyword Mnemonic	Pegword Mnemonic	Music Mnemonic	Control group convectional method
Immediate recall	**X**1	**X**2	**X**3	**X**4
Delayed recall	**Y**1	**Y**2	**Y**3	**Y**4

Table: 3.6: Illustration of one-way ANOVA Data analysis for Objective Three, Mnemonic Three Techniques on Social Studies and Mathematics Subject Learning Outcomes

Experimental group Control group

Learning outcome	Keyword Mnemonic	Pegword Mnemonic	Music Mnemonic	Control group convectional method
Social Studies and Maths	**P**1	**P**2	**P**3	**P**4

KEY

X1-X3 Immediate recall learning outcomes after treatment
X4 Immediate recall learning outcomes for control group
Y1-Y3 Delayed recall learning outcomes after treatment
Y4 Delayed Serial recall learning outcomes for control group
P1-P3 Social Studies and Mathematics learning outcomes after treatment
P4-Social Studies and Mathematics learning outcomes for control group

CHAPTER FOUR
DATA ANALYSIS, RESULTS, INTERPRETATION AND DISCUSSION OF FINDINGS

4.1. Introduction

In the previous chapters, introduction of the problem, development of tools, methods of study and analysis of data were discussed. This chapter is organized into three main sections. The first section is introduction, the second section is general and demographic information, and the third section is findings, interpretation and discussions.

The purpose of this study was to investigate appropriateness of Mnemonic techniques on learning outcomes in public upper primary school pupils in Machakos Sub-County, Kenya. The data were obtained from pupils in four primary schools name: Muthini primary school, Mumbuni primary school, Kyasila primary school and Kiangini primary school.

The study was guided by the following research objectives:

i. To find out whether there are differences in Free Recall learning outcomes between learners using keyword, pegword and Music Mnemonic techniques among upper primary pupils
ii. To find out whether there are differences in Serial learning outcomes between learners using keyword, pegword and Music Mnemonic techniques among upper primary pupils.
iii. To determine the appropriateness of keyword, pegword and Music Mnemonic techniques on learning outcomes of Social Studies and mathematics subjects among upper primary pupils

The following Null hypotheses were tested in this chapter:

H_{01}: There are no significant differences in Free Recall learning outcomes between learners using keyword, pegword and Music Mnemonic techniques in public upper primary pupils.

$H0_{1.a}$: There are no significant differences between main effect factor A (Mnemonic instruction treatment conditions) and Free Recall learning outcomes.

$H0_{1.b}$: There are no significant differences between main effect factor B (type of assessment) and Free Recall learning outcomes.

$H0_{1c}$: There are no significant main interaction effect between Mnemonic techniques and Type of Assessment on the Free Recall learning outcomes.

H_{02}: There are no significant differences in Serial learning outcomes between learners using keyword, pegword and music Mnemonic techniques in public upper primary pupils.

$H0_{2.a}$: There are no significant differences between main effect factor A (Mnemonic Techniques) and Serial learning outcomes.

$H0_{2.b}$: There are no significant differences between main effect factor B (type of assessment) and Serial learning outcomes.

$H0_{2.c}$: There are no significant main interaction effect between Mnemonic techniques and type of assessment on Serial learning outcomes.

H_{03}: There are no significant differences in learning outcomes of mathematics and Social Studies subjects between learners using keyword, pegword and Music Mnemonic techniques public upper primary pupils.

$H0_{3.a}$: There are no significant differences in learning outcomes of Mathematics between learners using keyword, pegword and music mnemonic techniques.

$H0_{3.b}$: There are no significant differences in learning outcomes of Social Studies between learners using keyword, pegword and music Mnemonic techniques.

The present study adopted a 4x2 factorial design in which three Mnemonic instruction treatment conditions and control group were examined at two levels of assessment: immediate recall and delayed recall. Learning outcome was the dependent/response variable. Mnemonic techniques were the main effect (Factor A) and the Type of assessment (ToA) were the main effect (factor B). Each of the two hypotheses 1 and 2 had three supplementary hypotheses to test null hypotheses for factor A, to test Null hypotheses for factor B and to test Null hypotheses for main/interaction effect in factor A and B.

Two-way ANOVA was done on a 4x2 factorial design in objective 1 and 2. Where significant differences were identified, a post-hoc pairwise comparison was performed to establish which group(s) the differences were significant. A 4x1 one-way ANOVA was performed to analyze data in objective three between four independent variables (three Mnemonic instruction treatment conditions and control groups) and learning outcomes of mathematics and Social Studies as independent variables

4.2. Demographic Information

The questionnaires contained information on student's demographic characteristics. The demographic information in the study included gender, age, class level and name of the school.

4.2.1: Gender Representation of Pupils

The data on the gender of pupils were analysed and results were presented as shown in Figure 4.1

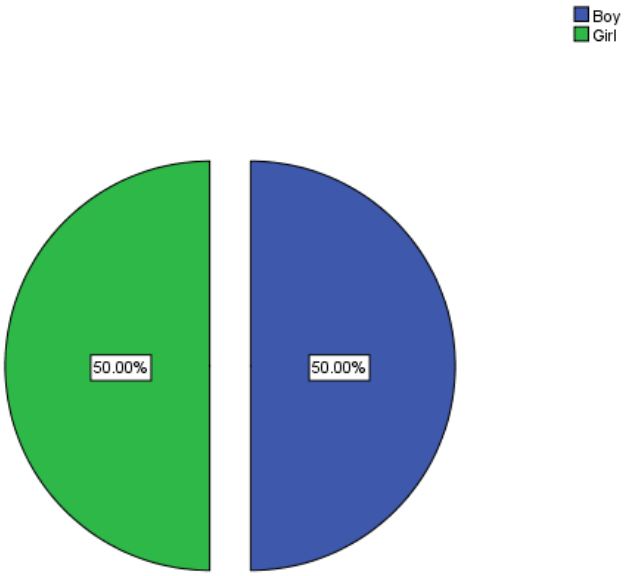


Figure 4.1: Respondents' Gender

n=314

From the data in figure 4.1, the gender of pupils who participated in the study was equal, boys who participated were 50% while girls were also 50%. This gave an equal representation of respondents from category of gender as an intervening variable. The data reveal that there was gender parity among the pupils who participated in the study. The findings imply that gender as an intervening variable was reduced to minimum because the ratio of boys to girls was 1.1. This also implies that the effect of Mnemonic instruction treatment condition on learning outcomes based on gender preferences was minimised.

4.2.2 Respondents according to Age

The data on the pupils' age was analysed and the results were reported as shown on Table 4.1.

Table 4.1: Descriptive Analysis of the Respondents' Age

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness
Age	100	2.00	12.00	14.00	12.7700	.78951	.561
Valid N (listwise)	100						

n=314

The findings on table 4.1 show that, the mean age of the pupils was 12.77. The maximum age was 15 years and the minimum age was 12 years. The range was 2 years. The distribution of the age is positively skewed (sk = 0.56) implying the age of the majority of respondents was less than the mean age of 12.77 years. This implies that majority of the respondents were less than 12.77 years. The implication of the age to the study is that the effect of the age as an intervening variable was minimum because the range was only 2 years and majority of the respondents were of the same age hence the age could not have affected the learning outcomes as an intervening variable.

4.2.3. Respondents' Age Based on Gender

The participants' gender was cross-tabulated with age and the results are indicated in Table 4.2.

Table 4.2: Descriptive Analysis of the Respondents' Age Based on Gender

Gender		n	Range	Minimum	Maximum	Mean	Std. Deviation	Skewness
Boy	Age	50	3.00	12.00	15.00	12.60	.83299	1.103
	Valid N (listwise)	50						
Girl	Age	50	2.00	12.00	14.00	12.94	.71171	.087
	Valid N (listwise)	50						

n=314

According to information presented in the table 4.2, girls were slightly older than boys with age range of

2 years while boys had a range of 3years. The minimum age of girls was 12 years and the maximum age was 14years. The minimum age of boys was 12 years and maximum age was 15years. This means that the girls who were randomly selected for the study were slightly older than the boys. However, boys' age had a bigger range than girls age. This implies that the age differences between the boys and girls was very minimal hence it was not likely to affect the learning outcomes as a result of Mnemonic instruction treatment conditions.

4.2.4 Ability to Apply Mnemonic Techniques

The task in this section was to analyse the extent at which the pupils were able to use Mnemonic techniques to remember content in other subjects other than mathematics and Social Studies. The pupils were expected to give a yes or no response. Figure 4.2 presents the summary of the results.

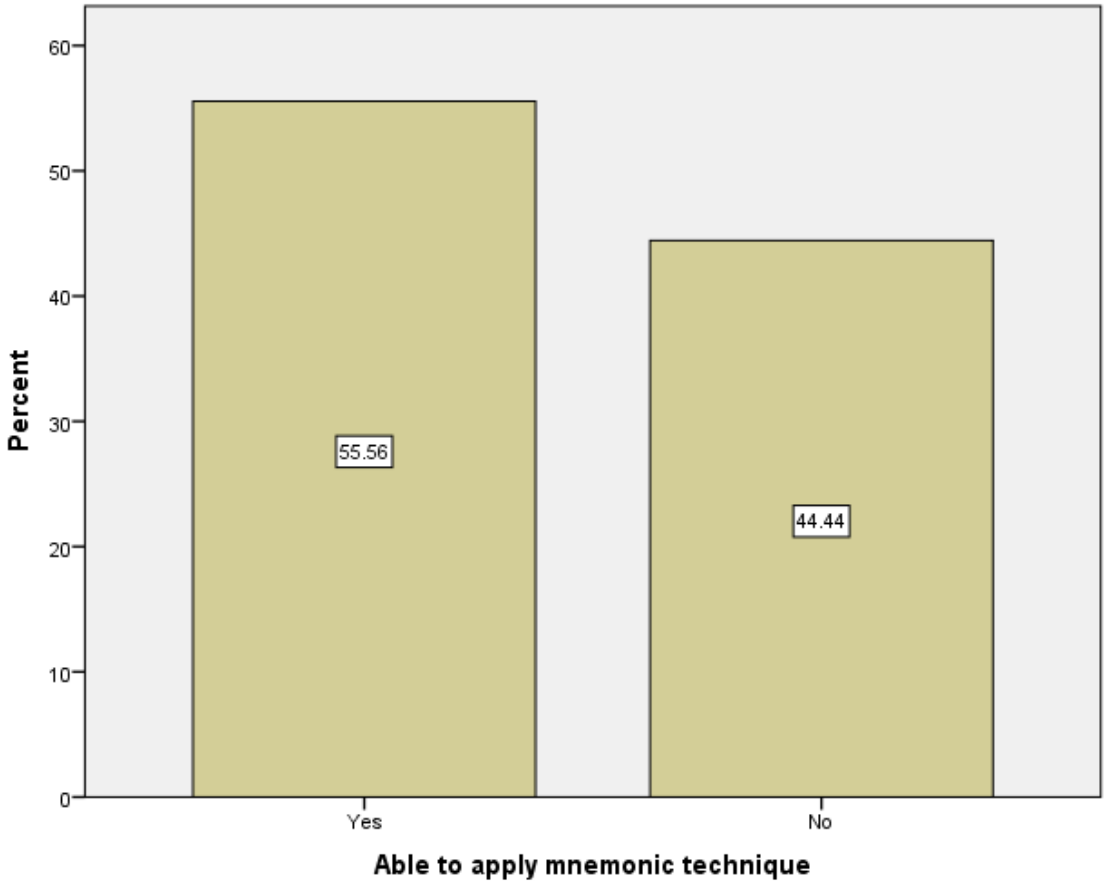


Figure 4.2: Ability to Apply Mnemonic Techniques in other Subjects.

n=314

When asked if they were able to use mnemonic strategies in other subjects to remember the content in other subjects, more than half (55.56%) of the respondents indicated that they were able to use Mnemonic techniques. Less than half (44.44%) indicated that, they were not able to use Mnemonic techniques in other subjects. This implies that learners required more training and time in order to effectively use Mnemonic techniques in other subjects. This also implies that, more effort is required to sensitize both teachers and learners to appreciate Mnemonic techniques as a devise for enhancing retention.

These results are consistent with the findings of (Bellezza, 1996 & Balch, 2005). Their findings suggested that, Mnemonic techniques involve deliberate, effortful learning and they sustain learners' attention in class. This is due to the focused attention learners pays to the materials while using and/or creating mnemonic techniques. Mnemonics supports encoding to long-term memory and require process of elaboration, which enhances encoding and supports successful retrieval.

4.2.5 Pupils' Attitudes towards Mnemonic Techniques

The task in this question was to analyse the preference of Mnemonic techniques among learners. The pupils responded to a three-point scale questionnaire which yielded scores indicating which of the three Mnemonic techniques (keyword, pegword and music) they preferred starting from most preferred number 1 to the least preferred number 3.

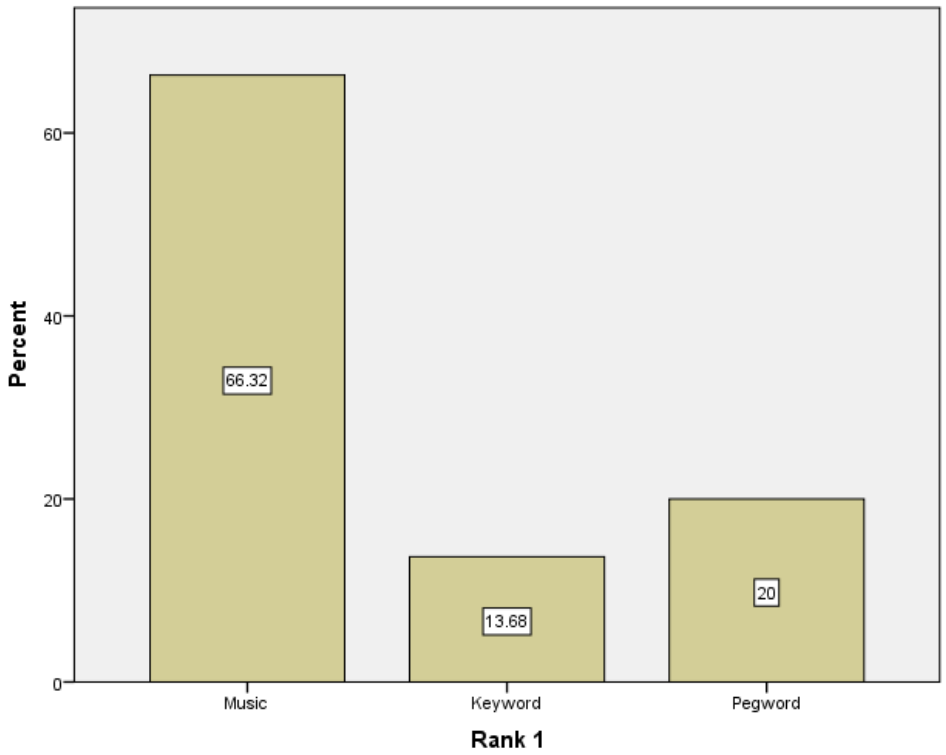


Figure 4.3 Pupils' attitude towards Mnemonic Technique among Learners

n=314

When asked about their preferences among the three Mnemonic instructional strategies, majority of students' preference of mnemonic instruction varied. They indicated that they learned more, and would prefer to use mnemonic instruction. Majority (66%) of the pupils indicated that they preferred music Mnemonic techniques. Slight less than a third (20%) pupils indicated that they preferred pegword Mnemonic techniques. Keyword Mnemonic techniques was least preferred (13%). This is a clear indication that music Mnemonic technique was the most preferred Mnemonic technique compared to the other two. Pupils rated music Mnemonic technique very highly compared to other Mnemonic techniques. Pupils also showed great interest in music than the other two Mnemonic techniques. These results have been supported by findings of this study in objective two and three in tables 4.7 and 4.10 on page 122 and 130 respectively. The findings indicated that there were significant differences between music Mnemonic techniques across all levels in type of assessment and Social Studies.

4.2.6 Learners Level of Involvement during Mnemonic Treatment Strategy

The investigator sought to establish whether learners were actively involved in teaching and learning process during Mnemonic instruction treatment intervention or not. The pupils were supposed to indicate by answering "yes" or "no". The pupils' responses were based on whether they had an opportunity to participate in class by either asking or answering questions during Mnemonic instruction treatment intervention. The summary of results is presented in Figure 4.4.

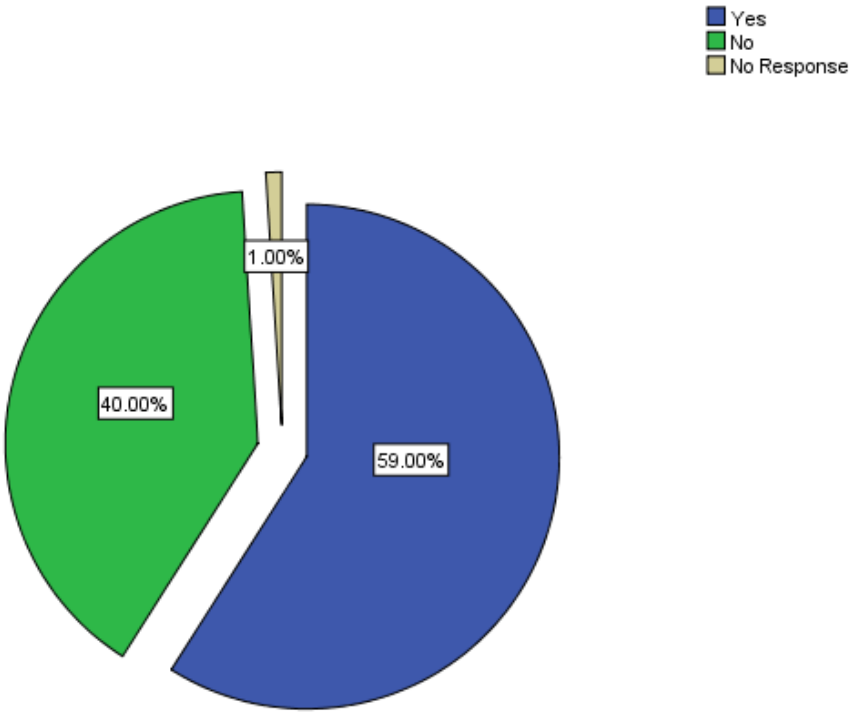


Figure 4.4: Level of Involvement during Mnemonic instruction treatment Strategy

n=314

Figure 4.4 shows that slightly more than half (59%) of the pupils stated that they were able to participate during Mnemonic technique instruction strategy. Slightly less than half (40%) of the respondents said that they did not participate during Mnemonic instruction strategy, Finally, those who did not respond were only 1%. This is a clear indication that Mnemonic techniques enhance learners' involvement in teaching and learning process and hence learners' attention is enhanced during teaching. These findings were consistent with Belize's (1996), whose study indicated that focus of learners' attention is enhanced when using Mnemonic techniques due to the attention the learners pay to the materials while using and/or creating Mnemonics to support encoding to the long-term memory. This is because they involve deliberate efforts at the initial stages of incorporating Mnemonic techniques.

4.3 Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Free Recall Learning Outcomes

Regarding the first objective, the researcher sought to investigate whether there were differences in Free Recall learning outcomes between learners using keyword, pegword and Music Mnemonic techniques. To obtain data, post-test scores were obtained after intervention process of the three Mnemonic instruction treatments groups and a control group. The scores were first subjected to a test of homogeneity and test of normality to ensure the scores met the conditions for two-way ANOVA data analysis method. The data were then analysed and presented descriptively and inferentially.

4.3.1 Tests of Assumptions

4.3.1.1 Normality Test

Test of normality was used to ascertain that the scores met the asumption that, they must be normally distributed. Test of normality showed that the scores were aligned in the line of best fit as shown in appendix xii A on page 203. The Q-Q Plot of observed score of pegword, Q-Q Plot of observed score keyword, Q-Q Plot observed score of music and Q-Q Plot observed score of control group indicated that they were aligned in a straight line. This implies that the scores were formimng normal curve hence normally distributed. This further implies that the scores met the assumption of normality.

4.3.1.2 Homogeneity of Variance Test

Test of homogeneity was done to ascertain that the scores met the asumption that the scores must be homgenoius. Levene's test was done and it showed that the variances for the observed scores for the Mnemonic techniques were equal ($F(3,322) = 2.12$, $P > 0.05$) as shown in appendix xii B on page 208. This implied that the scores were homogineous hence they met the assumption that the scores should be homogeneous.

4.3.2 Descriptive Analysis for Mnemonic Techniques Scores on Free Recall Learning Outcomes

In order to establish the differences in free learning outcomes between learners using keyword, pegword and Music Mnemonic techniques as well as control group, the raw data were first subjected to descriptive analysis. The scores were analyzed to get the mean and the standard deviation. The results are presented in Table 4.3.

Table 4.3: Descriptive Analysis for Keyword, Pegword and Music Mnemonic Techniques and Control Group on Free Recall Learning Outcomes

Mnemonic Device	Type of Assessment	n	Minimum	Maximum	Mean	Std. Deviation
Pegword	RAT	41	20.00	86.00	46.15	16.89
	CAT	41	22.00	67.00	52.40	10.19
Keyword	RAT	35	20.00	71.00	47.23	14.88
	CAT	35	25.00	73.00	53.43	12.39
Music	RAT	50	22.00	78.00	50.14	12.81
	CAT	50	34.00	83.00	55.54	10.37
Control Group	RAT	37	18.00	71.00	45.32	12.49
	CAT	37	17.00	83.00	50.11	16.88

Key:

CAT = Continuous Assessment Test, RAT = Random Assessment Test

Table 4.3 shows that there were mean differences between the three Mnemonic technique treatment conditions and control group. Music had the highest mean score of 50.14, 55.54 and standard deviation of 12.81, 10.37 for RAT and CAT respectively. Table 4.3 also show music RAT minimum and maximum scores were 22 and 78 respectively and CAT minimum and maximum scores were 34 and 83 respectively. Keyword was second with a mean of 47.23, 53.43 and standard deviation of 14.88, 12.39 for RAT and CAT respectively. The table 4.3 also show that the Keyword had RAT minimum and maximum scores of 20 and 71 respectively and CAT minimum and maximum scores were 25 and 73 respectively. Pegword was third with a mean of

(46.15, 52.40) and standard deviation of 16.89, 10.19 for RAT and CAT respectively. From the table 4.3 Pegword's RAT minimum and maximum scores were 20 and 86 respectively and CAT minimum and maximum scores were 22 and 67. Finally control group recorded a mean of 45.32, 50.11 and standard deviation of 16.89, 10.19 for RATs and CATs respectively.

The table also show that the control group's RAT minimum and maximum scores were 18 and 71 respectively and CAT minimum and maximum scores were 17 and 83 respectively. Descriptive analysis also showed that there were mean differences between the two type of assessment (RAT and CAT). This is an indication that mean scores of CAT (delayed recall) were higher than the mean scores for RAT (immediate recall) across all levels of factor A (Mnemonic technique) treatment conditions and control group.

4.3.3 Inferential Analysis for Mnemonic Techniques Scores on Free Recall Learning Outcomes

The first null hypothesis (H_{01}) stated that, there is no significant difference in Free Recall learning outcomes between learners taught using keyword, pegword and music Mnemonic techniques. A two-way ANOVA analysis was performed to test the hypothesis. The first hypothesis was divided into three supplementary hypotheses as follows; to test for significant differences between factor A (Mnemonic technique) and Free Recall learning outcomes, to test for significant differences between factor B (type of assessment) and Free Recall learning outcomes, and to test for main/interaction effect between factor A and B (A X B).

Table 4.4: Two-way ANOVA Test Analysis for Mnemonic Techniques Scores on Free Recall Learning Outcomes

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3849.601[a]	7	549.94	3.04	.004
Intercept	801315.664	1	801315.66	4434.27	.000
MnemD	1225.316	3	408.44	2.26	.081
ToA	2560.350	1	2560.35	14.17	.000
MnemD * ToA	27.965	3	9.32	.05	.985
Error	57465.737	318	180.71		
Total	884134.000	326			
Corrected Total	61315.337	325			

a. R Squared = .063 (Adjusted R Squared = .042)

Key: MnemD= Mnemonic techniques, TOA= Type of assessment

Supplementary hypotheses

4.3.3.1 $H0_{1.a}$: There is no significant difference between main effect factor A (Mnemonic instruction treatment conditions) and Free Recall learning outcomes

The researcher sought to establish whether there were significant differences between main effect factor A (learners exposed to learning through keyword, pegword, music and control group) and learning outcomes. The results showed that no significant differences ($F(3,318) = 2.26$, $P > 0.05$) were found between learners using keyword, pegword, music and control group Mnemonic instruction strategies on Free Recall learning outcomes and therefore, the null hypothesis was retained.

Although the mean of the observed scores on three Mnemonic technique treatments and control group were different, the differences were not statistically significant at all levels of factor A. This is an indication that there was no significant difference in Free Recall learning outcomes between learners who were taught using pegword, keyword and music Mnemonic technique instruction strategies and control group. These findings

further imply that whether learners were exposed to the three Mnemonic techniques or left as such, there were no differences in learning outcomes. This means that Mnemonic techniques had no effects in enhancing Free Recall learning outcomes. The implication is that the participants' performance in the three Mnemonic techniques are not statistically significant, indicating that the participants' performance in those groups was almost similar on the Free Recall learning outcomes. One factor which may have contributed to the obtained results could have been the participants' familiarity with the Mnemonic techniques. In fact, the selected participants indicated that they were not very familiar with mnemonic technique. This novelty could have generated either enthusiasm or confusion.

The findings concurred with those of Fontana, Scruggs and Mastropieri (2015) in their study which investigated the effectiveness of Mnemonic strategy instruction in inclusive secondary Social Studies classes. Their findings revealed that there were no significant differences existed between treatment and control groups on immediate recall. The findings also concurred with the studies done earlier by Melby and Charles (2010), who found that phoneme-awareness training improved Serial recall substantially and improved Free Recall to a lesser extent. Their findings also showed that Free Recall and Serial recall learning depends on common mechanisms. However, Serial recall relies more on phonological codes while Free Recall relies more on rehearsal. Richmond, Cummings and Klapp (2008) showed that there were no differences between the loci method, the pegword method and the control group conditions in recognizing the uses of specific tasks.

Based on these results, the researcher suggested that significant differences were not found because time was inadequate for rehearsal since the period provided may have

been insufficient as suggested by earlier findings done by Melby and Charles (2010). More time was needed for rehearsal since free call relies more on rehearsal. Based on these findings none of the three Mnemonic techniques were found appropriate for Free Recall learning tasks as hypothesized.

These results are in contrast from some earlier ones by (Elliott & Gentile 1986; Carney & Levin 1998; Shriberg, Levin, McCormick & Pressley 1982; Carney & Levin 2008) who reported that significant difference in Free Recall learning task existed between keyword and control groups. The present study provided conflicting results and one possible reason that may help to explain the observed contradictions is the cross-cultural differences. It is worth noting that all the previous studies cited were done in developed countries and no doubt the day-to-day schooling and school environment is very different from developing countries like Kenya.

4.3.3.2 $H0_{1b}$: There is no significant differences between main effect of factor B (Type of Assessment) and the observed scores

The study sought to establish whether there were significant differences between main effect factor B [when learners are tested immediately (immediate recall) or three weeks after exposure to learning through different mnemonic techniques delayed recall)] and learning outcomes. As shown in table 4.4, significant differences ($F(1,318) = 14.17$, $P < 0.05$) were found between main effect factor B and learning outcomes hence the null hypothesis was rejected. This indicated that statistically significant differences existed between main effect factor B [immediate recall (RAT) and delayed recall (RAT)] and learning outcomes. This implies that significant differences were found in the main effect factor B across all levels of Mnemonic techniques.

Post-hoc Pairwise Comparison by Least square difference (LSD) to determine Free Recall learning outcomes on type of assessment.

Having found significant differences between the learning outcomes in the type of assessment (CAT and RAT), the researcher sought to investigate further to establish where the differences existed by carrying out a post-hoc pairwise comparison LSD. The results were presented in table 4.5.

Table 4.5: Pairwise Comparisons Analysis for Type of Assessment on Free Recall Learning Outcomes

(I) Type of Assessment	(J) Type of Assessment	Mean Difference (I-J)	Std. Error	Sig.[b]
RAT	CAT	-5.657*	1.503	.000
CAT	RAT	5.657*	1.503	.000

Key: CAT= Continuous Assessment Test, RAT= Random assessment test

Table 4.5 shows that the mean of CAT scores was higher than the mean of RAT scores across all levels of factor A (Mnemonic techniques). There was significant difference between type of assessment and Free Recall learning outcomes. Learning outcomes of delayed recall (CAT) were higher than those of immediate recall (RAT) across all levels of mnemonic techniques. The learners scored much higher in delayed recall (CAT) when using any of the Mnemonic instruction treatment conditions than immediate recall (RAT) when they were subjected to any of the Mnemonic instruction treatment conditions.

These results agree with the study done by McCabe, et al., (2013). In their study to explore the use of Mnemonic techniques in studying Introduction to Psychology brain terms Free Recall type of learning. They compared three conditions: simple reading, instructor provided examples and keyword Mnemonics, self-generating examples, and self-generating keyword Mnemonics. Results indicated a learning advantage on a

structure-to-function matching test at both a 10-minute delay recall and a 2-day delay recall for the generate-keyword condition. Whereas the read-only and generate-example conditions were lower and similar to each other. Thus, for keyword Mnemonics, as with acrostics, evidence suggests that self-creation is beneficial for learning at delayed recall. The results also agree with the study by Elliott and Gentile (1986), who suggested that peg-word Mnemonic technique increased the memorability for both groups, by a factor of 2.3 vis-à-vis 2.4 at the immediate retention interval.

The findings also agree with studies done earlier by Carney and Levin (2008) and McCabe, Osha and Roche (2013), whose findings suggested that Mnemonic techniques exposure group outperformed control group for both delayed and immediate recall. Surprisingly, the current results were contrary to the traditional belief that immediate recall is usually much higher than delayed recall according the famous Ebbinghaus forgetting curve, (Ebbinghaus 1885, 1909, 2011). The current study findings suggest that Mnemonic techniques require time to learn and internalize them before the learners can use them to enhance retention.

4.3.3.3 $H0_{1c}$: There is No Significant Interaction Differences between Mnemonic Techniques and Type of Assessment on the Observed Scores

The researcher sought to investigate whether there is main/interaction effect between Mnemonic techniques and the type of assessment on free learning outcomes. The data were subjected to general linear model univariate analysis and the results are presented in figure 4.5.

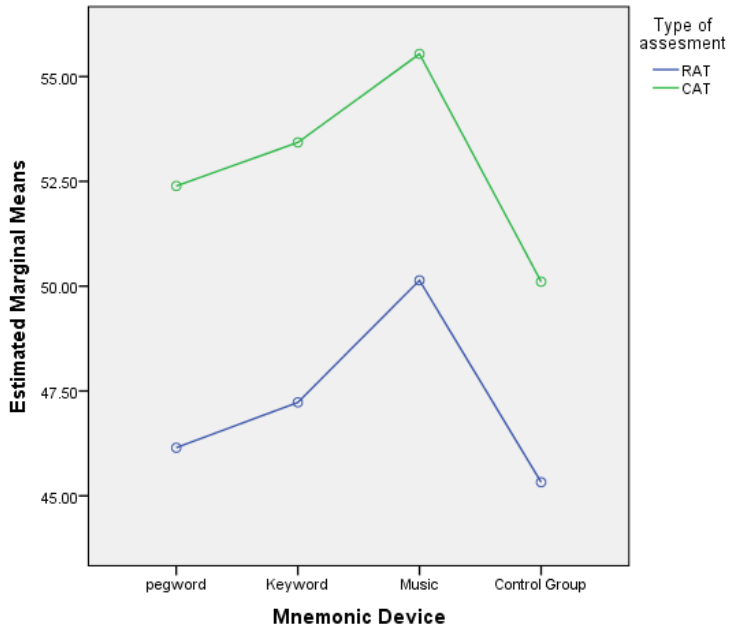


Figure 4.5: Profile Plots Showing Interaction Effect

Key: CAT Continuous Assessment Test, RAT: Random Assessment Test

Figure 4.5 indicate that no significant differences ($F(3,318)= 0.05$, $P> 0.05$) were found for main/interactions between factor A (Mnemonic technique) and factor B (Type of assessment). Therefore, the null hypothesis was retained. Parallel lines in the figure on estimated Marginal Means of observed score show that there was no main/interaction effect between the Mnemonic techniques and two types of assessment (RAT and CAT). This implies that the mean of CAT scores was higher than the mean of RAT across all levels of factor A (Mnemonic technique).

The results suggested that the mean scores of delayed recall (CAT) remained high compared to the mean scores of immediate recall (RAT) regardless whether the subjects were exposed to learning through keyword, pegword or music Mnemonic technique instruction strategies. These findings suggested that all Mnemonic techniques instruction method exposure required time to internalize and rehearse before they can be effectively used in improving retention in Free Recall learning tasks. These results

were contrary to the study done earlier by Elliott and Gentile (1986). In their findings he suggested that main/interactions were significant.

4.4. Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Serial Learning Outcomes

Regarding the second objective, the study sought to investigate whether there were differences in Serial learning outcomes between learners using keyword, pegword and Music Mnemonic techniques. To obtain data, post-test scores were obtained after intervention process of the three Mnemonic treatments groups and a control group. The scores were first subjected to a test of homogeneity and test of normality to ascertain that the scores met the conditions as a requirement for a two-way ANOVA data analysis method. The data was then analysed and presented descriptively and inferentially.

4.4.1 Tests of Assumptions

For two-way ANOVA analysis to be done, the scores should meet several assumptions. The researcher tested for the two main assumptions which must be met before two-way ANOVA analysis is done: test of normality and test of homogeneity as shown below.

4.4.1.1 Normality Test

Test of normality showed that the scores were aligned in the line of best fit as shown in Appendix xiii A on page 209. The Q-Q Plot for observed score of pegword, Q-Q Plot of observed score keyword, Q-Q Plot observed score of music and Q-Q Plot observed score of control group indicated that they were aligned in a straight line. This implies that the scores were having normal curve hence normaly distributed. This further implies that the scores met the assumption of normality.

4.4.1.2 Homogeneity of Variance test

Levene's test showed that the variances for the observed scores for the Mnemonic techniques were equal (F (3,321) = 2.14, P> 0.05) as shown in Appendix xiii B on page 213. This implied that the scores were homogeneaous distributed thus the differences between the scores were very minimal hence they met the condition of homogeneity of variance.

4.4.2 Descriptive Analysis for Mnemonic Techniques Scores on Serial Learning Outcomes

In order to establish the differences in Serial learning outcomes between learners using keyword, pegword and Music Mnemonic techniques the raw data was first subjected to descriptive analysis. The scores were analyzed to get the mean and the standard deviation. The results are presented in Table 4.6.

Table 4.6: Descriptive Analysis for Keyword, Pegword and Music Mnemonic Techniques and Control Group on Serial Learning Outcomes

Mnemonic Device	Type of assessment	n	Minimum	Maximum	Mean	Std. Deviation
Pegword	RAT	41	13.00	78.00	49.68	15.09
	CAT	41	30.00	90.00	59.02	15.98
Keyword	RAT	35	19.00	71.00	49.57	12.02
	CAT	35	26.00	83.00	57.89	14.18
Music	RAT	50	27.00	77.00	55.56	11.71
	CAT	49	27.00	89.00	62.37	18.60
Control Group	RAT	38	20.00	86.00	46.55	17.71
	CAT	36	24.00	78.00	54.44	12.61

Table 3.6 shows that there were mean differences between the three Mnemonic instruction treatment conditions and the control group. Music had the highest mean scores 62.37, 55.56 and standard deviation of 11.71, 18.60 for the CAT and RAT

respectively. Music's RAT minimum and maximum scores were 27 and 77 and CAT minimum and maximum scores were 27 and 89 respectively. Pegword was second with mean score of 59.02, 49.68 and standard deviation of 15.09, 15.98 CAT and RAT respectively. Pegword's RAT minimum and maximum scores were 13 and 78 respectively and CAT minimum and maximum scores were 30 and 90 respectively. Keyword was third with a mean score of 57.89, 49.57 and standard deviation of 12.02, 14.18 CAT and RAT respectively.

Keyword's RAT minimum and maximum scores were 19 and 71 respectively and CAT minimum and maximum scores were 26 and 83 respectively. Finally, the control group recorded the lowest mean score of 54.44, 46.55 and standard deviation of 17.71, 12.61 CAT and RAT respectively. The control group's RAT minimum and maximum scores were 20 and 86 respectively and CAT minimum and maximum scores were 24 and 78 respectively. Descriptive statistics also show that there were mean differences between the factor B (two types of assessment) across all levels of factor A (Mnemonic technique).

The mean scores of CAT (delayed recall) were higher than the mean scores for RAT (immediate recall) across all levels of factor A (Mnemonic technique) instruction treatment conditions and control group. This implies that learners scored higher marks for delayed recall than when tested for immediate recall in all Mnemonic instruction treatment conditions.

4.4.3 Inferential Analysis for Mnemonic Techniques Scores on Serial Learning Outcomes

To second null hypothesis (H_{02}:) which stated that there are no significant differences in Serial learning outcomes between learners using keyword, pegword and music

Mnemonic techniques, a two-way ANOVA data analysis was used to test the hypothesis and where significant differences were found to exist post-hoc pairwise comparison was performed. The second hypothesis was sub-divided into three supplementary hypotheses as follows: To investigate whether there are significant differences between factor A (Mnemonic technique) and learning outcomes. To investigate for significant differences between factor B (type of assessment). Finally, to test whether there is main/interaction effect between factors A and B.

Table 4.7: Two-way ANOVA Test Analysis for Mnemonic Technique on Serial Learning Outcomes

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8516.853[a]	7	1216.70	5.40	.000
Intercept	944504.252	1	944504.25	4183.90	.000
MnemD	3180.046	3	1060.02	4.70	.003
ToA	5223.100	1	5223.10	23.14	.000
MnemD * ToA	74.009	3	24.68	.11	.955
Error	71561.959	317	225.75		
Total	1052891.000	325			
Corrected Total	80078.812	324			

Supplementary hypotheses

Three supplementary hypotheses were analysed individually in order to establish differences between the groups, within the groups and main/interaction effect of factor A and B.

4.4.3.1 $H0_{2.a}$: There is no significant difference between main effect factor A (Mnemonic Techniques) and serial learning outcomes

There were significant differences ($F(3,317) = 4.70$, $P < 0.05$) between learners exposed to learning through the three Mnemonic techniques and Serial learning outcomes. Therefore, the null hypothesis was rejected.

Having found significant differences between Serial learning outcomes among learners taught using different Mnemonic techniques, the researcher sought to investigate further which group(s) was/were responsible for the differences by performing a post-hoc pairwise comparison.

Post-hoc Pairwise Comparison by Least Square Difference (LSD) to determine Mnemonic techniques on Serial learning outcomes

Having found significant differences between Mnemonic instruction condition and Serial learning outcomes, the researcher sought to find out which group(s) where responsible for the differences by performing a post-hoc pairwise comparison LSD. The findings were presented in table 4.8.

Table 4.8: Pairwise Comparisons Analysis for Mnemonic Technique on Serial Learning Outcomes

Dependent Variable: Observed Score

(I) Mnemonic Device	(J) Mnemonic Device	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
Pegword	Keyword	.63	2.45	.80	-4.19	5.436
	Music	-4.610*	2.24	.04	-9.02	-.196
	Control Group	3.855	2.41	.11	-.89	8.596
Keyword	Pegword	-.625	2.45	.80	-5.44	4.185
	Music	-5.235*	2.35	.03	-9.85	-.619
	Control Group	3.230	2.51	.20	-1.70	8.160
Music	Pegword	4.610*	2.24	.04	.20	9.024
	Keyword	5.235*	2.35	.03	.62	9.852
	Control Group	8.465*	2.31	.00	3.92	13.009
Control Group	Pegword	-3.855	2.41	.11	-8.60	.886
	Keyword	-3.230	2.51	.20	-8.16	1.700
	Music	-8.465*	2.31	.00	-13.01	-3.921

Key: I=mean score of main effect Mnemonic technique, J=means score other Mnemonic techniques

Based on estimated marginal means

* The mean difference is significant at the .05 level.

Based on Table 4.8 there were statistically significant differences in Serial learning outcomes between the keyword method and the pegword method groups. It can be concluded that the pegword group performed better than the keyword group. Similarly, the difference between the music and the keyword groups is statistically significant with the music group outperforming the keyword group. In addition, the results also revealed that the difference between the music and control groups is statistically significant. It is worth noting that, there are no statistically significant differences between the music group and the pegword group. The observed mean differences among other mnemonic techniques are statistically insignificant.

Based on the findings of the present study, the music method group had the highest mean of all groups on both immediate recall and delayed recall. The pegword group had the second highest mean on both post-tests. This indicates that the music method and the pegword method groups functioned better than keyword mnemonic and control groups on Serial learning tasks.

Post-hoc pairwise comparison indicated that Music Mnemonic technique had the highest scores across all levels of Mnemonic techniques. Pegword was second while keyword was third. Finally control group was least. The results of this study confirm that the music method and the pegword method is very effective and successful visual instructional tools to improve Serial learning outcomes. The findings of the study also indicated that the keyword has the lowest mean among all mnemonic technique groups on Serial learning outcomes but the third highest mean after the control groups.

These findings suggest that music was the most appropriate Mnemonic technique for Serial learning tasks. Pegword was more appropriate than keyword, keyword was more

appropriate than the control group (where learners were exposed to conventional instruction methods). The, conventional instruction method was least appropriate for learning and retaining Serial learning tasks.

These results are consistent with those found in a number of previous related studies. The study findings of (Levin & Cormick, 2009; Delin, 1990; Carney & Levin, 2008) whose their findings indicated that there were significant differences in learning outcomes, between Mnemonic techniques and control group in favor of Mnemonic techniques. Significant differences were found particularly in keyword and also other Mnemonic techniques for both immediate and delayed recall.

Other studies concurring with these findings include studies by Carney and Levin (1998) and Shriberg, et. al (1982). All these studies agree that Mnemonic techniques were superior in improving Serial learning than control group which used the conventional method.

4.4.3.2 $H0_{2.b}$: There is no Significant Main Effect of Factor B (Type of Assessment) on Serial Learning Outcomes

There were significant differences ($F(1,317) = 23.14$, $P< 0.05$) between type of assessment and Serial learning outcomes. Therefore, the null hypothesis was rejected. Having found significant differences between CAT and RAT on Serial learning outcomes, the researcher sought to investigate further which group(s) were responsible for the differences. A post-hoc pairwise comparison LCD was performed.

Post-hoc Pairwise Comparison by Least square difference (LSD) to determine type of assessment on serial learning outcomes

Having found significant differences between the two types of assessment (CATs and RATs) and learning outcomes in relation to learners exposed to learning through

different mnemonic techniques, the researcher sought to investigate further by finding out where the differences existed by carrying out a post-hoc pairwise comparison LSD. The results were presented in table 4.9.

Table 4.9: Pairwise Comparisons Analysis for Type of Assessment in Relation to Serial Learning Outcomes.

(I) Type of assessment	(J) Type of assessment	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
RAT	CAT	-8.089*	1.68	.00	-11.40	-4.780
CAT	RAT	8.089*	1.68	.00	4.78	11.397

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Key: CAT= Continuous Assessment Test, RAT= Random assessment test

The mean of CAT scores was higher than the mean of RAT across all levels of factor A (Mnemonic technique). There were statistically significant differences of type of assessment on observed score. Observed scores of CAT were higher than the observed score of RAT across all levels of factor A (Mnemonic technique). This means that learners scored much higher when tested for delayed recall in all Mnemonic instruction treatment conditions.

This finding agrees with McReynolds and Acker (1959) in their study to investigate Serial learning under conditions of rapid presentation of stimuli with the ratio between inter-stimulus interval and duration of exposure held constant. The subjects were

exposed to a list of 12 items for 0.082 seconds. Each was using intervals of 0.30, 0.69, and 1.45 seconds between their successive exposures. The findings revealed that the amount of learning increased with the length of the intervening interval. The findings also agree with Carney and Levin (2008) study, whose findings revealed significant advantages of the keyword Mnemonic over a repetition condition, on immediate and 2-day-delayed tests. Surprisingly, these results were contrary to the traditional belief that immediate recall is usually much higher than delayed recall according to the famous Ebbinghaus forgetting curve, (Ebbinghaus, 1885, 1909, 2011). The findings seem to suggest that Mnemonic techniques require time to learn and practice before they can be used to by learners to enhance retention and retrieval of information.

4.4.3.3 $H0_{2c}$: There is no Significant Main/Interaction Effect between Mnemonic Techniques and Type of Assessment on Serial Learning Outcomes

The researcher explored the main/ interaction effect between Mnemonic techniques and the type of assessment as factors influencing Serial learning outcomes. The data were subjected to general linear model (univariate) analysis and the results are presented in Figure 4.6.

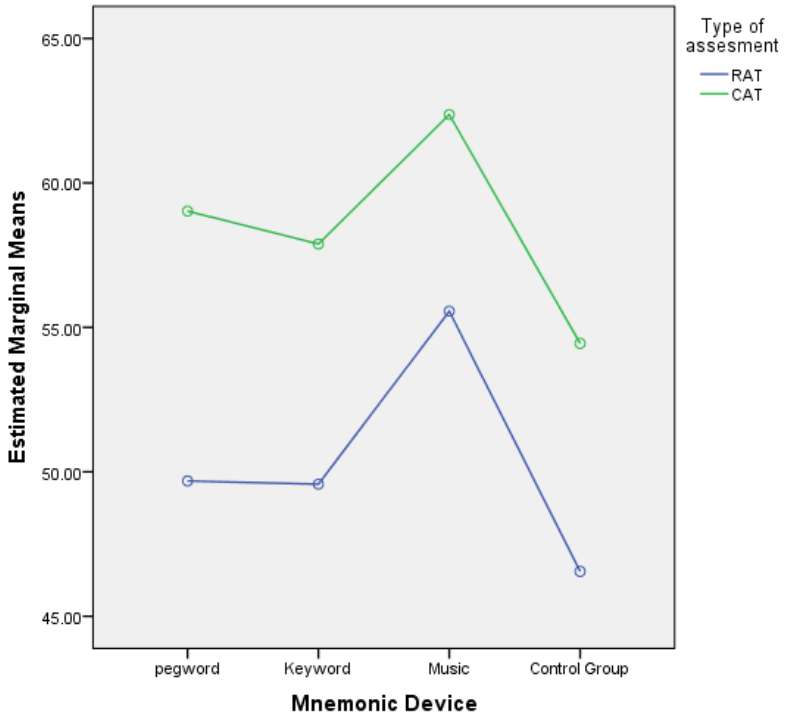


Figure 4.6: Profile Plots for Main/Interaction Effect of Factor A and Factor B in Relation to Serial Learning Outcomes

There were no significant interaction effects (F (3,317) = 0.11, P> 0.05) between factor A (Mnemonic technique) and factor B (type of assessment). Therefore, the null hypothesis was retained. Profile Plots on Estimated Marginal Means on observed score show that there was no main/interaction effect between the Mnemonic techniques and two types of assessment RAT and CAT. The parallel lines in figure 4.6 indicate no interaction effect on type of assessment on the observed score. This implies that the mean of CAT scores was higher than the mean of RAT across all levels of factor A (Mnemonic technique). The results suggest that the mean scores of CAT remained high compared to the mean scores of RAT regardless of whether the subjects were exposed to learning through keyword, pegword or music Mnemonic technique exposure. The findings suggested that all Mnemonic techniques required time for practice after exposure for them to be effective in improving retention in Serial learning tasks. These

results were contrary to the study done earlier by Elliott and Gentile (1986), whose findings suggested that interactions effects were significantly different.

4.5 Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Mathematics and Social Studies

Regarding the third objective, the study sought to establish whether there were significant differences between learners exposed to learning through keyword, pegword and music Mnemonic techniques instruction treatment condition and learning outcomes of mathematics and Social Studies. Data were obtained from post-test scores which were administered after intervention process of the three Mnemonic instruction treatment conditions and a control group. The scores were first subjected to a test of homogeneity and test of normality to ensure the scores met these conditions requirement for one-way ANOVA data analysis method. The data were then analysed and presented descriptively and inferentially as shown below:

4.5.1 Tests of Assumptions

For one-way ANOVA analysis to be done, the scores should meet several assumptions. The researcher tested for the two main assumptions which must be met before one-way ANOVA analysis is performed: test of normality and test homogeneity as shown below.

4.5.1.1 Normality Test

Test of normality showed that the scores were aligned in the line of best fit as shown in Appendix xiv A in page 214. The Q-Q Plot for observed score of pegword, Q-Q Plot of observed score keyword, Q-Q Plot observed score of music and Q-Q Plot observed score of control group indicated that they were aligned in a straight line. This implies that the scores were formimng normal curve hence normaly distributed. Hence the scores met the assumption of normality.

4.5.1.2 Homogeneity of Variance Test

Levene's test showed that the variances for the observed scores for the Mnemonic techniques were equal (F (3,322) = 2.16, P> 0.05) as shown in Appendix xiv B page on 218. This implied that the scores were homogineously disributed hence they met the condition of homogeneity of variance.

4.5.2 Descriptive Analysis for Mnemonic Techniques Scores on Serial Learning Outcomes

To establish the differences in Serial learning outcomes between learners using keyword, pegword and Music Mnemonic instruction treatment conditions. The raw data was first analysed descriptively. The descriptive analysis was done in order to obtain the means and the standard deviations. The results are presented in Table 4.10.

Table 4.10: Descriptive Analysis for Mathematics and Social Studies

Subject	Mnemonic Device	n	Minimum	Maximum	Mean	Std. Deviation
Maths	Pegword	44	26.00	68.00	49.90	9.526
	Keyword	35	23.00	86.00	50.54	16.41
	Music	35	34.00	80.00	50.69	12.01
	Control Group	37	26.00	72.00	50.89	13.33
Social	Pegword	44	17.00	92.00	49.14	16.74
Studies	Keyword	35	21.00	78.00	44.80	12.52
	Music	34	17.00	73.00	52.88	13.05
	Control Group	37	18.00	54.00	42.65	8.32

Table 4.10 shows that Social Studies had much higher mean differences between the three Mnemonic technique treatment instruction methods and control group compared to Mathematics which had close mean differences between the three Mnemonic instruction methods and control group. In mathematics, the mean differences were not significant with control group having the highest mean score of 50.89 and standard deviation of 13.33. Control group had minimum and maximum scores of 26 and 72

respectively. Music was second with mean 50.69 and standard deviation 12.01. Music had minimum and maximum scores of 34 and 80 respectively. Keyword was third with a mean 50.54 and standard deviation 16.41. Keyword had minimum and maximum scores of 23 and 86 respectively. Finally, pegword had the lowest of mean of 49.54 and standard deviation of 9.53. Pegword had minimum and maximum scores of 26 and 68 respectively. This is an indication that Mnemonic instruction treatment condition did not have advantage over control group on learning outcomes of mathematics.

On the other hand, Social Studies had higher mean score differences among the three Mnemonic instruction treatment condition and control group. Music had the highest mean of 52.88 and standard deviation of 13.05. Music had minimum and maximum scores of 17 and 73 respectively. Pegword was second with a mean score of 49.14 and standard deviation of 16.74, Pegword had minimum and maximum scores of 17 and 92 respectively. Keyword was third with a mean 44.80 and standard deviation of 8.32. Keyword had minimum and maximum scores of 21 and 78 respectively. And finally control group had the lowest mean of 42.65 and standard deviation of 9.53. Control group had minimum and maximum scores of 18 and 54 respectively.

4.5.3 Inferential Analysis for Differences in Mnemonic Techniques Instruction Method on Mathematics and Social Studies Learning Outcomes.

To test the third null hypothesis (H_{03}:) which stated that there are no significant differences in mathematics and Social Studies learning outcomes between learners using keyword, pegword and music Mnemonic techniques instruction methods. One-way ANOVA analysis was done and pairwise comparison (LSD) was performed where significant differences were identified. The third hypothesis was divided into two supplementary hypotheses to test for the following.

1) Significant differences between learners exposed to learning through different Mnemonic technique and mathematics learning outcomes, and
2) Significant differences between learners exposed to learning through Mnemonic techniques and Social Studies learning outcomes.

Table 4.11: One-way ANOVA analysis for Mnemonic Technique on Mathematics and Social Studies Learning Outcomes

Subject		Sum of Squares	df	Mean Square	F	Sig.
Maths	Between Groups	25.79	3	8.60	.05	.984
	Within Groups	24357.683	147	165.70		
	Total	24383.47	150			
Social Studies	Between Groups	2226.35	3	742.12	4.25	.007
	Within Groups	25502.74	146	174.68		
	Total	27729.09	149			

Supplementary hypotheses

4.5.3.1 $H0_{3.a}$: There is no Significant Difference in Learning Outcomes of Mathematics between Learners using Keyword, Pegword and Music Mnemonic Techniques

No significant differences ($F(3,147)= 0.052$, $P< 0.05$) were found in mathematics learning outcomes between learners using various Mnemonic techniques instruction methods. Consequently**,** the null hypothesis was retained.

This is an indication that the three Mnemonic instruction treatment conditions did not have any significant differences in Mathematics learning outcomes. The implication of this finding is that learners did not benefit from the Mnemonic techniques instruction methods. Surprisingly the control group had the highest mean although they were not significant. This is indicated in the mean scores obtained from the post-test where the control group recorded highest mean of 50.89, music was second with a mean of 50.69,

keyword was third with 50.54 and finally pegword least mean of 49.54. The results indicated that learners were better off using conventional methods of teaching rather than Mnemonic techniques to learn and retain mathematics concepts.

The findings are consistent with studies done by DeLashmutt and Nebraska (2007) in their study on the role of Mnemonics in Learning Mathematics. Their findings suggested that Mnemonic techniques help some students to learn mathematics but not all of them. Some of the students preferred just learning the mathematics concepts, instead of having to learn a form of Mnemonics to remember the concepts. Their research findings revealed that some students in the lower levels used Mnemonics to help them retain key mathematics concepts.

There are many factors accounting for such results as well as the differences between the findings of this study and those of other similar studies. One possible reason which may account for insignificant differences may be partially due to the fact that in the present study, each selected technique was compared with other techniques, whereas in earlier studies comparison was done between each of the techniques with a control group only. Another reason could have been that the investigator used class seven pupils, who may have preferred using conventional methods rather having to learn a form of Mnemonics technique first. Inadequate time to practice and internalize mnemonic techniques may have affected the use of mnemonic techniques. This explains why the control group had the highest mean score compared to the three mnemonic techniques although the differences were not significant.

However, the findings of the current study on differences in Mnemonic techniques on mathematics learning outcomes contradicted with the findings of Irish (2002) in his

study to investigate the effective use of pegword and keyword Mnemonic techniques to study basic multiplication facts. His findings revealed that there was significant difference in performance of basic multiplication facts with respect to the length of treatment. The students who remained in the treatment phase for the longest time experienced the greatest gains. The number of sessions per week was significant to the level and rapidity of change. Those students who interacted more frequently each week demonstrated the greatest increase during the Memory Math. Students who had Memory Math computer sessions at least 3 times per week were more likely to experience gains in their multiplication performance than those who interacted with the software on a less frequent basis.

In the current study, the length of Mnemonic technique intervention may have affected the results as highlighted by Irish study especially for immediate recall where learners were tested immediately after the lesson. The current study findings also contrast with the findings of Everett, Harsy, Hupp, and Jewell (2014), which indicated the use of Mnemonics improved mathematics scores in both 5 minute and 3-week maintenance delayed recall.

The findings also contradicted with those of Greene (1999) who compared the effects of a pegword mnemonic technique strategy with conventional instruction to teach multiplication facts to 23 elementary and middle school learning disabled students. The findings indicated that there were significant advantages of students who used mnemonic technique than those who used the traditional strategy at post-test, in 24 hours and seven days delayed tests.

4.5.3.2 $H0_{3.b}$: There is no Significant Difference in Learning Outcomes of Social Studies between Learners using Keyword, Pegword and Music Mnemonic Techniques

The data in Table 4.11 show that indeed there were significant mean differences $F(3,146) = 4.25$, $P< 0.05$) in learning outcomes of Social Studies between learners taught using pegword, keyword, music Mnemonic techniques and control groups Therefore, the null hypothesis was rejected. Having found significant differences between the learning outcomes in Social Studies among learners taught using different Mnemonic techniques, the researcher sought to investigate which groups were responsible for the differences by performing a post-hoc pairwise comparison (LSD).

Post-hoc Pairwise Comparison by Least square difference (LSD) to determine Mnemonic techniques on Social Studies learning outcomes.

Having found significant differences in Social Studies learning outcomes between learners taught using different Mnemonic techniques, the researcher sought to investigate further to establish where the differences existed by carrying out a post-hoc pairwise comparison (LSD). The results were presented in table 4.12.

Table 4.12: Pairwise Comparisons Analysis for Mnemonic Technique in Relation to Social Studies Learning Outcomes.

Subject	(I) Mnemonic Device	(J) Mnemonic Device	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Social studies	Pegword	Keyword	4.34	2.99	.15	-1.58	10.25
		Music	-3.75	3.02	.22	-9.72	2.22
		Control Group	6.49*	2.95	.03	.66	12.31
	Keyword	pegword	-4.34	2.99	.15	-10.25	1.58
		Music	-8.08*	3.18	.01	-14.38	-1.80
		Control Group	2.15	3.12	.49	-4.01	8.31
	Music	pegword	3.75	3.02	.22	-2.22	9.71
		Keyword	8.08*	3.19	.01	1.80	14.37
		Control Group	10.23*	3.14	.00	4.03	16.44
	Control Group	Pegword	-6.45*	2.95	.03	-12.31	-.66
		Keyword	-2.15	3.12	.49	-8.31	4.01
		Music	-10.23*	3.14	.00	-16.44	-4.03

*. The mean difference was significant at the 0.05 level.

Based on Table 4.12, for Social Studies learning outcomes there are statistically significant differences between the music method and the keyword method groups. It can be concluded that the music group performed better than the keyword group. Similarly, the difference between the music and the control groups is statistically significant with the music group outperforming the control group. In addition, the results also revealed that the differences between pegword mnemonics and the control group is statistically significant, with the pegword group outperforming the control group. Moreover, although there is a difference between the means of the pegword method and music method, the differences are not statistically significant. The observed mean differences among other mnemonic techniques are statistically insignificant.

Based on the findings of the present study, the music mnemonic instruction group had the highest mean among the three groups on both immediate recall and delayed recall. The pegword group had the second highest mean on both tests. This indicates that the music method and the pegword method groups functioned better than the keyword mnemonic technique and control groups on Social Studies. The obtained results also indicated that the differences between the means of the pegword method group and the keyword method group was not statistically significant on Social Studies subject.

The implication of these findings was that music was the most appropriate Mnemonic technique for learning and retaining Social Studies content among learners. Pegword mnemonic technique was more appropriate than keyword mnemonic technique. Finally, control group which was using conventional methods was the least appropriate among the four groups.

These findings agree with a study done earlier by Mastropieri and Scruggs (1998) to determine effectiveness of Mnemonic instruction in Social Studies. All students received Mnemonic instruction for one chapter, and on other chapter they were taught using traditional methods of instruction. Each chapter was taught daily over a period of one week, in each of the three classrooms. Chapter tests were given at the end of the week (immediate), and two weeks later (delayed).

Analysis of the results revealed that students under mnemonic technique instructions performed significantly higher in both immediate and delayed learning outcome tests than those under conventional instruction conditions. It is worth noting that while the current study investigated effect of mnemonic techniques on Social Studies learning outcomes, the pervious study investigated effects of mnemonic techniques on both immediate and delayed recall but in both the current and previous studies the differences were significant.

The findings of this study are also supported the other research that was done by Maghy (2015) on the effectiveness of mnemonic music method in academic learning at school. Their findings revealed that, the music mnemonic technique is capable of enhancing the brain performance. A study finding by Köksal, Yağişan, and Çekiç (2013) indicated that teaching through music mnemonic significantly increased brain performance. This is due to the influence of music in balancing the right and left hemisphere thus improving brain performance.

Crowther (2012) suggests that songs make recalling of facts easier. The same process the learners use to remember the lyrics of their favorite songs can be applied to their studies for long term memory retention. However, Music technique cannot be used for

all subtopics because it requires a lot of time. It also requires a lot of intellectual effort for a teacher to compose songs and sing them in class. In addition, not all content and facts can be integrated in a song, and therefore table, charts and diagrams as it may need to be used instead.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The summary, conclusions and recommendations of this study were presented in this chapter. The summary of the findings will be presented first, followed by the conclusions of the study. Thereafter, the recommendations of the study will be presented reflecting both policy issues and area of further research.

5.2 Summary of Findings

The study was designed to investigate appropriateness of Mnemonic techniques on learning outcomes among upper primary school pupils in Machakos Sub-County as measured by Free Recall learning and Serial learning outcomes. In the investigation part the study sought to find out whether significant differences existed between keyword, pegword and music Mnemonic techniques and Free Recall and Serial recall learning outcomes. The study also investigated whether significant differences existed within the RAT and CAT types of assessment.

The study further sought to examine the interaction effect of factor A (Mnemonic techniques) and factor B (type of assessment). The study also explored appropriateness of Mnemonic techniques on mathematics and Social Studies learning outcomes. In the exploratory part of the study, Keyword, pegword and music Mnemonic techniques were compared with mathematics learning outcomes. Further Keyword, pegword and music Mnemonic techniques were also compared with Social Studies learning outcomes. The ultimate goal of the study was to identify the most appropriate Mnemonic technique for Free Recall and Serial learning outcomes.

5.2.1 Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Free Recall Learning Outcomes

The first objective of the study was to determine whether there were significant differences in Free Recall learning outcomes between learners using keyword, pegword and Music Mnemonic techniques. Three supplementary hypotheses were developed and tested from this objective: the first supplementary null hypothesis was ($H0_{1.a}$:) which stated that, there is no significant difference between main effect factor A (Mnemonic technique strategies) and observed scores.

Empirical evidence showed that, although the means of observed scores on three Mnemonic technique treatments and control group were different, the differences were not statistically significant at all levels of factor A. This is an indication that there were no significant differences ($F(3,318) = 2.26$, $P > 0.05$) in Free Recall learning outcomes between learners who were taught using pegword, keyword and music Mnemonic techniques and the control group. These findings further imply that, whether learners were exposed to the three Mnemonic techniques or left as such, there were no differences in free recall learning outcomes. Based on these findings, none of the three Mnemonic techniques (pegword, keyword and music) was found to be appropriate for Free Recall learning tasks.

The second supplementary null hypothesis was ($H0_{1b}$): There is no significant differences between main effect factor B (Type of assessment) and observed scores. Empirical evidence revealed that there were significant differences ($F(1,318)= 14.17$, $P< 0.05$) between main effect factor B (type of assessment) and observed score at all levels of Mnemonic techniques treatment conditions. Further analysis using post-hoc pairwise (LSD) revealed that the mean of CAT scores (delayed recall) was higher than

the mean of RAT scores (immediate recall) across all levels of factor A (Mnemonic technique). Observed scores of CAT were found to be higher where the learners were tested for delayed recall after three weeks compared to the observed score of RAT scores of learners who were tested immediately after Mnemonic technique treatment. Surprisingly, this was contrary to the traditional belief that immediate recall is usually much higher than delayed recall. In summary, the findings suggested that time is essential to learn and practice Mnemonic technique before the learners can be required to use them. This is evident in the differences between the immediate and delayed scores whereby delayed (CAT) scores were much higher than immediate (RAT) scores.

The third supplementary null hypothesis was ($H0_{1.c}$): There is no main/interaction effect between factor A (Mnemonic instruction treatment condition) and factor B (type of assessment) and learning outcomes. Results of Profile Plots on Estimated Marginal Means revealed that no interaction effect ($F(3,318) = 0.05$, $P > 0.05$) between keyword, pegword and music and CAT and RAT in relation to learning outcomes. In summary the findings suggested that Mnemonic technique exposure did not have any interaction effect to the type of assessment.

In summary, mean scores of CAT (delayed recall) remained higher than the mean scores of RAT (immediate recall) across all levels of factor A (Mnemonic technique). The results suggested that the mean scores of CAT remained high compared to the mean scores of RAT regardless of whether the subjects were exposed to keyword, pegword or music Mnemonic technique exposure, hence the parallel lines.

5.2.2 Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Serial Learning Outcomes

The second objective of the study was to determine whether there were significant differences in Serial learning outcomes between learners using keyword, pegword and Music Mnemonic techniques. Three supplementary hypotheses were developed and tested from this objective. The first supplementary null hypothesis was ($H0_{2.a}$): There is no significant difference of main effect factor A (Mnemonic Technique strategies) on the Serial learning outcomes. Empirical evidence revealed the existence of a statistically significant differences ($F(3,317)= 4.70, P< 0.05$) between learners exposed to learning through keyword, pegword music and control group and to Serial learning outcomes.

Further analysis using Post-hoc Pairwise Comparison by Least square difference to establish which group was responsible for the differences revealed that Music Mnemonic technique had the highest scores across all levels of Mnemonic techniques, pegword was second, keyword was third and finally control group. In summary, the findings suggest that music was the most appropriate Mnemonic technique for Serial learning tasks, Pegword was second appropriate, and keyword was least appropriate among the three mnemonic techniques. Control group which was using conventional methods of teaching and learning was least appropriate for Serial learning tasks. The findings further suggest that to enhance Serial learning outcomes, learners need to be encouraged to use music Mnemonic technique and not the other two type of mnemonic technique.

The Second supplementary null hypothesis ($H0_{2.b}$:) stated that there are no significant differences between of main effect factor B (Type of assessment) and Serial learning outcomes. Empirical evidence showed that there were significant differences

(F(1,317)= 23.14, P< 0.05) between the type of assessment and levels Mnemonic technique treatment conditions in relation to learning outcomes. Further analysis using post-hoc pairwise (LSD) to establish which groups were responsible for the differences revealed that, the mean scores of CAT were higher than the mean scores of RAT across all levels of factor A (Mnemonic technique). Observed scores of Serial learning outcomes of CAT were found to be higher when the learners were tested for delayed recall after three weeks compared to the observed score of RAT when the learners were tested for immediate recall at the end of the lesson during Mnemonic instruction treatment condition.

In summary the findings revealed that time is essential to learn and practise Mnemonic technique before the learners can be required to use them. This is evident in the differences between the immediate and delayed scores whereby delayed recall (CAT) scores were much higher than immediate recall (RAT) scores. The third supplementary hypothesis was ($H0_{2.c}$:) which stated that, there is no main/interaction effect between factor A (Mnemonic Technique) and factor B (type of assessment) in relation to Serial learning outcomes.

Results of profile plots on estimated marginal means revealed that there were no interaction effect (F (3,317) = 0.11, P> 0.05) between keyword, pegword and music, and CAT and RAT in relation to learning outcomes. In summary the findings suggested that Mnemonic technique treatment conditions did not have any interaction effect on the type of assessment used, whether the learners had been tested earlier for RAT immediately after Mnemonic technique exposure or tested for CAT three weeks after Mnemonic technique exposure; the two type of assessment did not have any significant interaction effect to affect Serial learning outcomes between the two scores.

5.2.3 Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Mathematics and Social Studies

The third objective of this study was to determine whether there were significant differences in learning outcomes of mathematics and Social Studies subjects between learners using keyword, pegword and music Mnemonic techniques.

Two supplementary null hypotheses were developed and tested from this objective: The first supplementary null hypothesis was ($H0_{3a}$) there is no significant differences in learning outcomes of mathematics between learners using keyword, pegword and music Mnemonic techniques. The results indicated that there were no significant differences ($F(3,147)= 0.052$, $P< 0.05$) in learning outcomes of mathematics between learners taught using keyword, pegword and music Mnemonic techniques. Empirical evidence further showed that although the means of the observed scores on the three Mnemonic technique treatments and control group were different, the differences were not statistically significant in the four groups.

Further, although the control group recorded slightly higher mean than the rest of the groups, the differences were not significant. Differences were found between three Mnemonic techniques with music slightly being higher than keyword and pegword. Keyword was second, and finally pegword had the least mean score. In summary, based on these findings learners exposed to the three Mnemonic techniques did not have any significant difference in mathematics learning outcomes. Hence none of the three Mnemonic techniques (pegword, keyword and music) was found to be appropriate for learning and retention of mathematics.

The second supplementary null hypothesis was ($H0_{3b}$) which stated that there are no significant differences in learning outcomes of Social Studies between learners taught

using keyword, pegword and music Mnemonic techniques. There were significant differences ($F(3,146) = 4.25$, $P< 0.05$) between the three Mnemonic techniques and control group in relation to Social Studies learning outcomes. Further analysis to establish which groups were responsible for the differences using post-hoc pairwise (LSD) revealed that mean differences were statistically significant in Social Studies learning outcomes scores among subjects exposed to learning through Music, keyword and control group. More specifically, participants exposed to Music had significantly high mean as compared to the mean scores of participants exposed to keyword and the control group.

Although there were differences between participants exposed to music and pegword, the differences were not significant. This is an indication that between music and pegword Mnemonic technique exposure, there were no significant differences in learning outcomes. In summary music Mnemonic technique was found TO be the most appropriate for Social Studies. Pegword was more appropriate than keyword, keyword was least appropriate among the three mnemonic instruction treatment conditions. Control group which was using conventional methods was the least appropriate among the four groups.

5.3 Conclusions

This section focused on conclusions of the findings based on the objectives of the study. The results of the study presented some evidence of the existence of the hypothesized relationship between Mnemonic technique treatment conditions and Free Recall as well as Serial recall learning outcomes. The conclusions were presented per objectives as follows:

5.3.1 Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Free Recall Learning Outcomes

Three supplementary hypotheses were developed from the first objective. The findings provided the following conclusions: First, based on the $H0_{1a,}$ there is no significant differences of main effect of factor A (Mnemonic Technique strategies) on Free Recall learning outcomes. No significant differences ($F(3,318)= 2.26$, $P> 0.05$) were found between learners taught using pegword, keyword, music Mnemonic techniques and control group. The null hypothesis was retained. Based on these findings, a logical conclusion of this evidence is that none of the three Mnemonic Technique strategies was found to be appropriate for Free Recall learning tasks.

Further, conclusions reached is that whether learners used any of the three Mnemonic treatment conditions (pegword, keyword and music Mnemonic techniques as well as conventional method of teaching) to learn, retain or remember Free Recall tasks there was no significant difference on the learning outcomes and hence none of the three Mnemonic techniques was found to be most appropriate as hypothesized.

Second, based on $H0_{1b}$, there is no significant difference between main effect of factor B (Type of Assessment) and Free Recall learning outcomes. The null hypothesis was rejected. This means that significant differences ($F(1,318)= 14.17$, $P< 0.05$) were found between the two types of assessment (immediate and delayed recall) across all levels of mnemonic technique treatment conditions. Further analysis indicated that the mean scores of CAT were higher than the mean scores of RAT across all levels of the three Mnemonic technique conditions. It is the investigator's a logical conclusion that when using Mnemonic techniques time is required first to internalize the Mnemonic techniques before the learners can use them to enhance memory, hence learners were getting higher mean scores in delayed recall than immediate recall. The findings suggest

that time may have not been adequate for practice and rehearsal with Mnemonic techniques before testing for immediate recall.

Third, based on $H0_{1c}$ There is no significant main/interaction effect between factor A (Mnemonic techniques) and Factor B (Type of Assessment) in relation to observed scores. No significant main/interaction effect ($F(3,318)= 0.05$, $P> 0.05$) between Mnemonic techniques and Type of Assessment. In conclusion, the findings suggested that Mnemonic techniques exposure did not have any main/interaction effect with type of assessment used. Whether learners were taught using any the of three Mnemonic technique conditions, this did not affect immediate or delayed recall learning outcomes hence delayed recall remained higher than immediate recall regardless. This means that the CAT scores remained higher than RAT scores in all the three Mnemonic technique treatment conditions.

The findings of the present study also showed that despite mean differences between various mnemonic techniques in Free Recall learning outcomes, they failed to help to learners achieve good results in comparison with the Control group. Such failure may be partly due to the fact that they are not very common and acceptable in our educational system.

5.3.2 Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Serial Learning Outcomes

The second objective had three main conclusions as follows: First, based on the hypothesis that ($H0_{2a}$): there is no significant difference of main effect factor A (Mnemonic technique) on Serial learning outcomes. The null hypothesis was rejected. There were significant differences ($F(3,317)= 4.70$, $P< 0.05$) between Mnemonic technique treatment conditions and Serial learning outcomes. Further analysis indicated

that Music technique had the highest scores across all levels of Mnemonic techniques, pegword was second and keyword was least appropriate among three Mnemonic technique treatment conditions. Control group was least appropriate among the four groups. It is researcher's logical conclusion that Mnemonic techniques can be used to improve Serial learning outcomes. However, music is the most appropriate while keyword is the least appropriate.

Second, based on the hypothesis ($H0_{2b}$) there is no significant difference of main effect of factor B (Type of Assessment) on Serial learning outcomes. The null hypothesis was rejected. There were significant differences ($F(1,317) = 23.14$, $P< 0.05$) between main effect of factor B (Type of Assessment) and Serial learning outcomes. Further analysis indicated that the mean of CAT scores was higher than the mean of RAT scores across all levels of factor A (Mnemonic technique). The investigator's conclusion that learners require time to learn, practise and internalize the Mnemonics techniques before they can be used to enhance learning outcomes.

Third, as hypothesised $H0_{2.c}$: there is no significant main/interaction effect of factor A (Mnemonic techniques) and factor B (Type of Assessment) on Serial learning outcomes. The null hypothesis was retained. No main/interaction effects ($F(3,317)= 0.11$, $P> 0.05$) were found In conclusion, the findings suggested that Mnemonic techniques exposure did not have any interaction effect between Mnemonic techniques and the type of assessment used. This means that whether the learners were taught using any of the three Mnemonic techniques treatment conditions or not, this did not have any effect on the observed score of the type of assessment [immediate recall (RAT) and delayed recall (CAT). Hence the score remained constant across all the levels Mnemonic techniques instruction treatment conditions.

From an educational perspective, mnemonic instructional methods such as the music and the pegword methods are very effective and valuable visual training tools. The results of this study corroborate the viability of mnemonic instructions in Serial learning tasks.

According to these study findings, the researcher has concluded that music mnemonic technique is effective in improving Serial learning outcomes. Music as an instruction tool has proven to apply multimodality process. Music also uses chunking and rehearsal process which gives a good impact to the working process of memory by managing new information in the form of Serial learning tasks.

5.3.3 Appropriateness of Keyword, Pegword and Music Mnemonic Techniques on Mathematics and Social Studies Learning Outcomes

This objective had resulted in two conclusions as follows. First, as hypothesised that: $H0_{3.a}$: there is no significant difference in learning outcomes of mathematics between learners taught using keyword, pegword and music Mnemonic techniques. The null hypothesis was retained. No significant differences ($F(3,147)= 0.052$, $P< 0.05$) were found between learners exposed to learning through keyword, pegword and music Mnemonic techniques. Although mean differences existed between the three mnemonic technique groups and control group, they were not statistically significant. Hence mnemonic techniques had no effect on mathematics learning outcomes. It is the researcher's conclusion that Mnemonic techniques help some learners to learn mathematics but not all of them and that some of the learners would rather just learn the math concepts, instead of having to learn a form of Mnemonics to remember the concepts.

Second, as hypothesised that ($H0_{3b}$): there is no significant difference in learning outcomes of Social Studies between learners taught using keyword, pegword and music Mnemonic techniques**.** The null hypothesis was rejected. There were significant differences ($F(3,146) = 4.25$, $P< 0.05$) in Social Studies learning outcomes between learners exposed to learning through different mnemonic techniques. Mean differences were significant in Social Studies learning outcomes scores among subjects exposed to Music, keyword and control group. Further, participants exposed to Music had significantly higher mean as compared to the mean scores obtained using pegword. In conclusion, mnemonic techniques can be used to improve Social Studies learning outcomes. However, music was most the appropriate in improving Social Studies learning outcomes while keyword was least appropriate.

Based on the findings of the present study, it is the researcher's conclusion that different mnemonic techniques have differential effects on learning Social Studies. This implies that careful and informed selection of the teaching technique can facilitate learning Social Studies.

5.4 Recommendations

Based on the findings of the study, the following recommendations for policy and further research were made.

5.4.1 Policy Recommendations

i. The Ministry of Education needs to establish policies that will effectively support integration of Mnemonic techniques in teaching and learning process especially in the lower levels particularly the Competency Based Curriculum (CBC). These include:

a) Allocating more funds for primary schools and specifically for purchasing relevant materials for Mnemonic techniques.
b) Ensuring proper supervision of the teaching process by Mnemonic techniques.
c) Ensuring that the content is well integrated with Mnemonic techniques.

ii. There is need to in-cooperate Mnemonic techniques topics in teacher training colleges.

iii. Serving teachers should be retooled on the use of Mnemonic techniques during teaching.

iv. Mnemonic techniques which are culture friendly should be developed in line with diverse African cultures. This will lead to increased acceptance among teachers and learners. The more these mnemonic techniques are accepted, the more they are likely to be used to enhance learning outcomes.

v. The Head teachers should construct laboratories facilities for storing Mnemonic technique materials.

vi. The Kenya Institute of Curriculum Development (KICD) should strengthen the e-learning programmes in order to ensure all primary schools benefit from them. This is because Mnemonic techniques can be effectively integrated in curriculum by use of e-learning programmes such as computer simulations.

5.4.2 Recommendation for Further Research

The researcher suggests that further researches should be carried out on:

i. No significant mean differences were found in keyword, pegword and Music Mnemonic techniques. It was noted that the content used in this study was class 7 Social Studies term one syllabus. There is need to investigate relationship

between Free Recall learning outcomes and keyword, pegword and Music Mnemonic techniques using content from other levels like between grade one and four to establish whether the results will show no significant differences.

ii. The findings of this study have shown that keyword, pegword and music Mnemonic techniques have a positive and significant predictive value on Serial learning outcomes. However, the study did not investigate the relationship between Serial learning and other Mnemonic techniques. For this purpose, there is need to carry out further research to identify the effect of other Mnemonic techniques on Serial learning.

iii. The findings of this study have shown that keyword, pegword and music Mnemonic techniques have a positive and significant predictive value on Social Studies learning outcomes. However, the study did not investigate the relationship between Social Studies and other Mnemonic techniques. For this purpose, there is need to carry out further research to identify the effect of other Mnemonic techniques on Social Studies.

iv. The results of this study may be generalized to the Kenyan upper primary school pupils' population with caution because it covered a small sample drawn from only one County. To control the effects of cultural, geographical and, or class differences, the study should be replicated in other counties and with pupils in different levels like pre-primary, grade one, two and three.

v. The findings of this study were based on primary school pupils. To further contribute to the understanding of the relationship(s) between Mnemonic techniques and learning outcomes, a similar study should be replicated with samples drawn from students in secondary schools, colleges and universities.

vi. In this study, learning outcomes were measured using the achievement test scores drawn from Random Assessment Tests and Continuous Assessment Tests done immediately after a lesson and after three weeks. Although the scores were valid and reliable, future studies should involve the use of a standard classroom test developed by local researchers and administered at the end of the term or level to reflect total performance of the learners. This will improve the reliability and validity of the scores.

REFERENCES

Abagi, O. & Odipo, G. (1997). Efficiency of primary education in Kenya, *situational analysis and implications for educational reform*; Nairobi, Institute of Policy Analysis and Research.

Abbas, A., Zarei A. A & Keysan F. (2016).*The Effect of Mnemonic and Mapping Techniques on L2 Vocabulary Learning*, Imam Khomeini International University, Faculty of Humanities, Department of English, Qazvin, Iran.

Adam L. Putnam (2015). "Mnemonics in Education: Current Research and Applications". In *American Psychological Association 2015, Vol. 1, No. 2,* 130–139. Page 130. Washington University in St. Louis.

African Population and Health Research Center, (2008). Policy and program issues emerging from the education research in urban informal settlements of Nairobi, Kenya

Albers B. D. & Bach R. (2003). Rockin' soc: *Using popular music to introduce sociological concepts. Teach Social., 31,* 237–245.

Altenmu, Ller, E. & Schlaug, G. (2013). *Neurobiological aspects of neurologic music therapy.* Music and Medicine, 5(4), 210-216.

Amiryousefi, M., & Ketabi, S. (2011). Mnemonic instruction: A way to boost vocabulary learning and recall. *Journal of Language Teaching and Research, 2(1), 178-182.*

Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. In K.W. Spence (Eds.), *The psychology of learning and motivation: Advances in research and theory.* (Vol. 2, pp. 89-195). New York: Academic Press.

Atkinson, R. C. (1975). *Mnemonic technics in second-language learning.* American Psychologist, New York: Academic Press.

Baddeley, A. D. (1978). The trouble with levels: *A re-examination of Craik and Lockhart's framework for memory research*. Psychological Review, 85. 13-152.

Balch, W. R. (2005). Elaborations of introductory psychology terms: Effects on test performance and subjective ratings. *Teaching of Psychology, 32,* 29-34. http://dx.doi.org/10.1207/s15328023top3201-7

Baker, J. G., Ceci, S.J. & Herrmann G. (1987). Semantic structure and processing: Implications for the learning-disabled child. In 11. L. Swanson (Ed.), Ad Yangeain_learning and behamigral digabtlities supplepent 2; memory and earning dtg abilittes (pp.83-110). Greenwich, CT: JAI Press.

Bakken, J. P., & Simpson, C. G. (2011). Mnemonic strategies: Success for the young adult learner. *The Journal of Human Resource and Adult Learning, 7*(2), 79-85.

Bellezza, F. (1996). Mnemonic methods to enhance storage and retrieval. In E. L. Bjork, & RA. Bjork (Eds.), *Memory: Handbook of perception and cognition* (pp. 345-380). San Diego, CA: Academic Press.

Betz, W. (1999). *Algebra for today* (Vol. 1, p. 291). Boston, MA: Ginn and Company.

Blick, K. A. & Boltwood, C. E. (1972). *Mnemonic techniques used by college students in paired associatelearning*. *Psychological* reports, Journals sage publication .com

Bower, G. H., & Clark, M. C. (1969). *Narrative stories as mediators for Serial learning*. *Psychonomic Science, 14*(4), 181-182.

Bower, G. H. (1972). Mental imagery and associative learning. In L. W. Gregg, *Cognition in learning and memory.* Oxford, England: John Wiley & Sons.

Brigham, F. J., Scruggs, T. E., & Mastropieri, M. A. (2011). Science education and students with learning disabilities. *Learning Disabilities Research & Practice, 26 (4), 223-232.*

Bryant, D. P., Bryant, B. R., Shin, M., & Pfannenstiel, K. H. (2015). *Learning disabilities:* Mathematics characteristics and instructional exemplars. In S. Chin (Ed.), *The Routledge international handbook on of dyslexia and mathematical learning difficulties* (pp. 243-254). New York, NY: Routledge.

Campabello, N., De Carlo, M. J., O'Neil, J., & Vacek, M. J. (2002). *Music enhances*

Learning .Retrieved from http://search.ebscohost.com/login.aspx

Carney, D. R., Cuddy A. J. C., (1994). *Power Posing Brief Nonverbal Displays Affect Neuroendocrine Levels and Risk Tolerance*

Carney, D.R., Hall J.A., Smith L., Beau, L. (2005). *Beliefs about the nonverbal expression of social power*. Journal of Nonverbal Behavior, 29, 105–123

Carney, R. N. & Levin, J. R. (1998). Coming to terms with the keyword method in Introductory Psychology: *A 'NeuroMnemonic' example. Teaching of Psychology, 25,* 132-134. http://dx.doi.org/10.1207/s15328023top2502_15

Carney, R., Levin, J., & Levin, M. (1994). Enhancing the psychology of memory by enhancing memory of psychology. *Teaching of Psychology, 21*, 171-174.

Carney, R. N., & Levin J. R. (2008). *Conquering Mnemonophobia, with help from three practical measures of memory and application. Teaching of Psychology,* 35, 176–183. doi:10.1080/00986280802186151

Ceci, S. (1985). A developmental study of learning disabilities and memory. *Journal of Prenatal Child Psychology.*

Cepeda, N., Pashler, H., Vul, E., Wixted, J. T., Rohrer, King-Sears, M. E., Mercer, C D., & Sindelar, P. T. (1992). Toward independence with keyword Mnemonics: A strategy for science vocabulary instruction. Remedial and Special Education, 13, 22–33.

Chazin, S. & Neuschatz J.S., (1990). Using a Mnemonic to Aid in the Information: Sage journal

Cirigliano, M. (2013). Musical Mnemonics in health science: A first look. *Medical Teacher, 35*(3), e1020 - e1026. doi:10.3109/0142159X.2012.733042.

Cook, S. C., Collins, L. W., Morin, L. L., & Riccomini, P. J. (2019). Schema-based instruction for mathematical word problem solving: An evidence-based review for students with learning disabilities. *Learning Disability Quarterly.* Advance online publication. doi:10.1177/0731948718823080

Conderman, G., & Pedersen, T. (2005). Promoting positive special education practices. *NASSP Bulletin, 89 (644), 90-98.*

Conway, J. & Ryba, A. (2016). Remembering spherical trigonometry, Volume 100, Issue 547, page 1 – 8. https://doi.org/10.1017/mag.2016.3

Crowther G. (2012). Using science songs to enhance learning: an interdisciplinary approach. *CBE Life Science Educ*., 11(1), 26-30. doi: 10.1187/cbe.11-08-0068.

Delin, P. S. (1969). The effects of a Mnemonic instruction and list length on Serial learning and retention. Psychonomic Science, 17, 111–113, *Sage journal*

DeLashmutt, K. (2007). A study of the role of Mnemonics in Learning Mathematics. Summative projects for MA Degree. 19.

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest, 14,* 4–58. http://dx.doi.org/ 10.1177/1529100612453266

Education sector report (2008). *Realizing vision 2030 goals through effective and efficient public spending*, Republic of Kenya

Elhinney & Annett (1996). *Pattern of Efficacy of a Musical Mnemonic Recall Familia Words over Several Presentations*: Sage Journals.

Ekuni, R., Vaz L.J., & Bueno, O. F. A. (2011). Instructor Clarity and Student Motivation: Academic Performance as A Product of Students' Ability and Motivation to Process Instructional Material, *Communication Education* Volume 66, 2017, Issue 1

Erickson, Ingram & Young, (1963). *Paired, Associate Learning as a Function of Rate of Presentation and Prior Serial Learning;* Texas City, University of Illinois Press

Elliott and Gentile (1986). The Efficacy of a Mnemonic Technique for Learning Disabled and Nondisabled Adolescents. Sage Journal

Fraenkel, J. R. & Wallen. N., (2000). *How to design and evaluate research in education*. New York; Mc Graw Hill Companies.

Fontana, J., Scrugs, T. & Mastropieri, A., (2015). Mnemonic Strategy Instruction in Inclusive Secondary Social Studies Classes.

Harsy, J. D., Everett, G. E., . Hupp, S.,D. A. & Jewell J. D., (2014), An Investigation of the Look-Ask-Pick Mnemonic to Improve Fraction Skills Syiah Kuala University, Banda Aceh, Indonesia.

Horowitz, S. H., Rawe, J., & Whittaker, M. C. (2017). *The state of learning disabilities: Understanding the 1 in 5.* New York, NY: National Center for Learning Disabilities.

Hunt, J., Valentine, C., Bryant, D., Pfannenstiel, K., & Bryant, B. (2016). Supplemental mathematics intervention: How and why special educators intensify intervention for students with learning disabilities. *Remedial and Special Education, 37*(2), 78–88.

Geary, D. C. (2003). *Learning disabilities and arithmetic:* Problem-solving differences and cognitive deficits. In H. L. Swanson, K. R. Harris, & S. Graham (Eds.), *Handbook of learning disabilities* (pp. 199–212). New York, NY: Guilford.

Geary, D. C., Hoard, M. K., Nugent, L., & Bailey, D. H. (2012). Mathematical cognition deficits in children with learning disabilities and persistent low achievement: A five-year prospective study. *Journal of Educational Psychology, 104*(1), 206–223.

GoK. (1999). National Development Plan 1997-2001. Nairobi: Government Printer.

Grünke, M., & Morrison Cavendish, W. (2016). Learning disabilities around the globe: Making sense of the heterogeneity of the different viewpoints. *Learning Disabilities: A Contemporary Journal, 14(1), 1-8.*

Higbee, K. L. (1979). *Recent research on visual Mnemonics*: Historical roots an educational fruit. Review of Educational Research, 49, 611–629

Higbee, K. L. & Kunihira, S. (1985). Cross-cultural applications of Yodai mnemonics in education. *Educational Psychologist, 20*(2), 57–64.

Higbee, K. L., (1994). More motivational aspect of imagery mnemonics. *Applied cognitive Educational Psychologist, 20(4), 70–84.*

Hillecke, T., Nickel, A., & Bolay, H. V. (2005). Scientific perspectives on music therapy. Annals of the New York Academy of Sciences, 1060(1), 271-282.

Irish, C. (2002a). Using peg-word and keyword mnemonics and computer-assisted instruction to enhance basic multiplication performance in elementary students

with learning and cognitive disabilities. *Journal of Special Education Technology, 17*(4), 29–40.

Irish, C. (2002b). Memory Math (Unpublished Beta Version) [Computer software].

Jagero, N.O. (1999). An Evaluation of the Factors Affecting the Quality of Education in Day Secondary Schools in Kenya*: A case study of Kisumu District;* M. Phil Thesis, Moi University, Eldoret.

Jewitt, C (2005). ''*Reading and writing for the 21st century*", *in Discourse Studies in the Cultural Politics of Education,* Vol. 26 (3), pp 315-331.

Jitendra, A. K., Nelson, G., Pulles, S. M., Kiss, A. J., & Houseworth, J. (2016). Is mathematical representation of problems an evidence-based strategy for students with mathematics difficulties? *Exceptional Children, 83*(1), 8–25.

Jitendra, A. K., Lein, A., Im, S., Alghamdi, A., Hefte, S., & Mouanoutoua, J. (2018). Mathematical interventions for secondary students with learning disabilities and mathematics difficulties: A meta-analysis. *Exceptional Children, 84*(2), 177–196.

Kithokoo, A. (2011). *School factors affecting performance in Kenya certificate of primary education in public primary schools*. Masters' thesis, Kenyatta University, Kenya.

Kiru, E., Doabler, C., Sorrells, A., & Cooc, N. (2018). A synthesis of technology-mediated mathematics interventions for students with or at risk for mathematics learning disabilities. *Journal of Special Education Technology, 33*(2), 111–123.

Ki-Zerbo, J. (1990). *Educate or perish: Africa's impass and prospects.* Dakar, Senegal, UNESCO Regional Office for Education in Africa; Abidjan, Côte d'Ivoire.

Koelsch, S. (2009). A neuroscientific perspective on music therapy. The Neurosciences and Music III: Disorders and Plasticity, 1169, 374-384.

Köksal, O., Yagişan, N., & Çekiç, A., (2013). The effects of music on achievement, attitude and retention in primary school English lessons in Procedia: Social and Behavioral Sciences vol. 93. pp1897–1900.

Kotz S. (2013). Brain correlates of music-evoked emotions. Nature Reviews Neuroscience, 15(3), 170-180.

Kombo, D., K. (2006). *Proposal and theses writing*: Nairobi: Pauline Publication

Kombo, D., K & Tromp D., L. (2011). An introduction to *Proposal and theses writing*: Nairobi: Pauline Publication.

Kothari, C. R. (2004). *Research methodology and techniques* (2nded.) Delhi: New Age International Limited Publishers.

Laing, G. (2010). An empirical test of mnemonic devices to improve learning in elementary accounting. *Journal of Education for Business, 85*(6), 349-358.

Levin, J. R. (1993). *Mnemonic strategies and classroom learning: A twenty-year report card.* Elementary School Journal, 94(2), 235-244.

Levin, J. R., Shriberg L. K., & Berry J. K**, (**1983). *A Concrete Strategy for Remembering Abstract Prose:* American Educational Research journal.

Levin, J. R., Dretzke B. J, McCormick C. B., Scruggs, T .E., McGivern J. E., & Mastropieri M. A., (1983), Learning via Mnemonic Pictures: Analysis of the Presidential Process *Educational Communication and Technology Journal*, Vol. 31, No. 3, pp. 161-173

Levin, J. R., Shriberg, L. K., Miller, G. E., & McCormick, C. B., (1982). The keyword method in the classroom: How to remember the states and their capitals. *Elementary School Journal*, 1980, 80, 186-191.

Li., T. H. & Julaihi, N. H., (2013), Lecturers' Perceptions, Students' Problems and Solutions for Handling High-Failure Rate Mathematics Courses, Faculty of Computer& Mathematical Sciences, Universities Teknologi Mar
Sarawak, Malaysia

Liddell, H. G., & Scott, R. (1889). *An intermediate Greek- English lexicon.* Oxford, UK: Clarendon Press.

Lloyd, J. W., Forness, S. R., & Kavale K. A. (1998). Some methods are more effective than others. *Intervention in School and Clinic, 33(4), 195-200.*

Lorayne, H. (1990). *How to develop a super power memory*. Toronto, Canada: Prentice

Hall Canada. Manalo, E. (2002). Uses of mnemonics in educational settings: A brief review of selected research. *Psychologia: An International Journal of Psychology in the Orient, 45,* 69–79.

Lubin, J., & Polloway, E. A. (2016). Mnemonic instruction in science and Social Studies for students with learning problems: A review. *Learning Disabilities: A Contemporary Journal, 14*(2), 207–224.

Machakos County Government, (2017). Retrieved January 2019 from http://*www.machakosgovernment.com.*

Mackenzie, K. (1997)**.** *Kenyan Women, Education Status in the Nyayo Era***.** Nairobi: Instaprint Ltd.

Maghy, S. J. (2015). Effectiveness of mnemonics on achievement of students in mathematics at high school level: *International Journal of Modern Engineering Research (IJMER), Vol. 5 (4).*

Marita, S. & Hord, C. (2017). Review of mathematics interventions for secondary students with learning disabilities. *Learning Disability Quarterly, 4*0(1), 29– 40.

Mastropieri, M., Sweda, J. & Scruggs, T. (2000). Putting Mnemonic strategies to work in an inclusive classroom. *Learning Disabilities Research & Practice (Lawrence Erlbaum), 15(2), 10/1/11-69-74.*

Mastropieri, M. A., Scruggs, T. E., & Fulk, B. J. M. (1990). Teaching abstract vocabulary with the keyword method: Effects on recall and comprehension. *Journal of Learning Disabilities, 23*, 92-96.

Mastropieri, M. A., & Scruggs, T. E. (1991). *Teaching students ways to remember: Strategies for learning mnemonics.* Cambridge, MA: Brookline Books.

Mastropieri, M. A. & Scruggs, T. E. (1998). Constructing more meaningful relationships in the classroom: A review of research on Mnemonic techniques. *Remedial and Special Education, 6*, 20–35.

Mastropieri, M. A., Scruggs, T. E. & Levin, J. R. (1985). Maximizing what exceptional students can learn: A review of research on Mnemonic techniques. *Remedial and Special Education, 6*, 39–45.

Mbilinyi, D. A. (2003). *Equity in Learning: The Gender Dimension*. Paris, France: ADEA.

McDaniel, M. A., & Einstein, G. O., (1986). Aging and prospective memory: Examining the influences of self-initiated retrieval processes. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21*(4), 996–1007. https://doi.org/10.1037/0278-7393.21.4.996

McCabe, J. A., Osha K. L. & Roche J. A., (2013),*Psychology Students' Knowledge and Use of Mnemonics:* Goucher College in Baltimore, Maryland, sage journal

McElhinney, M, & Annett J. M., (1996).Pattern of efficacy of a musical Mnemonic on recall of familiar words over several presentations. *Sage journal*

McReynolds, P. & Acker, M. (1959). *Serial Learning under Conditions of Rapid Presentation of Stimuli*; Texas City, University of Illinois Press

Melby-Lervåg, M. & Hulme, C. (2010). *Serial and Free Recall in Children Can Be Improved by Training:* Evidence for the Importance of Phonological and Semantic Representations in Immediate Memory Tasks

Mgala, M. & Audrey Mbogho, A, (2015) Data-Driven Intervention-Level Prediction Modeling forAcademic Performance: Cape Town, University of Cape Town.

Morris, C. D., Bransford, J. D., & Franks, J. J. (1977). Levels of processing versus transfer-appropriate processing. *Journal of Verbal Learning and Verbal Behavior, 16*, 519-533.

Miller, G. A. Galanter E., & Pribram, K. H., (1960). *Plans and the structure of behavior*. New York: Henry Holt.

National Center for Education Statistics (2017). The nation's report card: 2017 mathematics assessment. Retrieved fromhttps://nces.ed.gov/nationsreportcard/mathematics/

National Mathematics Advisory Panel. (2008). *Foundations for success: The final report of the national mathematics advisory panel.* Washington, DC: U.S. Department of Education.

Oloo, M. A. (2003). *Gender Disparity in Pupils' Performance in KCSE in Mixed Day Secondary Schools in Migori District Kenya.* Masters' thesis, Maseno University, Maseno Kenya.

Onur, K, Ali, M. S., Yunus, E. O., & Musa, O. (2013). The impact of Mnemonic devices on attainment and recall in basic knowledge acquisition in nursing education. *Mevlana International Journal of Education, 3*(4), 265-278.

Orodho, A. (2009). *Elements of education and social science research methods*. Maseno, Kenya: kanezja.

Paivio, A. (1971), Imagery in recall and recognition. In J. Brown (Ed.), *Recall and recognition.* London:

Petty, G. (2009). *Evidence Based Teaching* (2nd ed.). Nelson Thornes: Cheltenham.

Pikulski, J. J. & Templeton, S. (2014). Teaching and Developing Vocabulary: Key to Long-Term Reading Success", in Research in Language and Reading. Houghton Mifflin Company, USA, SHA15M1203, G-23748.

Putnam, A. L. (2015). Mnemonics in education: Current research and applications. *Translational Issues in Psychological Science, 1*(2), 130–139.

Rainey, D.W. & Larsen, J. D. (2000). *The Effect of Familiar Melodies on Initial Learning and Long -term memory for unconnected text.* University of California Press

Richmond, A. S., Cummings, R., & Klapp, M. (2008). Transfer of the method of loci, pegword, and keyword mnemonics in the eighth grade classroom. Researcher, 21(2), 1-13.

Rivera-Batiz, F. L. (1992). Quantitative literacy and the likelihood of employment among young adults in the United States. *The Journal of Human Resources, 27*(2), 313–328.

Roediger, L. (2014), *Classroom-based programs of retrieval practice reduce middle school and high school students' test anxiety.* Washington University in St. Louis, United States Fort Zumwalt School District, United States Washington University in St. Louis, United States b Fort Zumwalt School District, United States.

Russell L. A. (1992). Comparisons of cognitive, music, and imagery techniques on anxiety reduction with university students. *J Coll Stud Dev., 33, 516-523.*

Sacks, N. (2007). Review article: instructed second language vocabulary learning", in Language Teaching Research, Vol 12 (3), pp 329-363

Savan A. (*1999*). *The effect of background music on learning. Psychol Music, 27, 138-146.*

Sarkamo, T., Tervaniemi, M., Laitinen, S., Forsblom, A., Soinila, S., Mikkonen, M., et al. (2008). Music listening enhances cognitive recovery and mood after middle cerebral artery stroke. Brain, 131(3), 866-876.

Scruggs, T. E., & Mastropieri, M. A. (2000). The effectiveness of mnemonic instruction for students with learning and behavior problems: An update and research synthesis.

Scruggs, T. E., Mastropieri, M. A., Berkeley, S. L., & Marshak, L. (2010). Mnemonic strategies: Evidence-based practice and practice-based evidence. *Intervention in School and Clinic*, *46*(2), 79–86.

Shmidman, A., & Ehri, L. (2010). Embedded picture Mnemonics to learn letters. *Scientific studies of reading*, *14*(2), 159-182.

Simmons-Stern, N. R., Budson, A. E., & Ally, B. A. (2010). Music as a memory enhancer in patients with Alzheimer's disease. Neuropsychologia, 48(10), 3164-3167.

Sifuna D. (2010). The illusion of free primary education, Journal of social and religious concern, retrieved from www.africa.peacelink.org/wajibu/articles/art_6901.html on 27th August 2010

Sifuna, D. N., & Sawamura, N. (2008). Universalizing primary education in Kenya: Is it beneficial and sustainable? *Journal of International Cooperation in Education,*11(3): 103-118.

Simmons-Stern, N. R., Budson, A. E., & Ally, B. A. (2010). *Music as a memory enhancer in patients with Alzheimer's disease.* Retrieved 1/5/2013,

Stahl, B., Henseler, I., Turner, R., Geyer, S., & Kotz, S. A (2013). how to engage the right brain hemisphere in aphasics without even singing: evidence for two paths of speech recovery. frontiers in human neuroscience.

Thompson, R., Moulin, C., Hayre, S., & Jones, R. (2005). Music enhances category fluency in healthy older adults and alzheimer's disease patients. experimental aging research, 31(1), 91-99.

Thaut, M. H., Gardiner, J. C., Holmberg, D., Horwitz, J., Kent, L., Andrews, G., et al. (2009). Neurologic music therapy improves executive function and emotional adjustment in traumatic brain injury rehabilitation. Annals of the New York Academy of Sciences, 1169(1), 406-416.

Therrein, W. J., Taylor, J. C., Hosp, J. L., & Kaldenberg, E. R. (2011). Science instruction for students with learning disabilities: A meta-analysis. *Learning Disabilities Research and Practice, 26(4), 188- 203.*

Tsin, P., Y. & Isabel (2015). Using songs for teaching 21st century learners Composing Songs for Teaching Science to College Students. *Jalan University, Bandar Sunway, 46150 Petaling Jaya, Selangor.*

Triana, M., Johar, R. Ansari, B., (2016). *Students' understanding in learning trigonometry using Mnemonic method.* Proceedings of English Education International Conference**,** [S.l.], v. 1, n. 2, p. 418-422, Nov. ISSN 2527-8037.

UNICEF, (2005, November 17). Kenya: Regional disparities threaten progress towards education for all. http://www.unicef.org/infobycountry/kenya_newsline.html

Watt, S. J., Watkins, J. R. & Abbitt, J. (2016). Teaching algebra to students with learning disabilities: Where have we come and where should we go? *Journal of Learning Disabilities*, *49*(4), 437–447.

Winoto, E. N., Yudiarso A. & Sugoto S. (2017). Effect of music Mnemonic and Flash Cards to increase fourth grade students' english vocabulary acquisition: Journal of Advances in Social Science, Education and Humanities Research, volume 173

Willott, P. C. (1982). The use of imagery as a mnemonic to teach basic multiplication facts to students with learning disabilities (Unpublished doctoral dissertation). West Virginia University, Morgantown, WV.

Wolters, C. A, & Rosenthal H. (2000). The relation between students' motivational beliefs and their use of motivational regulation strategies. *Int J Educ Res.*, 33, 801-820.

Worthen, J. B., & Hunt, R. R. (2011). *Mnemonology: Mnemonics for the 21st century*. New York, NY: Taylor & Francis.

Yates, F. (1966). The art of memory. Chicago: The University of Chicago Press.

Yeoh, M. P. (2014), *Musical Mnemonics to facilitate learning of transcription of RNA* Kolej Matrikulasi: Selangor Kementerian Pendidikan Malaysia

Ying, L.，Guoqing Z., Guozhen, M & Yuwei B (2014). Standard Journal of Education and Essay Vol 2(1) pp. 017– 031, April 2014 *Available online http://standresjournals.org/journals/SJERE/index.html*

The Effect of Mind Mapping on Teaching and Learning：A Meta-Analysis

Zumbansen, A., Peretz, I., & Bert, S. (2014). Melodic intonation therapy: Back to basics for future research. Frontiers in Neurology.

APPENDICES

APPENDIX I

CONSENT TO PARTICIPATE IN THE STUDY

This is a research study designed to investigate the appropriateness of Mnemonic techniques on learning outcomes among upper primary school pupils in Machakos Sub-County Kenya. The findings will help to provide better strategies for teaching in order to improve learning outcomes in National examinations.

I would like to request you to participate in this research which will take part in January-April, 2019. Your commitment and cooperation in this noble task will be highly appreciated.

Kindly sign in the space provided if you agree to participate in the study.

(……) I agree to participate in this study.

Thank you very much for agreeing to participate in the study.

Yours Respectfully,

Patricia M. Makau

APPENDIX II
TEACHERS' INSTRUCTION MATERIAL: KEYWORD MNEMONIC INSTRUCTION METHOD

Introduction

My name is Patricia Makau, a student in Machakos University undertaking Ph.D. in Educational Psychology. This Mnemonic instruction method will be used for the purpose of instruction during teaching and learning process to enable learners to retain and remember content being taught. The teacher using this Mnemonic instruction method should strictly use this method and encourage pupils to use this particular Mnemonic instruction strategy when they are rehearsing to assist them to recall the content.

The keyword Mnemonic instruction method is based on linking new information to ''keywords'' that are already encoded to memory. By so doing it takes unfamiliar information and makes it more meaningful and concrete and thus making it much easier to remember. The keyword Mnemonic instruction strategy will involve two stages: an acoustic link stage and an imagery link stage. First, the pupil will be given a 'keyword' that is acoustically similar to, and that can be visualized as interacting with the item to-be- remembered. In the second stage, the pupils will be required to form the visual image of the keyword and the target word interacting in some way. The Teacher will start by introducing the keyword Mnemonic instruction method by explaining how it is used. The teacher will then ask the learners to link each keyword interacting with the item to be remembered.

General instructions by teachers to the learners

Teacher: Use the "keyword" given in section A, B and C for each word in the lists to help you remember the items in each list. Visualize the item interacting with the keyword item in some way.

SECTION A. FREE RECALL LEARNING

Lesson expected Learning outcomes

By the end of the lesson, the learners should be able to recall the lists of items without necessarily following the order in which they appear

Social Studies

Use the keyword to learn, memorize and recall the names below;

Topic one: The Kapenguria six

1. Jomo Kenyatta: Kenyatta sounds like Kenya
2. Ochieng Oneko: Oneko sounds like corn for maize
3. Paul Ngei: Ngei sounds like gay for homosexual
4. Bildad Kagia: Kagia sounds like gear for the car
5. Fred Kumbai: Kumbai sounds like bye
6. Kungu Karumba: Karumba sounds like rumba a type of dance

Topic two: COMESA Member Countries (Common market for Eastern and Southern Africa)

By trying to remember COMESA countries create an image of the map of Arica in your mind … "COME'' means arrive or move from, "SA'' would mean South Africa; these are countries above South Africa

1. Kenya
2. Uganda
3. Zimbabwe
4. Ethiopia
5. Rwanda
6. Burundi
7. Lesotho
8. Swaziland

Topic three: SADC Member Countries (Southern African Development Community)

To be able to remember SADC Member Countries, take SA to stands for Southern Africa therefore these are countries within Southern region of Africa. Visualize the map of Africa and take those countries in that region as SADC member countries.

1. South Africa
2. Namibia
3. Mauritius
4. Zambia
5. Botswana
6. Swaziland
7. Lesotho
8. Botswana
9. Tanzania
10. Malawi

Topic four: ECOWAS Member Countries (Economic Community of Western States)

ECO sounds like echo visualize a school boy echoing his teacher in a mockery manner.

WAS has 'W' which stands for western and letter 'A' which stands for Africa

1. Senegal
2. Gambia
3. Guinea
4. Zambia
5. Burkina Faso
6. Bissau,
7. Cote d'lvoire
8. Ghana
9. Togo
10. Nigeria

SECTION B. SERIAL LEARNING

Lesson expected learning outcomes;

By the end of the lesson the learners should be able to recall the items in the order in

which they appear.

Use the keyword provided for each item to learn, memorize and recall the following content below;

Topic one: Mountain vegetation

1. Savannah grass land: Savannah sounds like service. Visualize a waitress serving customers in the bar.
2. Rain forest: Rain forest sounds like rain. Visualize a heavy down pour.
3. Bamboo forest: Bamboo sounds like *babu* Kiswahili word for grand-father. Visualize an old man with a walking stick.
4. Heath and moorland: Heath sounds like health and moorland sounds like moon light. Visualize a very healthy girls playing outside in a bright moonlight.
5. Snow and bare rock: Snow sounds like snoring. Visualize a drunkard man sleeping on rocks snoring very loud.

Topic two: Nine planets

Teacher: Memorize the following content by using the 'keyword' provided for each word, create mental images interacting with the word in some way as follows;

1. Mercury: Visualize Mercury metal being melted in a hot fire
2. Venus: Visualize a beautiful girl applying herself with Venus body lotion
3. Earth: Visualize tree planted on Earth
4. Mars: Visualize catholic priest performing mass service.
5. Jupiter: Visualize bees coming out of hive forming letter J
6. Saturn; Visualize huge ugly Satan
7. Uranus: Visualize a boy urinating behind a house
8. Neptune: Visualize two gates with handle resembling letter N
9. Pluto: Visualize vine tree with P shaped fruits

Topic Three: Language group in Kenya

a) Bantus: Their main activity was crop cultivation
b) Cushites: Their main activity was livestock keeping
c) Nilotes: Their main activity was pastoralism
d) Semites: Their main activity was trade

Teacher: memorize the following content by using the 'keyword' provided for each word, create mental images interacting with the word in some way as follows;

a) Bantu sound like Bun. Visualize a big bun floating on water
b) Cushites sounds Cushion. Visualize a man sleeping placing his head on a big Cushion.
c) Nilotes sounds like river Nile. Visualize a long river flowing its waters into the lake.
d) Semites sounds like seams. Visualize a beautiful seam knitted at the end of the skirt

Topic four: Coastal towns in Eastern African

Use the keyword provided for each item to learn, memorize and recall the following content below:

1. Mogadishu: Mogadishu sounds like 'dish'. Visualize dish full of delicious meal
2. Kismayo: Kismayo sounds like 'kiss'. Visualize a bride groom kissing the bride
3. Lamu: Lamu sounds like 'lamb'. Visualize a huge lamb eating grass
4. Malindi: Malindi sounds like 'land'. Visualize a big land coved by water.
5. Kilifi: Kilifi sounds like 'climb'. Visualize a boy climbing on top of tree
6. Mombasa: Mombasa sounds like 'bursar'. Visualize a bursar taking off with a lot of money.
7. Zanzibar: Zanzibar sounds like 'bar'. Visualize a bar shop full of alcoholic drinks
8. Dar es Salaam: Dar es Salaam sounds like 'Salam' Kiswahili word for greetings. Visualize two women shaking hands.
9. Kilwa: Kilwa sounds like Kichwa Kiswahili word for head. Visualize a man with a very big head.

Topic five: East African Countries crossed by Equator

Use the keyword provided for each item to learn, memorize and recall the following content below;

1. Congo: Congo sounds like ‘cone’. Visualize a hung cone of maize
2. Uganda: Uganda is a country with of bananas. Visualize a banana plantation.
3. Kenya: Kenya is known athletes. Visualize a young Man running in a track holding Kenyan flag.
4. Somalia: Somalia is known for militia groupings. Visualize a person covering his face.

SECTION C: MATHEMATICS AND SOCIAL STUDIES

i) Mathematics

Lesson expected Learning outcomes;

By the end of the lesson the learners should be able to recall the items in the order in which they appear in the list.

Instructions by the teacher to the learners.

Teacher: Use the “keyword” given to for each word in the lists to help you remember the items in each list. Visualize the item interacting with the keyword item in some way.

Topic one: Metric System Prefixes in Value Order

1. **K**ilo = x 1000.” Kilo”, visualize weight of meat
2. **H**ecta = x 100. “Hectare” visualizes piece of land measuring one hectare
3. **D**eca = x 10. “Decker”, visualize a double decker bed
4. **D**eci =x 0.1. “Decimal” visualize decimal point
5. **C**enti = x 0.01. “Cent”, visualize coin with a hole
6. **M**illi = x 0.001. “Millicent”, visualize insect with many legs

Instructions

Teacher: Use the “keyword” given for each word in the lists to help you remember the items in each list; visualize the item interacting with the keyword item in some way.

Topic two: Multiplication facts using "2 Family"

Visual images for the "2 Family"

1. 2x2, skateboard with 2 sets of wheels
2. 3x2, six pack of soda
3. 4x2, spider with two sets of four legs
4. 5x2, two hands with all fingers held up
5. 6x2, dozen eggs in a carton
6. 7x2, calendar with 2 weeks circled
7. 8x2, two octopi, each with eight tentacles
8. 9x2, an 18-wheel truck

ii) Social Studies

Lesson expected Learning outcomes;

By the end of the lesson the learners should be able to recall the items in the order in which they appear

Topic one: Language groups

a) Bantus: Their main activity was crop cultivation
b) Cushites: Their main activity was livestock keeping
c) Nilotes: Their main activity was pastoralism
d) Semites: Their main activity was trade

1. Bantu sound like Bun. Visualize a big bun floating on water
2. Cushites sounds cushion. Visualize old man sleeping placing his head on a big cushion
3. Nilotes sounds like river Nile. Visualize a long river flowing its waters into the red sea.
4. Semites sounds like seams. Visualize a beautiful seam knitted at the hem of a skirt.

Examples of tribes

1. Bantus: Akamba, Agikuyu, Abagusii, Abaluyha, Mijikenda. Bantu sound like bun. Visualize a big bun floating on water. Bantus are tribes whose language has Kiswahili words and sounds
2. Cushites; Somali, Lendile, Borana. Cushites sounds like cushion. Visuialize cushion bouncing on semi-arid regions of Kenya. Cushites are tribes whose hair and skin colour look like a mixture of Africans and Asians. They live in semi-arid regions.
3. Nilotes: Kalenjin, Maasai, Luo. Nilotes sounds like Nile. Visualize river Nile flowing from the highlands down to plains and then to the red sea. Nilotes are tribes which mostly live in highlands, lakeVictoria region, rift valley region and plains.

Sub-tribes

1. Kalenjin Sub-tribes; Turgen, Nandi, Pokot, Marakwet, kipsigis
2. Mijikenda Sub-tribe: Kame, Ribe, Digo, Giriama, Kauma, Duruma
3. Luyha Sub-tribes: Bukusu, Maragori, Tiriki, Banyore, Kabaras

Topic two: Coastal towns in Eastern African

1. Mogadishu: Mogadishu sounds like ‘dish’. Visualize dish full of delicious meal
2. Kismayo: Kismayo sounds like ‘kiss’. Visualize a bride groom kissing a bride
3. Lamu: Lamu sounds like ‘lamb’. Visualize a huge lamb eating grass
4. Malindi: Malindi sounds like ‘land’. Visualize a bear piece of land
5. Kilifi: Kilifi sounds like ‘climb’. Visualize a boy climbing on top of tree
6. Mombasa: Mombasa sounds like ‘bursar’. Visualize a bursar taking off with a lot of money.
7. Zanzibar: Zanzibar sounds like ‘bar’ visualize a bar shop full of alcoholic drinks
8. Dar es Salaam: Dar es Salaam sounds like ‘salam’ Kiswahili word for greetings. Visualize two women shaking hands
9. Kilwa: Kilwa sounds like Kichwa Kiswahili word for head. Visualize a man with a big head.

Topic three: East Africa Countries crossed by Equator

1. Congo: Congo sounds like ‘cone’. Visualize a huge cone of maize
2. Uganda: Uganda is known for bananas farming. Visualize a big banana plantation
3. Kenya: Kenya is known for athletics. Visualize a man running holding a Kenyan flag.
4. Somalia: Somalia is known for militia groupings. Visualize a person covering his face.

APPENDIX III

TEACHERS INSTRUCTION MATERIAL: PEGWORD MNEMONIC INSTRUCTION METHOD

Introduction

My name is Patricia Makau, a student in Machakos University undertaking PhD in Educational Psychology. This Mnemonic Instruction method will be used for the purpose of instruction during teaching and learning process to enable learners to retain and remember content being taught. The teacher using this Mnemonic instruction method should strictly use this method and encourage pupils to use this particular Mnemonic when they are rehearsing to assist them to recall the contents.

The Pegword Mnemonic instruction treatment condition involves two stages. First, the pupils will memorize rhyming schemes for the numbers 1 to 10. Next the learner will be expected to create a mental image of each item in the list interacting with the word that rhymes with the appropriate number in some way. These numbers act as hooks or pegs where learners can hang anything on them. In the second stage, learners are asked to visualize the to-be-remembered content linking with the rhyming words.

Specific Instructions by teachers to the learners

Teacher: Memorize the following lists/ pegs until master them

1. Bun
2. Shoe
3. Tree
4. Door
5. Hive
6. Sticks
7. Heaven
8. Gate
9. Vine
10. Hen

Teacher: Close your eyes, say the number, and form a vivid mental image of the rhyming word. Do this several times and review this over and over again until you commit it into your long-term memory.

Teacher: Look at the following lists in sections A, B, and C below and form mental image interacting with respective items in some way with corresponding words in the list. Always use these pegs and images when you want to remember this list in future. Do this several times and review this over and over again until you commit it into your long-term memory.

SECTION A: FREE RECALL LEARNING

Lesson expected Learning outcomes

By the end of the lesson the learners should be able to recall the items without necessarily following order in which they appear

Social Studies

Topic one: The Kapenguria six

1. Bun: Jomo Kenyatta. Visualize a bun placed on the map of Kenya
2. Shoe: Ochieng Oneko. Visualize Oneko wearing a big shoe
3. Tree: Paul Ngei. Visualize Ngei climbing on a pig tree
4. Door; Bildad Kagia. Visualize Kagia opening a door
5. Hive: Fred Kumbai. Visualize Kumbai carrying a big bee hive
6. Sticks: Kungu Karumba. Visualize Karumba carrying bundle of sticks

Topic two: COMESA Member Countries (Common market for Eastern and Southern Africa)

1. Bun; Kenya. Visualize a bun with Kenyan flag colours
2. Shoe; Uganda. Visualize Ugandan flag with a shoe like shape.
3. Tree; Zimbabwe. Visualize a big tree with Zimbabwean flag colours.

4. Door; Ethiopian. Visualize a beautiful door with Ethiopian flag colours.
5. Hive; Rwandan. Visualize a Rwandan flag made in a bee hive shape.
6. Sticks; Burundi Visualize a Burundian flag made of pieces of sticks.

Topic three: SADC Member Countries (Southern African Development Community)

Visualize a map of southern Africa region. Place each country the respective peg. For example, South Africa place a burn, Namibia place a shoe and so forth:

1. Bun: South Africa
2. Shoe: Namibia,
3. Tree: Mauritius
4. Door: Zambia
5. Hive: Botswana,
6. Sticks: Swaziland
7. Heaven: Lesotho,
8. Gate: Botswana
9. Vine: Tanzania
10. Gate: Malawi

Topic four: ECOWAS Member Countries (Economic Community of Western States)

Visualize a map of Africa as a slice of western Africa region. Place each country on the respective peg. For example, Senegal place a burn, Gambia place a shoe and so forth:

1. Bun: Senegal
2. Shoe: Gambia,
3. Tree: Guinea
4. Door: Zambia
5. Hive: Burkina Faso
6. Sticks: Bissau,
7. Heaven: Cote d'l voire
8. Gate: Ghana
9. Vine: Togo
10. Gate: Nigeria

SECTION B: SERIAL RECALL LEARNING

Lesson expected Learning outcomes

By the end of the lesson the learners should be able to recall the items in the order in which they appear

Topic one: Mountain vegetation

Teacher: create mental images as follows;

1. Bun: Visualize a bun growing on top of rain forest
2. Shoe: Visualize boy wearing one shoe walking on the thickets of bamboo forest
3. Tree: Visualize a tree growing on top of savannah grass land
4. Door: Visualize a beautiful door standing at the woodland vegetation
5. Hive: Visualize beehive placed on rocks with snow flowing down

Topic two: Nine planets

Teacher: Use the pegs provided for each items in the content and create mental images to assist you recall the words:

1. Bun: Visualize a big bun a M shape bun
2. Shoe: Visualize V shaped shoe
3. Tree: Visualize tree planted on earth
4. Door: Visualize door with M shaped handle
5. Hive: Visualize bees coming out of hive forming letter J
6. Sticks: Visualize ugly Satan made of sticks
7. Heaven: Visualize Angels holding letter U
8. Gate: Visualise two gates with handles resembling letter N
9. Vine: Visualise vine tree with P shaped fruits

Topic three: Colours of the Rainbow

Teacher: Use the pegs provided for each item word and create mental images as to assist to recall items in the content below:

1. Bun for red. Visualize a Red bun
2. Shoes for Orange. Visualize a Big orange shoe
3. Tree for Yellow. Visualize a Beautiful tree with yellow leaves
4. Doo for Green. Visualize a Small door with big green padlock
5. Hive for Blue. Visualize a Hive with blue honey hosing out
6. Sticks for Indigo. Visualize a Fence made of indigo sticks
7. Heaven for Violent. Visualize an Angels wearing violet gown

Topic Four: Language group in Kenya

a) Bantus: Their main activity was crop cultivation
b) Cushites: Their main activity was livestock keeping
c) Nilotes: Their main activity was pastoralism
d) Semites: Their main activity was trade

1. Bun for Bantus. Visualize a woman cultivating a Shamba and with a bun on her back
2. Shoe for Cushites. Visualize a Goat wearing beautiful shoes.
3. Tree for Nilotes. Visualize a boy on top of a tree with camels and goats resting under the tree.
4. Door for Semites. Visualize an old Arabian man opening two wide doors of a shop

SECTION C: MATHEMATICS AND SOCIAL STUDIES

i) Mathematics

Lesson expected Learning outcomes

By the end of the lesson the learners should be able to recall the items in the order in which they appear.

Topic one: Metric System Prefixes in Value Order:

i. **K**ilo=x 1000, visualize a big bun weighing one Kilo
ii. **H**ecta=x 100, visualise one plot hectare which is shoe shaped
iii. **D**eca=x 10, visualise tree having a double decker shape

iv. **D**eci=x 0.1, door with a big decimal point at the handle

v. **C**enti=x 0.01, bee hive full of coins with holes

vi. **M**illi=x 0.001, visualize a pile to totaling1 million sticks

Instructions

Teacher: Use the pegword given for each word in the lists to help you remember the items in each list; visualize the item interacting with the pegword item in some way.

Topic two: Multiplication facts using "2 Family"

Teacher: create mental images as follows;

Visual images for the "2 Family"

1. 2x2 for Bun. Visualize a small car with four wheels carrying buns
2. 3x2 for shoe. Visualize a big shoe placed on top of six pack of soda
3. 4x2 for tree. Visualize huge spider on top of a tree
4. 5x2 for door. Visualize a two hands hanging on door with 10 fingers spread out
5. 6x2 for hive. Visualize dozens of eggs placed on top of huge beehive
6. 7x2 for sticks. Visualize 2 weeks' calendar, hanging on two sticks
7. 8x2 for heaven. Visualize two octopi each with eight tentacles being ushered to Heaven by angels
8. 9x2; for gate. Visualize an 18-wheel truck carrying ripe fruits entering a big gate

ii) Social Studies

Lesson expected Learning outcomes

By the end of the lesson the learners should be able to recall the items without necessarily following the order in which they appear.

Topic one: Language group

1. Bantus: Akamba, Agikuyu, Abagusii, Abaluyha, Mijikenda
2. Cuchites; Somali, Lendile, Borana
3. Nilotes: Kalenjin, Maasai Luo,

Sub-tribes

1. Kalenjini Sub-tribes; Turgen, Nandi, Pokot, Marakwet, Kipsigis
2. Mijikenda Sub-tribes: Kambe Ribe, Digo, Giriama, Kauma
3. Luyha Sub-tribes: Bukusu, Maragori, Tiriki, Banyore, Kabaras

Topic two: Coastal towns in Eastern African

1. Bun for Mogadishu. Visualize a big bun placed on capital city Mogadishu
2. Shoe for Kismayo. Visualize a small boy wearing big shoes walking into Kismayo
3. Tree for Lamu. Visualize tall trees sounding Lamu town
4. Door for Malindi. Visualize a town with similar doors for all the buildings
5. Hive for Kilifi. Visualize a town with bee hive hanging in every house
6. Sticks for Mombasa. Visualize a town fortified fenced of sticks
7. Heaven for Zanzibar. Visualize beautiful town guarded by angels
8. Gate for Dar es Salaam. Visualize two hung gates opening up to city of Dar es Salaam
9. Vine for Kilwa. Visualize vine fruits arranged on the streets of Kilwa town

Topic three: Countries crossed by Equator

1. Bun for Congo. Visualize a big bun place on country Congo
2. Shoe for DRC. Visualize a boy wearing a big shoes walking on the country DRC
3. Tree for Uganda. Visualize beautiful bananas fence
4. Door for Kenya. Visualize beautiful door with Kenyan flag
5. Hive for Somalia. Visualize bee hives with Somalia flag

APPENDIX IV

TEACHERS INSTRUCTION MATERIAL: MUSIC MNEMONIC INSTRUCTION METHOD

Introduction

My name is Patricia Makau, a student in Machakos University undertaking PhD in Educational Psychology. This Mnemonic Instruction method will be used for the purpose of instruction during teaching and learning process to enable learners to retain and remember content being taught. The teacher using this Mnemonic instruction method should strictly use this method and encourage pupils to use this particular Mnemonic when they are rehearsing to assist them to recall the contents.

Rhyming music lyrics was used to learn different contents by composing songs.

The teacher used songs which were composed and compiled in CD. Teacher used the CD drive, computers, TVs and LCD Power point projectors to project the videos. The Music Mnemonic will use both visual and audial during learning process. Each and every topic has a different song tune, each song will take approximately 10 minutes. Two topics can be played in one lessons. The same music was also played during tuition time where learners were expected to sing the songs as it was being played. The teacher gave learners CD copies with songs to play them at home in order to master the songs.

Specific Instruction by the Teachers to Learners

Teacher: Listen carefully to the following songs and try to learn the tunes. You can practice the songs during break time and you can also listen to the songs at home.

SECTION A: FREE RECALL LEARNING

Lesson Expected Learning Outcomes

By the end of the lesson the learners should be able to recall the items without necessarily following the order in which they appear

Social Studies

Topic one: The Kapenguria six

1. Jomo Kenyatta
2. Ocieng Oneko
3. Paul Ngei
4. Bildad Kagia
5. Fred Kubai
6. Kung'u Karuba

Topic two: COMESA Member Countries (Common market for Eastern and Southern Africa)

Kenya, Uganda, Zimbabwe, Ethiopia, Rwanda, Burundi, Lesotho, Swaziland, Madagascar, Djibouti, Seychelles, Malawi, Comoros, Angola, Egypt and DRC.

Topic three: SADC Member Countries (Southern African Development Community)

South Africa, Namibia, Mauritius, Zambia, Botswana, Lesotho Tanzania, Mozambique, Malawi, Seychelles, and Swaziland

Topic four: ECOWAS Member Countries (Economic Community of Western States)

Senegal, Gambia, Guinea, Burkina Faso, Bissau, cote d'l voire, Ghana, Togo, Nigeria, Cape Verde, Benin, Niger and Mali

SECTION B: SERIAL LEARNING

Lesson expected Learning outcomes

By the end of the lesson the learners should be able to recall the items in the order in which they appear

Topic one: Mountain vegetation
Teacher: Listen to the following song lyrics and master the words in the song;

1. Savanna grass land
2. Rain forest
3. Bamboo forest
4. Heath and moorland
5. Snow and bare rock

Topic two: The Nine planets

Teacher: Listen to the following song lyrics and master the words in the song;

1. Mercury
2. Venus
3. Earth
4. Mars
5. Jupiter
6. Saturn
7. Uranus
8. Neptune
9. Pluto

Topic three: Colours of the Rainbow

Teacher: Listen to the following song lyrics and master the words in the song;

1. Red
2. Orange
3. Yellow
4. Green
5. Blue
6. Indigo
7. Violet

Topic Four: Language group in Kenya

a) Bantus: Their main activity was crop cultivation
b) Cushites: Their main activity was livestock keeping
c) Nilotes: Their main activity was pastoralism
d) Semites: Their main activity was trade

Examples tribes of four language group

a) Bantus: Akamba, Agikuyu, Abagusii, Abaluyha, Mijikenda. Bantus are tribes whose language has Kiswahili words and sounds.
b) Cuchites; Somali, Lendile, Borana. Cuchites sounds like cushion bouncing on semi-arid regions of Kenya Cuchites are tribes whose hair and skin colour look like a mixture of Africans and Asians. They live in semi-arid regions.
c) Nilotes: Kalenjin, Maasai, Luo. Nilotes sound like Nile river which flows from the highlands down to plains and then to the lake. Nilotes are tribes which mostly live in Highlands, Lake Victoria region, Rift valley region and Plains and they are not Bantus.
d) Semites: Arabs, Nubians. Semites main activity was tribe.

Sub-tribes

1. Kalenjin Sub-tribes; Turgen, Nandi, Pokot, Marakwet, Kipsigis
2. Mijikenda Sub-tribe: Kame, Ribe, Digo, Giriama, Kauma, Duruma
3. Luyha Sub-tribes: Bukusu, Maragori, Tiriki, Banyore, Kabaras

SECTION C: MATHEMATICS AND SOCIAL STUDES

i) Mathematics

Lesson expected Learning outcomes

By the end of the lesson the learners should be able to recall the items in the order in which they appear

Topic one: King **H**enry **D**ied **D**rinking **C**hocolate **M**ilk

1. Kilo -x1000
2. Hecta -x100

3. Deca -x10
4. Deci -x0.1
5. Centi -x0.01
6. Milli-x0.001

Topic two: Multiplication facts using "2 Family

Instructions

Teacher: Use the memorize the music lyrics to help you remember the contents "keyword" given for each word in the lists to help you remember the items in each list; visualize the item interacting with the keyword item in some way.

Visual images for the "2 Family"

1. 2x2 skateboard with 2 sets of wheels
2. 3x2 six pack of soda
3. 4x2 spider with two sets of four legs
4. 5x2 two hands with all fingers held up
5. 6x2 dozen eggs in a carton
6. 7x2 calendar with 2 weeks circled
7. 8x2 two octopi, each with eight tentacles
8. 9x2 an 18wheel truck

ii) Social Studies

Lesson expected Learning outcomes

By the end of the lesson the learners should be able to recall the items in the order in which they appear

Topic one: language groups

1. Bantus: Akamba, Agikuyu, Abagusii, Abaluyha, Mijikenda
2. Cushites; Somali, Lendile, Borana
3. Nilotes: Kalenjin, Maasai Luo

Sub-tribes

1. Kalenjini Sub-tribes: Turgen, Nandi, Pokot, Marakweti
2. Mijikenda Sub-tribes: Dorombo, Taita, Taveta, Ndigo
3. Luyha Sub-tribes: Bukusu, Maragoli, Banyore, Kabaras, Tiriki

Topic two: Coastal towns in Eastern African

1. Mogadishu
2. Kismayo
3. Lamu
4. Malindi
5. Mombasa
6. Zanzibar
7. Dar es Salaam
8. Kilwa

Topic three: Countries crossed by Equator

1. Congo
2. DRC
3. Uganda
4. Kenya
5. Somalia

APPENDIX V

TEACHERS CLASSROOM OBSERVATION SCHEDULE

My name is Patricia Makau, a student in Machakos University undertaking Ph.D. in Educational Psychology. This Observation Schedule was used by the researcher to observe and monitor treatment instruction interventions during teaching and learning process. Note: This Observation Schedule is not a judgment of pupils or teachers; but it is just an informational tool which was used to monitor treatment process in the classrooms. The teachers were informed three days before the actual day of visit. This will enable teachers to prepare adequately for the lesson.

Name of the school_____

Subject _____Level_____

Date _____Time _____

1. Teacher introduces the lesson in reference to Mnemonics.
    i. Music Mnemonic instruction method
    ii. Keyword Mnemonic instruction method
    iii. Pegword Mnemonic instruction method
2. Teacher activities/Teacher uses Mnemonics instruction method when teaching the content (Tick one)
    i. Well done
    ii. Good
    iii. Fairly done
3. Students activities (Tick where applicable)
    i. Receiving enthusiastically new teaching method,
    ii. Applying new teaching method
    iii. Practicing new teaching method

4. Teachers' ability to use Mnemonic instruction method during teaching

    i. Excellent
    ii. Well done
    iii. Fairly done
    iv. Poorly done

5. Teachers' ability to link the content with Mnemonic instruction method was

    i. Excellent
    ii. Well done
    iii. Fairly done
    iv. Poorly done

6. Overall comments and conclusions:

    Teacher student interaction with Mnemonic instruction method was

    i. Very satisfactory
    ii. Satisfactory
    iii. Less satisfactory
    iv. Not satisfactory

7. Overall comments and conclusions: researcher to note areas which may need modifications and areas of difficulties

    _____

    _____

APPENDIX VI

PUPILS' SATISFACTORY SURVEY QUESTIONNAIRES

My name is Patricia Makau, a student in Machakos University undertaking PhD in Educational Psychology. This questionnaire will be filled by pupils immediately after the lesson of Mnemonic instruction method as an informational tool for monitoring treatment/intervention process during teaching and learning process in the classrooms. Please pupils feel free to ask any question for clarification. Fill this questionnaire to the best of your knowledge and ability.

Section A: Demographic Information

1) Name of the school_____
2) Name of subject_____
3) Class/standard_____
4) Age_____
5) Gender Boy ( ) Girl ( )
6) Date: _____Time _____

Section B: Pupils Satisfaction survey

7) Was the lesson exciting:

   Yes_____ No. _____

8) Which Mnemonic instruction method did the teacher use today? (Tick one)

   i. Music Mnemonic instruction method (1)
   ii. Keyword Mnemonic instruction method (2)
   iii. Pegword Mnemonic instruction method (3)

9) Are you able to remember the content more easily using Mnemonic instruction method?

Yes_____ No._____

10) Are you able to apply Mnemonic technique on other subject?

Yes_____ No._____

11) Did you have an opportunity to answer questions asked by the teacher during teaching process?

Yes_____ No._____

12) Rank the three Mnemonic instruction method from most favourable to least favourable

NB. Most favourable is 1. least favourable is 3

1) Music Mnemonic instruction method ( )
2) Keyword Mnemonic instruction method ( )
3) Pegword Mnemonic instruction method ( )

APPENDIX VII A

FREE RECALL ACHIEVEMENT TEST: SOCIAL STUDIES

NAME……Date……

Instruction to Candidates: Circle the correct answer

Random Assessment Test (RAT)

1) The following three tribes are Mijikenda, which one is not?

   a. Pokot b. Giriama c. Ndigo d. Nduruma

2) Who among the following tribes are Cushite speakers?

   a. Dahalo b. Gusii c. Pokomo d. Pokot

3) The following three tribes are western Bantus which one is not?

   a. Akamba b. Abakuria c. Abagusii d. Abaluy

4) The four main language groups in Kenya are the Bantus, the Nilotes, Semite and the___

   a. Arabs b. Europeans c. Cushites d. Mijikenda

5) Abagusii and Akamba are

   a. Nilotes b. Bantus c. Cushites d. Mijikenda

APPENDIX VII B

FREE RECALL ACHIEVEMENT TEST: SOCIAL STUDIES

NAME……Date……

Instruction to Candidate: Circle the correct answer

Continues Assessment Tests (CATs)

1) Which of these lakes is not located within rift valley?

   a. Lake Victoria b. Lake Elementaita c. Lake Magadi d. Lake Turkana

2) Which one of these rivers does not drain into lake Turkana?

   a. River Kerio b. River Turkwel c. River Kuja d. River Suguta

3) Which of these counties is not correctly matched with its Headquarters?

   a. Makueni-Makueni b. Kisumu-Kisumu c. Narok-Narok d. Nyeri-Nyeri

4) Who among the following is a Cushites Speaker?

   a. Dahalo b. Abagusii c. Pokomo d. Pokot

5) The highest mountain in Kenya is _____

   a. Mt. Ndoto b. Mt. Kenya c. Mt. Elgon d. Mt. Kilimanjaro

6) Which one of the following industries is a processing industry?

   a. Cement making b. Paper making c. Vehicle assembling d. Milk factory

7) The following are western Bantus which one is not?

   a. Akamba b. Abakuria c. Abagusii d. Abaluyha

8) One of the following tribe is not a Kalenjin Sub-tribe. Which one is NOT?

   a. Turgen b. Terik c. Nandi d. Turkana

9) The third biggest region in Kenya is _____

   a. Rift valley c. Central C. North Eastern d. Coast

10) Which of the following towns is Headquarters of East African community?

   a. Jinja b. Kampala c. Moshi d. Arusha

APPENDIX VIII A

SERIAL LEARNING ACHIEVEMENT TEST: SOCIAL STUDIES

NAME……Date……

Instruction to Candidate: Circle the correct answer

Random Assessment Test (RAT)

1. Which one of the following is the correct order of Rain-bow colours?

   a. Red, orange, yellow, green, blue, indigo, violet
   b. Red, blue orange, yellow, green, indigo, violet
   c. Violet, red, orange, yellow, green, blue, indigo,
   d. Red, indigo, orange, yellow, green, blue, violet

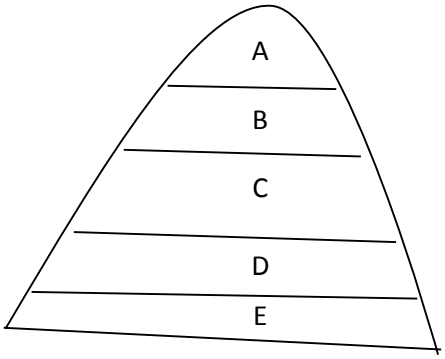
2. Which one of the following is correct order of mountain vegetation?

   a. Rain forest -Bamboo forest- Savanna Grass-Heath & Moorland -Snow & bare rock
   b. Savanna Grass-Rain forest -Bamboo Forest-Heath & Moorland-Snow & bare rock
   c. Savanna Grass-Rain forest-Bamboo Forest Snow & bare rock-Heath & moorland
   d. Savanna Grass-Rain forest -Bamboo Forest-Heath & Moorland-Snow & bare rock

3. Which one of the following is the correct order of Buganda Kingdom?

   a. Lukiku -Katikiru -Omwanika-Bataka -Muyasi -Gabunga -Kabaka -Omulamuzi
   b. Lukiku - Omwanika-Katikiru -Omulamuzi - Bataka -Muyasi -Gabunga – Kabaka
   c. Lukiku -Katikiru -Omulamuzi -Omwanika-Bataka -Muyasi -Gabunga - Kabaka,
   d. Lukiku -Katikiru -Omulamuzi -Omwanika-Bataka -Gabunga –Kabaka-Muyasi

Answer question 4 and 5 using diagram below;



4. Which vegetation is found in the region Marked B?

a. Booboo
b. Heath and Moorland
c. Rain forest
d. Savannah

5. Which is the main economic activity carried out in the region marked E?

a) Saw milling
b) Mining
c) Trade
d) Pastoralism

APPENDIX VIII B

SERIAL LEARNING ACHIEVEMENT TEST: SOCIAL STUDIES

NAME……Date……

Instruction to Candidate: Circle the correct answer

Continues Assessment Tests (CATs)

1. Which is the correct order of the lines which divide the world into three equal parts?
   a. Greenwich Meridian, Tropical of cancer, Equator, Tropical of Capricorn
   b. Tropical of cancer, Equator, Tropical of Capricorn
   c. Equator, Tropical of cancer, Equator, Tropical of Capricorn
   d. Tropical of Capricorn, Equator, Tropical of cancer
2. Which one of the following is the correct order of rain bow colours?
   a. Red, orange, yellow, green, blue, indigo, violet
   b. Red, blue orange, yellow, green, indigo, violet
   c. Violet, red, orange, yellow, green, blue, indigo,
   d. Red, indigo, orange, yellow, green, blue, violet
3. Which one of the following is the correct order of mountain vegetation?
   a. Rain forest, Bamboo forest, Savanna Grass, Heath & Moorland, Snow & bare rock
   b. Savanna Grass, Rain forest, Bamboo forest, Heath & Moorland, Snow & bare rock
   c. Savanna grass, Rain forest, Bamboo Forest, Snow & bare rock, Heath & Moorland
   d. Savanna grass, Rain forest, Bamboo Forest, Heath & moorland, Snow & bare rock
4. John is Marys' brother; their parents are Mr. And Mrs Kamau; their grandparents are Mr and Mrs. Macharia; what is the correct order of John's generation?
   a. Grandparents, Children and parents
   b. Grandparents, parents and Children
   c. Grandparents, parents, Brothers and sisters
   d. parents, grandparents, and Children

5. Name nine planets starting from nearest to furthest
    a. Mercury, Venus, Mars, Earth, Jupiter, Saturn, Uranus Venus Neptune and Pluto
    b. Mercury, Mars, Jupiter, Saturn, Uranus Venus, Earth, Neptune Pluto and Neptune
    c. Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Earth, Neptune, Earth and Pluto
    d. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus Neptune and Pluto
6. Which is the correct order of the coastal towns starting from North to south coast of East Africa?
    a. Malindi, Lamu, Zanzibar, Mombasa, Kismayo
    b. Malindi, Lamu, Mombasa Zanzibar, Kismayo
    c. Kismayo Malindi, Lamu, Mombasa, Zanzibar
    d. Kismayo, Lamu, Malindi Mombasa Zanzibar
7. Give the four main language groups in order in which they came to Kenya
    a. Semites, Bantus, Cushites, Nilotes
    b. Cushites, Nilotes, Bantus, Semites
    c. Cushites, Bantus, Semites, Nilotes
    d. Nilotes, Semites, Bantus Cushites
8. Which one of the following is COMESA member countries?
    a. Kenya, Uganda, Zimbabwe, Ethiopia
    b. Kenya, Ethiopia, Rwanda, Burundi
    c. Kenya, Ethiopia, Rwanda, Burundi
    d. Egypt, London, China, Uganda

APPENDIX IX A

SOCIAL STUDIES ACHIEVEMENT TEST

NAME……Date……

Instructions to Candidate: Circle the correct answer

Class Seven Random Assessment Test (RAT)

1. Which one of these lakes is not located within rift valley?

   a. Lake Victoria b. Lake Elementaita c. Lake Magadi d. Lake Turkana

2. Which one of these rivers does not drain into Indian Ocean?

   a. River Nzoia b. River Tana c. River Athi d. River Juba

3. Which one of the following rivers do not drain into Lake Victoria?

   a. River Nzoia b. River Sondu c. River Yala d. River Tana

4. Which of the One of these lakes is a man-made lake?

   a. Victoria b. Elementaita c. Sondu d. Masinga

5. Which One of these lake is a fresh water lake?

   a. Lake Victoria b. Lake Elementaita c. Lake Magadi d. Lake Turkana

APPENDIX IX B

SOCIAL STUDIES ACHIEVEMENT TEST

NAME……Date……

Instruction to Candidates: Circle the correct answer

Social Studies Continues Assessment Tests (CATs)

1. Masaku and Sakawa were prominent leaders of their communities. The two were

   Different from Somoei and Mekatilili in that:

   a. Masaku and Sakawa were`great leaders
   b. Masaku and Sakawa became supporters of white people
   c. Masaku and Sakawa fore saw the defeat of Africans by Europeans
   d. Masaku and Sakawa prophesied about coming of Europeans

2. Which one of the following group of industries consist of processing industries?
   a. Grain-milling, Sugar cane milling, fruit canning
   b. Motor vehicle assembling, Electricity generation, Bicycle assembling
   c. Printing, Baking, Insurance
   d. Soap making, Steel rolling, Shoe making

3. Which of following statement is not true about Pekerra irrigation scheme?
   a. The main crops grown are onions, chillies and pawpaw
   b. Furrow irrigation method is used
   c. It is located between river Nyamindi and Thiba
   d. The scheme provides livelihood to people living in the area

4. Which one of the following groups of communities in Kenya consist of the Highland Nilotes?

   a. Saboat, Turkana b. Maasai, Samburu c. Tugen, Iteso d. Marakwet, Keiyo

5. Which one of the following was the main reason why Abagusii settled in Kisii highlands?

a. Availability of pasture for their livestock
b. Favourable climate for faming activities
c. Presented a save hiding place
d. The highlands were far from the enemies of Abagusii

6. Which one of the following is not United Nations Body?

a. ECOWAS b. UNESCO c. UNEP d. WHO

7. The mineral extracted from Lake Magadi is____

a. Limestone b. Soda Ash c. Fluorspar d. Diatomite

8. Which of the following is the main reason for formation of UN?
a. To assist underdeveloped countries
b. To prevent making nuclear weapon
c. To find lasting peace in the world
d. To punish those who had caused First World War
9. Which one of the following security department is not is a member of national defence force?

a. Kenya Police b. Kenya air force c. Kenya Arm d. Kenya Navy

10. In Kenya people exercise their democratic rights by _____

a. Walking freely b. Getting free education

c. Voting during election d. Attending community Barazas

APPENDIX X A

MATHEMATICS ACHIEVEMENT TEST

NAME……Date……

Instruction to Candidate: Circle the correct answer

Random Assessment Test (RAT)

1. Write this number in roman 69; a. LXVII b.VIIX c. LXIX d. IXLX

2. Which fraction among the following is the smallest?

   a. $\frac{2}{3}$ b. $\frac{1}{2}$ c. $\frac{3}{4}$ d. $\frac{5}{6}$

3. A crate holds 24 bottles of soda. A shopkeeper sells, 3 crates daily, how many bottles does the shopkeeper sell in 6 days? a. 72 b. 33 c. 422 d. 432

4. Express 96 by its prime factor;

   a. 2 X 2 X 2 X 2 X 3 b. 2 X 2 X 2 X 2 X 3 X3

   c. 2 X 2 X 2 X 2 X 2 X3 d. 2 X 2 X 2 X 2 X 2 X2

5. Rono is 1m 25cm tall, John is 1m 35cm tall and Mark is 1m 85cm tall. What is their total height?

   a. 2m 45cm b. 3m 20cm c. 3m 45cm d. 4m 45cm

APPENDIX X B
MATHEMATICS ACHIEVEMENT TEST

NAME……Date……

Instruction to Candidate: Circle the correct answer

Continues Assessment Tests (CATs)

1. What is the place value of $6\frac{3}{4}+3\frac{1}{2}$; a. 360 b. 39 c.72 d. 306

2. Write this number in roman numbers 69;

   a. LXVII b. VIIX c. LXIX d. IXLX

3. The following are measures of central tendency mean, mode and____

   a. Variance b. median c. graph d. range

4. Which one of the following decimals is greater than the others?

   a. 0.12 b. 0.121 c. 0.13 d. 0.104

5. A crate holds 24 bottles of soda. A shopkeeper sells, 3 crates daily. How many bottles does the shopkeeper sell in 6 days? a. 72 b. 33 c. 422 d. 432

6. Work out:

L	ML
13	76
+ 8	51
_____	
_____	

   a. 22 L 17ML b. 21L 27ML c. 21L 17ML d. 22L 27ML

6. Express 96 by its prime factor;

   a. 2 X 2 X 2 X 2X 3 b. 2 X 2 X 2 X 2 X 3

   c. 2 X 2 X 2 X 2 X 2 X3 d. 2 X 2 X 2 X 2 X 2 X2

7. Find perimeter of a square whose sides is 25m

   a. 50M b. 20M. c. 100M d. 80M

8. Write 0.55 as a fraction; a. $\frac{55}{1000}$ b. $\frac{11}{20}$ c. $\frac{55}{100}$ d. $\frac{11}{100}$

9. Change this fraction $\mathbf{8\frac{7}{8}}$ into improper fraction; a. $\frac{56}{8}$ b. $\frac{71}{8}$ c. $\frac{64}{8}$ d. $\frac{8}{71}$

10. A container can hold 20 litres of milk. If there are 5 such containers, how many half packet litres of milk will they hold altogether?

    a. 50 b. 100 c. 200 d. 300

APPENDIX XI A

Pupils' Answer Sheet for Achievement Tests for Random Assessment Test (RAT)

Name: _____

Class: _____

Subject: _____

School: _____

Date: _____

Time: _____

Instructions' to the Pupils:

Circle the Right Letter Only

Q.1 a b c d

Q.2 a b c d

Q.3 a b c d

Q.4 a b c d

Q.5 a b c d

APPENDIX XI B

Pupils' Answer Sheet for Achievement Tests for Continuous Assessment Tests (CAT)

Name: _____

Class: _____

Subject: _____

School: _____

Date: _____

Time: _____

Instructions' to the Pupils: Circle the Right Letter Only

Q.1 a b c d

Q.2 a b c d

Q.3 a b c d

Q.4 a b c d

Q.5 a b c d

Q.6 a b c d

Q.7 a b c d

Q.8 a b c d

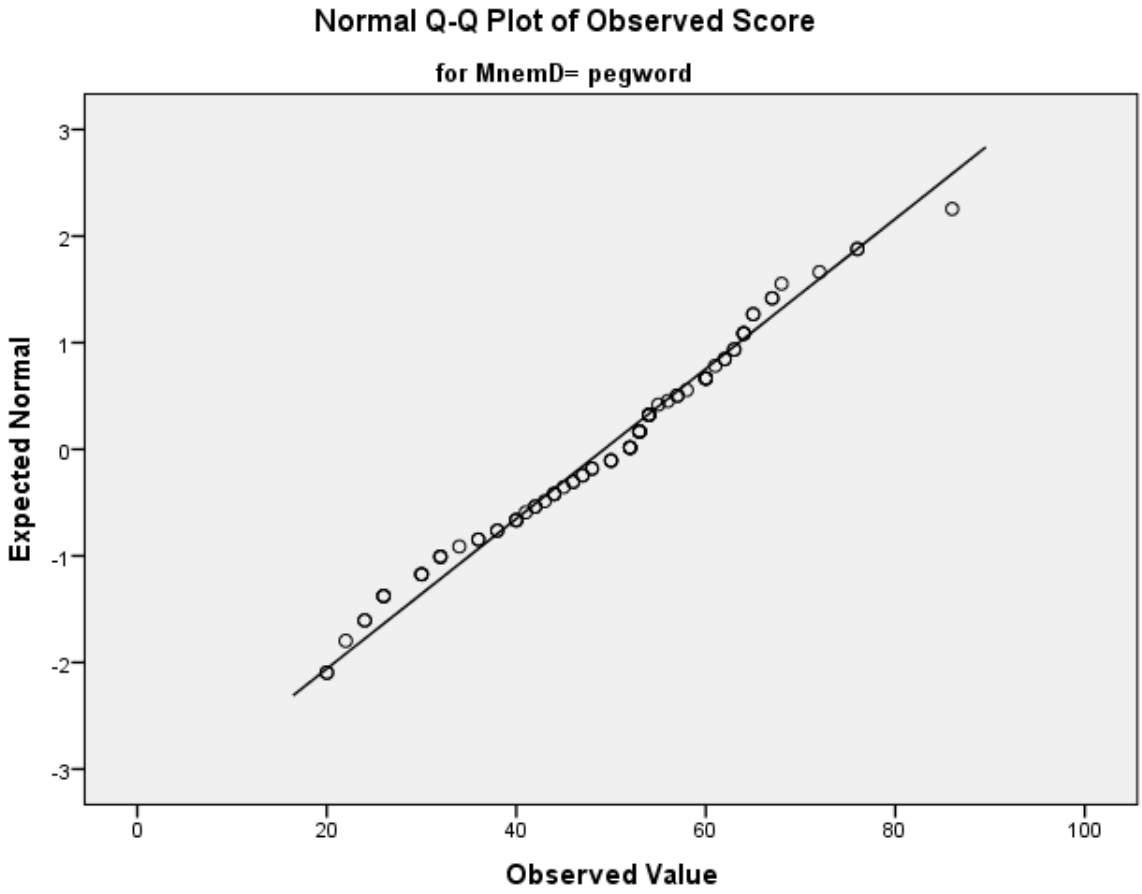
Q.9 a b c d

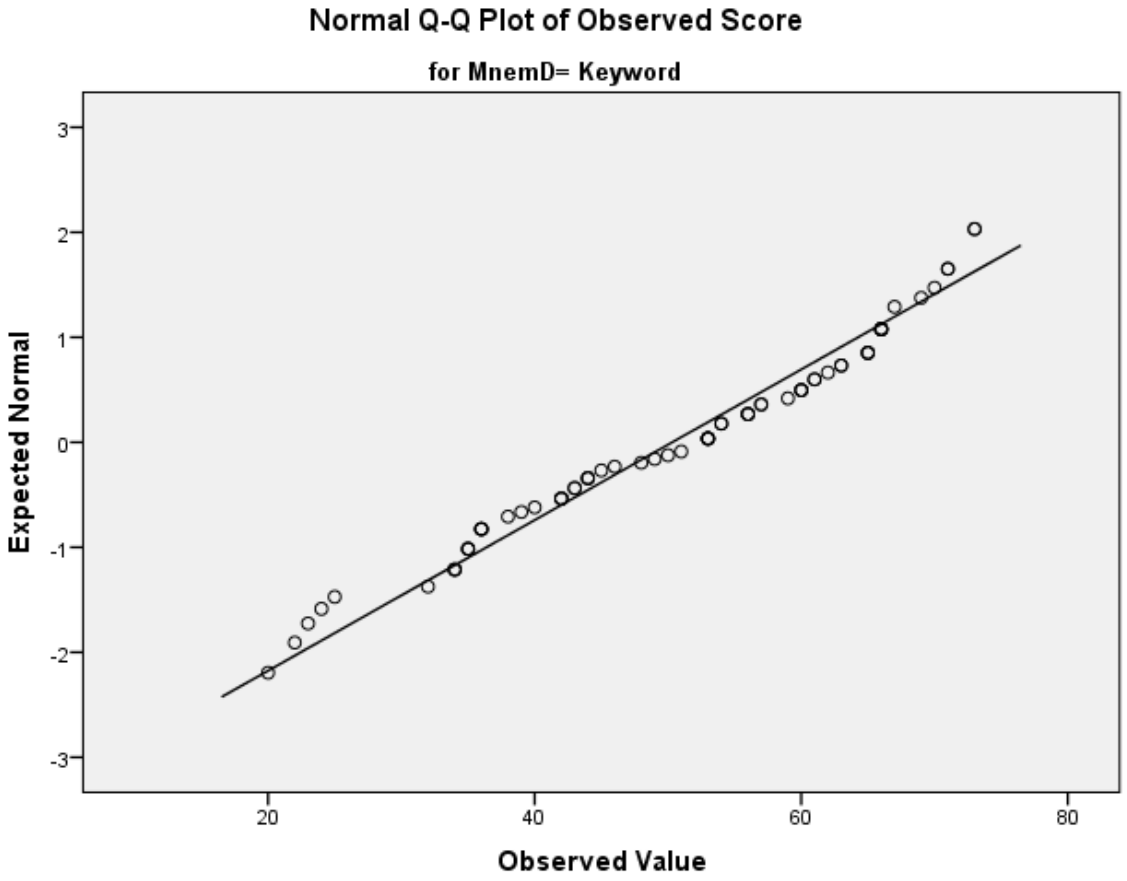
Q.10 a b c d

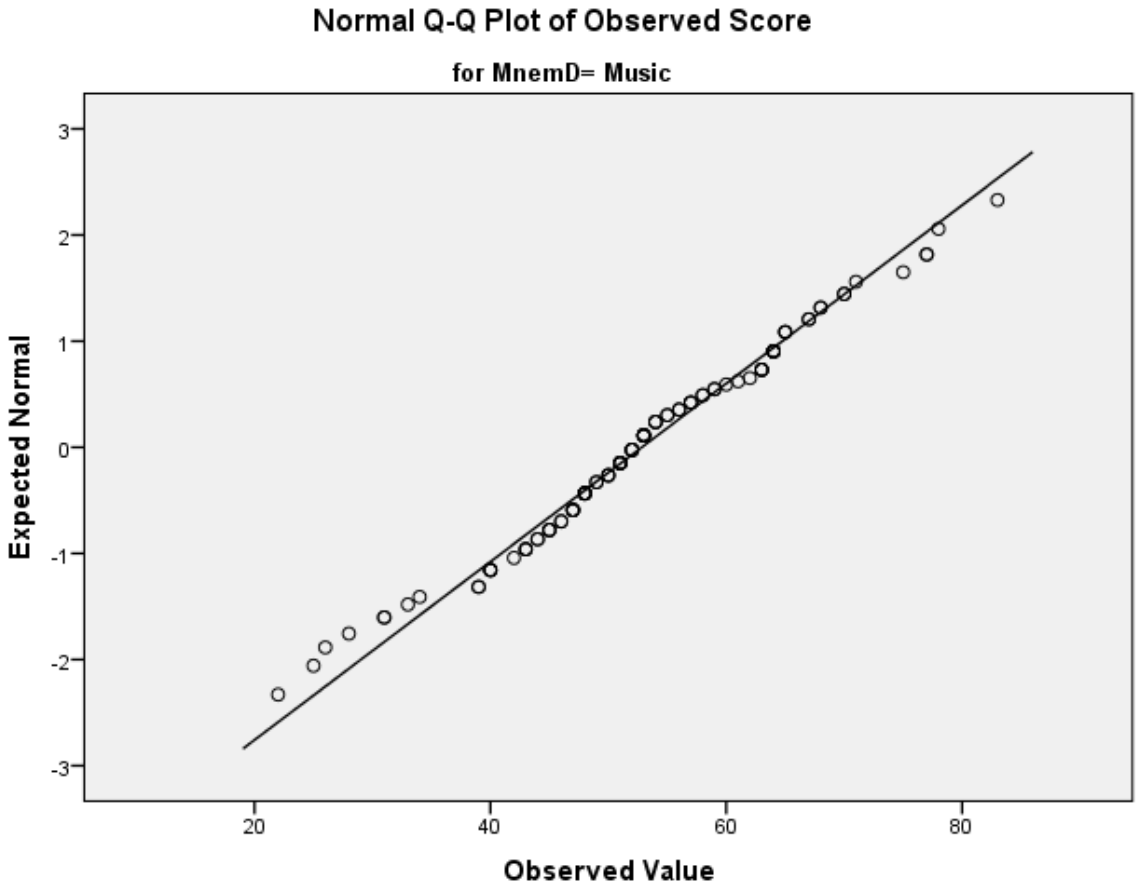
APPENDIX XII A

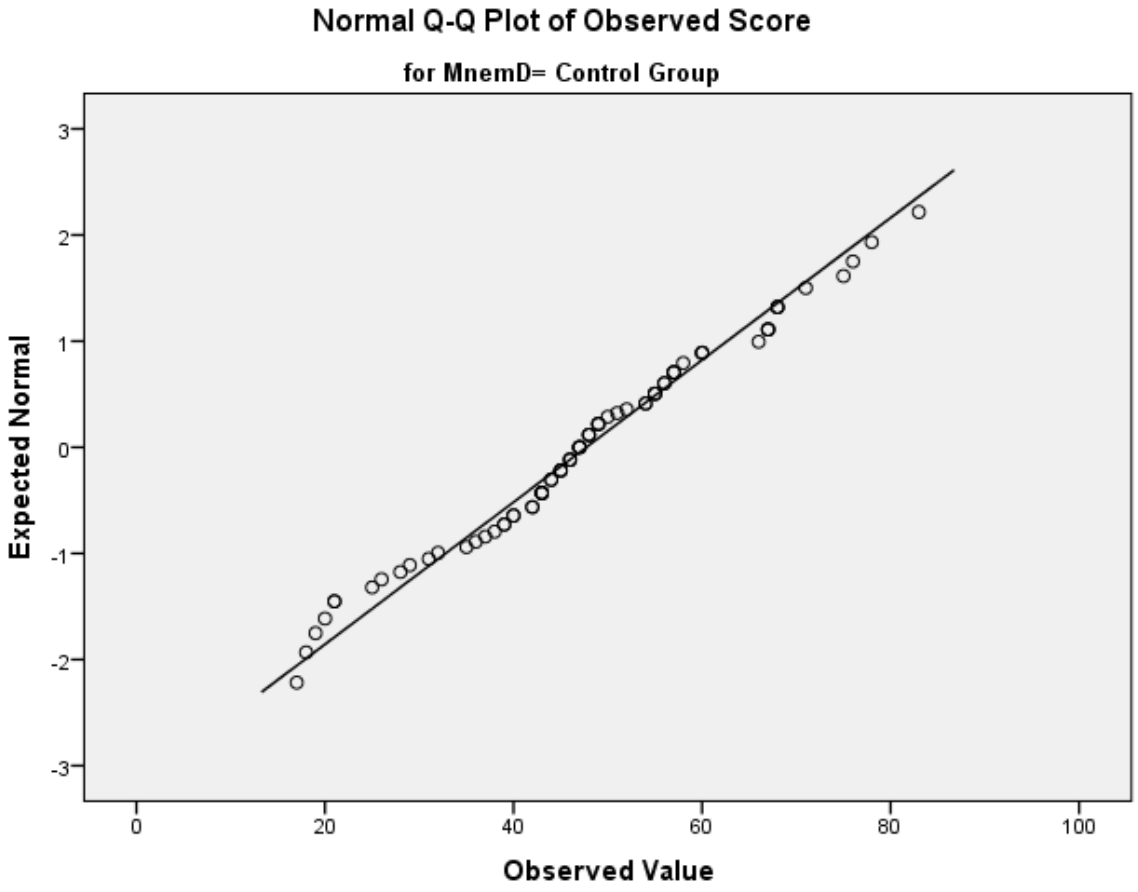
TEST OF ASSUMPTIONS FOR OBJECTIVE 1

Test of normality




Normal Q-Q Plot of Observed Score
for MnemD= Keyword
Expected Normal
3
2
1
0
-1
-2
-3
20
40
60
80
Observed Value


Normal Q-Q Plot of Observed Score
for MnemD= Music
Expected Normal
3
2
1
0
-1
-2
-3
20
40
60
80
Observed Value


Normal Q-Q Plot of Observed Score
for MnemD= Control Group
Expected Normal
3
2
1
0
-1
-2
-3
0
20
40
60
80
100
Observed Value

APPENDIX XII B

TEST OF ASSUMPTIONS FOR OBJECTIVE 1

Test of Homogeneity of Variance

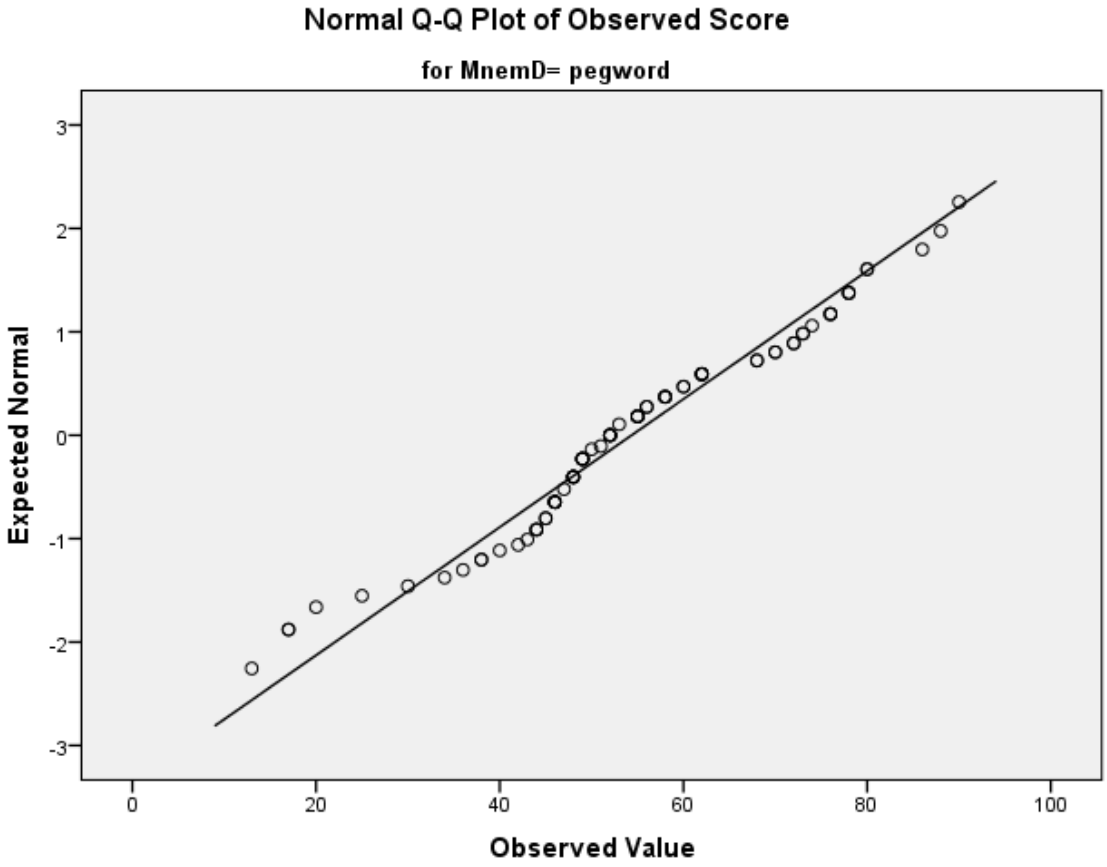
		Levene Statistic	df1	df2	Sig.
Observed Score	Based on Mean	2.115*	3	322	.098*
	Based on Median	1.753	3	322	.156
	Based on Median and with adjusted df	1.753	3	311.327	.156
	Based on trimmed mean	2.084	3	322	.102

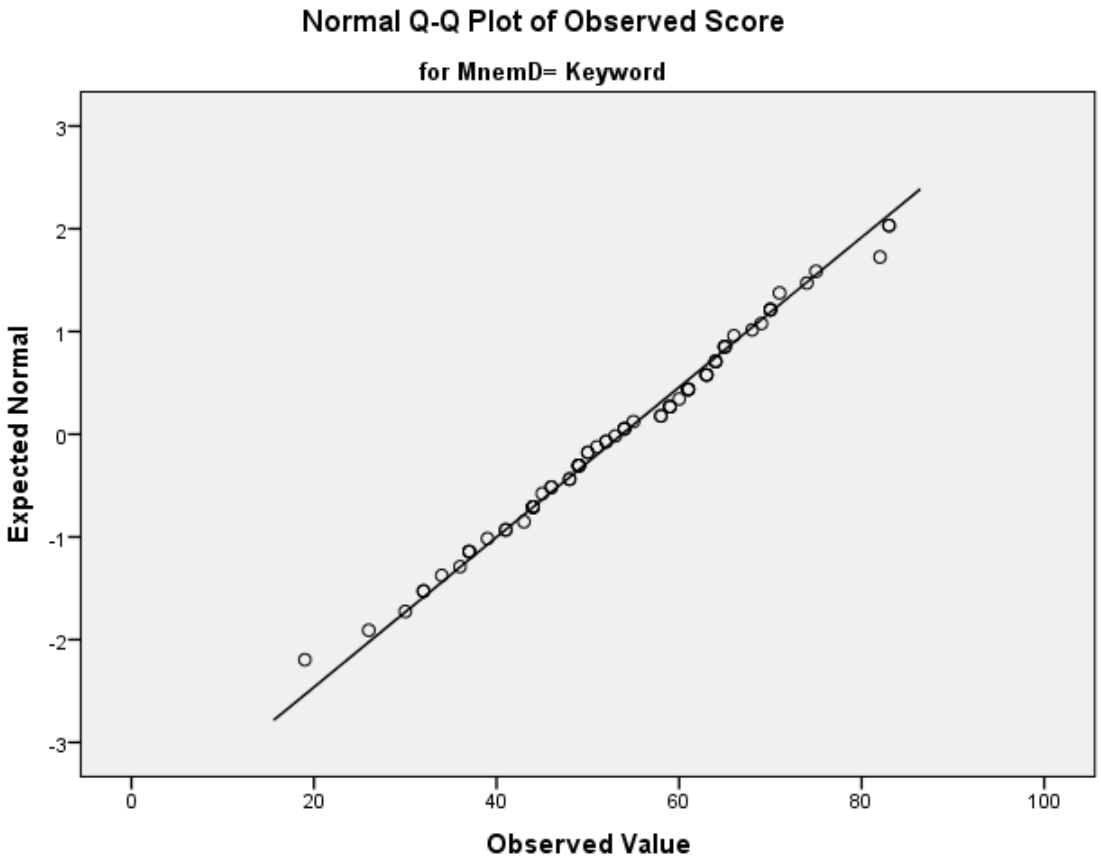
*Levene's test is insignificant: (F(3,322)= 2.12, P> 0.05)

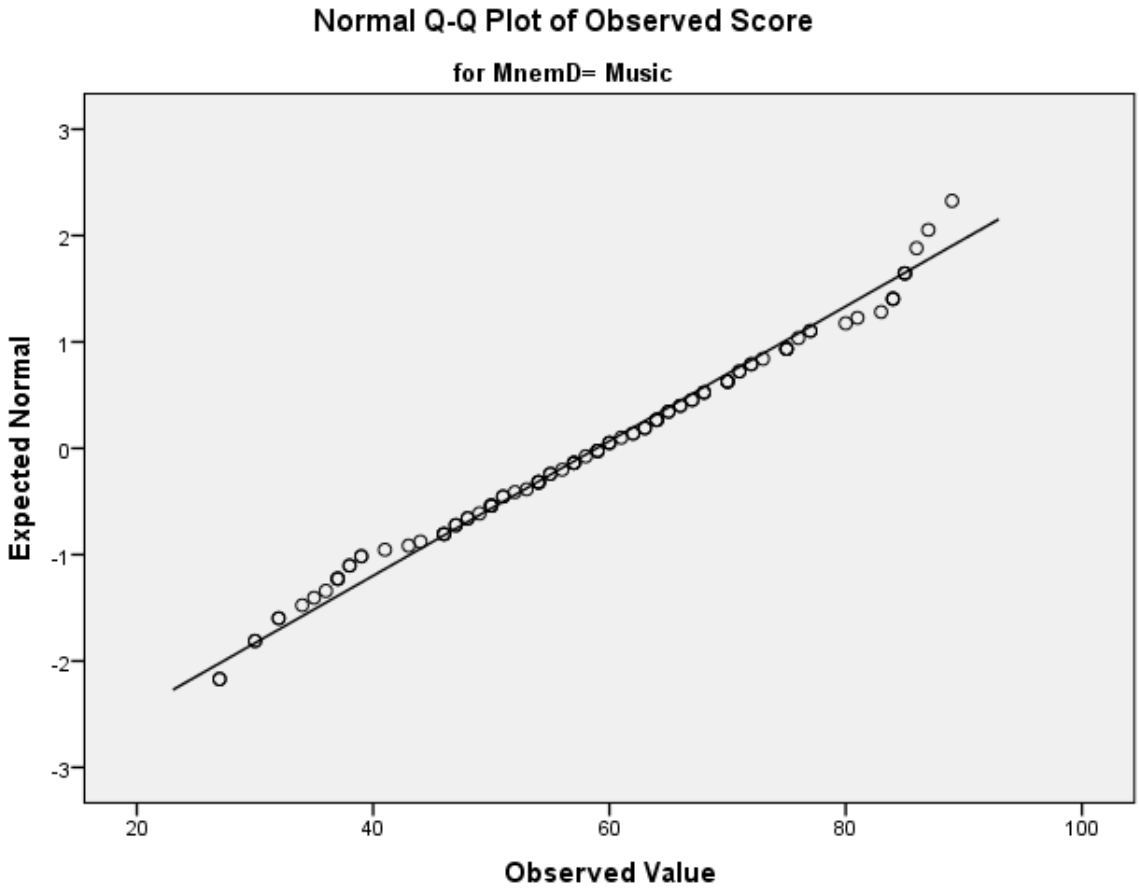
APPENDIX XIII A

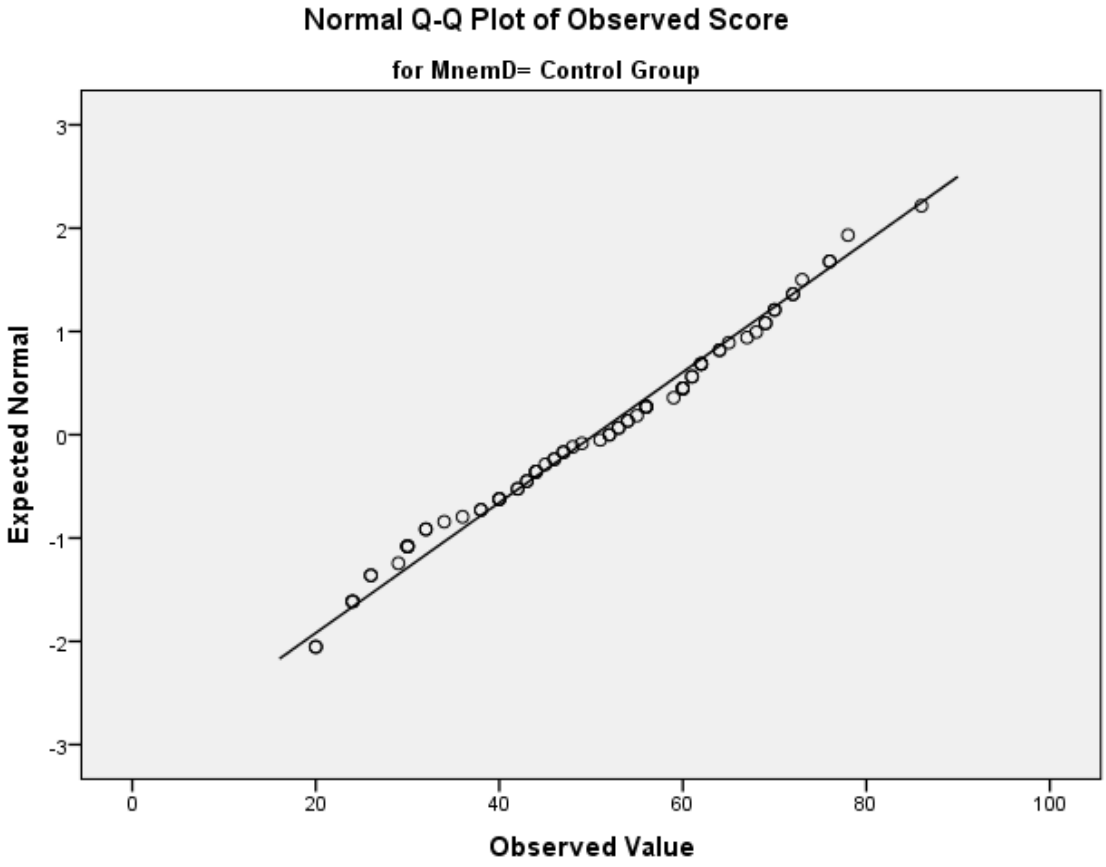
TEST OF ASSUMPTIONS FOR OBJECTIVE 2

Test of Normality




Normal Q-Q Plot of Observed Score
for MnemD= Keyword
Expected Normal
3
2
1
0
-1
-2
-3
0
20
40
60
80
100
Observed Value


Normal Q-Q Plot of Observed Score
for MnemD= Music
Expected Normal
3
2
1
0
-1
-2
-3
20
40
60
80
100
Observed Value


Normal Q-Q Plot of Observed Score
for MnemD= Control Group
Expected Normal
3
2
1
0
-1
-2
-3
0
20
40
60
80
100
Observed Value

APPENDIX XIII B

TEST OF ASSUMPTIONS FOR OBJECTIVE 2

Test of Homogeneity of variance

Test of Homogeneity of Variance

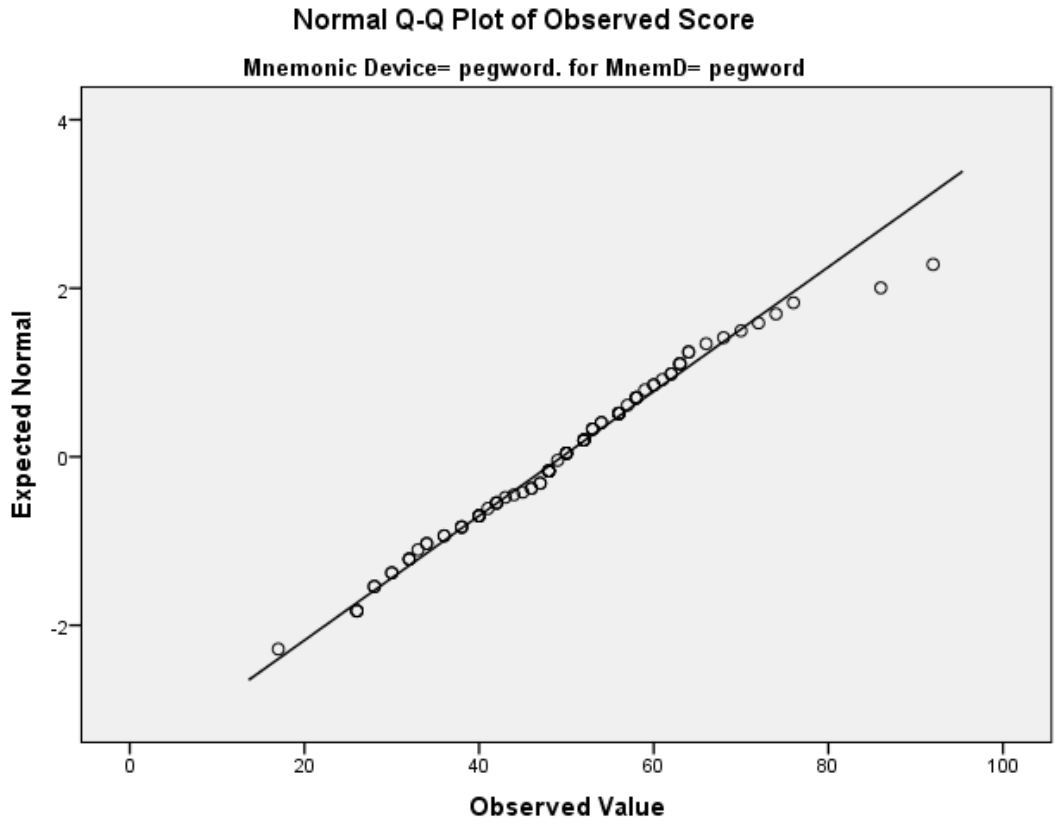
		Levene Statistic	df1	df2	Sig.
Observed Score	Based on Mean	2.118*	3	321	.099*
	Based on Median	1.749	3	321	.159
	Based on Median and with adjusted df	1.749	3	304.928	.159
	Based on trimmed mean	1.790	3	321	.104

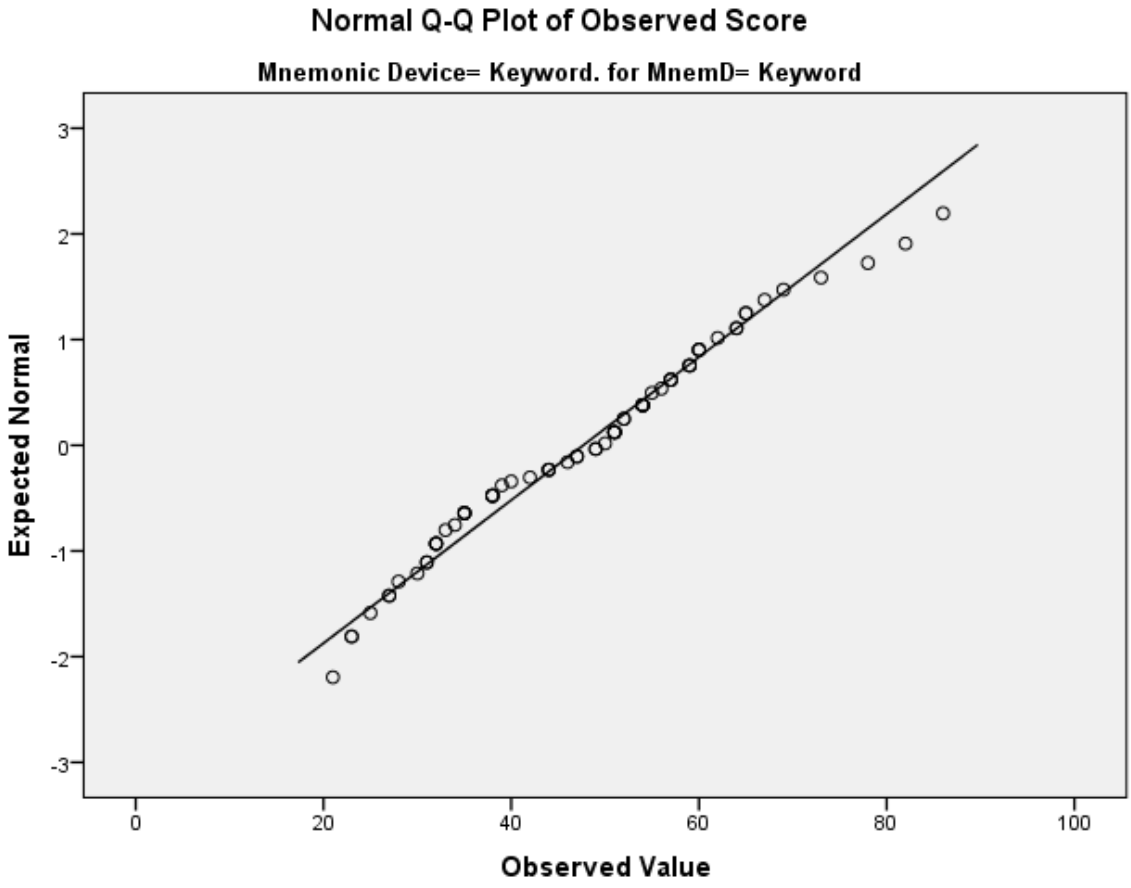
NB. *Levene's test is insignificant: (F (3,321) = 2.14, P> 0.05)

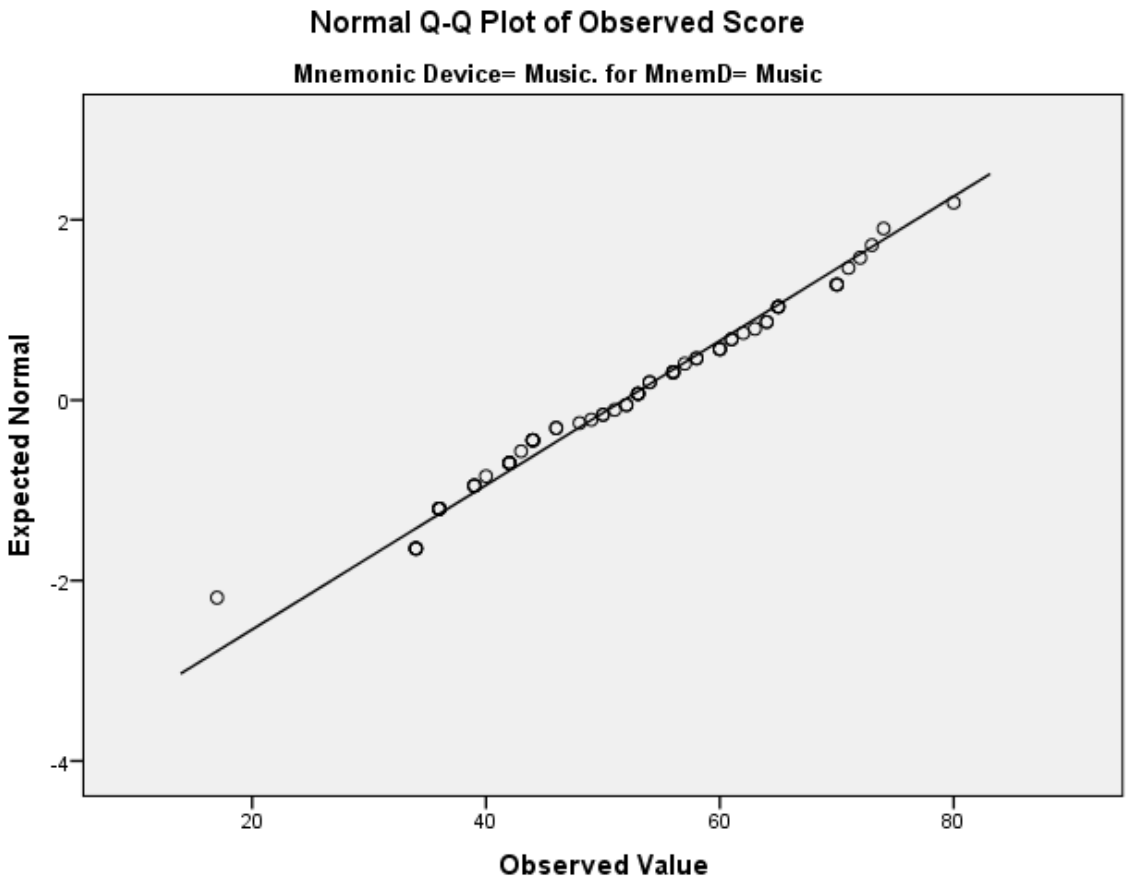
APPENDIX XIV A

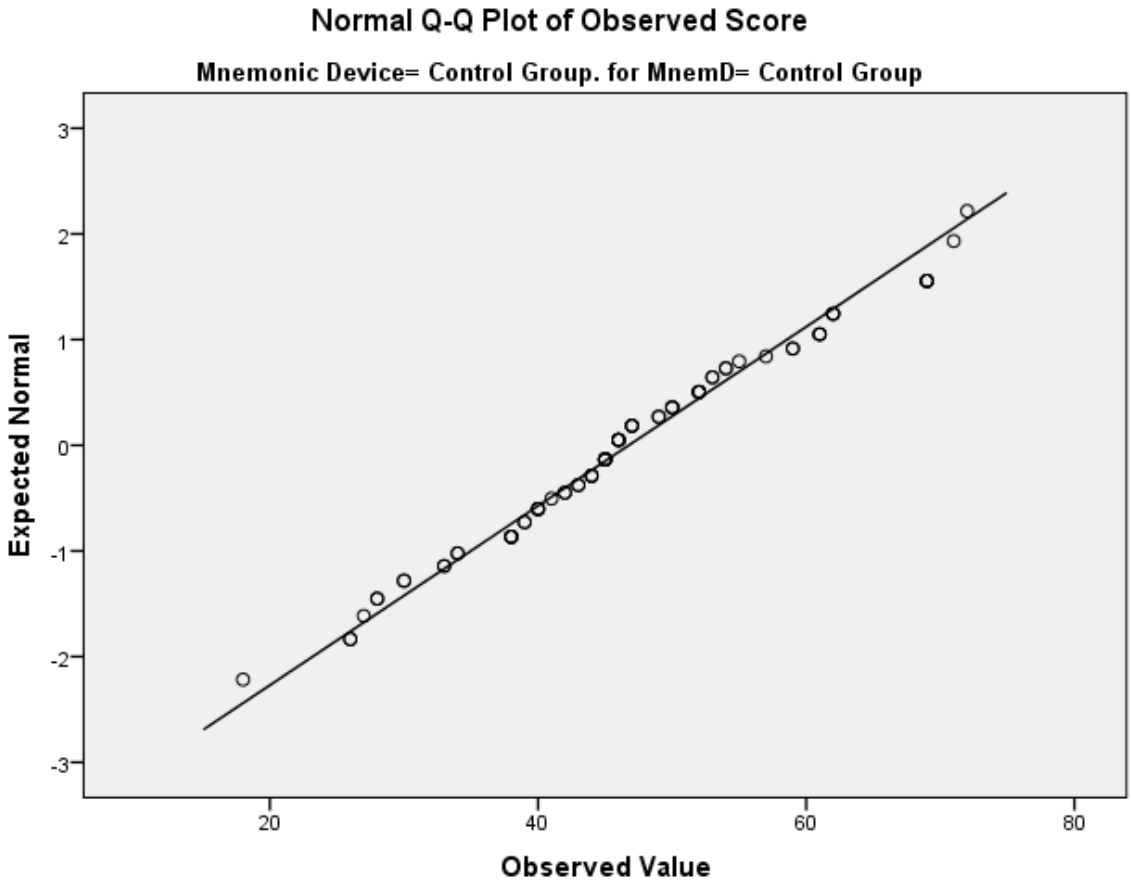
TEST OF ASSUMPTIONS FOR OBJECTIVE 3

Test of Normality




Normal Q-Q Plot of Observed Score
Mnemonic Device= Keyword. for MnemD= Keyword
Expected Normal
3
2
1
0
-1
-2
-3
0
20
40
60
80
100
Observed Value


Normal Q-Q Plot of Observed Score
Mnemonic Device= Music. for MnemD= Music
Expected Normal
2
0
-2
-4
20
40
60
80
Observed Value


Normal Q-Q Plot of Observed Score
Mnemonic Device= Control Group. for MnemD= Control Group
Expected Normal
3
2
1
0
-1
-2
-3
20
40
60
80
Observed Value

APPENDIX XIV B

TEST OF ASSUMPTIONS FOR OBJECTIVE 3

Test of Homogeneity of variance

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Observed Score	Based on Mean	2.005*	3	321	.096*
	Based on Median	.749	3	321	.149
	Based on Median and with adjusted df	.749	3	304.928	.149
	Based on trimmed mean	.790	3	321	.104

NB. *Levene's test is insignificant: (F (3,321)= 2.16, P> 0.05)

APPENDIX XV

MACHAKOS COUNTY AND MACHAKOS SUB-COUNTY MAPS

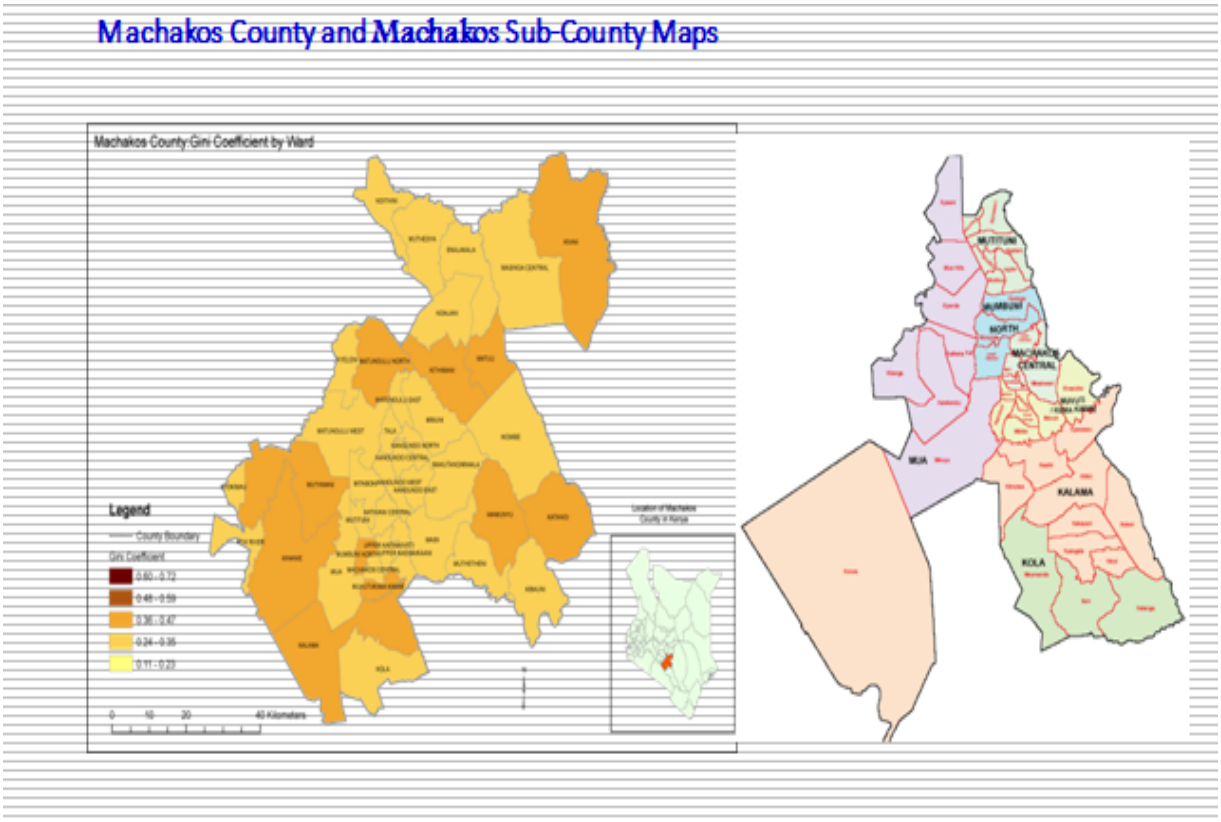


Figure 3.1: Map of Machakos County and Machakos Sub-County

Source: www.machakoscounty.ac.ke retrieved in January 2018

APPENDIX XVI

RESEARCH AUTHORIZATION

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/19/57459/28489**

Date: **19th March, 2019**

Patricia Mwikali Makau
Machakos University
P.O. BOX 136 – 90100
MACHAKOS.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on ***"Appropriateness of mnemonic techniques on learning outcomes among Upper Primary School pupils in Machakos Sub-County Kenya"*** I am pleased to inform you that you have been authorized to undertake research in **Machakos County** for the period ending **19th March, 2020.**

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

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Machakos County.

The County Director of Education
Machakos County.

APPENDIX XVII

RESEARCH LICENSE

THIS IS TO CERTIFY THAT:
MS. PATRICIA MWIKALI MAKAU
of MACHAKOS UNIVERSITY, 136-90100 MACHAKOS,has been permitted to conduct research in *Machakos County*

Permit No : NACOSTI/P/19/57459/28489
Date Of Issue : 19th March,2019
Fee Recieved :Ksh 2000

on the topic: *APPROPRIATENESS OF MNEMONIC TECHNIQUES ON LEARNING OUTCOMES AMONG UPPER PRIMARYS CHOOL PUPILS IN MACHAKOS SUB-COUNTY KENYA*

for the period ending:
19th March,2020

.....
Applicant's Signature

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

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014.

CONDITIONS

1. The License is valid for the proposed research, location and specified period.
2. The License and any rights thereunder are non-transferable.
3. The Licensee shall inform the County Governor before commencement of the research.
4. Excavation, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
5. The License does not give authority to transfer research materials.
6. NACOSTI may monitor and evaluate the licensed research project.
7. The Licensee shall submit one hard copy and upload a soft copy of their final report within one year of completion of the research.
8. NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice.

National Commission for Science, Technology and innovation
P.O. Box 30623 - 00100, Nairobi, Kenya
TEL: 020 400 7000, 0713 788787, 0735 404245
Email: dg@nacosti.go.ke, registry@nacosti.go.ke
Website: www.nacosti.go.ke

REPUBLIC OF KENYA

National Commission for Science, Technology and Innovation

RESEARCH LICENSE

Serial No.A 23717

CONDITIONS: see back page

APPENDIX XVIII

ANTIPLAGIARISM REPORT

APPROPRIATENESS OF MNEMONIC TECHNIQUES ON LEARNING OUTCOMES IN PUBLIC PRIMARY SCHOOLS IN MACHAKOS SUB-COUNTY, KENYA

by Patricia Makau

ORIGINALITY REPORT

3%	3%	0%	0%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	teachpsych.org Internet Source	3%

Exclude quotes	On	Exclude matches	< 2%
Exclude bibliography	On		

Submission date: 20-Mar-2020 04:23PM (UTC+0300)
Submission ID: 1278743537
File name: THESIS_PATRICIA_FINAL_DRAFT_20-3-2020.docx (2.38M)
Word count: 51656
Character count: 286869