

**ROLE OF GRAPHIC ORGANIZERS ON LEARNING OUTCOME OF
TRAINEES WITH DIVERSE LEARNING NEEDS IN KENYATTA
INDUSTRIAL VOCATIONAL REHABILITATION
CENTRE, NAIROBI COUNTY,
KENYA**

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**A Research Thesis Submitted to the School of Education in Partial Fulfilment of
the Requirements for the Award of Degree of Master of Educational
Communication Technology of Machakos University, Kenya**

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DECLARATION

Declaration by Student:

This Thesis is my original work and has not been submitted for the award of a degree in Machakos University or any other institution.

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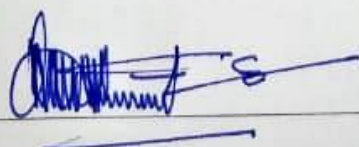
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DEDICATION

This Thesis is dedicated to my beloved Family.

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ABBREVIATIONS AND ACRONYMS

AAO	: Ausubel's Advance Organizers
AO	: Advanced Organizers
CRT	: Criterion Referenced Test
DLN	: Diverse Learning Needs
GO	: Graphic Organizers
ICT	: Information and Communication Technology
KMTC	: Kenya Medical Training College
LO	: Learning Outcome
NACOSTI	: National Commission for Science and Technology Innovation
SPSS	: Statistical Package for Social Sciences
UNESCO	: United Nations Educational, Scientific and Cultural Organization
WHO	: World Health Organization

ABSTRACT

Education is essential for all children regardless of their diverse learning needs in the attainment of the millennium development goals. ICT in education has offered particular benefits for learners with diverse learning needs such as visual presentations, self-paced learning, highly motivating graphics and opportunity to be in control of their own learning. However, research on the factors that contribute to the development of inclusive Graphic Organizers that are effective and customizable so as to accommodate the diverse learning needs where all learners feel valued and supported is limited. The present study sought to bridge the gap in the traditional existing literature of instructions and investigated the role of graphic organizers designed on the principles of Ausubel Advance Organizer Model theory which emphasizes the use of graphic organizers, visual cues and hierarchical structures to aid learning and knowledge retention on learning outcome of trainees with diverse learning needs. The main objective was to determine the role of Graphic Organizers on learning outcomes of trainees with diverse learning needs, assess how trainees with diverse learning needs perceive and engage with Graphic Organizers as a learning tool and establish how instructors perceive and engage with Graphic Organizers as an instructional tool at Kenyatta Industrial Vocational Rehabilitation Center in Nairobi. The study adopted a mixed methodology and an Experimental research design and in particular a pretest-posttest study employing experiment and controlled groups to measure the outcome before and after intervention. Pre-test measures were administered before the intervention to establish a baseline level of knowledge and understanding. Post-test was conducted after the intervention to determine the role of Graphic Organizers. The target population was 52 respondents who included the Centre Manager, 7 Instructors and 44 trainees with diverse learning needs who were purposely selected. The Learning Outcome was measured by specifically developed achievement test known as Criterion Referenced Test in the form of Graphic Organizer Computer Test. Questionnaires were used as a research instrument for trainees and instructors and an interview schedule was applied to the Centre Manager. The research instruments were piloted in Machakos Vocational Rehabilitation Centre, Machakos County. A reliability of 0.7 was obtained. Quantitative data was analyzed descriptively using frequencies, means, percentage and standard deviation while the narrative approach was adopted to analyze qualitative data from the Centre Manager. The inferential analysis used the t-test, chi-square techniques Wilcoxon Signed-Rank Test with the aid of Statistical Package for Social Science version 27. The hypotheses of the study were tested at $\alpha=0.05$ level significance. The study established the Graphic Organizers improve learning outcome of learners with diverse learning needs with reference to comprehension, organization skills and retention of learned information. Visual mapping Graphic Organizers approach was ranked first by the trainees and that instructors incorporate Graphic Organizers in all facets of training. It was discovered that insufficient training in computer applications hinders instructor's application of the Graphic Organizers at the college. The study emphasizes on integration of Graphic Organizers into curriculum to support diverse learning needs and styles, provide training for instructors on the effective use of Graphic Organizers for different content areas and tailoring them to meet the needs of diverse learners, encourage the ministry of education, educators and policy makers to develop customizable Graphic Organizers since not all GO will work for every learner and provide options that allow learners with DLN to choose which type of GO best suits their learning preferences and needs.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter discussed the following: Background Information to the study modelled on Graphic Organizers based on Ausubel's Advance Organizer, Statement of the Problem, Purpose of the Study, Objectives of the Study, Research Instruments, Justification of the Study, Significance of the Study, Scope, Limitations and Delimitations of the Study, Theoretical and Conceptual Framework and Operational Definitions of the Terms Used.

1.1 Background to the Study

Globally, Studies have shown that advance organizers improve students' achievement. A study by Keraro and Shihusa (2009) demonstrate that advance organizers have positive effects on students' motivation in learning Biology. The findings of the researches have suggested that advance organizers are of considerable value where the learner may not be able to recognize his or her prior knowledge as relevant and where the teacher wishes to focus students' attention on relationships among linked parts of an idea and on connections between parts and the whole (Curzon, 1990). A comparative study by Teichert (1996) on using illustrations, brainstorming and questions as advance organizers in intermediate college German conversation classes found out that the use of advance organizers (with video and audio tapes) developed superior listening skills in German classes. Wittich and Schuller (1973) argue that computers are useful in simulations which provide real life experiences. Graphic organizers are effective in enhancing learning of social studies in secondary schools for students with learning difficulties in grades 4 and 5.

Advance organizers on students' conceptualization of pollution in Biology, the findings of the study by Willerman and Mac Harg (1992) revealed that students were not passive subjects in the learning process if concept mapping were used as advance organizers. Dexter, D.D. & Hughes, C.A. (2013) explains that studies have demonstrated that advance organizers are associated with improved learning. On using integrated syntax of advance organizer model, the findings indicate that students had a higher positive attitude towards mathematics in comparison to those taught by traditional method. Walia, P., & Walia, A. (2014). A study by Chen (2007) demonstrates that advance organizers have positive effects on students' attitudes. According to (Wachanga et al., 2013), employing an advance organizer approach has the potential to improve students' performance. They discovered that when students are given advance organizers before the lesson begins, their focus is actually on the most crucial part of the lesson that is understanding the main idea rather than on remembering definitions, facts, and formulas.

Based on students' initial reactions to the material in the organizer, advance organizers are a great way to help them develop and build schema before they actually learn new material. Teachers can modify the lesson plan and material to better fit the prior knowledge of their students; in addition, they efficiently structure their time and critical points that need to be covered while simplifying complicated texts. Bransford, J. D. (2004). This enhances the development of higher order thinking in their students by helping them to quickly organize their ideas especially when they don't have prior knowledge.

Advance Organizers use familiar terms and concepts to link what already the student knows to new information that will be presented in the lesson, which aid in the process

of transforming knowledge and creatively applying it in new situations. This process helps to embed the new information in to long term memory. Advance Organizers don't have to be length or complex just clearly understood and related to the material. Advance Organizers can include pictures, verbal description, requisitioning techniques, graphic, visual Advance Organizers. Ausubel, David P., and Robinson, Floyd G. (1969) contend that the material presented to the learner must possess relevant ideas to which the new idea can be related or anchored to. Mohammad, (2010) investigated the role of Advance Organizers in English language learning and found out that research findings have provided evidence of the superior effects when various types of Advance Organizers are used to facilitate reading comprehensions. Evans (2003) investigated the effect of graphic organizers for Japanese readers on expository texts in English and found out that students generated graphic organizers help accommodate different learners' styles leads to meaningful learning and enhance reading comprehension. Mayer (2003) believed that Advance Organizers helped to organize new materials by outlining, arranging and sequencing the main ideas of the new materials based on what already the learner knows.

Advance organizers can have a significant effect on the acquisition of knowledge, especially in the second language. (Mohammad et al., 2010). Graphic advance organizers significantly promoted English language learning as a second language, revealed from the pre-test and post-test scores. It claims that the organizer could help to organize information and ideas as it facilitates thinking processes while organizing and classifying new concepts. Tamir P, (1992) states that advance organizers can also be a language tool that allows students to exercise language. A study by Racheal M, (2013) shows that advance organizers have positive effects on students' achievement,

perception and attitude towards the learning of narratives in literature in English in secondary schools in Kilifi District Kenya

Research on the use of Advance Organizers for teaching Biology in Bureti District, Kenya, found that students who learned with this method achieved significantly better results compared to those taught using traditional approaches (Keraro & Shihusa, 2009). Similarly, a study examining the Advance Organizer teaching approach for Chemistry in Maara District, Kenya, observed that students instructed using this method attained higher average scores and showed a significant improvement in their Chemistry Assessment Test results after the instruction. Samwel et al., (2010)

Researches conducted on different teaching subjects in Kenya shows that advance organizers have positive effects on students learning outcome. However, very little has been done on effects of graphic organizer and learning outcome of trainees with diverse learning needs. In a study conducted by Waichigo N. Addy. (2013), Trainees with diverse learning needs have learning disabilities such as Reading (Dyslexia), Writing (Dysgraphia) and Arithmetic (Dyscalculia) that make it harder for them to learn or access education than most learners of their age. These trainees with diverse learning needs may need extra or different help from that given to other children of same age. Traditional instructions may not effectively cater to their diverse needs and learning styles. Westwood (2003). The instructors' attitude and techno phobia towards use and application of ICT at this level of the study and trainees with learning needs inability to apply computer application as part of their study are believed to be the cause of ineffective teaching in transferring learned information and comprehension to trainees with diverse learning needs. This study therefore sought to investigate the role of

graphic organizers on learning outcome of trainees with diverse learning needs studying in Kenyatta Industrial Vocational Rehabilitation Centre in Nairobi County, Kenya.

1.2 Statement of the Problem

The provision of the best and most effective education to trainees with diverse learning needs is still a challenge. Despite the increasing recognition of the importance of inclusive education, trainees with diverse learning needs still face significant barriers when it comes to learning and comprehending instructions. They have diverse learning needs such as Reading (Dyslexia), Writing (Dysgraphia) and Arithmetic (Dyscalculia) that makes it harder for them to learn or access education than most learners of their age. These trainees with diverse learning needs may need extra instructional approach or different help from that given to other children of same age. (Waichigo N. Addy, 2013).

Difficulties in learning are not due to intrinsic causes such as cognitive ability, perceptual impairment, deficiencies in memory and attention or poor motivation. Instead, difficulties are caused by either ineffective or insufficient teaching or inappropriateness of the curriculum content. Westwood, P., & Graham, L. (2003) explains that traditional instructions may not effectively cater to their diverse learning needs and learning styles. Therefore, there is need to explore alternative instructional strategies that may enhance the learning experiences and outcomes for trainees with diverse learning needs. Researches conducted on different teaching subjects in Kenya shows that advance organizers have positive effects on students learning outcomes. In light of these findings, it can be argued that very little has been done on role of graphic organizers on learning outcome of trainees with diverse learning needs.

This study therefore investigated the role of graphic organizers. Perhaps, computer graphics which brings in words, sound and pictures to the level of verbal communication, visual communication may help these trainees? Perhaps use and application of audio logical instruments coupled with computer graphic organizers based on (Ausubel's, 1963, 1968) in computing, may help? The problems these trainees with diverse learning needs to read, write and to solve the mathematical problems may be made easier through Graphic Organizers. Graphic Organizers designed on Ausubel's Advance Organizer model theory has been suggested as a potential solution as they offer visual cues and hierarchical structures that may aid in learning outcome of comprehension of prior knowledge, organizational skills and retention of learned information.

Therefore, by investigating this problem, this research sought to bridge the gap in the traditional existing literature of instructions and contribute to the development of inclusive Graphic Organizers designed on Ausubel's Advance Organizer model theory that are effective and customizable so as to accommodate the diverse learning needs where all learners feel valued and supported in Kenyatta Industrial Vocational Rehabilitation Centre, Nairobi County, Kenya shape their learning outcome of reading (Dyslexia), writing (Dysgraphia) and problem solving (Dyscalculia) by comprehending or improving prior knowledge, organizational skills and retention of learned information.

1.3 Purpose of the Study

The purpose of this study was to determine the role of Graphic Organizers on the learning outcomes of trainees with diverse learning needs using an Experimental Research Design and in particular pre-test-posttest employing experimental and control

group with a view of improving comprehension of prior knowledge, organizational skills and retention of learned information.

1.4 Objectives of the Study

The following objectives were applied in this study:

1. To determine the role of Graphic Organizers on learning outcomes of trainees with diverse learning needs.
2. To assess how trainees with diverse learning needs perceive and engage with Graphic Organizers as a learning tool.
3. To establish how instructors perceive and engage with Graphic Organizers as an instructional tool.

1.5 Hypotheses of the Study

1. **H₁:** There is no significant difference in role of graphic organizers and learning outcome of trainees with diverse learning needs.
2. **H₂:** There is no significant difference in trainees' perception and engagement with graphic organizers on learning outcome of trainees with diverse learning needs.
3. **H₃:** There is no significant difference in instructors' perception and engagement with graphic organizers on learning outcome of trainees with diverse learning needs.

1.6 Justification of the Study

The study justified Ausubel's Advance Organizer model theory presented before and in between the lesson to have a permanent solution of meaningful learning, cognitive structure and active receptive learning to the effects that graphic organizers presentation affects comprehension of prior knowledge, organizational skills and retention of

learned information of trainees with diverse learning needs. The study looked at the role graphic organizer played to capture trainees with diverse learning needs' attention when the problem was displayed to them. The study also looked at the reaction ability of trainees with diverse learning needs based on their reading (dyslexia) and writing (dysgraphia) abilities, figure recognition, beauty of the designed graphic organizers and the roller coaster of the interaction abilities of this subject with graphic organizers presented in advance.

1.7 Significance of the Study

The findings of the study may be seen in the way in which the respondents interacted with Graphic organizers designed on Ausubel's Advance Organizer model theory of instructional design. The Researcher believes that Graphic Organizers is a potential solution to trainees as they offer visual cues and hierarchical structures that aid in their learning outcome. The findings may enable trainees with diverse learning needs to improve comprehension of prior knowledge, organizational skills and retention of learned information as well as enable those with low verbal ability to gain more. Graphic organizers can be really helpful for trainees with a wide range of learning needs, not just when it comes to applying what they've learned right away or remembering facts, but also for more complex tasks that require applying knowledge in new situations. They can even help those who are starting out with little or no background knowledge in a subject to understand it better. Since these organizers are usually created by teachers, they can be adjusted in complexity to suit different learning styles, making them an effective tool for everyone. They're great for grouping concepts and ideas together, helping learners see how they connect and encouraging them to figure out the relationships between them. Using them before, during, or after a lesson

is often effective because they make thinking easier and don't overload the brain's working memory. The findings of the study may be effective and provide insights into the potentials benefits that may guide Ministry of Education, educationist and policy makers in the development of inclusive graphic organizers leading to improved educational equity and success for all trainees regardless of their diverse learning needs.

1.8 Scope/Delimitation of the Study

This study was based on role of Graphic organizers designed on Ausubel's Advance Organizers model theory and trainees with diverse learning needs studying in Kenyatta Industrial Vocational Rehabilitation Centre in Nairobi County, Kenya.

1.9 Limitations of the Study

The study encountered the following limitations:

- i. Instructors' attitude towards trainees with diverse learning needs and technophobia towards use and application of ICT.
- ii. Trainees with diverse learning needs inability to apply computer application as part of their study. The researcher overcame this limitation by integrating learners with computer literacy to assist in translating and explaining the content to the respondents.

1.10 Assumptions of the Study

It is assumed that this study will enlighten many research scholars to apply graphic organizers as designed by Ausubel advance organizers model theory and apply them in classroom situations with respect to trainees with diverse learning needs and able students. Another assumption is that Graphic Organizers may differ from conventional or traditional methods on learners' outcome. The study further assumed that the sample

drawn from the population might be enough to deal with the research problem and the results might be generalized.

1.11 Theoretical Framework

This study employed Ausubel's Advance Organizer Model Theory as utilized in a classroom situation. Ausubel's Advance Organizer is given by David Ausubel (1963) who is one of the educational psychologists. This theory of meaningful verbal learning deals with how knowledge or curriculum content is organized, how the mind works to process new information /learning and how teacher can apply these ideas about curriculum and learning when they present new material/instruction to students. This model is designed to strengthen student's cognitive structure.

Ausubel's Advance Organizer theory by David Ausubel's (1963) is preferred over to constructivism, cognitivism and connectivism theories which the researcher feels cannot suffice because according to Jean Piaget (1964) in his theory of constructivism says that learning takes place by building information, Cognitivism founded by Piaget, J. (1964) contends that learning chiefly takes place by engaging learners in group discussions while Siemens, G. (2004) and Stephen Downes (2005) said connectivism learning bring more educational technology into classroom without putting into considerations the diverse learning needs of dyslexia, dysgraphia and dyscalculia in classroom situations. As adapted to this study, the theory holds that the Graphic Organizers based on Ausubel's Advance Organizer would influence the learning outcomes or cognitive abilities for trainees with diverse learning needs.

This is true considering the fact that Graphic Organizers has been suggested as a potential solution as they offer visual cues and hierarchical structures that aid in learning outcome of improving comprehension of prior knowledge, organizational

skills and retention of learned information. However, in adopting this theory, the researcher is not ignorant of its shortcomings in controlling Instructors level barriers such as attitude towards trainees with diverse learning needs, Instructors techno phobia (fear/attitude towards use and application of ICT), Trainees with diverse learning needs inability to apply computer application as part of their study and controlling Parental involvement to promote friendly atmosphere in terms of computer use to their children, poor quality of ICT infrastructure i.e. hardware and software, system rigid structure of traditional schooling system such as curriculum content.

1.12 Conceptual Framework

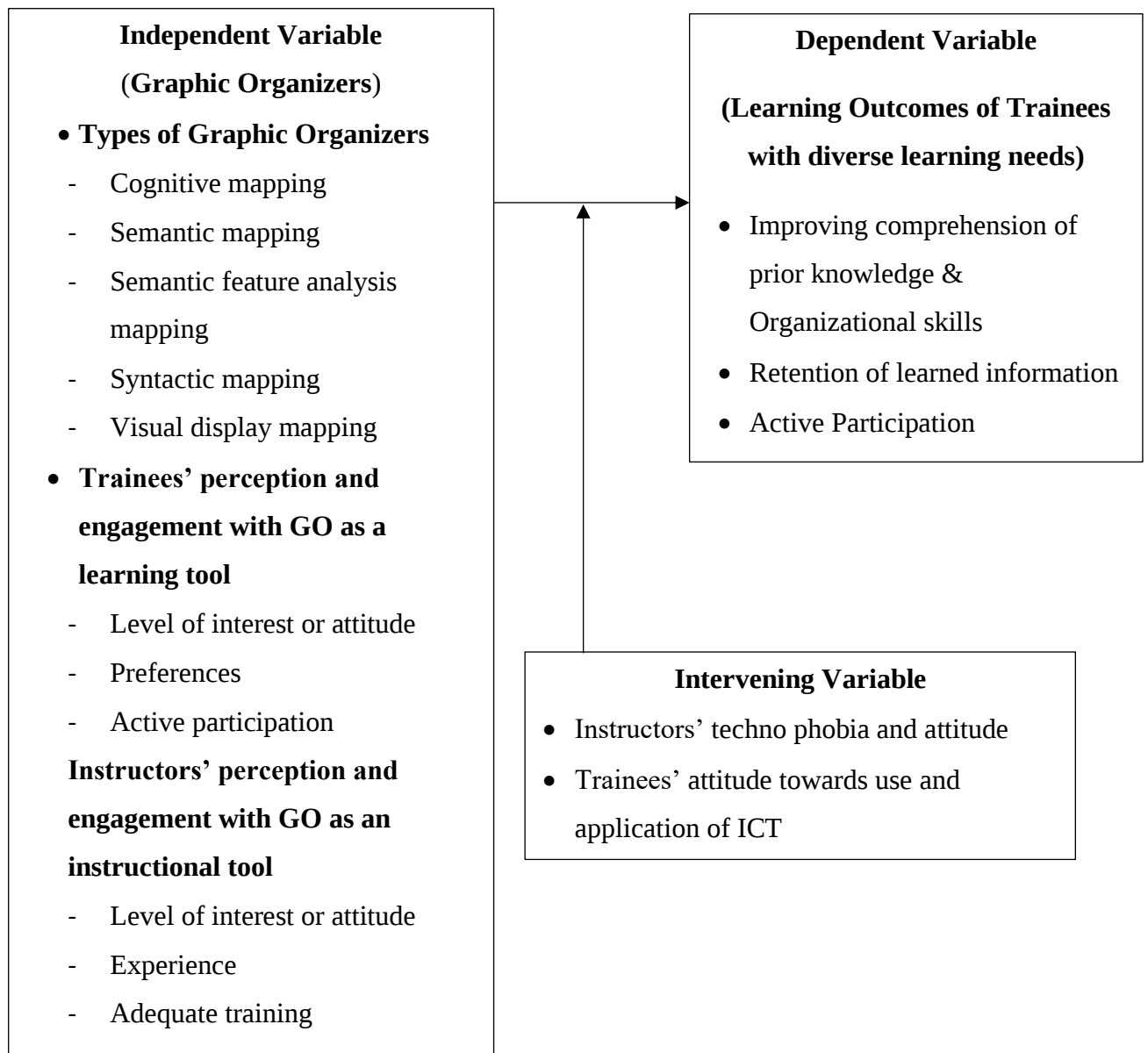


Figure 1.1: Conceptual Framework

Source: Researcher (2025)

The concepts of Ausubel's advance organizer will be designed in terms of definitions of terms, analogy and generalization as advanced organizer.

In the Conceptual framework depicted in Figure 1.1: Graphic Organizers designed on Ausubel's Advance Organizer is hypothesized to influence the learning outcomes in comprehension of prior knowledge, organizational skills (reading/writing, figure, sound, space) and retention of learned information of trainees with diverse learning needs. Graphic organizers test the reaction abilities of trainees with diverse learning needs in reading and writing abilities, Visual cues or presentation to test the recognition abilities of figure, picture, sound and space recognition and Hierarchical structures to test the comprehension and retention of data visualization abilities of relating picture with sound and text. The framework postulates that the analysis of graphic organizer, visual cues and hierarchical structures designed on Ausubel's Advance Organizer Model theory directly affects trainees with diverse learning needs learning outcomes in improving comprehension of prior knowledge, organizational skills (reading/writing, figure, space, sound) and retention of learned information. However, this relationship may be modified by instructors' techno phobia or attitude towards use and application of graphic organizers and trainee attitude towards use and application of ICT.

1.13 Operational Definition of Terms

Advance Organizer Model	:	Pedagogic devices or tools that bridge the gap between what learners already know and what learners need to know.
Criterion Referenced Test	:	A tool designed to measure a student's academic performance against some standard predetermined before students begins the test.
Design	:	Construction of knowledge and skills through pictorial representation
Diverse Learning Needs	:	Trainees who have a learning problem or disability that makes it more difficult for them to learn than most trainees of their age; dyslexia (reading), dysgraphia (writing) and dyscalculia (problem solving).
Graphic	:	Pictorial representation of data or visual images on surface such as charts or designs on computer to inform or illustrate.
Graphic Design	:	The art and practice of planning and projecting ideas and experiences with visual and textual content.

Graphic Organizers	:	A tool designed on Ausubel's Advance Organizer model theory used to create and manipulate images on a computer to help the trainees with diverse learning needs in improving comprehension of prior knowledge, organizational skills (reading/writing, figure/space/sound) and retention of learned information.
Inclusion	:	Trainees with diverse learning needs being taught in the same general education classroom with proper support.
Information Communication Technology	:	Set of integrated technological resources that provide data processing using computers.
Instructors' Perception and Engagement	:	Refers to how educators view and interact with these visual aids in their instructional practices. Perception in terms of opinions about usefulness, effectiveness and appropriateness of using graphic organizers in instruction. Engagement in terms of level of active involvement and commitment in incorporating graphic organizers into their instruction.

Instructional Tools	:	Materials, tools, hardware and software that help the trainee to interact with them under the guidance of the instructor and use them anytime, anywhere with ease.
Kenyatta Industrial Vocational Rehabilitation Centre	:	Refers to a specialized institution designed to provide training to trainees with diverse learning needs and physical disabilities enabling them to be self-reliant.
Meaningful Learning	:	The concept that knowledge is fully understood by the learner and that the individual knows how that specific fact relates to other stored facts.
Scoring Key	:	A way to evaluate a student's performance over the term.
Trainees' Perception and Engagement	:	Refers to how trainees view and interact with graphic organizers during their learning process. Perception in terms of whether graphic organizers are helpful, easy to use and improve their understanding and retention of information. Engagement in terms of level of active involvement and participation in interacting and manipulating these visual tools during their lessons.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter focused on the concept of Graphic Organizers designed for trainees with diverse learning needs and theories of existing literature related to Ausubel's Advance Organizer model theory and the conceptual framework developed. The review was organized under the following sub-headings; Learning Outcomes of trainees with diverse learning Needs, types of graphic organizers, trainees' perception and engagement with graphic organizers and instructors' perception and engagement with graphic organizers

2.2 Graphic Organizers Designed on Ausubel's Advance Organizer Model Theory and Learning Outcomes of Trainees with Diverse Learning Needs

(Ausubel,1963) states that just like Taba's Model, Advance Organizers has got the potential of being used in all individual lessons or as an organizational pattern for curriculum designing, hence a deductive strategy. An organizing statement called advance organizer acts as a connection between the material to be learned and the learner's cognitive structure, Muiriri M., Wambugu, P., & Wamukuru K. 2016). It also acts as a cognitive road map, guiding students over new content to be learned. Ausubel's Model is also a deductive Information Processing Model designed to teach interrelated bodies of content where broader or more inclusive ideas are presented first, followed by less inclusive ones. Advance organizers are therefore instructional sets designed to provide students with an understanding of what the lesson is all about. An advance organizer is a cognitive bridge used by instructors to help learners make a link between what they know and what they need to know.

Advance Organizer is designed to teach organized bodies of content in a way that they can stay in the student's mind for long term period. The Advance Organizer furnish students with an overview and focus content differentiation provide item of information that can be more easily understood and integration stipulate meaningful learning by helping students understand the relationship among the elements of the content to be taught. Donald et.al. (2009). The instructor needs to identify clear connection between past content and how the current topic relates to what is already known. Moreover, learning will be facilitated if the learner makes a connection between the new information and previous knowledge hence meaningful learning experience. Rose (2010)

According to (Ausubel's, 2000), Advance organizers are pedagogical devices that bridge the gap between what learners already know and what learners need to know. (Ausubel's, 1968) defines Advance Organizer as appropriately relevant and inclusive introductory materials. David Ausubel (1963), states that at any point in time, a learner has an existing organization and clarity of knowledge in a particular subject matter field. He called this organization a cognitive structure and relationship. Meaning can appear from new materials only if they are joined with existing cognitive structures of previous learning. In meaningful learning teacher teach new material, connecting it with the previous knowledge of the students. A study by Burnning et al, (1999) shows that advance organizer is a small amount of verbal or visual information presented to the learner before the introduction of the new material and learning becomes meaningful. According to Siddiqui (1991) advance organizer is a powerful technique of presenting data produced in altering shape, as required. Teaching is facilitated to help students increase the number of information and also to relate it with previous information.

Ausubel uses two principles to organize curriculum and instruction: Progressive differentiation and Integrative reconciliation. Progressive differentiation refers to the most general ideas of the discipline presented first followed by a gradual increase in details and specificity. (Ausubel's 1968) When subject matter is programmed in accordance with the principle of progressive differentiation the most general and inclusive ideas of a discipline are presented first and progressively differentiated in terms of detail and specificity. Integrative reconciliation refers to the practice of interrelating or cross referencing these units or ideas so that significant similarities and differences are recognized and real or apparent inconsistencies are reconciled. This means that new ideas should be consciously related to previously learned content. In integrative reconciliation, teacher attempts to make the logical relationship between ideas in the developing schema apparent to students.

According to Bruce Joyce & Marshall Well (1980), Ausubel's idea of an Advance Organizer is to relate what a student already knows to the new content to be learned and thus increase retention. In this approach, instructor is responsible for organizing and presenting what is to be learned. He or she plays the role of organizer of subject matter and presents information through lectures, readings and providing tasks to the learner to integrate what has been learned. The learner's primary role is to master ideas and information. The Ausubel's Advance Organizers provide concepts and principles to the students directly. They describe models of teaching as a plan that can be used to shape curricula to design instructional materials and to guide instructions in the classroom and other setting.

Ausubel study demonstrates that there is a parallel between the way subject matter is organized and the way people organize knowledge in their minds (their cognitive structures). In this study Graphic organizers designed on Ausubel's Advance Organizer model theory is used as a tool to create and manipulate images on a computer to help the students with special needs to attain the concepts of reading, writing and solving problems hence comprehension or improving knowledge, retention and transfer of learned information. According to Joyce et al. (2000), the advance organizer model has three phases of activity.

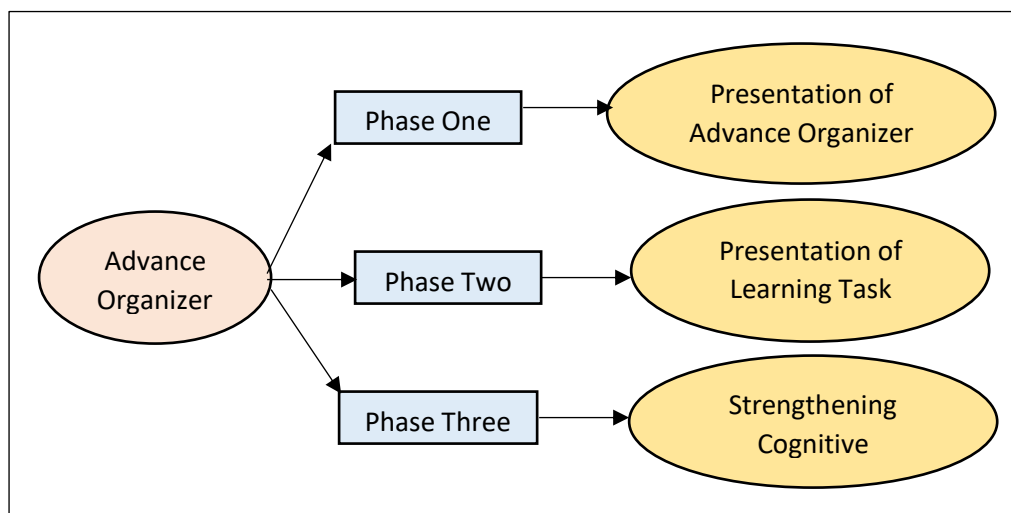


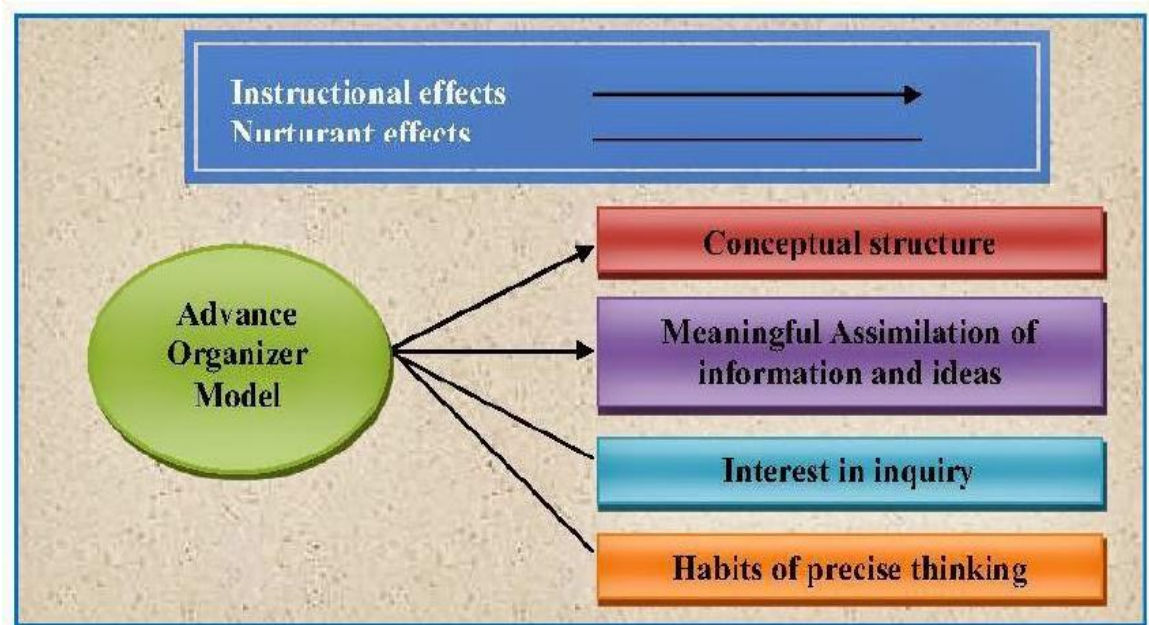
Figure 2.1: Syntax of Ausubel's Advance Organizer (Ausubel, 1968)

Phases of Advanced Organizers

Phase	Outline	Activity
Phase one	Presentation of Advance Organizer	Instructor clarifies aims of the lesson and present organizer by identifying defining attributes, give examples, provide context, repeat and prompt awareness of student's relevant knowledge and experience.
Phase two	Presentation of learning Task or Material	Instructor presents the material, maintains attention and make logical order of learning material explicit.
Phase three	Strengthening Cognitive organization	Instructor uses principles of integrative reconciliation to promote active reception learning and elicit critical approach to subject matter.

In Ausubel's Advance Organizer component, social system means that the teacher retains control of the intellectual structure, to relate the learning material to the organizers and to help students with special needs differentiate new material from previously leads to the successful acquisition of material. Principles of reaction is negotiation of meaning and responses between the teacher and the student clarifies the meaning of the new learning material with existing knowledge of the students. Mutual interaction between teacher and student responsively connects organizers and learning material. The effectiveness of the advance organizer depends on an integral and appropriate relationship between the conceptual organizer and the content. This approach provides guidelines for recognizing structural materials called support

system. Instructional and Nurturant effects as a component of advance organizer are the instrumental values such as the ideas themselves that are used as the organizer are learned, as well as information presented to the students.



**Figure 2.2: Instructional and Nurturant effects of Advance Organizer Model
(Ausubel, 1968)**

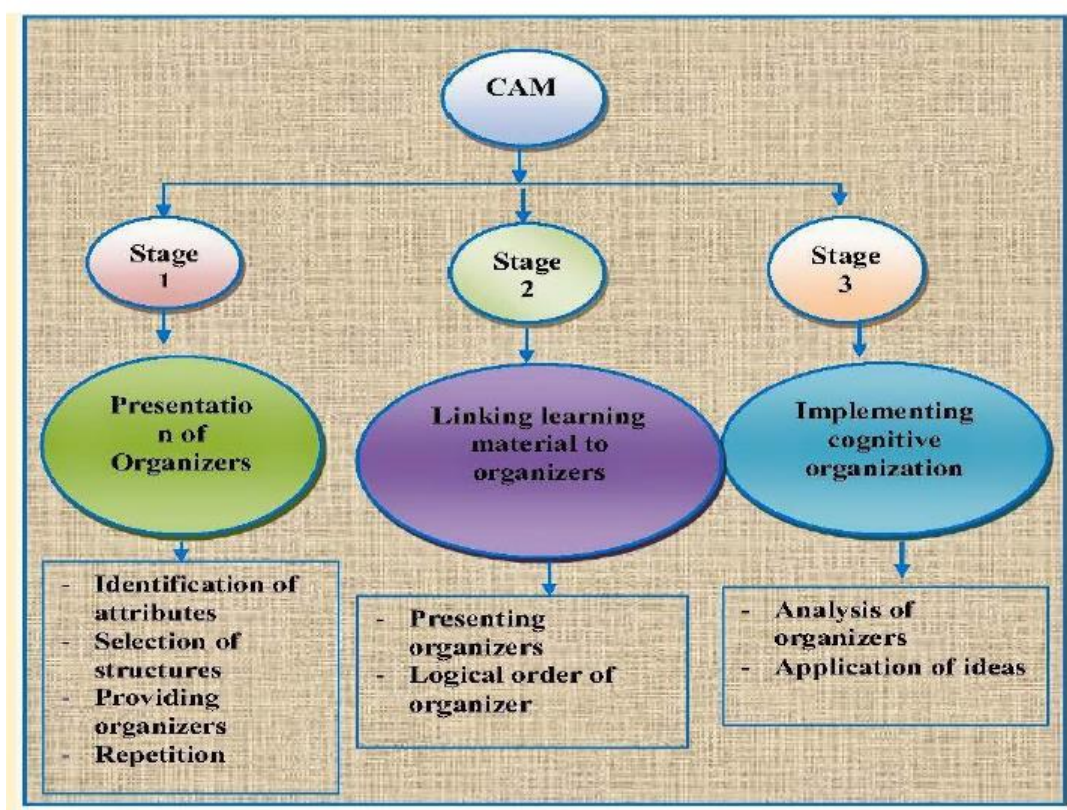


Figure 2.3: A Diagrammatic Representation of Strategies of Advance Organizer Model (Ausubel, 1968)

Types of Advance Organizer such as Expository organizers describe the new content to which students are to be exposed hence helpful in expressing ideational scaffolding for unfamiliar material. New knowledge is provided to students so as to understand the upcoming information. Siddiqui (1991) explains Comparative advance organizer as organizers used with relatively most familiar material. These organizers connect new learning to previously learned material. They are designed to integrate the new concepts with basically similar concepts that exists in the cognitive structure, yet they are also designed to distinguish between the old and new concepts in order to put off the confusion caused by their similarity. Skimming the information before reading is also a type of advance organizer used when detailed information is not essential. Howard Pitler (2007) defines Narrative Advance Organizer as the new information in the form

of a story. Robert J. Marzano (2007) defines Graphic Advance Organizer as the visual representative for students. It is usually organized in tables, charts or artistic works, which is beneficial to students with special needs to understand the relationship between the subject matter.

Dyslexics in early years have difficulty naming known objects such as chair, table, rhyming words like bat, cat, mat and speech development resulting in trouble pronouncing words like “wabbit” instead of “rabbit” or “thoap” instead of “soap”. In later years, dyslexics tend to avoid language tasks such as reading books and reading out loud. They have trouble recalling alphabets and occasionally confuses ‘q’ and ‘p’, ‘b’ and ‘d’ or ‘m’ and ‘w’ and finally have difficulty in reading single words such as “tip” instead of “pit”. DSM-5 (American Psychiatric Association 2013). Brown et.al (2010) describes dysgraphia as a specific learning disorder/disability where an individual written language skills such as spelling, application of grammar, punctuation, usage skills, letter formation, letter spacing and overall sentence production are significantly below the level that would be predicted from the individual’s level of intellectual ability. Dysgraphia students in their early years have difficulty in gripping the pencil, tires quickly when writing, poorly formed or inverted letters, maintains an incorrect writing posture and trouble writing within margins or space out text. In later years, they tend to struggle with cognitive -linguistic aspects of writing whereby they are able to express themselves verbally but struggle to put their thoughts and ideas on paper, trouble keeping pace when taking notes, poor grammar and lack a clear purpose for writing and organizational skills.

According to Brown et al., (2010), dyscalculia is a specific learning disability in mathematics, where an individual’s math skills such as acquisition of number facts,

written calculations and mathematical/logical reasoning are below the level that would be predicted from the individual's level of intellectual ability. Dyscalculia students have problems in the following level of learning: in early years, they have difficulty in Counting in the correct order and even backwards, they tend to forget and skip numbers more often than peers. Understating basic number concepts despite repeated practice for instance they may not know that '7' is the same as "seven". Difficulty in recognizing number patterns such as small versus large or tallest versus shortest and finally connecting a number to an object for instance knowing that '5' applies to groups of things like 5 biscuits, 5 books or 3 tables. In later years, they have trouble remembering basic math facts such as $5 + 10 = 15$ and counting with fingers, difficulty in recognizing difference between mathematical words like "plus" and "minus" and cannot use them correctly, applying borrowing and carrying concepts, understanding words like "less than" or "more than". In conclusion, Dyscalculia students experience mental confusion, math anxiety, phobia and distress when doing number-related tasks.

There is promising evidence that graphic organizer can support students with Special Needs. O'Malley et al (2013) found that among a small number of students with Special Needs the majority benefited from using graphic organizer to increase numeracy. While Gonzalez-Ledo et al (2015) found that literacy among a group of Students with Special Needs increased when they were provided with a computer graphics organizer (they wrote more words and included more story elements in their composition). Computer Graphic Organizers can improve numeracy skills such as subtraction. Peltenberg et al., (2009) found that, among 8–12-year-old students with Special Needs in some special schools in the Netherlands, the approach to learning and practicing subtraction in the graphic advance organizer had a positive effect on their competence. They argued that

the students with Special Needs were better able to see their mistakes and to better understand what went wrong. Devlin et al. (2013) demonstrated how virtual interactive worlds can be used to enable a small group of secondary age looked after children to develop their team work and negotiation skills.

Graphic Organizers are used to outline the relationship between concept and propositions. Cognitive map is a kind of visual road map showing some of the ways to connect meaning of the concept. Patti Drapeau, (1991) defines Graphic organizers as the teaching tools that can be used for all types of students. They help visual learner to see what the model are trying to convey and provide a structure that helps students with special needs to stay focused and attached in their studies. According to Darolyn (2004) graphic organizers are graphic, pictures, lines, circle and other shapes that organize your reading and helps to guide the thoughts of the learner. To create the map, the student must concentrate on the relationships between the items and examine the meaning attached to each of them. While creating a map, the instructor must also prioritize the information, determining which parts of the material are the most important and should be focused upon, and where each item should be placed in a map. The resulting visual display conveys complex information in a simple to understand manner. Learning is a permanent change in behavior or capacity acquired through experiences. The learning takes place when it is related to the needs and experiences of the learner. The learning is favored when meaningful association is established.

According to Ausubel, (1968) Graphic Organizers are pedagogical tools used to visually convey information and ideas in a way that is easy to comprehend and internalize by use of elements such as arrows, icons, pictures, charts, flowcharts and graphics that demonstrate the relationship between facts and ideas. They are

categorized into cognitive mapping, semantic mapping, semantic feature analysis, syntactic mapping and visual display. Cognitive Mapping enables individuals to make connections between primary concepts and recognitions explicit by utilizing "lines, arrows, and spatial arrangements to explain text content, structure, and key conceptual relationships" (Darch C., Eaves R. 1986, p. 310). Through visual depiction of the major themes, cognitive mapping can represent and enhance the organizational strategies that are core for reading and writing of the content area materials by bridging the gap between idea organization and written language structures (Pehrsson & Denner, 1988). Also, Boyle and Yeager (1997) have recognized that eliminating sentences and details in the Graphic Organizer is a significant part of cognitive mapping. They advise the use of the keywords and simple pictures instead of complex sentences or complicated drawings. Most often, teachers create cognitive mapping Graphic Organizers to use as advance organizers for difficult text. Students can also fit in teacher-prepared blank cognitive mapping Graphic Organizers during or after listening to challenging verbal material.

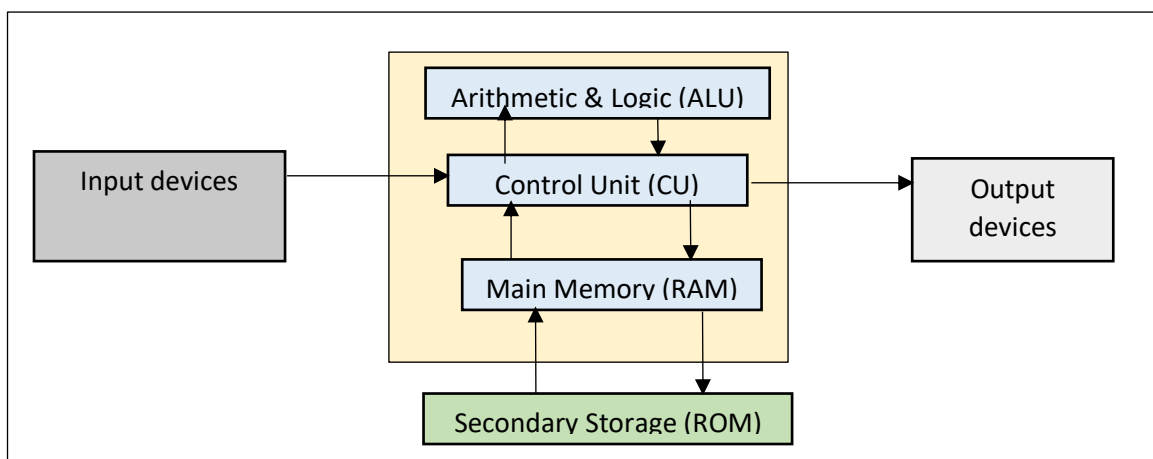


Figure 2.4: An Exemplar of a Cognitive Mapping Graphic Organizer

According to Bos, C. S., & Anders, P. L. (1992), Semantic mapping as a category of graphic organizers enables students to recognize relevant information from lecture and text. In contrast with cognitive mapping, when teachers and students employ semantic mapping, they are more actively involved in creating a visual representation which illustrates the relationships among the concepts. The concepts are first listed, then the teacher and students make predictions about how the concepts can be arranged on the Graphic Organizers to demonstrate those relationships. A good Graphic Organizer is one which consists of a superordinate concept (e.g., main idea, topic) written in an oval at the center or on the top of the page. Coordinate concepts (e.g., categories representing related concepts) are placed in ovals around or below the superordinate concept and are connected to it by lines. Coordinate concepts can be considered as a variety of examples, functions, or characteristics of the superordinate concept.

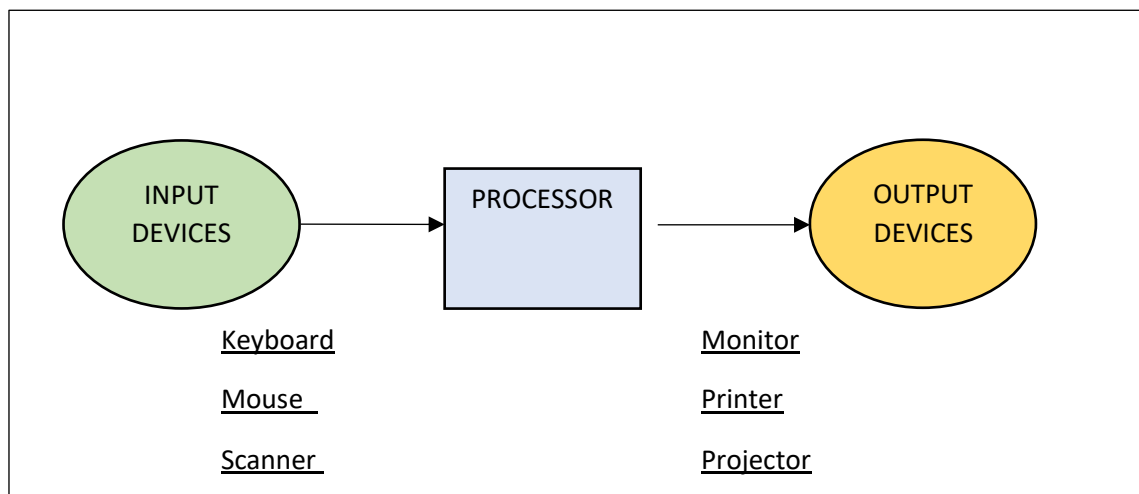


Figure 2.5: An Example of Semantic Mapping Graphic Organizer

Semantic Feature Analysis is similar to semantic mapping. It enables students to identify appropriate information from lecture and text. This is done through a presentation of related concept organized in a matrix format.

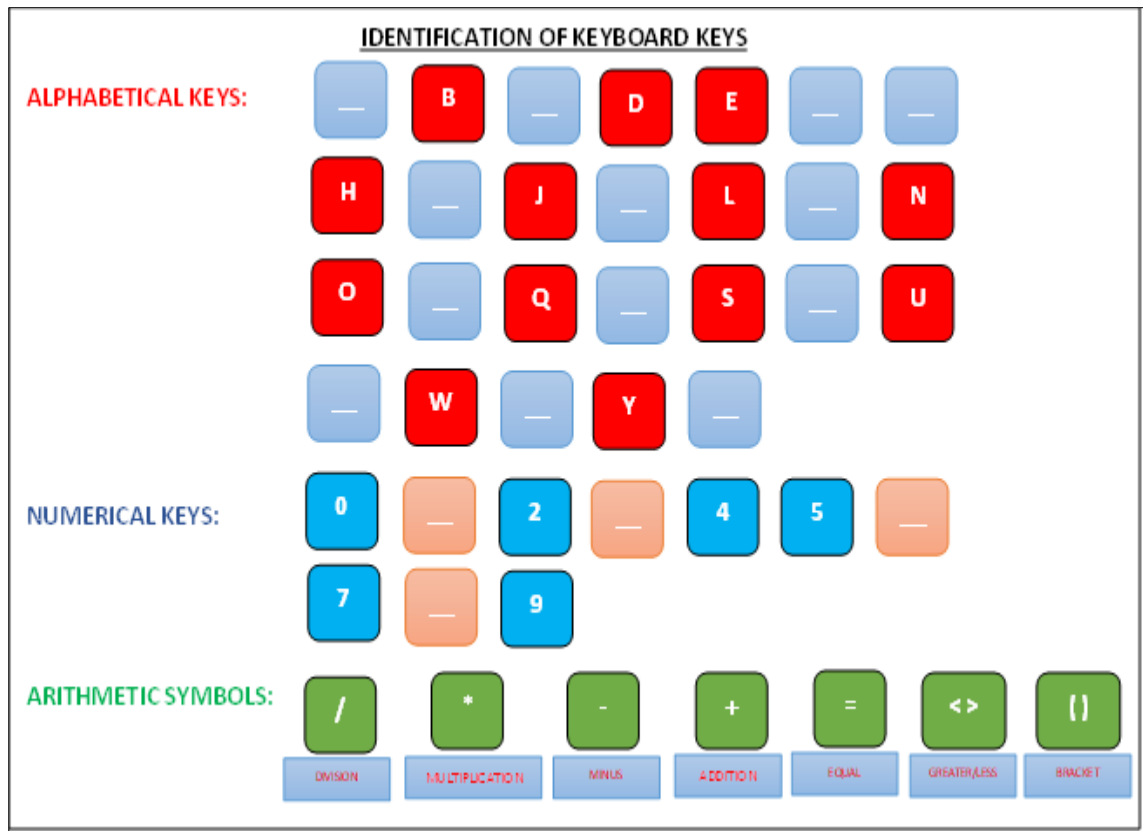


Figure 2.6: An Example of a Semantic Feature Analysis

Syntactic/Semantic Feature Analysis is the same as Semantic mapping, but it adds sentences that are similar to fill-in-the-blanks questions. According to Bos, C. S., & Anders, P. L. (1992), these sentences, called cloze-type sentences, have blank spaces where the new vocabulary words should be. Students need to use the context of the sentence and the information from the semantic feature analysis matrix to figure out what words belong in the blanks.

ARITHMETIC SYMBOLS (Fill in the blank spaces)

						
DI _____	MUL _____	MI _____	AD _____	E _____	G ____/L ____	BRA _____

Prior Knowledge



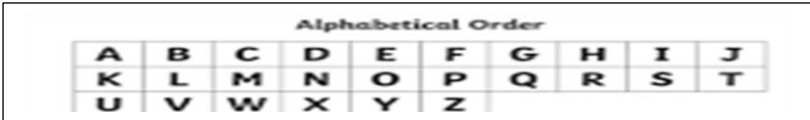
This is a MONITOR Lizard



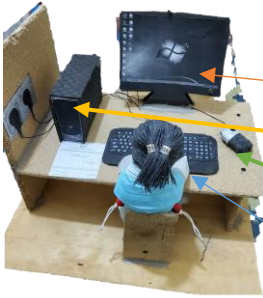
This is a Human BRAIN



This is a MOUSE



This is a KEYBOARD



PARTS OF A COMPUTER (Fill in the blank spaces)

This is a _____

This is a _____

This is a _____

This is a _____

(Choose the letter A, B, C or D of the word that fits each gap)

A. CPU

B. MONITOR

C. MOUSE

D. KEYBOARD

Figure 2.7: Example of Syntactic/Semantic Feature Analysis Mapping

Visual Display mapping are drawings or formats which uses graphics, diagrams, flow charts, pictures, charts pictures or any visual means that demonstrates relationship between facts, concepts or ideas.

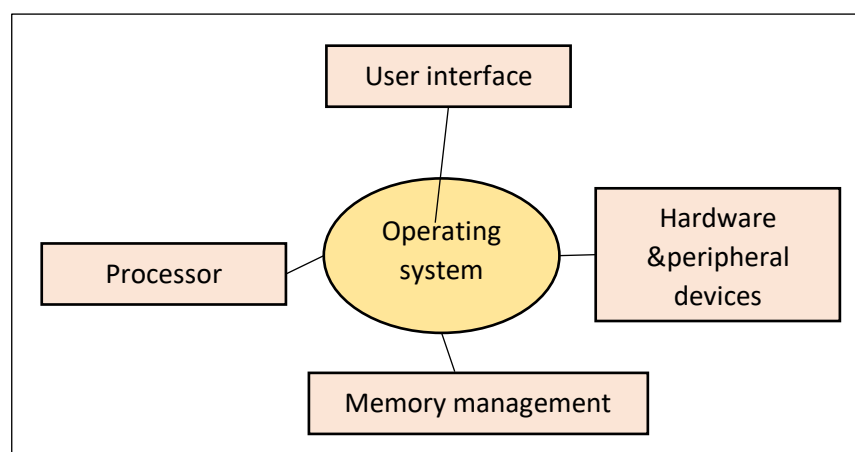
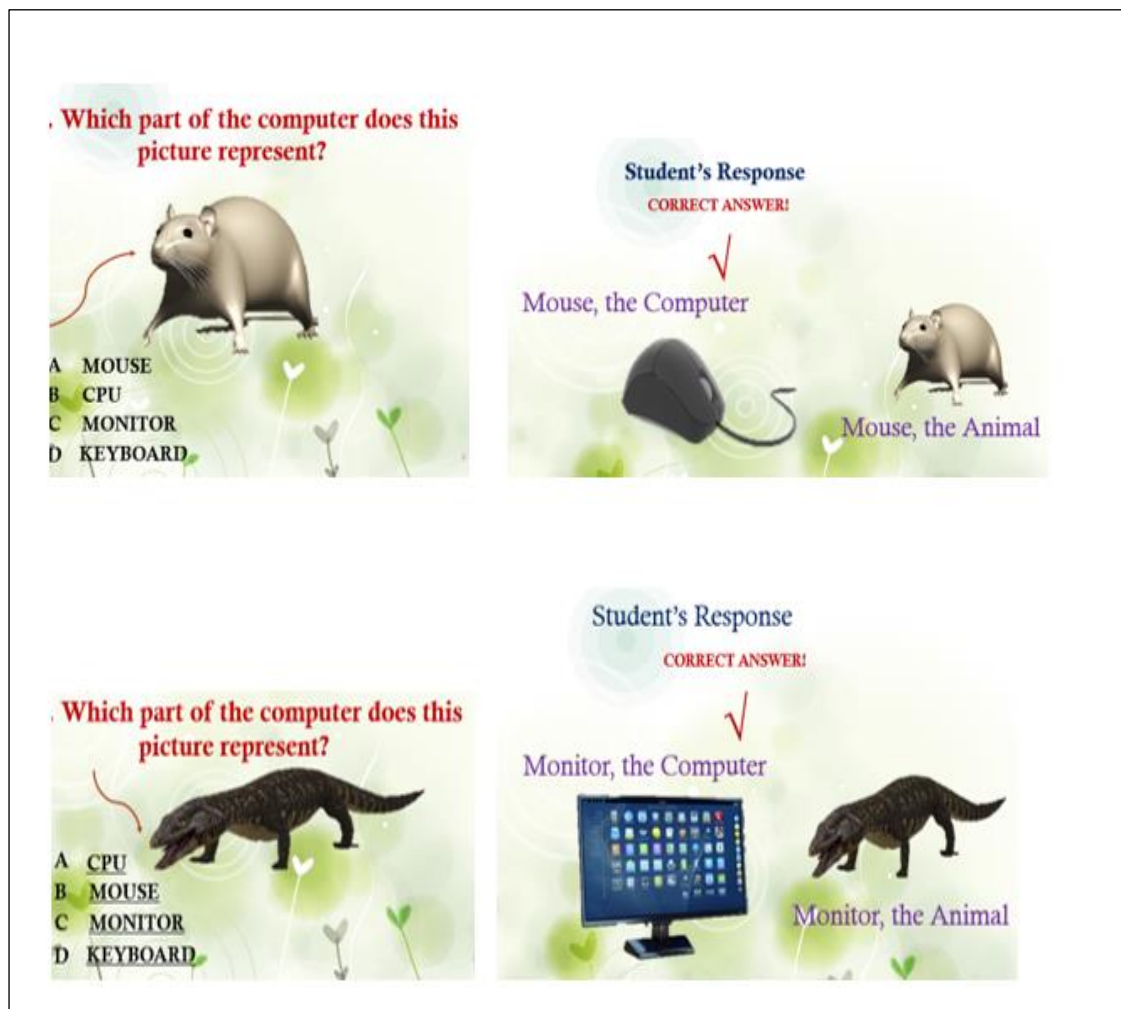


Figure 2.8: Example of Visual Display Mapping

Many researchers have looked into the effectiveness of using Graphic Organizers with students who are doing well academically. There have been numerous reviews and meta-analyses on this topic, including studies by Ausubel (1968), Mayer (1979), Moore and Readence (1984), Nesbit and Adesope (2006). Very little study has been done on trainees with diverse learning needs such as reading, writing and arithmetic skills, therefore, this study will investigate the role of Graphic Organizers designed on Ausubel Advance Organizer model theory and its impact on learning outcomes of trainees with diverse learning needs studying in Kenyatta Industrial Vocational Rehabilitation Centre in Nairobi County, Kenya.

2.3 Trainees' Perception and Engagement with Graphic Organizers

GO are very effective and useful tools across subjects for students who struggle with reading comprehension (Sheriff & Boon, 2014). Integrating GO aids students make connections and visualize the relationship between general concepts. GO serve as a place to visualize connections and organize information. According to Zollman (2009), fourth grade students who used graphic organizers to arrange their ideas improved both their reading comprehension and communication skills. GO work well for the elementary level reading and writing process because they allow students to brainstorm ideas without being concerned with the correct order. GO in the classrooms are a good tool for differentiation. They provide starting points for the lower ability students improve their communication skills. (Torres et al., 2014; Nakiboglu, 2017; Ponce et al., 2018; Tandog and Bucayong, 2019) in their studies states that GO are visual learning aids that assist in categorizing and articulating the students' thoughts. These enable the learners to formulate and establish information and communicate it effectively. Torres et al., 2014 found that GO can improve students learning in chemistry because these

organizers help students better understand and remember concepts. Sakiyo and Waziri (2015) noted that concept mapping had improved students' biology achievement. This result means that students like and enjoy using GO. GO can manage information because these tools can quickly understand new and complex concepts. (Ropic and Abersek, 2012; Knight et al., 2013; Ayverde et al., 2014).

Investigating both the attitudes of the participants towards using graphic organizers and their effects on facilitating learning, Torres, Espana and Orleans (2014) determined that infusing graphic organizers into teachers' presentations in different formats such as pictorial graphics were well received by the participants and obtained positive attitudes. It was also indicated that the participants improved their attitudes towards learning. On the other hand, there are studies which reported no conclusion regarding attitudes towards the use of graphic organizers as mixed results were obtained.

2.4 Instructors' Perception and Engagement with Graphic Organizers

Teachers are crucial to initiate the use of GO as they are directly responsible for the propagation of knowledge. (Akyuz, 1978). When GO are effectively used in the classroom, they can improve learning outcomes while also motivating learners to become more active. Teachers who use GO in their classrooms have found them to be useful tools for assessing students' knowledge.

GO are visual tools used to organize and structure information, making complex concepts more accessible and easier to understand. Teachers' perception of GO can range from seeing them as helpful tool for promoting critical thinking and creativity to viewing them as a time consuming. Engagement with GO can depend on factors such as Training and support. Teachers who receive adequate training and support are more

likely to effectively integrate GO into their instructions. Curriculum alignment is also another factor that determines teacher engagement with GO. GO that align with curriculum goals and objectives can increase teacher engagement. They are more likely to GO if they see positive student responses and improved understanding. GO are a quick assessment for teachers to see what the students understand and where any misconceptions may be (Zollman, 2009). The use GO helps teachers to evaluate students independently and design assessment that meets the students at their learning level, rather than with an assessment that is high above their depth of understanding.

Teachers need to pick and choose from a variety of strategies and accommodations to meet the needs of all students (Wallace & West, 1998). Meaningful instructional tool that leads to modifying and adapting classroom learning is integrating GO. (Ostois, 1999). Researches have studied the impact of integrating GO with classified students and proved to be one of the more successful intervention strategies to help students comprehend text more effectively (Guastello, 2000)

2.5 Gaps in Literature

The research on the advance organizer model has been extensive and decidedly mixed. (McEneany, 1990) and (Ruthkosky et al, 1996) in their study differs that the use of advance organizer has either limited or no efficacy in promoting understanding of the information or recall. (Chun & Plass, 1998) and (Willerman et al, 1992) agrees that the use advance organizers are very effective. They concluded that the use of concept mapping as an advance organizer produces a significant increment in academic gain for the students in 8th grade physical science class.

In view of this discrepancy, it is clear that limited studies have been conducted on role of graphic organizer on learning outcome of trainees with diverse learning needs. There is need to determine the suitable instructional methods that can cater for the trainees with diverse learning needs. If this is not addressed, these trainees may not attain comprehension, organizational skills (reading/writing) and retention of learned information despite the increasing recognition of the importance of inclusive education. The present study therefore sought to bridge the gap in the traditional existing literature of instructions and contribute to the development of inclusive Graphic Organizers designed on Ausubel Advance Organizer model theory and its potential solutions to offer visual cues and hierarchical structures that may aid trainees with diverse learning needs shape their learning outcome of comprehension, organizational skills (reading/writing) and retention of learned information in Kenyatta Industrial Vocational Rehabilitation Centre, Nairobi County, Kenya.

2.6 Summary of Literature

In this Chapter, literature have been reviewed both Thematically and Empirically covering the researches conducted on various teaching subjects designed on Advance Organizers. The theoretical framework employed Ausubel's Advance Organizer Theory Model as utilized in a classroom situation also known as the Theory of Meaningful Verbal Learning Theory. The Theory deals with how knowledge or curriculum content is organized, how the mind works to process new information/learning and how the teacher can apply ideas about curriculum and learning when presenting new ideas, material and instructions to students.

The research on the Advance Organizer Model has been extensive and decidedly mixed. Some researchers (McEneany, 1990) have suggested that the use of advance organizers

has either limited or no efficacy in promoting understanding of the information or recall and others (Ruthkosky & Dwyer, 1996; Relan, 1991) have pointed out that particular types of advance organizers such as visual have no or only limited effect. On the other hand, many researchers and practitioners Rinehart et al., 1991; Lawton & Johnson, 1992; Chun & Plass, 1998; Willerman & Mac Harg, (1991) believe advance organizers are very effective. Among the favorable findings, Chun & Plass, (1996) reported that the use of visual advance organizers “does aid in overall comprehension”. Willerman & Mac Harg, (1991) concluded that the use of concept mapping as an advance organizer produces a significant increment in academic gain for the students in eighth grade physical science classes. Rinehart et al., (1991) stated that an advance organizer read orally by the teacher and followed with guided discussion significantly increased recall. Story C. M. (1998) in the conclusion of her review of the research on advance organizers: “Instructional designers can feel confident that advance organizers are an important part of the instructional designs that organizers are needed whatever the media of instructions and that organizers themselves can be delivered by a variety of media”.

The present study therefore, investigated the role of Graphic Organizers designed on Ausubel Advance Organizer model theory and its potential solutions to offer visual cues and hierarchical structures that may aid trainees with diverse learning needs shape their learning outcome of comprehension, organizational skills (reading/writing) and retention of learned information in Kenyatta Industrial Vocational Rehabilitation Centre, Nairobi County, Kenya.

CHAPTER THREE

RESEARCH METHODOLOGY AND RESEARCH DESIGN

3.1 Introduction

This section deals with the methodology which was used by the researcher in carrying out the study. The chapter entails Research Methodology, Research Design, Location of the Study, Target Population, Sampling and Sampling Techniques, Sample, Sample size, Research Instruments/Pilot Study, Validity, Reliability, Data Collection Procedures, Data Analysis Procedures, Ethical Issues that the researcher will use.

3.2 Research Methodology

Mixed methodology was used in data collection which combines qualitative and quantitative approaches. The assumption of qualitative and quantitative approach provides different types of information Johnson, et al., (2007). Detailed views of participants are analyzed qualitatively while score of instruments are quantitatively analyzed.

3.3 Research Design

Research design is the blue print for collection, measurement and analysis of data. Kothari and Garg (2014). This investigation used an experimental research design and in particular a pretest-posttest study employing experiment and controlled groups to measure the outcome before and after intervention. The design helped to establish whether the intervention of Graphic Organizers had an effect on the learning outcome. Pre-test measures were administered before the intervention to establish a baseline level of knowledge and understanding. Post-test measures were conducted after the intervention to assess the role of Graphic Organizers.

3.4 Location of the Study

Kombo and Tromp (2006) explain that selection of the research location is very important and it influences the usefulness of the information produced. This study on role of Graphic organizers on Learning Outcomes of trainees with diverse learning needs was carried out in Nairobi County, Kenya purposely since little research had been done in Kenyatta Industrial Vocational Rehabilitation Centre all of the studies found in literature were based on general students. It is located along Kenyatta Hospital near KMTC. Nairobi County is the capital city of Kenya, located in the south-central part of the country and 483km northwest of Mombasa. The county latitude and longitude coordinates are 1.286389 and 36.817223 with the GPS coordinates of 1°17'11.0004" S, 36°49'2.0028" E.

3.5 Target Population

According to Borg and Gall (1989) target population refers to all members of a real or hypothetical set of people, events or objects to which the researcher wishes to generalize results of the research. The target population was 52: 1 institution hosting trainees with diverse learning needs, 1 centre manager, 7 Instructors of both genders and 44 trainees with diverse learning needs of both genders.

3.6 Sampling and Sampling Techniques

Orodho and Kombo (2002) define sampling technique as a process of selecting some individuals or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group. This study employed probability and non-probability sampling. Under non-probability sampling, the Researcher employed purposive sampling technique to sample 1 institution hosting trainees with diverse learning needs, 1 centre manager and 44 trainees with diverse

learning needs of both genders while under probability, simple random sampling technique was used to select 7 Instructors of both genders.

3.7 Sample Size

A sample size is a subgroup of the target population that the researcher plans to study for generalizing about the target population (Creswell, 2012). This study used a sample of (52) subjects. Yamane (1967) proposes the use of a simplified formula to calculate sample size. Therefore, the Yamane's formula was adopted to get the sample size of the study.

Formula:

$$n = \frac{N}{1 + N (e)^2}$$

Whereby,

n = Sample Size

N = Population

e = Sample Error = 0.1

N = 52

$$1 + 52(0.1)^2$$

N = 52

$$1 + 52(0.01)$$

N = 52

$$1.52$$

n = 34

Table 3.1: Sample and Sampling Technique - Distribution of Sample Size

Categories	Sampling Technique	Sample Size
Centre Manager	Purposive Sampling	1
Instructors	Purposive Sampling	7
Experimental group	Purposive Sampling	22
Control group	Purposive Sampling	22
Total		52

The table above shows the distribution of sample size whereby the sample size of this study was 52.

3.8 Research Instruments

The following Research Instruments formed part of the study. A Computer test designed on Ausubel's Advance Graphic Organizers to measure the respondents' reaction ability to read, write and recognize graphic space, figures and sound recognition, Trainees' perception and engagement questionnaire to measure satisfaction with graphic organizers as a learning tool, Instructors' perception and engagement questionnaire to measure satisfaction with graphic organizers as an instructional tool and Interview Schedule for Center Manager to measure satisfaction with graphic organizers.

3.9 Graphic Organizers (GO)

In this study Graphic Organizers means a tool designed on Ausubel's Advance Organizer used to create and manipulate images on a computer to help the trainees with diverse learning needs to attain the concepts of reading, writing and solving problems hence comprehension or improving knowledge, organizational skills and retention of learned information. The topic of the study on Introduction to Computing comprised the following: Entry Behavior Competency Test to test attention and concentration

span, Graphic tests to test space, figure and sound recognition, written test to test cognitive reading and writing abilities, knowledge and comprehension skills and Practical test to test retention and transfer of learned information. It is Developed, Standardized and Validated by the Investigator to measure the respondents' ability to recognize graphic space figures as designed through Ausubel's Advance Organizer.

3.9.1 Criterion Reference Test (CRT) Written Exam

Criterion Referenced Test is the process of evaluating and grading the learning of students against a set of pre-specified qualities or criteria without reference to the achievement of others (Brown, 2010). In this study Criterion Referenced Test means a Summative Evaluation tool designed to measure a student's academic performance against some standard predetermined before students begin the test. Summative Evaluation means a type of evaluation that occurs at the end of a learning period to evaluate the effectiveness of a learning program for a student's performance (Brown H.D., & Abeywickrama, 2010; The assessment items contain multiple choice questions, True or False questions, Match questions, Completion or Filling the gaps questions, Drawing and Labelling questions on Introduction to Computing, the topic of the study. CRT is Developed, Standardized and Validated by the Investigator to determine whether students have learned expected knowledge and skills.

3.9.2 Scoring Key for CRT Written Exam

Criterion Referenced Scoring uses the content of the test itself as the basis of comparison for assessing the student's performance to determine the level of achievement at which to begin a student, to determine how much a student has learned from given section of material and to determine a student's potential in a given field (James M. Cooper, 1986). In this study Scoring key means a way to evaluate a student's

performance over the term. The total achievable score will be 50 marks. A content referenced score of 80% means that the student correctly answered 80% of the items on the test. The Scoring Key for CRT is Developed, Standardized and Validated by the Investigator.

3.9.3 Formative Evaluation

Formative evaluation refers to frequent, interactive assessments of students' development and understanding to recognize their needs and adjust teaching appropriately (Alahmadi et al., 2019). According to Black et al. (2004), using formative tests for formative purposes improves classroom practice whereby students can be encouraged in both reflective and active review of course content. In this study Formative Evaluation means a range of formal and informal assessment procedures conducted by teachers during the learning process in order to modify teaching and learning activities to improve student attainment. It is Developed, Standardized and Validated by the Investigator.

3.9.4 Scoring Key for Formative Evaluation

Criterion Referenced Scoring uses the content of the test itself as the basis of comparison for assessing the student's performance to determine the level of achievement at which to begin a student, to determine how much a student has learned from given section of material and to determine a student's potential in a given field (Cooper, J.M. 1986). In this study Scoring key means a way to evaluate a student's performance over the term. The total achievable score will be 50 marks. A content referenced score of 80% means that the student correctly answered 80% of the items on the test. Scoring Key for Formative Evaluation is Developed, Standardized and Validated by the Investigator.

3.9.5 Trainees’ Perception and Engagement Questionnaire for Vocational Trainees with Diverse Learning Needs to Measure Satisfaction with Graphic Organizers as a Learning Tool

This questionnaire was intended to gather information trainees’ perception on Role of Graphic organizers on learning outcomes of trainees with diverse learning needs. The trainee is required to specify the satisfaction level with the statement about integrating graphic organizers by putting a tick (✓) in the space provided against the statement.

Key: [SA] Strongly Agree [A] Agree [NS] Not Sure [D] Disagree [SD] Strongly Disagree

3.9.6 Instructors’ Perception and Engagement Questionnaire to Measure Satisfaction with Graphic Organizers as an Instructional Tool

This section of questionnaire aimed at establishing instructors’ satisfaction with graphic organizers as an instructional tool.

Key: [SA] Strongly Agree [A] Agree [NS] Not Sure [D] Disagree [SD] Strongly Disagree

3.9.7 Interview Schedule for Principal to Measure Satisfaction with Graphic Organizers

This interview schedule was meant for academic purpose and sought to gather information on satisfaction of “Role of Graphic organizers on learning outcomes of trainees with diverse learning needs.

3.10 Piloting of Instruments

The piloting of Instruments was conducted in a neighboring county, Machakos County, Vocational Rehabilitation Centre having homogeneous group from the same category. According to Kenneth S. and Bruce B. (2014), a pilot study is a miniature version of the study to be sure that the chosen procedure and materials work the way that you think

they will. The piloting of Instruments was conducted to check if the research instrument's validity will provide the target information whether unambiguous and well understood or whether the research instruments is inappropriate. The selected school for piloting was excluded in the main study.

3.11 Validity

Mugenda O. M., & Mugenda (2003) define validity as the measurement of the extent to which a questionnaire measures what it claims to measure. This study used content and face validity. According to Borg and Gall (1989) content validity is a measure of the degree to which data collected using a particular instrument represents a specific domain of indicators or content of a particular concept Face validity is about whether a test appears to measure what it's supposed to measure. The researcher arrived at content and face validity through the results and comments of the pilot study which was conducted in the neighboring Machakos County in Machakos Vocational Rehabilitation Centre.

3.12 Reliability

According to (Mugenda and Mugenda, 2003), reliability is a measure of the degree to which the instrument yields consistent results or data after repeated trials. Seamus & Hegarty, (1982) states that reliability of an instrument is tested in order to find out if it will bring out the required information. To check its reliability the Pre-test and post-test assessment was administered to the subjects. Kothari (2014) states that instruments with reliability's coefficients of at least 0.7 are accepted as valid and reliable in research. Cronbach's Alpha technique was employed to test the reliability of the instruments.

3.13 Data Collection Procedures

The researcher collected an approval letter from the office of Dean (Graduate School) that allowed her to conduct the research study. The approval letter was used to obtain research permit from National Council of Science and Technology and Innovation (NACOSTI). These documents enabled the researcher to collect permit from Nairobi County Director of Education. Enon, J. C. (1998) says that instruments are the tools or methods that the researcher uses to collect data from the respondents. The course instructor introduced the researcher to the students and guided them accordingly on how the lesson was to be conducted and its objectives. He also made the students aware that they would work together with the researcher during the lesson. The researcher collected data by administering Validated research instruments to the respondents in Kenyatta Industrial Vocational Rehabilitation Centre.

The researcher implemented the research instruments in the institution by administering pre-test to control group and experimental group to determine the entry behavior competency test of the trainees before the use of Graphic Organizers. The researcher taught the experimental group using Advance Organizer Treatments for a period of two weeks (10 lessons), where every week there were 5 lessons taught while the control group were taught by their regular Instructor using conventional or traditional method for the same period of time. In the subsequent two weeks of instruction, the post-test was administered to experimental and control group. The assistant researcher assisted in administering, supervising and marking. After the two-week instructional period, the questionnaires were administered to the respondents and the directions were provided and the way to respond to the Questionnaire statements. Instructors and Trainees were

asked to fill the questionnaire on their perception and engagement with GO and interview schedule was given to the principal.

3.14 Data Analysis

The study utilized qualitative and quantitative research methods to analyze data. Descriptive statistics was used to analyze quantitative data by using mean scores, frequencies and percentages presented in tables, charts and graphs. The qualitative data was thematically presented in narrative form reinforced by suitable interpretations. Inferential analysis of chi-square and t-test were used to statistically list significant differences within and among means in the pre-test and pos-test scores for the experimental group and controlled group. Wilcoxon Signed-Rank test was tested using statistical package for social sciences (SPSS) Version 27. Hypotheses were tested at alpha value $\alpha = 0.05$ level of significance.

3.15 Ethical Issues

Research ethics in research are a set of principles that guide research designs and practices such as informed consent, confidentiality and data protection and respect for persons. Creswell (2012) asserts that the subjects should be protected by keeping the information provided confidentially. The researcher informed the subjects on the research procedure and the purpose of undertaking the research which will enable the subjects to voluntarily participate in research study. The researcher kept into considerations confidentiality, friendliness, use of simple and clear language and enough time to fill the out full information required.

CHAPTER FOUR

FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents findings and their discussion. There are two main subsections in the chapter. The first sub-section focuses on demographic statistics related to the study participants, while the second sub-section comprises results based on the study objectives. Preceding these subsections, the chapter presents the study's response rate, reliability, and validity of the instruments.

4.2 Response Rate

The study's response rate refers to the number of respondents is very critical when it comes to drawing conclusions from a study. A response rate of at least 60 percent is considered sufficient for data analysis and inferences. This study targeted 44 trainees with diverse learning needs, 1 center manager and 7 instructors. Table 4.1 presents the data of the study's response rate.

Table 4.1: Study Response Rate

Participant's Category	Instruments Administered	Instruments Collected	Response Rate
Center Manager	1	1	100%
Instructors	7	7	100%
Trainees	44	44	100.00%
Overall response rate			100%

Data in Table 4.1 indicate that the study achieved 100 percent response rate. This achievement can be attributed to the face-to-face administration of the research

instruments. This response rate was considered sufficient for data analysis. Reliability and validity of the study instruments are presented in the next section.

4.3 Reliability

Cronbach Alpha test was conducted to establish the reliability of the study instrument especially the Likert scale items. Table 4.2 illustrates findings of the reliability test.

Table 4.2: Reliability Test

Variables (Likert Scale)	Number of items	Cronbach Alpha	Interpretation
Trainees' Perception and Engagement with Graphic Organizers	5	.775	Reliable
Trainees Preference on role of different types of GO	5	.702	Reliable
Instructor's perception and Engagement with Graphic Organizers	4	.957	Reliable
Role of graphic organizers on learning outcomes	5	.862	Reliable

The reliability of the instrument is confirmed when the coefficient of Cronbach Alpha is at least 0.7. The findings presented in Table 4.2 shows that all the data collection instrument was reliable since the Alpha coefficients are at least 0.7.

4.4 Demographic Characteristics

This sub-section focuses on the demographic characteristics of the trainees and their instructors. Specifically, gender, age, and the level of education of the respondents were examined. To begin with, Figure 4.1 illustrates the gender of the trainees.

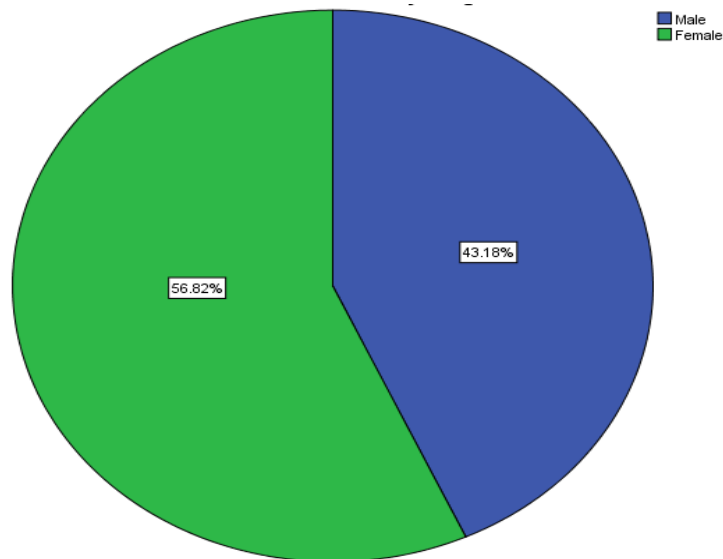


Figure 4.1: Gender of the Trainees

The study shows that there were more female trainees (56.62%) than male trainees at 43.18% in Kenyatta Industrial Vocational Rehabilitation Centre, who participated in the study. Concerning the age of the trainees, Figure 4.2 presents summary statistics.

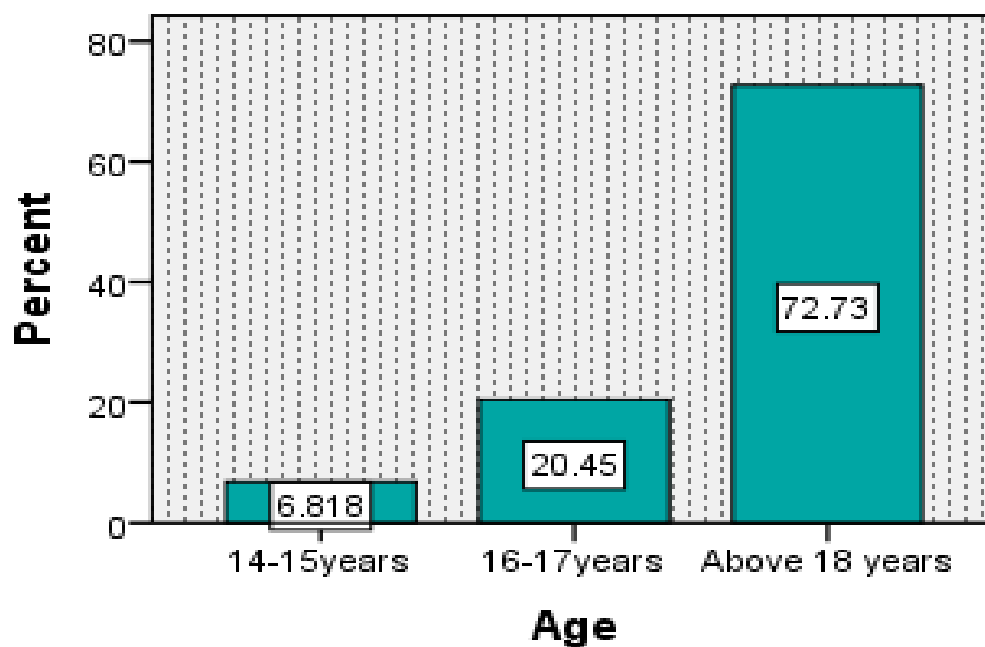


Figure 4.2: Age of Trainees

According to the data, most learners with diverse needs in Kenyatta Industrial Vocational Rehabilitation Centre are above the age of 18 years (72.73%). This was followed by those between 16-17 years (20.45%), and finally, 14-15 years at 6.8%.

Besides the demographics of the trainees, the study also established the background characteristics of the instructors. Their gender, age, level of education and where they gained their experience on graphic organizations (GO) were examined. Statistics on the gender of instructors are presented in Figure 4.3 below.

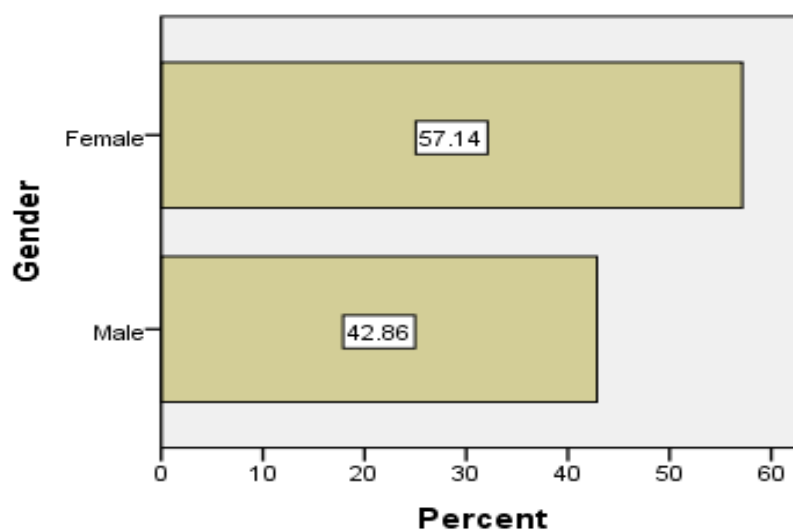


Figure 4.3: Gender of Instructor

Summary statistics demonstrate that most instructors of learners with diverse needs at Kenyatta Industrial Vocational Rehabilitation Centre are female at 57.14%. The composition of male instructors stood at 42.86%.

The instructors were also asked to indicate what their age was. Table 4.4 presents summary statistics.

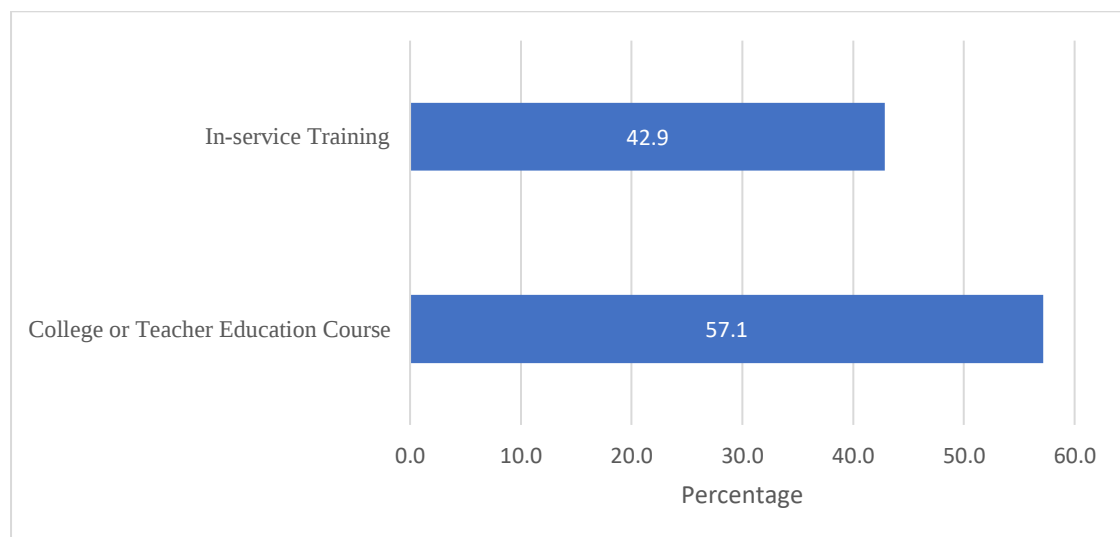
Table 4.3: Age of Instructors

Age Category	Percent
25-35years	14.3
35-46years	42.9
Above 47 years	42.9
Total	100.0

Data in Table 4.3 indicate the most instructors at Kenyatta Industrial Vocation Rehabilitation Centre are above 35 years. Those aged 25-35 years stands at 14.3%. Concerning the instructor's highest level of education, the study show that all the 7 instructors interviewed had Diploma qualifications.

This means that the instructors at the Kenyatta Industrial Vocational Rehabilitation Centre were competent to teach learners with diverse learning needs.

Finally on demographics, the instructors were asked to indicate where they had acquired their GO experiences. The Figure 4.4 below presents summary statistics.

**Figure 4.4: Where Instructors Acquired GO Experiences**

The findings indicate that most instructors acquired their GO experiences in college by undertaking a teacher education (57.1%). The remaining 42.9% of the instructors obtained their GO experience through in-service training.

4.5 Role of Graphic Organizers on Learning Outcomes of Trainees with Diverse Learning Needs

The first objective, the study sought to determine the role of Graphic Organizers on learning outcomes of trainees with diverse learning needs. To begin with, an analysis of the learning outcomes that arose from the test given to the trainees, and later, descriptive statistics of trainees' perception and engagement with GO was conducted.

4.5.1 Learning Outcomes of Trainees with Diverse Learning Needs

The performance scores for the trainees with diverse learning needs were assessed for both experimental and control groups pre-and post-intervention (the GO). Table 4.4 illustrates the computed frequency distribution of the trainees' learning outcomes.

Table 4.4: Frequency Distribution of Learning Outcome Before and After the Intervention

% score	Pre-test		Post-test	
	Frequency		Frequency	
	Experimental	Control	Experimental	Control
10-20	0	0	0	2
21-30	2	1	0	0
31-40	1	2	0	0
41-50	3	2	0	1
51-60	0	3	0	1
61-70	9	6	2	7
71-80	7	6	2	3
81-90	0	0	6	2
91-100	0	2	12	6
Total	22	22	22	22

The frequency statistics indicate that before the intervention (treatment), the learning outcomes of the two groups were almost the same. For instance, there was no trainee

who scored between 10-20 percent of the possible 100 marks in the two groups. Similarly, there was no trainee who scored between 81-90 percent of the test in both the experiment and control groups. For the other categories of the scores, the frequency statistics indicate a small deviation among the two groups during the pre-test. This imply that at the baseline, the learning outcome levels of the experimental and control group was almost similar which means that this study adhered to the pre-requisites of the experimental surveys. During the post-test, the statistics indicate a wider gap in the learning outcomes of the trainees in the two groups signifying an impact of the GO. For example, none of the trainees in the experimental group scored score less than 61 percent of the possible 100 marks while in the control group, 4 trainees representing 18.18% scored less than 61% of the marks. Additionally, more than half (12) of the learners in the experimental group scored between 91-100 marks while in the control group, only 6 trainees managed to get between 91-100 marks. In a nutshell, learners in the experimental group performed better than their counterparts in the control group during the post-test.

Previous evidence shows that graphic organizers play a significant role in enhancing learners' outcomes. For instance, a study by Miranda (2011) established that GO aids students in visualization, organization, and effective understanding of information. In another study, Sakiyo and Waziri (2015) argue that GO helps to break down complex ideas, identification of relationships among ideas, and improve memory retention, which ultimately improves understanding, that is crucial for overall performance.

Next, Table 4.5 presents learning outcomes of the experimental and control groups, including the percentage change in scores.

Table 4.5: Learning Outcome of Trainees Before and After the Intervention

Experimental Group				Control Group		
Trainees	Post Test Score (%)	Pre-Test Score (%)	% Change	Post Test Score (%)	Pre-Test Score (%)	% Change
1	92	30	62	56	48	8
2	92	42	50	100	92	8
3	92	74	18	84	74	10
4	92	72	20	64	72	-8
5	92	74	18	100	100	0
6	88	74	14	12	28	-16
7	68	48	20	20	40	-20
8	88	68	20	62	56	6
9	88	74	14	70	76	-6
10	64	40	24	68	66	2
11	86	74	12	80	70	10
12	80	68	12	44	36	8
13	74	28	46	72	74	-2
14	92	70	22	64	60	4
15	86	48	38	72	66	6
16	96	62	34	68	62	6
17	96	74	22	84	70	14
18	92	70	22	96	48	48
19	88	70	18	96	66	30
20	96	66	30	96	74	22
21	92	66	26	92	76	16
22	96	62	34	68	52	16
Summation	1930	1354	576	1568	1406	162
Mean	87.72	61.54	26.18	71.27	63.91	7.36
STD. Deviation	8.8	14.98	13.08	23.56	17.19	14.61

The computed test scores for the experimental group shows that there was a drastic improvement in the trainees' outcome after the intervention with the mean mark of 87.72% as compared to 61.54% before the intervention. This improvement is demonstrated by positive changes for all the trainees in this group. With reference to the control group, the results show a slight difference between the post-test and pre-test scores for all the trainees. In fact, the mean difference in the group is only 7.36% while that of the experimental group is 26.18%. This imply that trainees applying Graphic

Organizers are almost four times likely to post better learning outcomes than their counterparts in the control group. The relatively low standard deviation for post-test scores in the experimental groups indicates that GO is more likely to standardize the learning outcomes among the trainees with diverse learning needs.

In summary, these statistics demonstrate that GO has the power and ability to enhance the learning outcomes of trainees with diverse learning needs. In fact, the impact seems to be huge considering the shorter period of the intervention. These results are supported by findings of other authors. For instance, extant literature supports these findings. For instance, O'Malley et al (2013) established that graphic organizer can enhance learning among learners with special needs. This study observed that majority of learners with special needs improved their numeracy skills through application of graphic organizers (ibid). In another study, Gonzalez-Ledo et al (2015) found that provision of computer graphic organizers increased literacy among a group of Students with Special needs.

4.5.2 Trainees' Perception and Engagement with Graphic Organizers

Trainees with diverse learning needs were asked to indicate the level at which they agreed to the constructs associated with their perception and engagement on GO using a scale of 1-5 where; 1=Strongly Disagree (SD), 2=Disagree (D), 3=Not Sure (NS), 4=Agree (A), and 5=Strongly Agree (SA). Summary statistics are presented in Table 4.6.

Table 4.6: Summary Statistics on Trainees' Perception and Engagement with GO

Construct	SD (%)	D (%)	NS (%)	A (%)	SA (%)	Mean	Std. Deviation
GO motivates me to study more	0.0	0.0	0.0	36.4	63.6	4.6	0.4
GO have a significant impact to my learning process	2.3	0.0	6.8	29.5	61.4	4.4	0.8
GO improves my active participation	0.0	2.3	4.5	36.4	56.8	4.4	0.6
Go stimulates my learning interest	0.0	0.0	4.5	34.1	61.4	4.5	0.5
Go acts as an effective learning tool	0.0	0.0	2.3	31.8	65.9	4.6	0.5

Mean: SD=1.00-1.80, D=1.81-2.60, NS=2.61-3.40, A=3.41-4.20, SA=4.21-5.00

Summary statistics show that most (63.6%) trainees with diverse learning needs strongly agree with the assertion that GO motivates them to study more. This implies that GO has a motivational element to the trainees with diverse learning needs. Similarly, the statistics confirm a strong agreement from among the trainees on the construct that GO has a significant impact on the learning process. This was argued by 61.4 percent of the respondents. Additionally, the trainees strongly agreed to the assertion that GO improves their active participation. A total of 56.8 percent of the respondents strongly agreed and 36.4 percent agreed to this statement.

The study has also learnt that 61.4% of the respondents strongly agreed that GO stimulates their interest in learning. This could be attributed to GO's practical approach. The trainees have also supported the GO tool as being very effective. A total of 65.5 percent of the trainees interviewed strongly agreed to the argument that GO acts as an effective learning tool.

A qualitative interview with the center manager reveals how perception of learners towards the GO, and their involvement enhances their performance. A center manager was asked to relate learners' perception of GO and the learning outcomes. The manager argued that:

“.....the practical nature of GO makes it a powerful tool which motivates learners with diverse learning needs to get involved with the result being, better learning outcomes.”

In support of the findings, Zollman (2009) argued that graphic organizers motivated grade 4 student in arranging their ideas which ultimately improved both their reading comprehension and communication skills. GO allows learners to brainstorm ideas without being concerned with the correct order (ibid). In another study, Tandog and Bucayong, (2019) found that GO are visual learning aids that assist in categorizing and articulating the students' thoughts. Accordingly, Torres et al. (2014) had established that GO can improve students learning in chemistry because these organizers help students better understand and remember concepts. Ponce et al. (2018) argued that GO enhances the learning process in the sense that, GO are visual learning aids that assist in categorizing and articulating the students' thoughts.

4.5.2.1 Trainees' Preference on the Role of Different Types of Graphic Organizers

The second objective sought to assess how trainees with diverse learning needs perceive and engage with Graphic Organizers as a learning tool. This section examines the trainee's preferences on the role of different types of Go. The trainees were required to indicate the level at which they agreed with five statements about role of different types of graphic organizers on the scale of 1-5 where; 1=Strongly Disagree (SD), 2=Disagree (D), 3=Not Sure (NS), 4=Agree (A), and 5=Strongly Agree (SA). Summary statistics are presented in Table 4.7.

Table 4.7: Summary Statistics on Trainees Preference on Role of Different Types of GO

Construct	SD (%)	D (%)	NS (%)	A (%)	SA (%)	Mean	Std. Deviation
I prefer cognitive mapping GO.	2.3	0.0	9.1	45.5	43.2	4.2	0.8
I prefer semantic mapping GO.	2.3	0.0	20.5	40.9	36.4	4.0	0.8
I prefer semantic feature analysis mapping GO.	0.0	4.5	20.5	40.9	34.1	4.0	0.8
I prefer syntactic mapping GO.	0.0	2.3	11.4	43.2	43.2	4.2	0.7
I prefer visual display mapping GO.	0.0	0.0	20.3	20.5	77.3	4.7	0.4

Mean: SD=1.00-1.80, D=1.81-2.60, NS=2.61-3.40, A=3.41-4.20, SA=4.21-5.00

Summary statistics show that 45.5 percent of the trainees agreed with the statement that they prefer cognitive mapping GO as opposed to other types of GO. The mean response and its standard deviation stood at 4.2 and 0.8, respectively. Similar findings were reported with respect to their preference to semantic mapping GO, where 40.9 percent of the trainees agreed with a mean score of 4.0 and a standard deviation of 0.8.

Additionally, the statistics indicate that most trainees with diverse learning needs (40.9 percent) preferred semantic feature analysis mapping GO over other types of GO. Most trainees (43.2 percent) also agreed to the assertion that syntactic mapping GO was the best, with a mean and standard deviation of 4.2 and 0.7, respectively. Finally, most trainees seemed to favor visual display mapping GO over all other types of GO, with the highest percentage of 71.4 percent and a mean response of 4.4. However, a few trainees disagreed on the role of different types of GO. For instance, 4.5 percent of the trainees disagreed with the statement that they prefer semantic feature analysis mapping GO. Additionally, 2.3 percent of the trainees disagreed with the argument that they prefer syntactic mapping GO. These results imply that trainees prefer different types of graphic organizers.

A qualitative interview with the center manager revealed that the application of different GO types enhances trainee experiences, with each GO playing its role. When asked about whether there is any particular type of GO that the learners prefer, the manager had the following to say:

“..... There are various approaches to Go, and
each approach has its own merit.”

Overall, the trainees had varied preferences on the GO. However, visual display mapping was ranked first. Empirically, different types of GO play different roles and therefore, no one type of GO is sufficient. For instance, the classical works by Ausubel (1968) and Mayer (1979) categorized GO into cognitive mapping, semantic mapping, semantic feature analysis, syntactic mapping, advanced GO and visual display. While cognitive mapping assists in making major ideas and relationships explicit by using "lines, arrows, and spatial arrangements to describe text content, structure, and key

conceptual relationships, advance organizers refer pedagogical devices that bridge the gap between what learners already know and what learners need to know. Ausubel's (1969) argued that advance organizer are appropriately relevant and inclusive introductory materials.

4.5.3 Instructor's Perception and Engagement with Graphic Organizers

The third objective sought to establish how instructors perceive and engage with Graphic Organizers as an instructional tool. First, the instructors were asked to indicate the frequency at which they applied different GO principles on a scale of 1-5 where; 1=Never (N), 2= Rarely (R), 3=Sometimes (S), 4=Often (O), and 5=Always (A). Table 4.8 below illustrates summary statistics.

Table 4.8: Instructors Perception and Engagement with Graphic Organizers

Construct	N (%)	R (%)	S (%)	O (%)	A (%)	Mean	Std. Deviation
I incorporate GO when making lesson notes	0.0	12.3	16.3	14.3	57.1	4.1	1.2
I incorporate GO when making lesson plans	0.0	13.3	28.6	15.3	42.9	3.8	1.2
I incorporate GO when making schemes of work	0.0	16.3	12.3	42.9	28.6	3.8	1.1
I incorporate GO when giving instructions	0.0	0.0	0.0	28.6	71.4	4.4	0.9

Mean: Never=1.00-1.80, Rarely=1.81-2.60, Sometimes=2.61-3.40, Often=3.41-4.20, Always=4.21-5.00

The study has established that 57.1 percent of the instructors at Kenyatta Industrial Vocational Rehabilitation Centre always incorporate GO when making lesson notes. This translated to a mean response of 4.1 with a standard deviation of 1.2. Additionally,

the findings reveal that 42.9 percent of the instructors, which translates to a mean score of 3.8 percent, always incorporate GO when making lesson plans. On the question of whether the instructors incorporated GO when making schemes of work as 42.9 percent of the instructors argued that they often did. When giving instruction, the study reveals that 71.4 percent of the instructors always incorporated GO. This translates to a mean response of 4.4. However, there are a few trainers who rarely incorporate GO in the notes (12.3 percent), lesson plan (13.3 percent), and making schemes of work (16.3 percent). These findings imply that instructors at Kenyatta Industrial Vocational Rehabilitation Centre the GO techniques to a great extent. This revelation can explain the improvement in the assessment scores after the intervention (use of GO). Nonetheless, not all trainers have embraced GO.

Instructors were also asked to indicate the level of agreement with the statement associated with the role of GO on learning outcomes using a scale of 1-5 where; 1=Strongly Disagree (SD), 2=Disagree (D), 3=Not Sure (NS), 4=Agree (A), and 5=Strongly Agree (SA). Summary statistics are presented in Table 4.9.

Table 4.9: Summary Statistics on the Role of Graphic Organizers on Learning Outcomes

Construct	SD (%)	D (%)	NS (%)	A (%)	SA (%)	Mean	Std. Deviation
GO improves organizational skills	0.0	0.0	0.0	57.1	42.9	4.4	0.5
GO improves comprehension of prior knowledge	0.0	0.0	0.0	57.1	42.9	4.4	0.5
GO improves the retention of learned information	0.0	0.0	14.3	42.9	42.9	4.2	0.7
Go stimulates learning interest	0.0	0.0	0.0	14.3	85.7	4.8	0.3
Go acts as an effective instructional tool	0.0	0.0	0.0	28.6	71.4	4.7	0.4
I observe a positive response from trainees while teaching a lesson using GO	0.0	0.0	0.0	28.6	71.4	4.7	0.4
I experience difficulty while teaching through GO	0.0	71.4	0.0	28.6	0.0	2.5	0.9
I feel GO a time consuming to create for a specific need	13.3	43.9	0.0	42.9	0.0	2.7	1.2

Mean: SD=1.00-1.80, D=1.81-2.60, NS=2.61-3.40, A=3.41-4.20, SA=4.21-5.00

From the summary statistics, 57.1 percent of the instructors strongly agreed with the argument that GO improves organizational skills, with a mean of 4.4 and a standard deviation of 0.5. Additionally, 57.1 percent of the instructors strongly agreed that GO improves comprehension of prior knowledge of the trainees with diverse learning needs (mean response of 4.4) but, they agreed that GO improves retention of learned information (mean=4.2).

Most of the instructors, 85.7 percent, were of the view that GO stimulates learning interest, while, 71.4 percent of the instructors argued that GO acts as an effective instructional tool. Similarly, the study has established that most (71.4%) of the instructors strongly agreed having observed positive responses of trainees while teaching lessons using GO. Nonetheless, 71.4 percent of the instructors were not sure (mean=2.5) of having experienced difficulties while teaching through GO. Furthermore, the statistics indicate that most instructors were not sure on the question of whether GO is time-consuming to create for a specific need, with a mean of 2.7 and a standard deviation of 1.2.

Overall, these findings imply that GO plays a critical role in teaching based on the views of teachers. It has been reported that GO motivates learners, improves organizational skills, and retention of acquired knowledge. This evidence is consistent with several other studies. O'Malley et al (2013) established those learners with special needs benefited from using a graphic organizer to increase numeracy. Earlier on, Patti Drapeau (1991) found that GOs are used to outline the relationship between concept and propositions, which agrees with Darolyn (2004) that graphic organizers help to guide the thoughts of the learner.

During the qualitative interview with the center manager, it was discovered that GO, being practical oriented as opposed to theoretical, stimulates and inspires trainees, and in particular, those with diverse learning needs. For instance, when asked about the benefits of GO, one instructor argued:

“GO approaches comprise of visual representation of the content being studied and hence, it makes learning lively.”

Despite the benefits of GO, several challenges that influence the application of GO came to the fore during an interview with the Centre Manager. It was discovered that most instructors lack training in computer applications and hence, encounter challenges in employing GO which is based on ICT technology. Additionally, the Manager indicated that most instructors at the Centre are not trained in GO.

4.6 Hypothesis Testing

The study tested the null hypotheses to establish statistical significance on the role of organizers on learning outcomes. The results of the Chi-square tests are presented in Table 4.10. With p-value of less than 0.05 for the three hypotheses indicates rejection which means, graphic organizers, trainees' perception and engagement, instructors' perception and engagement has a statistical significance effect on the learning outcome of trainees with diverse learning needs.

Table 4.10: Summary of Hypothesis Testing

No	Hypothesis	P value	Verdict
H0 ₁	There is no significant difference in role of graphic organizers and learning outcome of trainees with diverse learning needs.	0.000<.05	Reject
H0 ₂ :	There is no significant difference in trainees' perception and engagement with graphic organizers on learning outcome of trainees with diverse learning needs.	0.000<0.05	Reject
H0 ₃	There is no significant difference in instructors' perception and engagement with graphic organizers on learning outcome of trainees with diverse learning needs.	0.000<0.05	Reject

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study investigated the role of Graphic Organizers on learning outcomes of trainees with diverse learning needs. The previous chapter has presented findings and the discussions based on the study objectives. This chapter summarizes the findings, provides conclusions and finally, suggests policy recommendations.

5.2 Summary

The aim of this study was to address three specific objectives:

1. To determine the role of Graphic Organizers and the learning outcomes of trainees with diverse learning needs;
2. To assess how trainees with diverse learning needs perceive and engage with Graphic Organizers as a learning tool;
3. To establish how instructors perceive and engage with Graphic Organizers as an instructional tool.

This study adopted an experimental research design and in particular pretest-posttest employing experimental and control group. Trainees with diverse learning needs at Kenyatta Industrial Vocational Rehabilitation Center were the target. Quantitative data was collected from 44 trainees and 7 instructors using a structured questionnaire. Key informant interview with the center manager was also conducted. The reliability and validity of the tools was checked using Cronbach alpha and expert opinion approaches respectively. While quantitative data was analyzed descriptively, a narrative approach was employed for the qualitative component.

Demographic statistics show that there were more female trainees than male trainees at Kenyatta Industrial Vocational Rehabilitation Centre, who participated in the study. Most trainees with diverse learning needs at the Center were above the age of 18 years, followed by those between 16-17 years, and finally, those aged 14-15 years.

Findings demonstrate that most instructors of trainees with diverse learning needs are female, followed by their male counterparts. Additionally, the majority of the instructors were above 35 years, and educationally, all the instructors had diploma qualification as their highest academic achievement. This means that their competency to teach in the center was not in doubt. Results further show that most instructors acquired their GO experiences in college by undertaking a teacher education and in-service training.

5.2.1 Role of GO and the Learning Outcomes of Trainees with Diverse Learning Needs

The first objective sought to investigate the role of Graphic Organizers and the learning outcomes of trainees with diverse learning needs. The study has established an improvement in the percent scores of trainees after the GO intervention. In fact, the number of trainees with diverse learning needs who scored below average drastically dropped at the exit assessment, an indication of the power of GO. Several studies support these findings. For instance, O'Malley et al (2013) argued that GO can enhance learning among learners with special needs. Similarly, Gonzalez-Ledo et al (2015) claim that provision of computer GO enhanced literacy among a group of Students with Special needs.

5.2.2 Trainees Perception and Engagement with Graphic Organizers

The second objective sought to assess how trainees with diverse learning needs perceive and engage with Graphic Organizers as a learning tool. The study established that, GO

motivates them to study more, a position that was taken by Zollman (2009), and also, GO allows learners to brainstorm ideas without being concerned with the correct order which is consistent with Tandog and Bucayong (2019) who established that GO are visual learning aids that assist in categorizing and articulating the students' thoughts. There was also a strong agreement among the learners that GO has a significant impact on the learning process. Similar findings have been argued by other researchers such as Torres et al. (2014) who observed that GO can improve students' learning because these organizers help students better understand and remember concepts.

5.2.2.1. Trainees Preference on Role of Different Types of Graphic Organizers

The results show mixed feelings among the trainees on the different types of GO they prefer. While other preferred cognitive GO approach, others expressed their preference for semantic mapping GO. Additionally, most trainees agreed with the argument that syntactic mapping GO was the best, while others favored visual display mapping GO over all other types of GO with the highest percentage.

In summary, even though trainees had different preferences on the GO, visual display mapping was ranked first. In support of these findings, Ausubel (1969) and Mayer (1979) in their classical works describe various GO approaches with each having a specific role. For instance, Ausubel's (1968) argued that advance organizers are appropriately relevant and inclusive introductory materials. However, a few trainees disagreed on the role of different types of GO. For instance, 4.5 percent of the trainees disagreed with the statement that they prefer semantic feature analysis mapping GO. Additionally, 2.3 percent of the trainees disagreed with the argument that they prefer syntactic mapping GO. These results imply that trainees prefer different types of graphic organizers.

5.2.3 Instructor's Perception and Engagement with Graphic Organizers

The third objective sought to establish how instructors perceive and engage with Graphic Organizers as an instructional tool. Findings indicate that most instructors incorporate GO in all facets of the training. For instance, the study results reveals that most instructors at Kenyatta Industrial Vocational Rehabilitation Centre incorporate GO when making lesson notes. Additionally, results denote that most instructors often incorporate GO when making lesson plans as well as when making schemes of work.

When giving instruction, the study reveals that most instructors often incorporated GO. Furthermore, findings of the study show that most instructors agreed with the assertion that GO improves organizational skills, comprehension of prior knowledge of the trainees with diverse learning needs and the retention of learned information. Positive responses of trainees during training with GO application were also observed. Furthermore, findings show that GO stimulates the interest of learners, and is therefore an effective tool.

Nevertheless, the study has established several challenges with the application of the GO at the Centre. It was shown the most instructors lack training in computer applications and therefore, met difficulties when using GO which is based on ICT technology. Additionally, most of the instructors at the Kenyatta Industrial Vocational Rehabilitation Centre are not well trained.

5.3 Conclusion

Based on the findings, several conclusions are drawn. First, the study concludes that GO improves comprehension of prior knowledge, organizational skills and retention of learners' information. This implies that GO is a powerful tool to enhance the learning process of trainees with diverse learning needs. Secondly, study results demonstrate

mixed feelings on the preferred type of GO among the trainees with diverse learning needs. This is notwithstanding that most trainees preferred visual display mapping GO approach. Thirdly, the study concludes that even though GO is a powerful instructional tool, some instructors at Kenyatta industrial vocational rehabilitation center are not well trained to handle the tool.

5.4 Recommendation

Given the summary and conclusions, the study recommends the following:

1. Integration of Graphic Organizers into curriculum to support diverse learning needs and styles,
2. Provide training for instructors on the effective use of Graphic Organizers for different content areas and tailoring them to meet the needs of diverse learners
3. Encourage the ministry of education, educators and policy makers to develop customizable Graphic Organizers since not all GO will work for every learner and provide options that allow learners with DLN to choose which type of GO best suits their learning preferences and needs.

5.5 Suggestion for Further Study

1. A study should be conducted to determine whether there are variations in other courses on the role of graphic organizers on learning outcome of trainees with diverse leaning needs.
2. Since this study was conducted in one institution hosting trainees with diverse learning needs, future studies should involve more participants drawn from a wider geographical score and allow for at least a 6-month time interval between the baseline test and the exit assessment of the trainees with diverse learning needs.

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APPENDICES

Appendix I: Letter of Introduction to Respondents

Killy Jebet Gladys

E55-12102-2021

MACHAKOS UNIVERISTY

Dear Respondent,

RE: REQUEST TO TAKE PART IN RESEARCH STUDY

I am a Post Graduate Student at Machakos University undertaking a Research Study on
**“Role of Graphic Organizers on Learning Outcome of Trainees with Diverse
Learning Needs in Kenyatta Industrial Vocational Rehabilitation Centre, Nairobi
County, Kenya.”**

I hereby request you to voluntarily participate in data collection. The information given
is mainly for research purpose and it will be treated with confidentiality.

Thank you.

Yours faithfully,

Killy Jebet Gladys

E55-12102-2021

Appendix II: Graphic Organizers (GO) for Vocational Trainees With Diverse Learning Needs on Computer Studies Level 1

GO Developed, Standardized and Validated by the Investigator to measure the respondents' ability to recognize graphic, space recognition and figures based on Ausubel's Advance Organizer

UNIT: INTRODUCTION TO COMPUTING (10 periods)

Unit Outcomes: Students will be able to:

- i. Define the terminologies used in computing
- ii. Explain the main different parts of a computer
- iii. Illustrate diagrams of major parts of computer, operating system, storage devices, input and output devices
- iv. Categorize the major parts of a computer
- v. Describe the functions of an operating system

Specification of Content

Topic/sub-topic	Contents (Unit)	Suggested activities
Students will be able to: Define the term: i. Computer ii. Information Communication Technology	(ICT) OVERVIEW (1 period)	• Begin the class by presenting the aims of the lesson • Identify defining attributes • Give examples • Provide context • Repeat • Prompt awareness of student's relevant knowledge and experience • Present material • Maintain attention • Students copy the notes of (ICT) Overview in their book
i. Draw the main parts of a computer ii. Label the parts in the above diagram iii. Explain the different parts of a computer named above	PARTS OF A COMPUTER (1 period)	• Apply syntax component of (AAO) to begin the class by presenting the aims of the lesson • Prompt awareness of student's relevant knowledge and experience through social system component of (AAO) • Introduce prior knowledge of realia through principles of reaction component of (AAO) by asking if anybody knows; monitor lizard, mouse, human brain and alphabetical keys • Draw them on the board • Explain the importance of prior knowledge • Present material through support system component of (AAO) • Relate the material with prior knowledge • Apply instructional and nurturant effects component of (AAO) to draw the major parts of a computer; monitor, keyboard, mouse, CPU (Brain) • Students copy the diagram of main parts of a computer in their book • Maintain attention • Make organization explicit • Make logical order of learning material explicit • Use principles of integrative reconciliation to promote active reception learning

i. Differentiate between a software and a hardware ii. List 3 types of input devices iii. List 3 types of output devices iv. Match the input and output diagrams with the corresponding names	COMPUTER SOFTWARE AND HARDWARE (2 periods)	• Clarify • Apply syntax component of (AAO) to begin the class by presenting the aims of the lesson • Prompt awareness of student's relevant knowledge and experience through social system component of (AAO) • Through principles of reaction component of (AAO) ask students to differentiate between a software and a hardware and to list different types of input and output devices • Present material through support system component of (AAO) • Explain the difference between a software and a hardware and list different types of input and output devices • Students copy the notes in their book • Apply instructional and nurturant effects component of (AAO) to draw the different types of input and output devices • Students copy the diagram of input and output devices in their book • Maintain attention • Make organization explicit • Make logical order of learning material explicit • Use principles of integrative reconciliation to promote active reception learning • Clarify
i. Define the term keyboard ii. Draw the keyboard layout iii. Describe types of keys in the keyboard	KEYBOARD MANIPULATION (2 periods)	• Apply syntax component of (AAO) to begin the class by presenting the aims of the lesson • Prompt awareness of student's relevant knowledge and experience through social system component of (AAO) • Through principles of reaction component of (AAO) ask students to define the term keyboard • Introduce prior knowledge of realia through principles of reaction component of (AAO) by asking if anybody knows alphabetical order, numeric figures and mathematical arithmetic symbols • Ask students to write them on the board • Explain the importance of prior knowledge

		• Present material through support system component of (AAO) • Relate the material with prior knowledge • Apply instructional and nurturant effects component of (AAO) to draw keyboard layout • Students copy the diagram of a keyboard layout in their book • Maintain attention • Make organization explicit • Make logical order of learning material explicit • Use principles of integrative reconciliation to promote active reception learning • Clarify
i. Define the terminologies used in mouse manipulation - Click and Double click - Drag and drop ii. With the help of a diagram label the parts of a mouse	MOUSE MANIPULATION (2 periods)	• Apply syntax component of (AAO) to begin the class by presenting the aims of the lesson • Prompt awareness of student's relevant knowledge and experience through social system component of (AAO) • Through principles of reaction component of (AAO) ask students to define the terminologies used in mouse manipulation; click and double click, drag and drop • Introduce prior knowledge of realia through principles of reaction component of (AAO) by asking if anybody knows a mouse • Ask students to sketch the picture of a mouse and label its parts on the board • Ask students to lift their book from its location say left and place it on a different location say right • Explain the importance of prior knowledge • Present material through support system component of (AAO) • Relate the material with prior knowledge • Apply instructional and nurturant effects component of (AAO) to draw the diagram of a mouse, label its parts and explain the difference between click and double click and drag and drop as used in mouse manipulation • Students copy the diagram of a mouse in their book

		• Maintain attention • Make organization explicit • Make logical order of learning material explicit • Use principles of integrative reconciliation to promote active reception learning • Clarify
i. Define the term operating system ii. Sketch an operating system iii. State the 2 types of storage devices iv. State the functions of an operating system	OPERATING SYSTEM (2 periods)	• Apply syntax component of (AAO) to begin the class by presenting the aims of the lesson • Prompt awareness of student's relevant knowledge and experience through social system component of (AAO) • Through principles of reaction component of (AAO) ask students to define the term operating system and state the types of storage devices • Introduce prior knowledge of realia through principles of reaction component of (AAO) by asking if anybody knows a human brain • Ask students to sketch the picture of a human brain and label its parts on the board • Explain the importance of prior knowledge • Present material through support system component of (AAO) • Relate the material with prior knowledge • Apply instructional and nurturant effects component of (AAO) to draw the diagram of an operating system and label its parts • Students copy the diagram of an operating system in their book • Maintain attention • Make organization explicit • Make logical order of learning material explicit • Use principles of integrative reconciliation to promote active reception learning • Clarify

Suggested Teaching Methods

- (AAO)
- Syntax
- Social System
- Principles of Reaction
- Support System
- Instructional and Nurturant Effects
- Graphic Organizers
- Cognitive mapping graphic organizer
- Semantic mapping graphic organizer
- Semantic feature analysis graphic organizer
- Syntactic graphic organizer
- Visual display graphic organizer

Suggested Learning Resources

- Graphic Organizers instructional packages
- Resource personnel

Suggested Assessment Methods

- Entry Behavior Competency Test to test the baseline of education level, attention and concentration span
- Graphic tests to test space, figure and sound recognition
- Written test to test cognitive reading/writing abilities, knowledge/comprehension and organizational skills
- Practical test to test retention and transfer of learned information

Types of Assessment Items

- Multiple choice
- True/False statements
- Match assessment Items
- Completion assessment items/ filling the gaps

Table of Specification

Topic/sub topic	Instructional objectives: students will be able to:	Time allocation (hour)	Item no	No. of items per objective	Mark allocation	Total marks
ICT OVERVIEW	i. What is a Computer? ii. A Computer is an electronic device that can store, manipulate and process data according to a set of instructions.	1	Section A: (1) Section B: (2)	1	2@1 2@1	4
PARTS OF A COMPUTER	i. Draw the main parts of a computer ii. Label the parts in the above diagram iii. What is the full form of CPU? iv. Which of the following is the Brain of the Computer?	1	Section D: (i, ii) Section A: (2,3)	2	4@3 4@2 2@1 2@1	24

COMPUTER SOFTWARE AND HARDWARE	i. Which of the following are physical devices of a computer? ii. Which one of the following is not an input device? iii. Match the input and output diagrams with the corresponding names	2	Section A: (4,5) Section C: (1)	2	2@1 2@1 2@5	14
KEYBOARD MANIPULATION	i. Alphabet keys are found in a Keyboard.	2	Section B: (4)	2	2@1	2
MOUSE MANIPULATION	i. Mouse is an output Device.	2	Section B: (3)	2	2@1	2
OPERATING SYSTEM	i. RAM stands for Read Access Memory. ii. Which of the following are physical devices of a computer?	2	Section B: (5) Section A: (4)		2@1 2@1	4

**Appendix II A: Criterion Reference Test (CRT) for Vocational Trainees with
diverse learning needs on Computer Studies Level 1 Written Exam
Test to measure Reading and Writing Abilities**

CRT Developed, Standardized and Validated by the Investigator

Computer Studies Test

Time: 1 Hour

Instructions:

QUESTIONS: SECTION A – MULTIPLE CHOICE QUESTIONS (10 MARKS)

- Answer all questions
- Each question carries TWO (2) marks
- Please cycle (☐) only one answer you think is correct below

Example: Which one of the following is not an output device?

A. *Projector*

B. *Printer*

☒ C. *Keyboard*

1. Which of the following is the correct definition of Computer?
 - A. A Computer is an electronic device that can store, manipulate and process data according to a set of instructions.
 - B. A Computer is an input processor machine
 - C. All of these
2. What is the full form of CPU?
 - A. Computer Principle Unit
 - B. Computer Processing Unit

- C. Central Processing Unit
3. Which of the following is the Brain of the Computer?
- A. Control Unit
 - B. CPU
 - C. Memory
4. Which of the following are physical devices of a computer?
- A. Hardware
 - B. System Software
 - C. Application Software
5. Which one of the following is not an input device?
- A. Monitor
 - B. Mouse
 - C. Keyboard

QUESTIONS: SECTION B – TRUE OR FALSE QUESTIONS (10 MARKS)

- Answer all questions
- Each question carries TWO (2) marks
- State whether each of the following statements is TRUE or FALSE

Example: Monitor is not an input device. TRUE

1. Hardware is a physical component of a computer.
2. A Computer is an electronic device that can store, manipulate and process data according to a set of instructions.
3. Mouse is an output Device.

4. Alphabet keys are found in a Keyboard.
5. RAM stands for Read Access Memory.

QUESTIONS: SECTION C – MATCH QUESTIONS (10 MARKS)

- Match all the diagrams
- Each match carries TWO (2) marks
- Use the arrow to match the input and output diagrams with the corresponding names

Example:



1. Match the input and output diagrams with the corresponding names

Device	Name
	Keyboard
	Mouse

	CPU
	Monitor
	Printer

QUESTIONS: SECTION D – DRAWING & LABELLING QUESTIONS (20 MARKS)

- Answer all questions
 - Each drawing carries THREE (3) marks
 - Each labelling carries TWO (2) marks
1. i. Draw the four main parts of a computer
- ii. Label the parts in question 1. i. above

TOTAL 50 MARKS

Appendix II B: Scoring Key for Vocational Instructors on Computer Studies Level
1 Written Exam Test to measure Reading and Writing Abilities

Scoring Key (Developed, Standardized and Validated by the Investigator)

Instructions:

QUESTIONS: SECTION A – MULTIPLE CHOICE QUESTIONS (10 MARKS)

- Answer all questions
- Each question carries TWO (2) marks
- Please cycle (☐) only one answer you think is correct below

Example: Which one of the following is not an output device?

A. Projector

☒ B. Printer

C. Keyboard

1. Which of the following is the correct definition of Computer?

A. A Computer is an electronic device that can store, manipulate and process data according to a set of instructions.

B. A Computer is an input processor machine

☒ C. All of these

Correct cycling @ 2 marks

2. What is the full form of CPU?

A. Computer Principle Unit

B. Computer Processing Unit

☒ C. Central Processing Unit

Correct cycling @ 2 marks

3. Which of the following is the Brain of the Computer?

A. Control Unit

B. CPU

C. Memory

Correct cycling @ 2 marks

4. Which of the following are physical devices of a computer?

A. Hardware

B. System Software

C. Application Software

Correct cycling @ 2 marks

5. Which one of the following is not an input device?

A. Monitor

B. Mouse

C. Keyboard

Correct cycling @ 2 marks

QUESTIONS: SECTION B – TRUE OR FALSE QUESTIONS (10 MARKS)

- Answer all questions
- Each question carries TWO (2) marks
- State whether each of the following statements is TRUE or FALSE

*Example: Monitor is not an input device. **TRUE***

Hardware is a physical component of a computer. **TRUE** (*Correct statement @ 2 marks*)

1. A Computer is an electronic device that can store, manipulate and process data according to a set of instructions. **TRUE** (*Correct statement @ 2 marks*)
2. Mouse is an output Device. **FALSE** (*Correct statement @ 2 marks*)
3. Alphabet keys are found in a Keyboard. **TRUE** (*Correct statement @ 2 marks*)
4. RAM stands for Read Access Memory. **TRUE** (*Correct statement @ 2 marks*)

QUESTIONS: SECTION C – MATCH QUESTIONS (10 MARKS)

- Match all the diagrams
- Each match carries TWO (2) marks
- Use the arrow to match the input and output diagrams with the corresponding names

Example:



1. Match the input and output diagrams with the corresponding names

Device	Name
	Keyboard
	Mouse
	CPU
	Monitor
	Printer

(Correct Match @ 2 marks)

Max = 2 x 5 = 10 marks

QUESTIONS: SECTION D – DRAWING & LABELLING QUESTIONS (20 MARKS)

- Answer all questions
 - Each drawing carries THREE (3) marks
 - Each labelling carries TWO (2) marks
1. i. Draw the four main parts of a computer



(Correct Drawing @ 4 marks)

Max = 3 x 4 = 12 marks

ii. Label the parts in question 1. i. above



MOUSE



KEYBOARD



MONITOR



CPU

(Correct Labelling @ 2 marks)

Max = 2 x 4 = 8 marks

TOTAL 50 MARKS

**Appendix III A: CRT for Vocational Trainees with diverse learning needs on
Computer Studies Level 1 Practical Exam to measure Figure, Space
and Sound Recognition Abilities**

CRT Developed, Standardized and Validated by the Investigator

Computer Studies Test

Time: 1 Hour

Instructions:

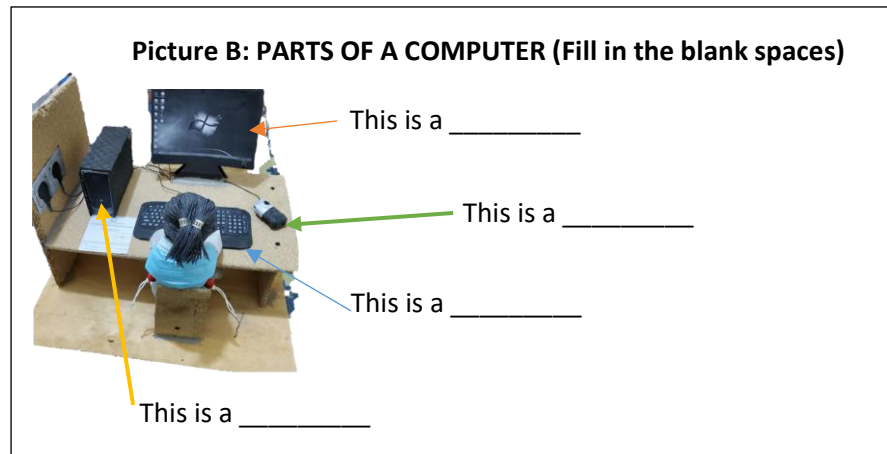
- Answer all questions below

Questions: (50 MARKS)

1. The picture below illustrates the major parts of a computer. Label the parts of a computer as indicated by the arrow. (8 marks)

Picture A: Prior Knowledge

	This is a MONITOR Lizard																																																				
	This is a Human BRAIN																																																				
	This is a MOUSE																																																				
<table border="1"><thead><tr><th colspan="13">Alphabetical Order</th></tr></thead><tbody><tr><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td><td>H</td><td>I</td><td>J</td><td></td><td></td><td></td></tr><tr><td>K</td><td>L</td><td>M</td><td>N</td><td>O</td><td>P</td><td>Q</td><td>R</td><td>S</td><td>T</td><td></td><td></td><td></td></tr><tr><td>U</td><td>V</td><td>W</td><td>X</td><td>Y</td><td>Z</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table>	Alphabetical Order													A	B	C	D	E	F	G	H	I	J				K	L	M	N	O	P	Q	R	S	T				U	V	W	X	Y	Z								This is a KEYBOARD
Alphabetical Order																																																					
A	B	C	D	E	F	G	H	I	J																																												
K	L	M	N	O	P	Q	R	S	T																																												
U	V	W	X	Y	Z																																																



2. Keyboard is an input device used to enter data into the computer. Fill in the missing Alphabetical and Numerical keys in the blank spaces shown below. (9 marks)

IDENTIFICATION OF KEYBOARD KEYS

ALPHABETICAL KEYS:

—	B	—	D	E	—	—
H	—	J	—	L	—	N
O	—	Q	—	S	—	U
—	W	—	Y	—		

NUMERICAL KEYS:

0	—	2	—	4	5	—
7	—	9				

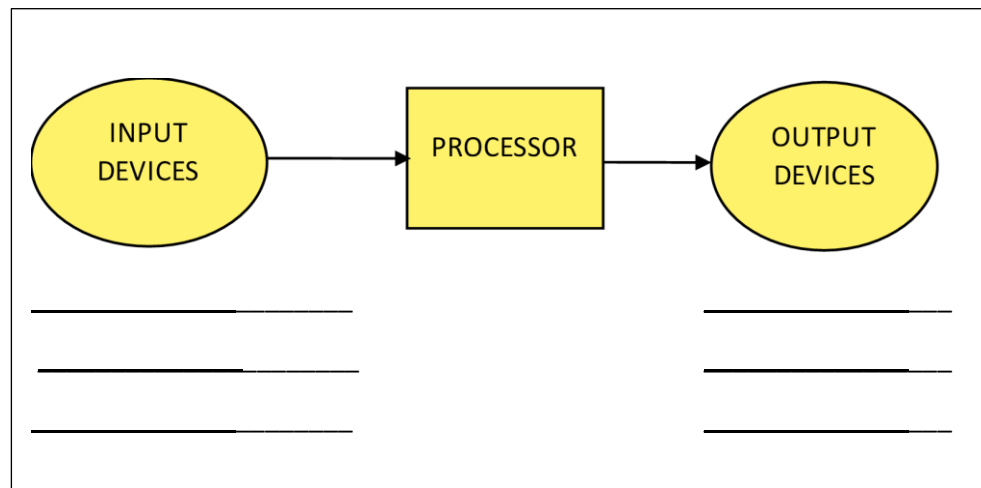
3. The diagram below shows the arithmetic symbols used in computing. Complete the names of the symbols in the blank spaces. (7 marks)

ARITHMETIC SYMBOLS (Fill in the blank spaces)

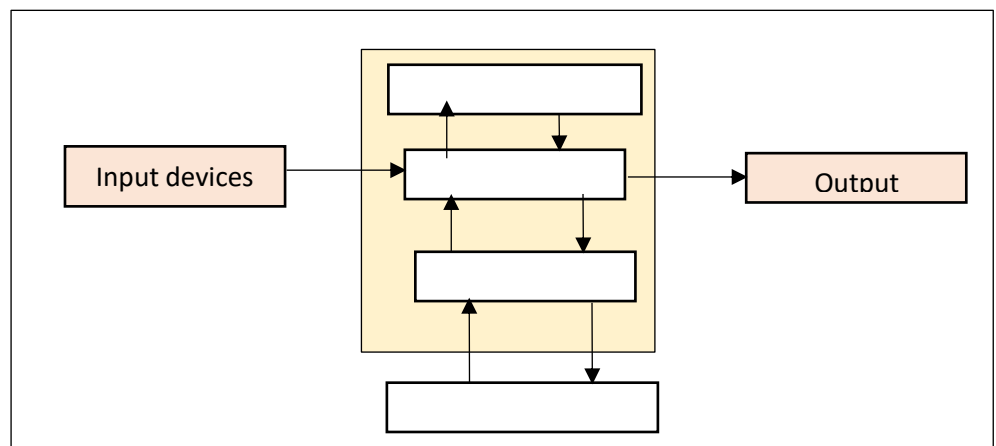
/	*	-	+	=	<>	()
DI _____	MUL	MI _____	AD	E _____	G ____/L ____	BRA _____

ARITHMETIC SYMBOLS (Fill in the blank spaces)

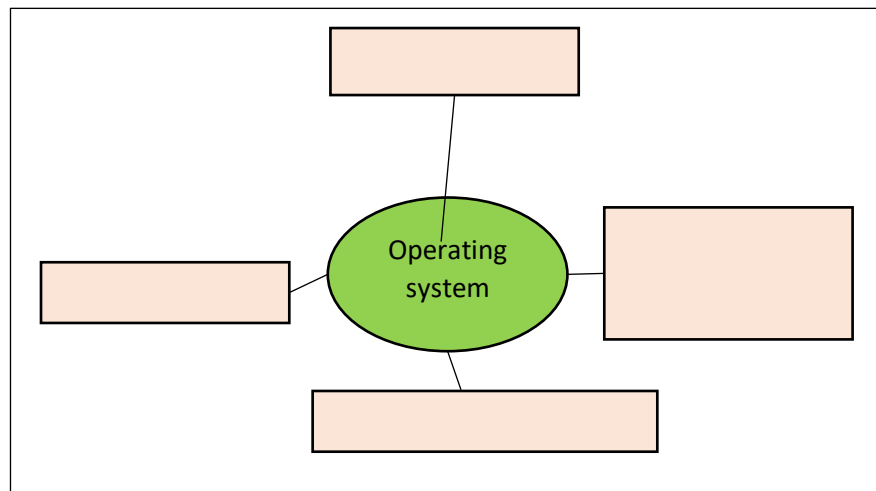
4. Operating System is a collection of software that manages computer hardware resources. List any three input and three output devices. (12 marks)



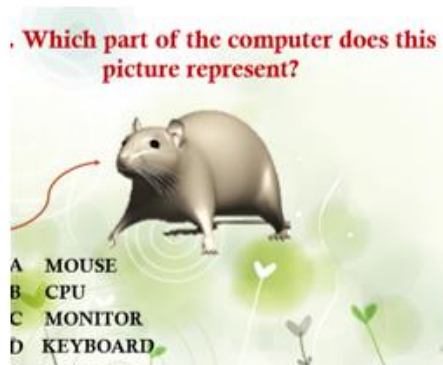
5. Label the three components of a Computer Processor in the diagram shown below. (6 marks)



6. State the functions of an operating system in the diagram below (4marks)



7. Identify the parts of a computer represented in the diagram below by cycling the appropriate name (4mks)



TOTAL 50 MARKS

Appendix III B: Scoring Key for Vocational Instructors on Computer Studies

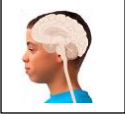
Level 1 Practical Exam to measure Figure, Space and Sound Recognition Abilities

Scoring Key Developed, Standardized and Validated by the Investigator

1. The picture below illustrates the major parts of a computer. Label the parts of a computer as indicated by the arrow. (8 marks)



This is a Monitor Lizard



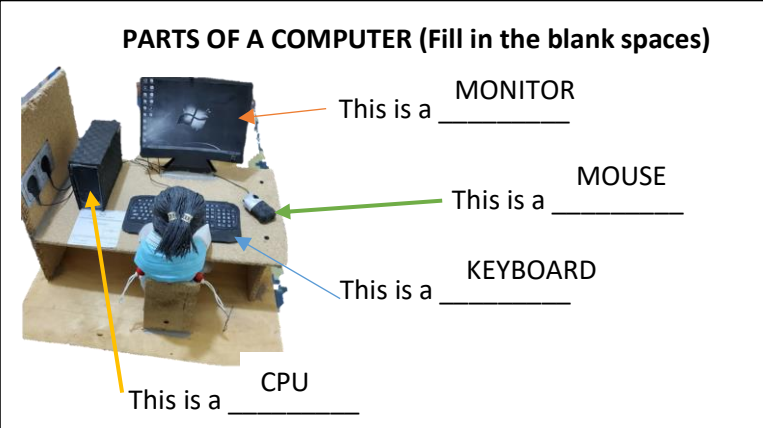
This is a Human Brain



This is a MOUSE

A	B	C	D	E	F	G	H	I	J
K	L	M	N	O	P	Q	R	S	T
U	V	W	X	Y	Z				

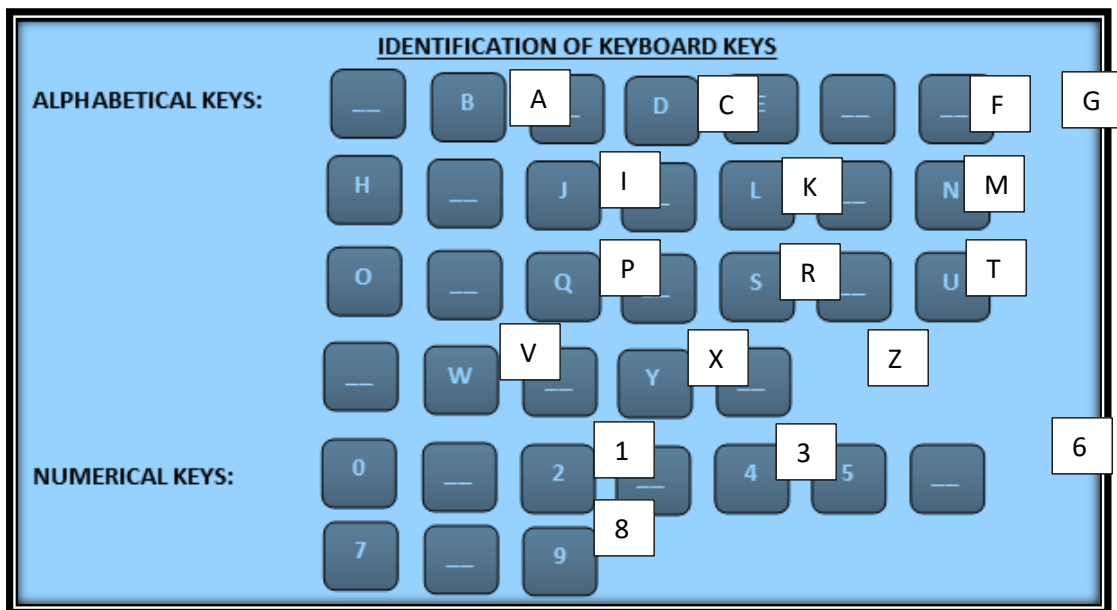
PARTS OF A COMPUTER (Fill in the blank spaces)



Correct Labelling @ 2 marks

Max 2 x 4 = 8 marks

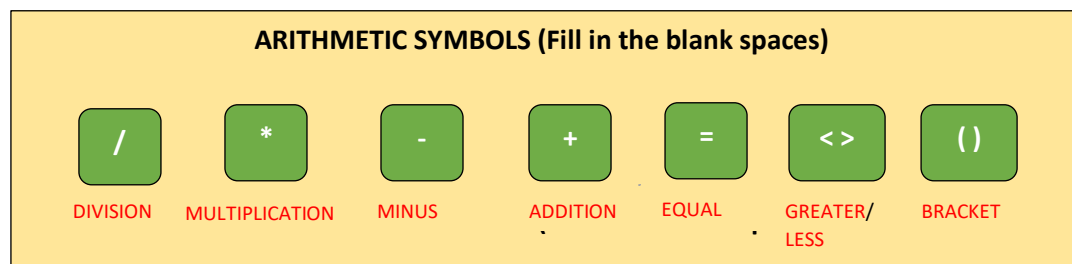
2. Keyboard is an input device used to enter data into the computer. Fill in the missing Alphabetical and Numerical in the blank spaces shown below. (9 marks)



Correct Filling @ ½ mark

Max ½ x 18 = 9 marks

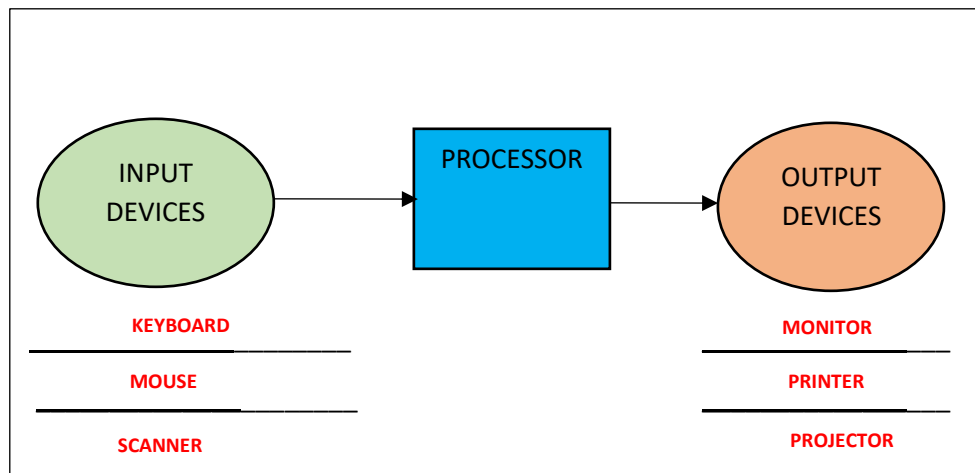
3. The diagram below shows the arithmetic symbols used in computing. Complete the names of the symbols in the blank spaces. (7 marks)



Correct Completion @ 1 mark

Max 1 x 7 = 7 marks

4. Operating System is a collection of software that manages computer hardware resources. List any three input and three output devices. (12 marks)

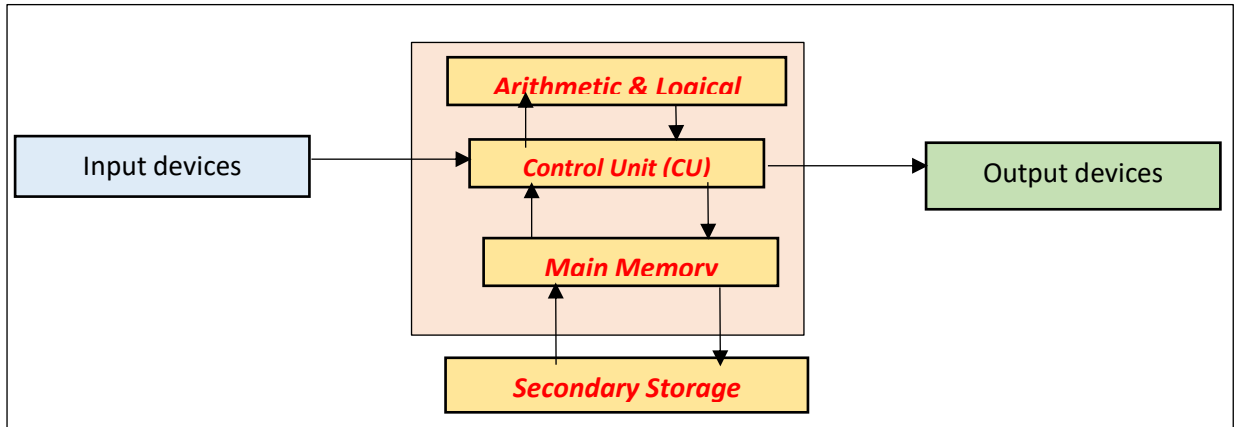


Correct Listing @ 2 marks

Max 2 x 6 = 12 marks

5. Label the three components of a Computer Processor in the diagram shown below.

(6)

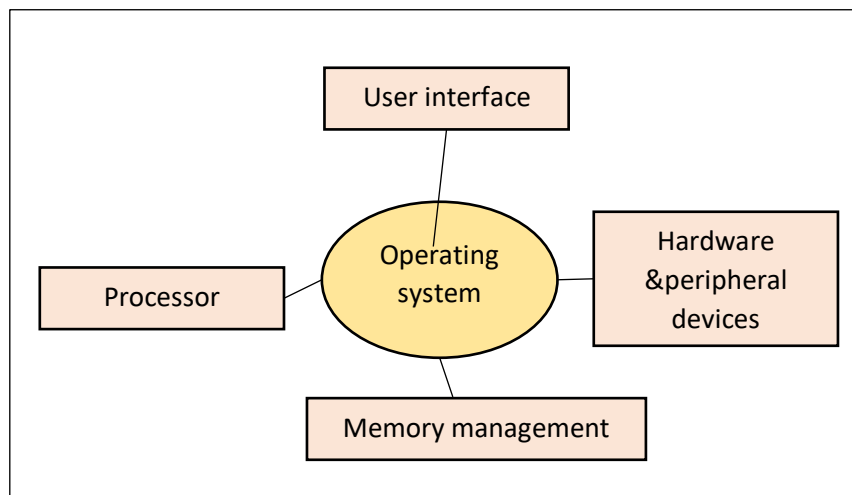


Correct Labelling @ 2 marks

Max 2 x 3 = 6 marks

6. State the functions of an operating system in the diagram below

(4marks)

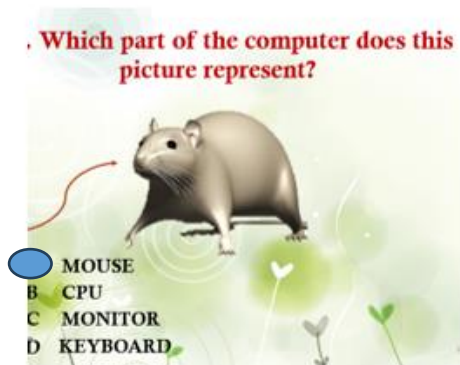


Stating @ 1 mark

Max 1 x 4 = 4 marks

7. Identify the parts of a computer represented in the diagram below by cycling the appropriate name

(4mks)



Cycling @ 2 marks

Max $2 \times 2 = 4$ marks

**Appendix IV: Trainees’ perception and engagement questionnaire for Vocational
Trainees with diverse learning needs to measure satisfaction with
graphic organizers**

Introduction

This questionnaire is not a test. It is intended to gather information on your perception on “Role of Graphic Organizers on Learning Outcome of Trainees with Diverse Learning Needs in Kenyatta Industrial Vocational Rehabilitation Centre, Nairobi County, Kenya. ”

Instructions

Do not indicate your name on the questionnaire

Answer all the questions

Section A: Demographic Information

1. What is your gender? (please tick ✓) ☐ Male ☐ Female
2. What is your age? (please tick ✓) ☐ 14-15years ☐ 16-17years ☐ above
18years

Section B: Trainees’ Perception and Engagement with Graphic Organizers

Specify the level to which you agree with the following statement about role of graphic organizers. Please put a tick (✓) in the space provided against the statement.

Key:

[SA] Strongly Agree-5 [A] Agree-4 [NS] Not Sure-3 [D] Disagree-2

[SD] Strongly Disagree-1

S/N	Statement	SA	A	NS	D	SD
1.	GO motivates me to study more					
2.	GO have significant impact to my learning process					
3.	GO improves my active participation					
4.	GO stimulates my learning interest					
5.	GO acts as an effective learning tool					

Section C: Trainees Preference on role of different types of GO

Specify the level to which you agree with the following statement about role of different types of graphic organizers. Please put a tick (✓) in the space provided against the statement.

Key:

[SA] Strongly Agree-5 [A] Agree-4 [NS] Not Sure-3 [D] Disagree-2

[SD] Strongly Disagree-1

S/N	Statement	SA	A	NS	D	SD
1	I prefer cognitive mapping GO					
2	I prefer semantic mapping GO					
3	I prefer semantic feature analysis mapping GO					
4	I prefer syntactic mapping GO					
5	I prefer visual display mapping GO					

THANK YOU FOR YOUR PARTICIPATION

Appendix V: Instructors' perception and engagement questionnaire to measure satisfaction with graphic organizers

Dear Sir/Madam

This questionnaire is intended to gather information for research purpose. The research study is on “Role of Graphic Organizers on Learning Outcome of Trainees with Diverse Learning Needs in Kenyatta Industrial Vocational Rehabilitation Centre, Nairobi County, Kenya”. Confidentiality will be upheld on all the information given.

Instructions:

Do not indicate your name on the questionnaire

Answer all the questions

Section A: Demographic Information

1. What is your gender? (please tick ✓) ☐ Male ☐ Female

2. What is your age? (please tick ✓) ☐ Below 24 years ☐ 25-35
years

☐ 35-46 years ☐ Above 47
years

3. What is your level of education? ☐ Diploma ☐ Degree ☐ Masters

4. Where did you experience use of GO?

☐ I learned GO in College or teacher educational course

☐ I learned about GO in in-service training

Section B: Perception and Engagement with Graphic Organizers

This section of questionnaire aims at establishing your satisfaction with graphic organizers as an instructional tool. Please put a tick (✓) in the space provided against the statement.

Key: [A] Always-5 [O] Often-4 [S] Sometimes-3 [R] Rarely-2 [N] Never-1

S/N	Statement	A	O	S	R	N
1.	I incorporate GO when making lesson notes					
2.	I incorporate GO when making lesson plans					
3.	I incorporate GO when making schemes of work					
4.	I incorporate GO when giving instructions					

Specify the level to which you agree with the following statement about role of graphic organizers on learning outcomes of trainees with diverse learning needs. Please put a tick (✓) in the space provided against the statement.

Key:

[SA] Strongly Agree-5 [A] Agree-4 [NS] Not Sure-3 [D] Disagree-2

[SD] Strongly Disagree-1

S/N	Statement	SA	A	NS	D	SD
1.	GO improves organizational skills					
2.	GO improves comprehension of prior knowledge					
3.	GO improves retention of learned information					
4.	GO stimulates learning interest					
5.	GO acts as an effective instructional tool					
6.	I observe positive response of trainees while teaching lesson using GO					
7.	I experience difficulty while teaching through GO					
8.	I feel GO a time consuming to create for a specific need					

THANK YOU FOR YOUR PARTICIPATION

Appendix VI: Interview Schedule for Principal to measure satisfaction with graphic organizers

Dear Sir/Madam

This research is meant for academic purpose and seeks to gather information on “Role of Graphic Organizers on Learning Outcome of Trainees with Diverse Learning Needs in Kenyatta Industrial Vocational Rehabilitation Centre, Nairobi County, Kenya”. Confidentiality will be upheld on all the information given.

Section A: Demographic Information

1. What is your gender? (please tick ✓) ☐ Male ☐ Female

Section B: Perception and Engagement with Graphic Organizers

1. Are all instructors in your institution adequately trained to use GO in training?

.....

Give reason (s)

.....

.....

2. Do instructors perceive that GO are particularly effective for trainees with diverse learning needs?

.....

Give reason (s)

.....
.....

3. Do instructors encounter any challenges in integrating graphic organizers in your institution?

.....

If yes, please explain:

.....
.....

4. In your opinion;

- a. Do you think integrating GO to trainees with diverse learning needs improves comprehension of prior knowledge, organizational skills and retention of learned information?

Give reason (s)

.....
.....

- b. Do you think trainees with diverse learning needs are satisfied with integrating GO as a learning tool?

Give reason (s)

.....
.....

- c. Do you think instructors are satisfied with integrating GO as an instructional tool?

Give reason (s)

.....

.....

- d. Do you think instructors incorporate GO when preparing lesson notes, lesson plans and schemes of work??

Give reason (s)

.....

.....

THANK YOU FOR YOUR PARTICIPATION

Appendix VII: University Letter of Introduction



MACHAKOS UNIVERSITY OFFICE OF THE DEAN GRADUATE SCHOOL

Telephone: 254-(0)735247939, (0)723805929
Email: graduateschool@mksu.ac.ke
Website: www.machakosuniversity.ac.ke

P.O Box 136-90100
Machakos
KENYA

REF. MksU/ASA/GS/3/3

25th June, 2024

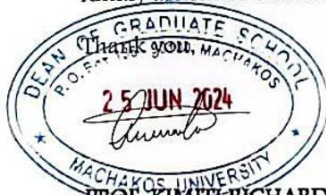
The Director,
National Commission for Science, Technology and Innovation
P.O Box 30623,
NAIROBI

Dear Sir

RE: KILLY JEBET GLADYS (E55/12102/2021)

The above-named is a masters student in the second year of study and has cleared coursework. The University has cleared her to conduct a research entitled: **"Role of Graphic Organizers on Learning Outcomes of Trainees With Diverse Learning Needs. A Case Study in Industrial Vocational Rehabilitation Centre."**

Kindly assist her with a Research Permit in order to undertake the research.



PROF. KIMET RICHARD PETER, PhD
DEAN GRADUATE SCHOOL

KRP/em

Appendix VIII: Research Authorization

 REPUBLIC OF KENYA Ref No: 229727	 NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION Date of Issue: 11/July/2024
RESEARCH LICENSE	
	
This is to Certify that Ms. Gladys Jebet Killy of Machakos University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: Role of Graphic Organizers on Learning Outcomes of Trainees with Diverse Learning Needs. A Case Study in Industrial Vocational Rehabilitation Centre, Nairobi County, Kenya, for the period ending : 11/July/2025.	
License No: NACOSTI/P/2407654	
Applicant Identification Number: 229727	
Director General NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION	
Verification QR Code 	
NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.	
See overleaf for conditions	

**Appendix IX: Locational Map of Kenyatta Industrial Vocational Rehabilitation
Centre, Nairobi County, Kenya.**

