UNIVERSITY OF EDUCATION, WINNEBA

IMPROVING BASIC PUPIL'S PERFORMANCE IN DIGESTION USING CONCEPT MAPPING AS AN INSTRUCTIONAL TOOL, A CASE STUDY

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A DISSERTATION IN THE DEPARTMENT OF SCIENCE EDUCATION, FACULTY OF SCIENCE EDUCATION, SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES, UNIVERSITY OF EDUCATION, WINNEBA IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF EDUCATION IN SCIENCE

DECEMBER, 2016

DECLARATION

CANDIDATE'S DECLEARATION

I, Doe Kplorla Felix hereby declare that this dissertation, with the exception of quotations and references contained in published works which have been identified and acknowledged, is entirely, my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE: ....

DATE...

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this thesis were supervised by me, in accordance with the guidelines and supervision of thesis as laid down by the University of Education, Winneba.

SUPERVISOR: VICTUS SAMLAFO (PhD)

SIGNATURE...

DATE...

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DEDICATION

This dissertation is dedicated to my tender Heavenly Father whose astounding grace and clemency has brought me this far and all members of the DOE-KUMORDZI family.

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ABSTRACT

The research investigated the influence of concept mapping on basic students' performance in the concept of digestion. The study was a case study in Junior High School using concept mapping as an intervention teaching strategy. The study used 25 Junior High students at Danbesco Firm Foundation School in the Ashaiman Municipality, Ghana. The students were tested with teacher–constructed pre-intervention tests consisting of twenty (20) multiple–choice and five (5) detailed theory test items. The mean scores of the students were calculated compared and analyzed using descriptive and paired t-test statistics for testing research questions. The concept maps were scored using Novak and Gowin's scoring system. The results revealed that the performance and concept mapping construction ability of students as well as their content knowledge in digestion improved tremendously. It came out that there exists a significant statistical difference in the achievement in digestion of the post-test after the intervention activity with the use of concept mapping. This showed that concept mapping is an effective instructional technique for improving students' performance in digestion as an aspect of science concept, students' ability to construct good concept maps was also reviewed.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter covers background to the study, statement of the problem, purpose, and significance of the study, limitation, delimitation, and research questions.

1.1 Background to the Study

In the past teaching was just a matter of transfer of sensibly planned information from the teacher to the learner. But new philosophers of science reject the long-established collective view of scientific knowledge, and replaced it with more modern strategies of teaching science so as to make it more significant and meaningful to the learner (Ackerman & Eden, 2001).

Social constructivist view learning as an active process where learners discover principles, concepts and facts for themselves, hence encouraging guesswork and intuitive thinking in learners (Ackerman & Eden, 2001). Students interact with the world by exploring and manipulating objects, wrestling with questions and controversies, or performing experiments. A lot of studies have shown that pupils develop misconception from their interactions with the physical environment (Bodner, 1986; Driver, 1981).

A number of teaching strategies have been derived to improve teaching and learning of science in the classroom (Beyerbach & Smith, 1990). Though the methods may be learner-centred, it may encourage rote learning of science concept. Memorization of whole passages of science textbooks and rote learning contributes very little to our knowledge structures, and therefore cannot underline creative thinking, or novel problem solving. According to Bruner (1960), schools often do a disservice to students because it limits teaching the important information. Learners need time to think analytically about information and simply use their intuition to solve a problem. There is the need to have a strong analytical mind to investigate the information presented. In order to invest in learning, learners must be interested in the concept to be learnt and appreciated its relationship to other concepts.

Science educators are still in search of effective teaching or learning strategies. Concept mapping has engaged the attention of science educators for some time now (Arnaudin, Miztzes, Dunn & Shafer, 1984). Concept maps have been described as information structures that show the core element of conceptual relationship in a hierarchical graphic network of nodes and links using two dimensional spaces. Nodes are labelled boxes that are used to represent concepts. In order to represent the relationships between concepts, nodes are connected by links which are verbs or short phases written on the lines connecting the node (Mintzes, Wandasee & Novak, 2005); Romance & Vitale, 1999). However in this study, in addition to the hierarchical conception of concept maps, the term has been used to include spoke chain and network structures (Chang, 2007; Kinchen, Hay & Adams, 2000).

Concept mapping tool allows students to customize maps in ways that are not possible using paper and pencil. Anderson–Inman and Zeith (1993) compared the use of the concept mapping programmes with paper and pencil approach and found that using this programme encourages revisions to the concept map because deletions, additions, and changes are accomplished quickly and easily. Especially young students who still struggle with handwriting skills benefit greatly from concept mapping tools. Novak (1998) mentioned that the process of concept mapping can reduce the need for rote memory and make learning more meaningful. It facilitates meaningful learning by making conceptual relationships explicit, serving as advance organizers to subsequent learning and highlighting misconceptions and alternative frameworks. Although originally developed as an evaluation tool, it can also be used as a technique for teaching and learning of science. Concept mapping is now widely used in many other aspects as an instructional strategy in education. For instance it has been used as a tool for curriculum development by Edmondson (1995) and Mintzes, Wandasee & Novak (2005)

It is hoped that, it can be used to improve the standard of poor performance in Science Education in Ghana. According to Esiobu and Soyibo (1995), it could be used as an instructional strategy to promote meaningful learning among students at all levels in the educational system. Abrams and Wandersee (1995) employed concept mapping to help teachers to become effective in their teaching. It could also be used as an evaluation tool as described by Lay- Dopyer and Beyerbach (1983), and Moreira (1978).

Concept mapping has been found to be significantly more effective than the traditional or expository texts. Findings from studies concluded that concept mapping tool helped students select, organise and recall relevant information, as measured by post-tests. Students were also able to transfer thinking and learning skills to novel situations and content. In the absence of concept mapping techniques, science education would be difficult. Teachers and students would be frustrated with teaching situation in the classroom (Asan, 2007).

1.2 Statement of the Problem

A number of studies show that when science is taught in the classroom, it is done as if the students have had no prior knowledge in relation to the topic under consideration (Anamuah-Mensah, Otuka & Ngman–wara, (2006). Students may generate or formulate views about their new environment from the moment of birth. Students may have explanations for how the world works prior to their first encounter with formal schooling. Kyle and Shymansky (1989) reported that, as children play with items or engage in activities at home, they construct meaning regarding how and why things behave. The conceptions of students before they are exposed to formal instruction are called preconceptions. When these preconceptions lead to contradictions with the science concepts (as intended by the community), then they are called misconceptions or alternate conceptions.

Students find it difficult since digestion is not an external phenomenon that can be visible but rather happens inside the body. Even though students have a fair knowledge that food is taken into the body through the mouth and comes out through the anus as faeces, student do not really know what actually happens to the food hence it becomes abstract to them. Rote and imaginative learning has become a stressful and difficult method for students to understand science concepts.

A better and more technical instructional method will be a remedy to solve this problem of understanding the concept of digestion. This instructional method will widen the scope of students understanding and improve their understanding of most science concepts.

1.3 Purpose of the Study

The reason for the study was to use concept mapping as an instructional strategy to improve students' performance in digestion.

1.4 Objectives of the Study

The objectives of the study were to

1. Use concept mapping as an instructional approach to improve basic student's performance in digestion.
2. Arouse students' interest in concept mapping as a teaching strategy.
3. Evaluate student's performance using concept maps.

1.5 Research Questions

1. To what extent would the use of concept mapping as an instructional strategy improve on student performance in digestion?

2. How do school students in Danbesco Firm Foundation perceive concept mapping as a teaching strategy?

1.6 Significance of the Study

It is normal that the result of this research would give confidence to science teachers to slot in concept maps into their teaching approach and would aid them to adopt new techniques to assess concept maps. Also the result of this research would aid science teachers at Danbesco firm foundation school to build new skills.

1.7 Delimitation of the Study

This study did not cover all the basic schools in the Ashaiman Municipality in the Greater Accra region of Ghana. The study was limited to only junior high students of Danbesco Firm Foundation as a result to the proximity to the researcher; students of this school find it difficult understanding science concepts. Population of students are relatively low to make it easy for the researcher.

1.8 Limitation of the Study

Limitations are conditions beyond the control of researcher that will place restriction on the validity of the study, according to Best and Kahan (1989).This study also, like any other research work, has limitations.

The collection of significant information to improve quality of study hinges on availability of enough funds, which was limited in the study. Therefore it would have been more financially burdensome if the study was extended to attract many schools in the study area.

The unwillingness of some of the participants to respond to the questionnaires was also likely to affect the quality of the result. Some respondents who willingly collected questionnaires too did not return them on time, and affected the return rate.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter covers the theoretical frame work, concept maps in testing and evaluation, evaluating concept maps, variety in scoring of concept maps, concept mapping tools, methods of scoring concept maps, other methods of scoring concept maps, standard concept map construction method, theory of learning, concepts maps and meaningful learning, conceptual framework of the study.

2.1 Theoretical Framework

Studies have showed that students have problems in understanding key topics of biology such as internal organs, organ systems and processes of their own bodies (e.g Bahar, Johnstone & Hansell, 1999). Toyoma (2000) have evaluated young children awareness of biological transformations associated with eating and breathing and showed that young children seldom refer to biological transformation. Results from an international study in (Reiss et al, 2002) about 15 year-olds students´ (from 11 different countries) understanding of different organ systems showed that the generally best known organs belong to the digestive system, the respiratory and the skeletal system. Tunnicliffe (2004) found that 9-10 year old students had greater difficulties in understanding the excretory systems than the digestive. In this study concept mapping has been used as a tool to identify middle school students' misconceptions about the human digestive system.

A variety of methods such as multiple choice items have been used to examine students' understandings and to detect alternative conceptions in science education and in biology. In Estonia (2002) the science is taught as an integrated subject from the 4th to 6th grade and from the 7th grade biology is taught as a separate subject. Within the primary science syllabus, the subject matter of digestion, respiration is introduced progressively from grade 2nd to grade 4th. In grade 2, pupils are introduced to the concept that living things need air, water and food to survive; they are taught life cycles of plants and animals. Each of the systems (skeletal, digestive, circulatory, respiratory, excretory and nervous) is taught simply at grade 4th. Different aspects with greater depth of understanding are covered in human anatomy lessons in grade 9th. According to the National Curriculum of Estonia, the students should have knowledge about the following content at the end of the 9thgrade (aged 15/16) students should: be able to identify human organs and organ systems and explain the relations between their structure and function; follow the principles of a healthy and sustainable way of life; put the knowledge acquired in biology lessons into practice and to relate it with knowledge acquired from other sources, plan and carry out simple biological experiments; make observations, record the results and present them. (Estonian Government, 2002). In Estonian lessons the human organs are taught individually, but it emphasized that, these organs are parts of systems.

A more traditional approach to teaching is practiced in Estonia. Students are expected to master an understanding of basic concepts, content, and vocabulary in biology. Previous study has showed, that student do not do so much laboratory investigation and experience applying scientific methodology (Henno & Reiska, 2008). The relatively strong "academism" has its positive side and perhaps is one of the possible factors that explain the Estonian students' success in Trends in International Mathematics and Science Study (TIMSS) 2003 and in Programme for International Students Assessment (PISA) 2006. In TIMSS 2003 according to mean scores Estonia ranked sixth in life science and in PISA 2006 fifth in science and on the basis of the mean score on the living systems' scale of scientific knowledge, third after Finland and Hong Kong–China. In TIMSS 2003 it was revealed, that an average of 80% of Estonian students taught by teachers using a textbook as primary basis of their lessons (Martin et al., 2004).

The science topic on human body systems is important for students academically and for understanding and maintaining a healthy lifestyle. Teaching middle school students about the digestive and excretory system can be a challenge for a teacher when the teacher wants to overcome rote learning of facts without a deeper understanding. It is crucial to realize that Estonian current biology textbooks have some shortcomings and cannot be relied upon to provide the inquiry instruction for biology at the middle school level. Teachers must contextualize the role of textbooks within effective instructional practices. The students use their teachers' terminologies and teachers should pay attention to words used in lessons. Acknowledging the difficulties in learning from textbooks, Ulerick (2000) have suggested some alternative ways to use and learn from textbooks. The study suggests using graphic strategies, such as concept mapping and related techniques, to assist students in visualizing how key ideas are related to each other. Given the particular weakness of textbooks in promoting the connections among ideas, this seems particularly an important strategy.

In Estonia homework is an important part of teachers` instructional strategy. Homework assignments can reinforce classroom learning and encourage students to extend their understanding of the biology. In the end of concrete themes/courses the students have summative science tests. Assessment is an integral part of teaching and learning, providing feedback on progress through the assessment period to both learners and teachers. Concept map can be used for showing the topics/contents, in introducing a topic to the students and for evaluation or assessment (Rice, Ryan & Samson, 1998).

Concepts maps are diagrams that indicate the relationship between concept (Moreira, (2006), Novak and Gowin (1984:14).The studies are explicit on open representations of the concepts and propositions someone has on a particular subject. These characteristics, are coherent with the explanation given by the Meaningful Learning Theory (Ausubel, Novak & Hanesian, 1978) about the relation between the structure of knowledge and the manner by which someone organizes it in cognitive in original conceptualization. It is clear then why negotiations of meanings are the dominant perspective in their original conceptualization. It is clear then why these characteristics promoted their immediate acceptance as an important tool for teaching in schools, where evidence shows that their use has always been very successful since the 1970s even though the original use was in research areas (Novak & Gowin, 1984).

More recently, there has been a productive appropriation of these tools in various contexts for all sorts of purposes (Novak, 1998; Canas, Novak & Gonzalez, 2004). However, it is predominantly in the educational field that their application in the original conception – focusing on scientific concepts (Novak, 1998; Novak & Gowin, 1984) - occurs. Therefore, it is this original conception that contributes to the successful use of the tools as instructional, learning, curricular planning and evaluation resources. Due to the specificity of the educational area and to the various uses concept maps may have, there is the option to use the term “map of concept to represent “bi-dimensional diagrams that try to show hierarchical relations between concepts of a certain body of knowledge and exactly the conceptual structure of this body knowledge from which they derive” (Moreira, 1977:10). In sum, we propose the use of “map of concepts” as a more adequate variation of concept maps for the educational context, structured primarily by scientific concepts, when the goal is conceptualization.

Investigations in the educational field have demonstrated that the potential of map of concepts in the optimization of the quality of teaching and learning processes is similar in its various functions, a fact that reveals an existing inter dependence. A good part of these investigations have highlighted the didactic and meta-cognitive potential of these tools, and use it as a basis for characterizing the impact of teaching on the acquisition of conceptual knowledge by those that elaborate these maps. For that reason, the analyses tend to give priority to the difference between the initial maps (as evidence of previous knowledge) and the final ones (as evidence of meaningful learning), and not to the process of learning itself. Therefore, it is not common to find accounts of investigations and/or experiences that have analyzed the learning process in constructing maps of concepts. More specifically, they have not also analyzed the relation between the knowledge represented in these maps of concepts, the evolution of the learning process and the teaching process developed during the experience. It is precisely in this partially unexplored direction that the materials. The study is considered as a pilot study for an ampler project, focuses on understanding the teaching and the learning processes that come about with the elaboration of map of concepts.

The meaningful learning process demands both personal negotiation of the new meanings – when the student compares and negotiates the new piece of information with the ones he has already got -, and interpersonal negotiation, when the student compares and negotiates what he thinks about the topic with the interpretation of the teacher. These steps demand attention (not only from the one who teaches, but also from the one who learns) to central concepts of the topic at hand and to the relations established between them. This aspect justifies the potential of the map of concepts as a facilitative resource for meaningful learning. On the other hand, it validates the coinciding steps in the orientations of specialists in the field to construct such maps: the selection and list of eight to ten key concepts, the ordination of the concepts from the more general to the more specific and the establishment of the vertical and horizontal relations between the concepts using lines and words (connectors) that explain these relations (Novak & Gowin, 1984; Moreira, 1978). From the above discussion, the teaching process can be said to be accomplished.

Concept mapping is a kind of teaching and learning method which was produced by Joseph D. Novak and his students in Cornell University in 1981. The theoretical assumption of the theory was based on Jean Piaget and David Ausebel's acquiring Cognitive Learning Theory. The learning style that Ausebel define as meaningful learning is forming a new conceptual frame in a learner's mind with the interaction of the new and previous concepts.

When the learner is trying to learn a new item, the learner is trying to relate this concept with the previous concepts in his or her mind (Hamachek, 1986). In 1984, Novak, as stated above, with the ideas from Ausebel, improved the concept mapping procedure for students to organize concepts in a meaningful structure. From that point, in the researches of West (1991), Stewart (1982), Novak & Gowin (1984) and Charden (1985), it was seen that concept mapping was an effective teaching method. Later, research related to concept mapping was made in many countries in the world.

2.2 Concept Maps in Testing and Evaluation

Concept maps can be used as teaching method and evaluation method. Maps can typically be used as an evaluation method before and after teaching. Only Lomask (1992) and his friends used concept maps in a large scale in a research, in and they reported the validity and reliability of the examinations with concept maps at the end of their research.

2.3 Evaluating Concept Maps

In order to evaluate concept maps with scores, students should have learned to make concept maps sufficiently. When students learn to make concept maps, their maps can be evaluated by giving scores. McClure and Bell (1990) stated six methods to score concept maps: Unified, Unified with Model Concept Maps, Interrelated, Interrelated with Model Concepts, Structural and Structural Model Concepts.

People who used unified scoring method are trained to test every concept map and the students' understanding of the concept. According to this evaluation, every map is evaluated measurement between 1 and 10 (McClure and Bell, 1990). The interrelated scoring system was adopted from a method which was improved by McClure and Bell (1990). In this method, individual maps composed from independent propositions which were defined in the map, were scored. A proposition is defined as a relationship between concepts, a connection of two concepts highlighted with a connection line. Every proposition was scored between 1 and 3 according to a scoring protocol accepted, the proposition as true. Structural scoring model was adopted from a method which was defined by Novak and Gowin (1984).

2.4 Variety in Scoring of Concept Maps

Scoring concept maps can be used in various ways. One of the most extreme suggestions: Scoring concept maps should be used for students' conceptual improvement's clinical pursuit. White & Gunstone (1992), the most sophisticated scoring system was produced by Novak and Gowin (1984). Propositions: A connection lines that construct the relationship between two concepts and connection words showed?

2.5 Concept Mapping Tools

This section presents descriptions of several of the more prominent tools that allow the construction of Concept Maps. Webster is not currently a commercial tool, but may become one at some point (Gaines & Shaw, 1995). Currently prototype versions are available for educators to test. Webster allows the incorporation of images and other media directly into the Concept Maps, as well as the attachment of resources. Webster also permits the development of sub maps, easy transition of a map section to a sub map, and conversion between map and outline format.

Researchers at the Knowledge Science Institute (KSI) at Calgary had an early interest in the use of Concept Maps and multimedia (Gaines & Shaw 1995). They have developed a number of demonstration programmes, such as KSI Mapper and Concept Map (CMap). These programs are not available for purchase, and some of the capabilities have been integrated into Smart Ideas from Smart Technologies. The Calgary group is interested in the use of Concept Maps in multimedia, for education, collaboration, and for the capture of expert knowledge. The primary contribution to date appears to be the development of a Concept library that will assists developers (CMap) and a demonstration programme (KSI Mapper) (Kremer & Gaines, 1996; Gaines & Shaw, 1989).

Concept map Tools has been extended to aid the user in the construction of Concept Maps. A search feature (Carvalho, Hewett & Canas, 2001) allows the user to locate resources (including Concept Maps) and Web pages that are related to a Map, facilitating the addition of explanatory resources to the Map (all Concepts amps servers in the network are automatically indexed making the search feature very fast). A word Net server allows users to navigate through definitions, synonyms, antonyms, etc. for any word in a Concept Map (Canas, Valerio, Lalinde-Pulido, Carvalho & Arguedas, 2003). Research is being done on “suggester” additions to the software that take advantage of the topology and semantics of Concept Maps to mine the Web and index servers to propose concepts (Canas et al., 2003), propositions, resources, resources, other Concepts Maps (Leake, Maguitman & Canas, 2002), and topics for related Concept Maps (Leake et al., 2003), that will help the user improve their Concept Map. A new recorder feature allows the recording and step-by- step playback of the whole Concept Map construction process which will facilitate the analysis of the Map construction process of their students.

Luckie Concept Connector is a software suite currently in development at Michigan State University. This system allows students to build Concept Maps online, and to receive immediate feedback about their maps based on automatic scoring system that are derived from scoring methods detailed in Novak and Gowin, (1984). The Concept Mapping system is based for online homework and assignment. Team Performance Lab-Knowledge Assessment Tool Suite (TPL-KATS) includes modules for both Concept Mapping and card sorting (Hoeft, et al., 2003). The suite is designed to assist with the assessment of what the developers call "Structural Knowledge". The system computerizes the administration of tasks such as the logging of user actions and the scoring of completed maps. The system provides concepts, and requires that all concepts be used and that all linking lines be labelled. The software includes an administrator mode in which task characteristics such as arrow types, may whether or not participants can add concepts, and the maximum number of concepts, can be specified. The system can also be used to make fill- in maps, to attach multimedia comments to maps, to prompt the user to specify the strength of a relationship, etc.

Several different methods of scoring are provided. The system can produce output files based on mapping tasks and completed Concept Map and characteristics that can be analysed with standard statistics packages.

Chung, Baker and Cheak (2002) describe the most recent version of their knowledge mapping called the Knowledge Mapping Prototype system. Research with their system suggests that users take some time to become proficient. The authoring system allows instructors to define tasks for students by specifying concepts and linking terms, to designate an existing Concept Map as the "expert map" to be used as a scoring criterion, and to assign groups of users and associated group privileges. Their system is a relatively constrained. Concept Mapping system, with predefined concepts and linking terms, although they describe some exploration of user-generated links that helps give meaning to concept under study.

2.6 Methods of Scoring Concept Maps

Although it has been over thirty years since Novak proposed the idea of a concept map in 1997, researchers are still impressed by its versatility in curriculum design (Edmondson, 1995), teaching strategy (Schmid & Telaro, 1990); and evaluation of teaching (Beyerbach & Smith, 1990; Goldsmith, Johnson, & Acton, 1991; novak & Gowin, 1984; Ruiz-Primo & Schavelson, 1996). A concept map consists of a set of propositions, which are made up of a pair of concept maps using pencil and paper has some obvious disadvantages (Chang, Sung, Chen, (2001). These include following:

1. It is inconvenient for teacher to provide appropriate feedback to student during concept mapping.
2. The construction of a concept map is complex and difficult for students, especially among novice students.
3. Concept maps constructed using pencil and paper are difficult to revise.
4. The 'pencil-and-paper' concept map is not an efficient tool for evaluation.

Because of the above difficulties, researchers have built computer-based concept mapping systems to help students construct concept maps more easily (Chang, Sung, and Chen, (2001). Generally speaking, there are three major approaches (Ruiz-Primo &

Schavelson, 1996) for scoring of the concept mapping in science. The first one is scoring a student's mapping component, like propositions, hierarchy, cross links and examples in Novak and Gowin (1984) scheme. The second approach is using a criterion map and comparing student's maps with that criterion map. The closeness index use in Goldsmith, Action and Johnson, (1991) is a typical example. The third approach combines both the component of a generated map and a criterion map.

Although scholars have proposed various scoring schemes for assessing and scoring concept maps, closeness index is that type of the weighted scheme of scoring that takes into account a number of students and teachers instructional needs. Teachers need to determine the importance of each proposition based on their professional knowledge, and each proposition is given a weight ranging from 0 to 1. A concept map which uses weighted propositions is what we term a "weighted concept map". The higher a proposition ranks in importance, the higher the weight it is assigned. The quantitative analysis is a similarity value found in the comparison of concept maps drawn by students and an expert concept map drawn by a teacher. To address this problem, this study proposes the use of a new style of concept map scoring technique called the weighted concept maps which are closeness index and similarity index developed by Goldsmith, John and Acton (1991).

The traditional method of concept map scoring was proposed by Novak and Gowin (1984) and is based on the components and structure of the Concept Map. Novak and Gowin's system assigns points for valid propositions (1 point each) as levels of hierarchy (5 points for each level), number of branching (1 point for each branch), Cross links (10 points for each valid cross-links), specific examples (1 point for each example), the number of hierarchical levels addresses the degree of subsumption, the number of branching indicates progressive differentiation, and the number of cross-links indicates the degree of integration of knowledge.

This scoring technique has proven to be time-consuming, but it does give a great deal of information about the creator's knowledge structure. Some other scoring techniques have been developed as extensions or variations of Novak and Gowin's system. For example, Pearsall, Skipper & Mintzes, 1997) score the same components of the map but weigh them differently.

Some researchers are pursuing the possibility of providing automated assessment of the structured components of concept maps (Abimbola, 1996,). Ruiz- Primo and Shavelson (1996) describe methods to compare a student's map to that of an expert. Expert maps may be constructed by a teacher, a domain expert or a group of teachers or experts. A comparison procedure must also be defined, and range from propositional comparisons to holistic comparisons of structure.

A computerized technique can be used to simplify the comparison of maps, and this possibility has been explored by researchers at Centre for Research on Evaluation, Standard, and Student Testing (CRESST) and other places (Chung, et al., 1997; Herl, et al., 1997). These automated scoring systems are typically based on propositional matching within limited sets of concepts and linking phrases. Holistic or structural comparisons are more difficult to automate, as they often require human judgement.

Some researchers have experimented with the combination of methods based on components and methods in comparisons to a criterion (e.g., “expert”) map. One example of this approach is to use traditional component- based scoring combined with some comparison to a criterion map, by assigning more weight to propositions that were considered to be critical by experts.

Rye & Rubba (2002) reported such a concept map scoring system that was based on components, but which used an expert map to weight propositions in the student maps.

2.7 Standard Concept Map Construction Method

The concept mapping method defined by Novak & Gowin (1984) involves a series of steps as listed below;

1. Define the topic or focus question. Concept maps that attempt to cover more than one question may become difficult to manage and read.
2. Once the key topic has been defined, the next step is to identify and list the most important or “general” concepts that are associated with that topic.
3. Next, those concepts are ordered from top to bottom in the mapping field, going from most general and inclusive to the most specific, and an action that fosters the explicit representation of subsumption relationship (ie, a hierarchical arrangement or morphology).
4. Once the key concepts have been identified and ordered, links are added to form a preliminary concept map.
5. Linking phrases are added to describe the relationships among concepts.

6. Once the preliminary concepts map has been built, the next step is to look for cross links, which link together concepts that are in different areas or sub-domains on the map. Cross-links help to elaborate how concepts are interrelated.
7. Finally, the map is reviewed and changes to the structure or content are made.

2.8 Theory of Learning

According to Bruner (1983), he explains the idea of learning as: most often, figuring out how to use what you already know in order to go beyond what you currently think. There are many ways of doing that. Some are more intuitive, others are formally derivational. But they all depend on knowing something structural about what you to go beyond your level of initial understanding.

As stated by Bruner (1983), learning is an active social process where students construct new ideas or concept based on current knowledge. The student selects information, originates hypotheses, and makes decisions in the process of integrating experiences into their existing mental constructs. This is similar to Information Processing Theory (IPT), where the learner selects and transforms newly-acquired information into meaning. By organizing the cognitive structure, using scheme and mental models, the learner can provide meaning and organization to experiences and go beyond the information given.

Bruner (1983) describes learning as what happens when one applies previous learning and life experience to the completion of a new task or the understanding of an unfamiliar concept. He also maintains that if given the proper organization and facilitation of the new information, a person at any age can learn, even if it only the most basic understanding of the material being taught. This type of scaffolding allows learners to use all of their biological as well as cultural tools in order to build their understanding of a task or topic.

Again, he maintains that learning follows a similar sequence no matter the age of the learner.

Brunner (1983) argues that there are three ways in which human beings interpret the world around them. In learning, we move through each stage to develop a more comprehensive understanding of what we are experiencing, but these stages are very integrated, occurring together in some cases, and only loosely sequential as one translates in to other. In these three stages which are enactive (action-based). Iconic (image based) and symbolic (language- based). Learners faced with new information move through each stage of representation as they grasp the concept of what is being learned.

Both Jean Piaget (Bruner's mentor) and Bruner (1983) himself demonstrate how thought processes could be subdivided into distinct modes of reasoning. While Piaget related each mode to a specific period of childhood development, Bruner saw each mode as dominant during each development phrase but present and accessible throughout. "Although Bruner derived these stages from Piaget, Bruner, unlike Piaget, did not contend that these stages were necessarily age-dependent"

In a related development, Brunner (1983) suggests that the approach taken with regards to structure in learning should be a practical one. "The teaching and learning of structure, rather than simply the mastery of facts and techniques, is at the centre of the classic of transfer. If earlier learning is to render later learning easier, it must do so by providing a general picture in terms of which the relations between things encountered earlier and later are made as clear as possible". He also suggests that interest in the concept to be learned is the best stimulus for learning, rather than external goals such as grades or competitive advantage.

Students build knowledge based on previously learned information in a spiralling fashion, which enables learners to connect prior schematic concepts. In a scholastic context, Bruner described this process as a spiral curriculum. Here he describes it: "the idea that in teaching a subject you begin with an intuitive account that is well within the reach of a student, and then circle back later to a more formal or highly structured account, until, with however many more recycling are necessary, the leaner has to master the topic or subject in its full generative power." For example, a student first learns how to add. Later the student learns how to multiply and connects the idea of multiplication as repeated addition. This is how students connect prior schemata with new information.

In 1983, Bruner maintained that knowing is a process, therefore his work focuses on the importance of understanding the structure of the subject being studied and the need for active learning as the basis for understanding. Bruner (1983) argues that when learners are presented with perplexing situations they will want to figure out the solution. This is the basis for discovery learning theory. Discovery learning is an inquiry- based, constructivist learning theory that takes place in problem solving situations where the learner draws on their own past experience and existing knowledge to discover facts and relationships and new truths to be learned. Students interact with the world by exploring and manipulating objects, wrestling with questions and controversies, or performing experiments. That is why the structure of learning is more important than simply memorizing facts and mnemonic. Learners should be able to make connections between concepts using appropriate concept relationships. According to Bruner (1983), schools often do a disservice to students because it limits teaching the important information and not simply use their intuition to solve a problem. There needs to be an analytical process to investigate the information presented. In order to be invest, learners must be interested in the concept to be learnt and appreciate its relationship that can be used in the teaching and learning situation.

2.9 Concepts Maps and Meaningful Learning

Concept Maps are graphical representation of knowledge that are comprised of concepts and the relationships between them (Canas et al., 2003,). Concept Mapping is grounded in a sound cognitive learning theory.

According to Ausubel's Theory (Ausubel, 1968; Ausubel, Novak, & Hanesian, 1978), new knowledge can be learned most effectively by relating it to previously existing knowledge. Concept Maps may be viewed as a methodological tool of Assimilation theory that displays fundamental elements of the theory such as subsumption, integrative reconciliation and progressive differentiation. The idea of a concept is defined as a perceived regularity in events or objects, a record of events or objects, designated by a label, symbols (Canas et al., 2003).

In principle, Concepts are usually enclosed in circles or boxes and relationships between concepts are indicated by connecting lines that link them together. Words on the linking line specify the relationship between the concepts. Another characteristic of Concept Maps is that the concepts are represented in a hierarchical fashion with the most inclusive, most general concepts at the top of the map and the more specific, less general concepts arranged below. The hierarchical structure for a particular domain of knowledge also depends on the context in which that knowledge is being applied or considered. Therefore, it is best to construct Concept Maps with reference to some particular question that seeks to answer, which we have called a focus question. The Concept Map may pertain to some situation or event that is understand through the organisation of relevant knowledge, thus providing the context for the Concept Map.

Also important and characteristic of Concept Maps is the inclusion of “cross-links”. These make explicit relationships between or among concepts in different regions or domains within the Concept Map Cross-links show how a concept in one domain of knowledge represented on the map is related to a concept in another domain shown on the map. In the creation of new knowledge, cross-links often represent creative leaps on the part of the knowledge producer. A final aspect of the structure of Concept Maps is the inclusion of specific examples of events or objects on the links towards nodes, as these can help to clarify the meaning of a given concept.

The fundamental idea in Ausubel’s cognitive psychology is that learning takes place by the assimilation of new concepts and propositions into existing concept and propositional frameworks held by the learner. This knowledge structure as held by a learner is also referred to as the individual’s cognitive structure.

One of the most fundamental goals in the use of Concept Maps is to foster meaningful learning. Ausubel made the very important distinction between rote learning and meaningful learning and stated that meaningful learning requires three conditions:

1. The material to be learned must be conceptually clear and presented with language and example relatable to the learner’s prior knowledge. Concept Maps

can be helpful to meet this condition, and by identifying general concepts prior to instruction in more specific concepts, and by assisting in the sequencing of learning tasks though progressively more explicit knowledge that can be anchored into developing conceptual frameworks.

2. The learner must possess relevant prior knowledge. This condition can be met after age 3 for virtually any domain of subject matter, but it is necessary to be careful and explicit in building concept frameworks if one hopes to present detailed specific knowledge in any field in subsequent lessons. We see, therefore, that conditions (1) and (2) are interrelated and both are important.
3. The learner must choose to learn meaningfully.

Another very powerful use of Concept Maps is as an evaluation tool, thus encouraging students to use meaningful-mode learning patterns (Novak & Gowin, 1984; Novak, 1998; Mintzes, Wandersee & Novak, 2000). Concept Maps are also effective in identifying both valid and invalid ideas held by students. They can be as effective as more time- consuming clinical interviews for identifying the relevant knowledge a learner possesses before or after instruction (Edwards & Fraser, 1983).

There is an important relationship between the psychologies of learning, as we understand it today, and the growing consensus among philosophers and epistemologists that new knowledge creation is a constructive process involving both our knowledge and our emotions or the drive to create new meanings and new ways to represent these meanings. Learners struggling to create good Concept Maps are themselves engaged in a creative process, and this can be challenging too many, especially to learners who have spent most of their life learning by rote. Rote learning contributes very little at best to our knowledge structures, and therefore cannot underlie creative thinking or novel problem solving.

Concept Mapping is an excellent studying–exercise for the promotion of creative thinking and identification of new problem-solving methods.

2.10 Conceptual Framework of the Study

One approach to understanding how teachers guide students' science learning is grounded in a situated approach to understanding learning. Specifically, learning is view as the gradual participation in the socially and historically organized practices of a community which bring a permanent change in behaviour (Lave, Wenger & Rogoff, 1991). A situated perspective is useful for understanding how students learn to participate in the disciplinary practices of science because. It draws attention to how classroom activities are organized and how participants positioned language and other cultural artefacts intended to support students' engagement in the central practices of science (Vygotsky, 1980). In classrooms, a teacher' decisions about how an activity is introduced, the teaching strategy to be used, and how much and what type of guidance that will be provided during an activity affect how students are able to participate in science (Roth & Bowen, 1994).

Classroom discourse patterns that focus on the authority of the teacher are limited in enabling students to become the kinds of people who explore ideas, ask questions, create connections and associations between ideas and experiences, and think and act critically. The important role of the learner in influencing and at times leading instructional interactions should not be overlooked: the give and take interaction between learners and teachers is especially relevant for our discussion of science activities in which students' ideas and insights form the basis of instruction.

Students are expected to have many and varied opportunities for collecting, sorting and cataloguing: observing, note-taking and sketching: interviewing, polling and surveying: and using hand lenses, microscopes, thermometers, cameras, and other common instruments. They should dissect: measure, count, graph and compute: explore the chemical properties of common substances, and systematically observe the social behaviour of human and other animals. Among these activities, none is more important than measurement, in that figuring out what to measure, what instruments to use, how to check the accuracy of measurements, and how to configure and make sense out of the results are at the heart of much of science concept development and understanding.

In reality, what conceptual understandings students achieve in a new learning activity is highly dependent on what they already know. Concept Maps have been used to examine students' prior knowledge, to track a students' progression of knowledge throughout a course, it also compare students at different levels of knowledge etc (Adamczyck & Willson, 1996: Hoz, Bowman & Kozminsky, 2001: Pearsall, Skipper & Mintzes, 1997: Songer & Mintzes, 1994).

CHAPTER THREE

METHODOLOGY

3.0 Overview

The chapter covers design of the study, population and sample procedure. It further discusses the instrumentation, reliability and validity of the instruments, data collection procedure, with data analysis.

3.1 Research Design

This research was an action research which aimed at improving student' learning and understanding of concepts in Biology. Also according to Alhassan (2006), an action research is a problem solving research devoted to the solution of an immediate problem in a given situation. In other words, action research is a research directed to find ways of solving practical problems of practitioners. An action research again, fosters an informed decision- making and systematic problem solving among practitioners. The process of this study involves identifying a problem in the college, putting in appropriate intervention to solve the problem.

Action research has been found useful for executing this study which aims at using concept mapping as instructional strategy to help basic students to overcome the difficulty they have in learning digestion at Danbesco Firm Foundation Junior High School. This research study design made use of pre- and post-treatment test as well as students' questionnaire items.

3.2 Population

A research population is a large well defined collection of individuals or objects having similar characteristics (Alhassan, 2006). There are two types of population, the target population and the accessible population. The target population which is also known as the theoretical population refers to the group of individuals to which researchers are interested in generalizing their findings. It is also known as the study population. Whilst the accessible population also known as the study population is the population in research which the researchers can apply their findings.

The target population for this study was junior high students of Danbesco Firm Foundation School in the Ashaiman Municipality. The school has a population of about 200 students, with 75 boys and 125 girls. It has pre –school, basic 1-6, and junior high 1-3. The accessible population were JHS 3. The students were between the ages of 11 to 15 with an average age of 13 years.

3.3 Sampling Technique

A sample is a finite part of a statistical population whose attributes are studied to gain information about the larger population (Webster, 1949). The sample for the study consisted of 25 students made up of 15 girls and 10 boys by purposive sampling technique. The sample was selected to include students of interest. (Frankel & Wallen, 2000).The school was selected due to familiarity, proximity to the researcher and willingness of the school and the students to participate in the study.

3.4 Instrumentation

The instruments used were pre-test and post-test and students' questionnaire. These were developed by the researcher. The pre-test consisted of 20 objective test items and 5 content tests on digestion. The post–test also consisted of 20 objective test items and 5 subjective tests on digestion. The objectives test items were different for both pre-test and post-test. The two tests were used to measure achievement. The first test (Appendix A) measured students' prerequisite knowledge in digestion. The second test (Appendix B) measured students' achievement at the end of the study. According to the Lehman, Carter, and Kahle (1985), a test can be at the comprehension level and above in order to measure meaningful learning. The scores of the pre-intervention and post intervention objectives and subjective test items were used in the analysis of the research questions.

All the items used in the students' questionnaire were close-ended (Appendix C). The questionnaire items were chosen to gather data on findings on the effectiveness of concept mapping as an instructional strategy integration and re-enforcement in science education.

Outweighing the merits and demerit of the questionnaire and other research instruments, the sample size and the time available for the research, the researcher is of the view that adopting questionnaire as an instrument for the study would be appropriate. It was probably the most common data collection instrument used in educational research which is more familiar to respondents (Muijs, 2010). However, the disadvantages are that questionnaires often have low response rates and cannot probe deeply into respondents' opinions and feelings Fraenkel & Wallen, 2000; Alhassan, (2006).

Close ended items made respondents to choose between answers of the researcher. The researcher used closed ended questionnaire items because respondents re more inclined to answer close-ended items (Oppenheim, 2000).

The questionnaire consists of two main parts (A and B). Part (A) contains four items that elicit information on the personal background of the participants such as respondents' gender, age and highest academic qualification. The second part (B) consists of thirteen items that elicited information on respondents' perception of concept mapping teaching and learning of digestion.

3.5 Scoring of the Instrument

A Likert scale with five (Strongly Agree (SA), Neutral (N), Agree (A), Disagree (D), and Strongly Disagree (SD) was used to score the questionnaire items. The items on the questionnaire were positively and negatively worded in order to minimize participant satisfying responses. For positively worded items A Likert scale was used to score the questionnaire items because it looked interesting to respondents and people often enjoy completing a scale of this type (Muijs, 2010). Again Likert scale is easier to construct, interpret and also provide the opportunity to compute frequencies and percentages as well as statistics such as the mean and standard deviation of scores. This in turn, allows for a more sophisticated statistical analysis such as the t-test. (Fraenkel & Wallen, 2000; Muijs, 2010). Additionally, Likert scales are often found to provide data with relatively high reliability (Oppenheim, 1992; Fraenkel & Wallen, 2000).

Variable scores were obtained by averaging the numerical values of the responses for the related items on the variable. A mean score near 5 was considered a very high level of knowledge, that is between 3 and 4 and a score between 1 and 2 was regarded as the low level of knowledge. For the perception of Effectiveness of concept mapping in the instructional process, a mean score of 3.0 represents a 'neutral position'. This value representing neutral position was used in this study to indicate a position that respondents neither agree nor disagree with a statement. A mean value below 3.0 gives a general picture of disagreement while a mean value above 3.0 gives a general picture of agreement with a statement. However, it must be noted that, a mean value above or below 3 does not imply that all respondents agreed or disagreed with a statement, but the majority were. Agreement or disagreement to a statement was therefore considered on majority basis. The percentages of the participants' response to the Likert scale items were also used to indicate the extent to which participants agreed or disagreed with the items.

3.6 Reliability and Validity

The issues of reliability and validity are vital in research because credibility of research results depends on the reliability of the data, methods of data collection and also on the validity of the findings (Lecompte & Preissle, 1993; Cohen, Manion & Morrison, 2000). Fraenkel and Wallen (2000) cautioned that it is possible to design a questionnaire that is reliable because the responses are consistent, but may be invalid because it may not measure the concept it intended to measure.

Validity of an instrument is the extent to which the items in an instrument measure what they are set out to measure, while reliability looks at the extent to which items in an instrument generate consistent r1esponses over several trials with different respondents in the same setting or circumstance. (LeCompte & Preissle, 1993; Cohen, Manion & Morrison, 2000; Fraenkel & Wallen, 2000).

The validations of the content material as well as the student and teacher Concept mapping Instructional Strategy Package were carried out through the assistance of the three moderators. The moderators were asked to determine the appropriateness of the content material and to find out whether the instructional package can be used to achieve the purpose of the study.

3.7 Data Collection Procedure

The data for the study were obtained from the questionnaire the researcher administered after the intervention to solicit their views on concept mapping. The questionnaires were given to the sample population that is junior high students to complete. Arrangement was made for students to stay in their classrooms after classes to complete the questionnaires under the researcher's supervision to ensure that the questionnaire were explained and the students were encouraged to respond to the items objectively.

3.8 Pre- intervention Test

An objective test consisting of 20 objective questions and 5 subjective tests on digestion was administered to the students as pre-intervention test. The pre-test was used to group the students into mix-ability groups. Test questions can be found in Appendix A.

3.9 Intervention

The students were put into groups of 5. After this treatment, a post intervention test was conducted using another 20 objective and 5 subjective test to assess the progress of the students and their understanding of the content of digestion.

The students were given tuition on how to construct concept maps for 3 lessons lasting 30 minutes each. Videos and charts were used to help students' understanding in this lesson, a well-constructed lesson note was used in this lessons as shown in Appendix D.

During these lessons, the students were made to individually construct micro concept maps on the content of each lesson. The students were to construct a detailed sample of concept maps (Figure 1) on digestion. The groups' concept maps in the post tests were scored using concept mapping scoring rubrics and gathered as data for the study. The researcher developed an expert concept map and a scoring rubric to monitor students when constructing concept maps.

3.10 Post Intervention

After this treatment, a post- intervention test was conducted using another twenty objective questions and 5 subjective items to assess the students' progress and their understandings of digestion. The students were further asked to construct detailed sample of concept maps on the treated digestion. The student's concept maps in the post-tests were scored using the qualitative classification put forward by Kinchin, Hay and Adams (2000) scoring technique, and gathered as data for study. The students' questionnaire items were administered after the post- treatment test.

3.11 Data Analysis

The data for the study were analyzed using SPSS software. Two statistical tools used to analyze the data were the descriptive statistics and inferential statistics software. Finding of function was used to organize students' score of the test into means and standard deviation.

It was also used to organize students' responses on the questionnaire item into frequency counts and converted into percentages. The pair sample t-test statistical tool was used to test or established whether there was any significant difference between the students mean of the two set of tests conducted.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

The chapter covers a general layout of a concept map on digestive system may by the students and the findings on the effect of concept mapping as an instructional strategy on student's performance in digestion and students views on concept mapping as a teaching strategy.

Descriptive statistics was used to organize the data into frequency counts and percentages while the T-test statistical tool was used to establish whether there was a significant difference between the pre and post- test of students score.

4.1 Students' Concept Map

Concept mapping was used in the science classroom to assess students' conceptual framework by analysing the ways students organize and present knowledge. It was intended to determine whether the use of concept maps in the classroom as an assessment tool to organize notes on a specific topic (digestion).

Students were grouped in a group of fives and five different concept maps were drawn and the groups came together to draw one common concept map.

An analysis of the concept map created by the junior high students in form three in science lesson under digestion lesson has revealed that participants demonstrate an understanding about how digestion takes place in humans, how the digestive system is composed of the alimentary canal and accessory organs. The accessory organs are the pancreas, liver and gall bladder.

The digestive system begins from the mouth through to the oesophagus to the stomach, small intestine, large intestine and ends at the anus. All these various parts of the digestive system has specific functions they perform and terms associated with them: (ingestion, peristalsis, digestion, absorption, assimilation and egestion).

The various enzymes found in the different part of the digestive system and the types of foods they act on and what the by-product are.

The concept maps were structured hierarchically. The best constructed concept map is presented on figure 1 and has several cross-links.

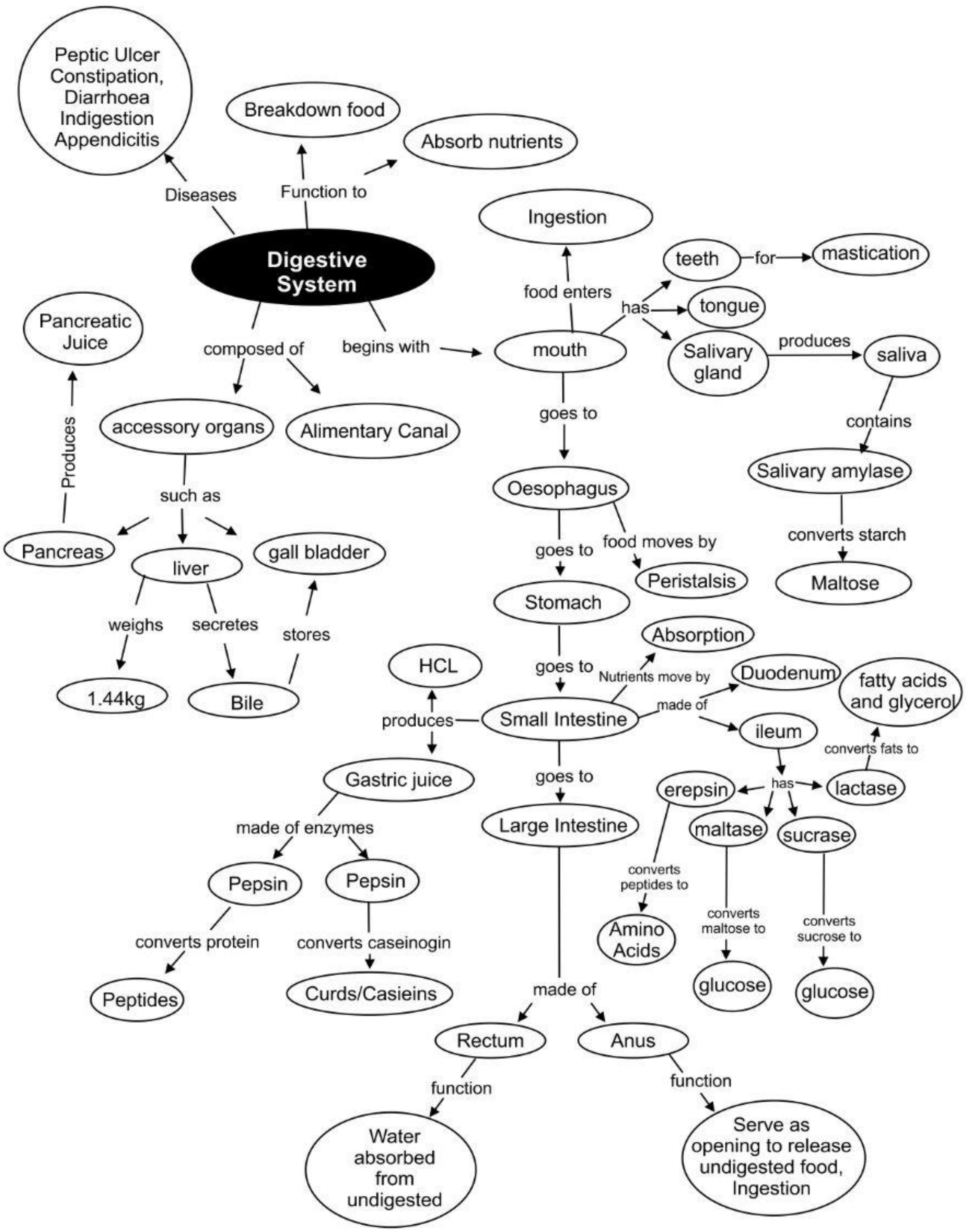

Fig 1: Students' Concept Map

4.2 What is the effect of concept mapping as an instructional strategy on students' performance in digestion?

This question sought to find out whether there was significant difference in the mean score of the students tests. The outcome is a t-test shown in Table 1 and 2.

Table 1: The mean score of the pre-test and post-test of students

Variable	No. of Students	Mean Score	Std. Deviation	P-value
Pre test	25	22.72	6.961	0.000
Post test	25	32.36	6.940	

Table 1 which shows the descriptive statistics of the marks of the students before the adoption of the concept mappings as a teaching strategy indicates that the mean marks for students before the introduction of the use of concept maps was 22.72. The mean scores or marks then rose to 32.36 after the adoption of the intervention strategy. It was observed from the mean scores of the pre-test and post-test that there have been some improvements in the performance of the students. The paired sample t-test was used to determine whether the improvement in the performance of the students would be significant.

The results indicates that there is no significant difference ($p < 0.05$) between the men scores of the students before and after the introduction of the use of concept maps in teaching. Although there was no statistical difference between the mean scores there was a clear difference in the absolute mean scores.

4.3 How do JHS students in Danbesco Firm Foundation School perceive concept mapping as a teaching strategy?

This question sought to find out the perception on students on concept mapping as an instructional strategy. Questionnaire was used to collect data, and organized into standard deviation and mean. Frequency count was converted into percentages as presented in table 2.

Table 2: Views of JHS students on the effectiveness of concept mapping in the teaching and learning of digestion

Item	SA N(%)	A N(%)	N N(%)	D N(%)	SD N(%)
1. I was more enthusiastic and motivated during the use of concept maps in the teaching and learning of digestion.	15(60)	5(20)	3(12)	1(4)	0(0)
2. The use of concept maps an instructional technique is an effective strategy for students of all abilities.	14(54)	2(8)	5(20)	3(12)	1(4)
3. The use of concept maps strategy in instruction reduces my personal interaction with my colleagues.	3(12)	3(12)	6(24)	9(36)	4(16)
4. When using concept maps, I will be able to better understand the use of prepositions and phrases for sentence construction in English language.	10(40)	10(40)	2(8)	2(8)	1(4)
5. The use of concept maps provides a means of expanding and applying what has been taught in class.	20(80)	2(8)	2(8)	1(4)	0(0)
6. When using concept maps to explain un-grasped concepts to a colleague, my role will be a facilitator of their learning.	16(64)	5(20)	2(8)	2(8)	1(4)
7. The use of Concept mapping instruction would promote the student understanding of concepts and do away rote learning memorization of facts.	17(68)	4(16)	3(12)	1(4)	1(4)
8. Concept maps hinder students' ability with learning tasks.	1(4)	1(4)	2(8)	3(12)	18(72)
9. The use of Concept mapping instruction is an effective means of helping students to understand relationships among concepts.	18(72)	3(12)	2(8)	2(8)	0(0)
10. The use of Concept mapping instruction would make the student feel more involved and to cooperate more on projects.	16(64)	2(8)	4(16)	2(8)	1(4)
11. The use of Concept maps for learning almost and always the personal undue forgetfulness and recitation of mnemonics as well as acronyms during examinations.	17(68)	3(12)	2(8)	2(8)	1(4)
12. Concept maps for instruction would enable me to interact more with other students to promote group discussion.	16(64)	5(20)	3(12)	1(4)	0(0)
13. I feel the use of concept maps for instruction would affect my learning during my private time in a positive way.	18(72)	4(16)	2(8)	1(4)	0(0)

Table 2 indicates that majority of the participants 20 (80%) were positive in their response with item 1, which indicates the; "integration of concept mapping in science teaching will elicit student interest in science concepts.'

For item 2, 16 (64%) of the 25 respondents were positive that concept mapping is an effective tool for improving the ability and knowledge of students. This was supported by two students who asserted that *"Concept mapping can help improve the technical abilities of individual students"*

With item 3 which was negatively worded 13 (54%) disagreed and strongly disagreed with the statement whiles 44% of the respondents established that concept mapping integration reduces their personal interaction with colleagues. The students were again asked whether the use of concepts maps for learning almost reduced their personal undue forgetfulness and recitation as well as the use of acronyms during examination.

In item 4, 20 (80%) of the participant agreed and strongly agreed that when using concept maps, there will be a better understanding and use of prepositions and phrases for sentence construction in English language.

For item 5, 22 (88%) of the participants agreed and strongly agreed that the use of concept maps provides a means of expanding and applying what has been taught in class and a participant indicated that; *the enforcement and integration of concept mapping in science will go a long way to affect the subject positively even though there may be some lapses. It will help us to have an in-depth understanding of most topics in science teaching and learning of Science.*

With item 6, 21 (84%) of participants agreed and strongly agreed that when using concept maps to explain un-grasped concepts to a colleague, my role will be a facilitator of their learning.

For item 7, 21 (84%) of the participants once again agreed and strongly agreed which indicated that, most of the students Concept mapping instruction would promote the student understanding of concepts and do away rote learning. This was indicated by some students that: *Using Concept maps for instruction would promote our understanding of concept and do away with rote learning during examinations and tests in schools, this will arouse our cooperation and confidence in the study of science in class.*

In item 8 which is also negatively worded had 18 (72%) of the students strongly disagreed, this shows that less than half of the respondents perceive that Concept maps hinder students' ability with learning tasks.

Notably with item 9, the significantly high number of 21 (84%) of the participants agreed and strongly agreed that the use of Concept mapping instruction is an effective means of helping students to understand relationships among concepts.

With item 10, 18 (72%) of the respondents agreed and strongly agreed that the use of Concept mapping instruction would make the student feel more involved and to cooperate more on projects.

For item 11, 20 (80%) of the participant agreed that the use of Concept maps for learning always reduced personal undue forgetfulness and recitation of mnemonics as well as acronyms during examinations, as one respondent indicated that concept mapping is a tool for quick revision.

For item 12, 21 (84%) of the participants agreed and strongly agreed, which indicated that Concept maps for instruction would enable them to interact more with other students to promote group discussion.

With item 13, 22 (88%) of the respondents felt the use of concept maps for instruction would affect learning during private time in a positive way.

With all these positive responses received from the participant it indicates that concept mapping as an instructional strategy will help science instruction and have a positive impact on individual students in their private studies.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND COMMENDATIONS

5.0 Overview

This chapter present the summary of the study, findings, conclusion and educational implication. The chapter ends with recommendations.

5.1 Summary

The objectives for which this study was carried out were in two folds. The first was to look at the use concept mapping as an instructional approach to improve basic student's performance in digestion and the second is to arouse students' interest in concept mapping as a teaching strategy, the third is to evaluate student's performance using concept maps. The study made use of a sample of twenty five (25) made up of fifteen (15) girls and ten (10) boys. A questionnaire which was designed was used as an instrument for the collection of data on the perception of students in the use of concept maps as an instructional strategy. The second approach by which data for the study was collected through the conduction of classroom exercises on digestion after the concept was introduced to the students.

5.1 Main Findings

From the study majority of the students were enthusiastic and motivated during the use of the concept maps. On the issue of whether the use of the concept maps for learning almost always reduces their personal undue forgetfulness and recitation of mnemonics as well as acronyms during examinations the study came out that majority of students were positive in the response.

Another finding was that majority of the students claimed that, the use of concept mapping as a tool for teaching them did not reduce their interaction with their colleagues but rather encourage them to study in groups.

A further finding were majority of the students claimed the use of concept maps instructional strategy would promote their understanding of concepts and do away with rote learning. It has also helped them to understand the relationship among concepts.

In the view of the students the use of concept maps is a means through which majority of them have expanded and applied what have been taught. Finally, it came out from the study that the use of concept maps did not in any way hinder their ability with leaning task such as writing, analysing data or solving problems.

5.3 Conclusion

In finding out the effect of the use of concept mapping as instructional strategy on students' performance, it can be concluded the although there was an improvement in the absolute mean scores of the participant after the introduction of concept maps the difference was not statistically significant.

Danbesco students said they were excited during the teaching periods when the concept was used. The participants claimed the use of the concept maps has aided them in attaching new ideas and establishing links between old and new materials that they were taught. The resultant of these were that it had reduced the personal undue forgetfulness and recitation of mnemonics as well as acronyms during examinations. Another conclusion was that it has promoted group discussion among students.

A further conclusion drawn was that, concept maps can be used as an effective teaching strategy for students of all academic abilities. This was so because in the view of the participants it afforded them the opportunity to expand and apply whatever they have been taught in class.

5.4 Educational Implication of the Study for Science Teaching

The result of the study revealed that the participants were enthusiastic and motivated during the use of concept maps. On the issue on whether the use of concept maps for learning almost always reduce their personal undue forgetfulness and recitation of mnemonics as well as acronyms. The participants were impressed about the teaching strategy. Another finding was that majority of the students claimed that, the use of concept mapping as a tool for teaching them did not reduce their interaction with colleagues but rather encourage them to study in groups. This implies that concept mapping promote group work which is one of the learning strategies which help low achievers to learn from higher achievers. It is therefore appropriate that science teachers prepare their science instructions using concept mapping instruction strategy.

5.5 Recommendations

The following recommendations were on the findings from the study:

1. The use of concept mapping in teaching scientific concepts in schools should intensified and encouraged at Danbesco Firm Foundation School and in-service training should be organised for all JHS teachers in the school.
2. JHS students at Danbesco Firm Foundation School should be introduced to concept map construction as a tool for meaningful learning. It would enable students to understand meaningfully the numerous interrelated biology concepts.

Concept maps could serve as memory aid for students, and gain serves as a revision tool.

3. It was also found in the study that JHS students generally have positive perception about the pedagogical usefulness of concept mapping in the teaching and learning process. Therefore, it is re4commended that all teachers teaching other subjects could also use concept mapping as an instructional strategy.

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APPENDIX A

PRE-TEST

SECTION A

1. Which of the following animals is not a non- ruminant?

   a. Rabbit b. cow c. Sheep d. Goat

2. Bile is produced in which organ?

   a. Liver b. large intestine c. Stomach d. Caecum

3. Which of the following is not a monogastric animal?

   a. Goat b. Rat c. Rabbit d. Chicken

4. Which of the following enzymes is a protease?

   a. Pepsin b. Lipase c. Maltase d. Amylase

5. Absorption takes place in the

   a. Duodenum b. Ileum c. Colon d. Buccal cavity

6. Protein digestion begins in the

   a. Buccal cavity b. Stomach c. Gullet d. Ileum

7. ………………… is the removal of undigested food materials from the body.

   a. Digestion b. Egestion c. Assimilation d. Removal

8. …………………… stores the bile produced by the liver.

   a. Gall bladder b. Anus c. Stomach d. Pancreas

9. Digestion of carbohydrate begins in the……………………

   a. Stomach b. Mouth c. Ileum d. Intestines

10. Salivary amylase is produced in the ……………………..

    a. Ileum b. Colon c. Mouth d. Stomach

11. The contraction and relaxation of the oesophagus to allow food passage is known as

    a. Swallowing b. peristalsis c. Expansion d. Contraction.

12. The normal weight of a human liver is

    a. 1.44-1.66kg b. 2.0-3.4 kg c. 0.44-1.44kg d. 1.66 -2.44kg

13. The largest organ in the human body is

    a. Skin b. Stomach c. heart d. Eye

14. The liver is located in the ………………. Cavity.

    a. Abdominal b. Pelvic c. Chest d. Neutral

15. The gastric gland secretes pepsin and …………………

    a. Lipase b. Trypsin c. Rennin d. Erepsin

16. The end product of protein is

    a. Glucose b. Amino acid c. Fatty acid and glycerol d. Casein

17. HCls is secreted by the

    a. Gullet b. Gizzard c. Stomach d. Duodenum

18. Which of the following is not a digestive enzyme?

    a. Trypsin b. Maltase c. Salivary amylase d. Bile

19. Undigested food substances are stored in the

    a. Stomach b. Small intestine c. Large intestine d. Gall bladder.

20. The linning of the oesophagus secretes ……………………… For the lubrication of the food.

    a. Lipase b. Casein c. Mucus d. Insulin

SECTION B

1. State the function of the following
   a. Liver
   b. Pancreas
   c. Stomach
   d. Buccal cavity
2. Name three structures that secrete digestive enzymes.
3. State four (4) ways of preventing constipation
4. Define enzymes and state three characteristics of enzymes.
5. What is peristalsis? How does it help in digestion of food?

ANSWERS

1. A	11. B
2. A	12. A
3. A	13. B
4. A	14. A
5. B	15. C
6. B	16. B
7. B	17. C
8. A	18. D
9. B	19. C
10. C	20. C

APPENDIX B

POST-TEST

SECTION A

1. Which of the following food substances is not digested in the human body?

   a. starch b. Vitamin c. Protein d. Fats and oils

2. The end product of starch digestion in humans is called

   a. Glycogen b. Glucose c. Amino acids d. Fatty acids and glycerol

3. All the following organs are associated with the alimentary canal in man except?

   a. Stomach b. Liver c. pancreas d. heart

4. In which part of the digestive system of man does carbohydrate digestion begin?

   a. Mouth b. Stomach c. Ileum d. Colon

5. Undigested food comes out of the human body through the

   a. Anus b. reproductive organs c. Colon d. Ileum

6. Which of the following is not a digestive enzyme?

   a. Mouth b. Rennin c. Thyroxin d. Pepsin

7. In humans, protein digestion begins in the

   a. mouth b. Stomach c. Liver d. Colon

8. The small intestine in humans consist of

   a. The duodenum and ileum b. the duodenum and liver

   c. ileum and colon d. the duodenum and the colon.

9. The process of taking in food into the body is known as

   a. Digestion b. Egestion c. Absorption d. Ingestion

10. The irregular and difficult passage of feaces is known as

    a. Indigestion b. Constipation c. Assimilation d. Egestion

11. Indigestion can be caused by the following except

    a. lack of roughage in diet b. eating to fast

    c. exercising the body regularly d. over eating

12. In which of the following is undigested food stored in humans?

    b. Rectum b. Colon c. Ileum d. Liver

13. In which organ of the digestive system of man is the gall bladder found?

    a. Stomach b. Liver c. Pancreas d. Large intestine

14. Which of the following produce bile?

    a. Liver b. Pancreas c. Gall bladder d. Salivary gland

15. The salivary glands in the mouth secretes

    a. Gastric juice b. Bile c. Saliva d. Pancreatic juice

16. Which of the following enzymes is found in gastric juice?

    a. Ptyalin b. Renin c. Lipase d. pancreatic amylase

17. The breakdown of complex food substances into simpler units is known as

    a. Digestion b. Egestion c. Ingestion d. Constipation

18. Which of the following is the function of bile in digestion?

    a. It breaks down carbohydrate into glucose

    b. It converts excess protein into amino acids

    c. It converts fats and oils into fatty acids and glycerol

    d. It emulsifies fat.

19. Excess glucose in the body is converted into

    a. Urea b. Glucogen c. Fatty acids and glycerol d. Amino acids.

20. Digested food substances are absorbed into the blood stream in the

a. Kidneys b. Liver c. Stomach d. Ileum

SECTION B

1. Define the following terms

a. Ingestion b. Egestion c. Digestion

2. a. Arrange the following processes in the order in which they occur *digestion, egestion, ingestion* and *absorption.*

b. Distinguish between *Absorption* and *Assimilation.*

3. Mention the causes of indigestion.
4. Describe briefly what happens to a morsel of kenkey in the mouth during eating.
5. What are digestive enzymes?

ANSWERS

1. B
2. B
3. D
4. A
5. A
6. C
7. B
8. A
9. D
10. B
11. A
12. B
13. B
14. A
15. C
16. B
17. A
18. D
19. B
20. D

APPENDIX C

STUDENTS'S QUESTIONNAIRE

APPENDIX C: Teaching with concept mapping strategy

TEACHING WITH CONCEPT MAPPING STRATEGY

INSTRUCTIONS

Thank you for taking time to complete this questionnaire. Please answer each question to the best of your ability. Your thoughtful and truthful responses will be greatly appreciated. Your individual name or identification number is not required and will not at any time be associated with your responses. Your r responses will be kept completely confidential and will not influence your course grade and any of your examination results anywhere.

Please read the following statements and kindly provide the information required.

A. Background Information

Please tick [ ] in the appropriate space provided below and supply answers where required.

1. Gender [ ] Female [ ] Male
2. Age ……………………… years
3. At what level were you taught the use of concept mapping? Please tick only one level.

Nursery Level	
Kindergarten level	
Junior high School level	
Other, please specify	

B. Perceptions of the effectiveness of Concept mapping on teaching and learning.

Please, tick [ ] the option that best reflects how you associate with each of the following statements.

Rating Scale**: Strongly Agree (SA =5), Agree (A=4), Neutral (N=3), Disagree (D=2), Strongly Disagree (SD=1)**

Statement	**SA**	**A**	**N**	**D**	**SD**
4. I was more enthusiastic and motivated during the use of concept maps in the teaching and learning of digestion.					
5. The use of concept maps an instructional technique is an effective strategy for students of all abilities.					
6. The use of concept maps strategy in instruction reduces my personal interaction with my colleagues.					
7. When using concept maps, I will be able to better understand the use of prepositions and phrases for sentence construction in English language.					
8. The use of concept maps provides a means of expanding and applying what has been taught in class.					
9. When using concept maps to explain un-grasped concepts to a colleague, my role will be a facilitator of their learning.					
10. The use of Concept mapping instruction would promote the student understanding of concepts and do away rote learning memorization of facts.					
11. Concept maps hinder students' ability with learning tasks.					
12. The use of Concept mapping instruction is an effective means of helping students to understand relationships among concepts.					
13. The use of Concept mapping instruction would make the student feel more involved and to cooperate more on projects.					
14. The use of Concept maps for learning almost and always the personal undue forgetfulness and recitation of mnemonics as well as acronyms during examinations.					
15. Concept maps for instruction would enable me to interact more with other students to promote group discussion.					
16. I feel the use of concept maps for instruction would affect my learning during my private time in a positive way.					

17. Please, give your general views(s) about the Perceptions of the effectiveness of Concept mapping integration in the teaching and learning of science as a practice to enhance student's performance in science I the space below.

APPENDIX D

SUBJECT: INTEGRATED SCIENCE **FORM:** 3

AV. AGE: 13 **CLASS SIZE:** 25

DATE: 19TH SEPTEMBER, 2016

REFERENCES: INTEGRSTED SCIENCE SYLLABUS, AKI OLA SCIENCE, SCIENCE IN SCOPE.

DAY/ DURATION	TOPIC/ SUBTOPIC/ ASPECT	OBJECTIVES/ RPK	TEACHER-LEARNER ACTIVITIES	TEACHING AND LEARNING MATERIALS (TLMs)	CORE POINTS	EVALUATION AND REMARKS
DAY: MONDAY **TIME:** 11AM -12PM **DURATION:** 60 MINUTES	**TOPIC**: DIGESTION IN HUMANS **SUB TOPIC:** PARTS OF THE DIGESTIVE SYSTEM	By the end of the lesson students will be able to : 1. Explain what is meant by digestion. 2. Identify the parts of the digestive system in humans and state their functions.	Teacher guides students to define digestion. Guides students to identify the parts of the digestive system. Guides students to draw a concept map on the definition of digestion and the parts of the digestive system.	1. A chart showing the digestive system. 2. A diagram showing the digestive system.	Digestion is the process by which the body breaks down complex food substances into simple soluble forms by means of enzymes so that they can be absorbed into the body to release energy.	1. Define the following terms: Digestion Absorption Assimilation Egestion. 2. List 5 parts of the digestive system and state their functions 3. Draw and label the digestive system.

		RPK The students already know that when they eat in it passes through their system and comes out as feaces.			Parts of the digestive system Buccal cavity (mouth), Salivary gland, Gullets or Oesophagus, Stomach, Small intestine, Pancreas, Liver, Gall bladder large intestine and Anus	**REMARKS** The lesson was successful.

SUBJECT: INTEGRATED SCIENCE **FORM:** 3

AV. AGE: 13 **CLASS SIZE:** 25

DATE: 20TH SEPTEMBER, 2016

REFERENCES: INTEGRSTED SCIENCE SYLLABUS, AKI OLA SCIENCE, SCIENCE IN SCOPE.

DAY/ DURATION	TOPIC/ SUBTOPIC/ ASPECT	OBJECTIVES/ RPK	TEACHER-LEARNER ACTIVITIES	TEACHING AND LEARNING MATERIALS (TLMs)	CORE POINTS	EVALUATION AND REMARKS
DAY: TUESDAY **TIME:** 11AM -12PM **DURATION:** 60 MINUTES	**TOPIC**: DIGESTION IN HUMANS **SUB TOPIC:** PARTS OF THE DIGESTIVE SYSTEM	By the end of the lesson students will be able to : Describe the changes that occur to different food substances as they pass though the alimentary canal. Describe what happens to the end products of digestion. Describe how undigested food substances are eliminated from the body.	Teacher guides students to Describe the changes that occur to different food substances as they pass though the alimentary canal. Guides students undigested food substances are eliminated from the body Guides students to draw a concept map on digestion.	1. A chart showing the movement and changes that occur on food in he alimentary canal. 2. A video on digestion.	Enzymes are biological catalyst which occur in smaller quantities and greatly speed up chemical reaction. Digestion in the mouth. Digestion in the stomach Digestion in the small intestine – duodenum. The end products of digestion.	Mention four food substances that when digested will produce: Amino acids, Glucose, Fatty acid and glycerol. Describe what happens to a morsel of kenkey in the mouth during eating. **REMARKS** The lesson was

		RPK The students can define digestion and can name the parts of the digestive system.			1, Carbohydrate – Glucose 2, Protein – Amino acids 3, Fats and oil – fatty acids and Glycerol.	successful.