

CHAPTER II

REVIEW OF THE RELATED LITERATURE

CHAPTER II

REVIEW OF THE RELATED LITERATURE

2.0.0 INTRODUCTION

The introduction, background of the study, descriptions on the collaborative concept mapping, significance of the study along with the objectives, hypotheses and the delimitations of the present investigation are given in the chapter- I. The present chapter is devoted to the review of related literature. The studies reviewed are related to concept mapping linked to as many different dependent variables as possible. The researches done by Olugbemi Jerede et al (1990), Okebukola (1990), Ross & Munby (1991), Gueastello, Beasley and Sinatra (2000), Sungur, Tekkaya and Geban (2001), Snead & Snead (2004), Chiou (2008) and many other scholars been summarized. A review of research studies related to the collaborative concept mapping has been presented afterwards.

A comprehensive review of the available literature was done, so as to find the gaps in the previous studies; also it suggested the necessary background of the study. The theoretical evidences that lead to the identification of the current problem are as follows:

2.1.0 Researches Studies related to Concept Mapping

Olugbemi Jerede et al (1990) studied the effect of concept mapping on students' anxiety and achievement in biology. A total of 51 (30 boys, 21 girls) senior secondary one (grade 10) students participated in this experiment. Two instruments—the Zuckerman Affect Adjective Checklist and the Biology Achievement Test—were used in pre- and posttest administrations to measure the treatment effect on anxiety and achievement, respectively. Findings supported the stand that concept mapping is significantly more effective than the traditional/expository teaching strategy in enhancing learning in biology. In addition, it apparently reduces students' anxiety towards the learning of biology. A significant reduction of anxiety was noticed for male subjects.

Okebukola (1990) worked on attaining meaningful learning of concepts in genetics and ecology: An examination of the potency of the concept-mapping technique. The efficacy of the concept-mapping strategy was tried out in this study with 138 pre-degree biology students. The results showed that the 63 students in the experimental group who employed the concept-mapping technique performed significantly better on the test of meaningful learning in genetics, $t(136) = 16.01, p < 0.001$, and ecology, $t(136) = 12.27, p < 0.001$, than their control group counterparts ($N = 75$).

Ross & Munby (1991) observed concept mapping and misconceptions: a study of high-school students' understandings of acids and bases. The methodology was grounded on a concept map constructed from the curriculum. This map was used in the design of a multiple-choice test and of clinical interviews. It was also used in the analysis of the data, and in constructing concept maps for each participant. The methodology and the resulting analyses are illustrated with two abbreviated cases selected from the study. It is shown that these participants hold idiosyncratic concepts not consistently coincident with those of the prescribed curriculum, and that everyday concepts are retained more than are scientific concepts. Discussion of concept mapping points to how it starkly represents gaps in the understanding of concepts that are interrelated.

Gueastello, Beasley and Sinatra (2000) observed concept mapping effects on science content comprehension of low-achieving inner-city seventh graders. Low-achieving seventh-grade students from an urban parochial school were randomly assigned to two equally sized groups ($n = 62$, each group). One group was taught by a read-and-discuss, teacher-directed method, and the second group, given the same type of introductory lesson as the first, followed a model of concept mapping that connected major and minor concept ideas. A criterion-referenced test based on the content of a science chapter served as the dependent variable. Prior to any teaching, a pretest was administered. An analysis of covariance with pretest scores as the covariate showed a statistically significant

difference in comprehension between the pretest and posttest for the experimental group

Sungur, Tekkaya and Geban (2001) carried an experimental research on the contribution of conceptual change texts accompanied by concept mapping to students' understanding of the human circulatory system. The data were obtained from 26 students in the experimental group taught with the conceptual change texts accompanied by concept mapping, and 23 students in the control group taught with the traditional instruction. Besides treatment, previous learning in biology and science process skills was other independent variables involved in this study. Multiple Regression Correlation analysis revealed that science process skill, the treatment, and previous learning in biology each made a statistically significant contribution to the variation in students' understanding of the human circulatory system. It was found that the conceptual change texts accompanied by concept mapping instruction produced a positive effect on students' understanding of concepts.

Wheeler, Susan and Collins (2003) observed the influence of concept mapping on critical thinking in baccalaureate nursing students. A convenience sample ($n = 76$) was randomly assigned to experimental ($n = 44$) and control ($n = 32$) groups. The experimental group was taught to use concept mapping of patient information to prepare for clinical experiences. The control group was taught to use traditional nursing care plans. Critical thinking skills were measured with the California Critical Thinking Skills Test, which yielded six scores: an overall score and five subscales (analysis, evaluation, inference, deductive reasoning, and inductive reasoning). A significant difference ($p < .05$) was found between the mean pretest and posttest scores and each subscale.

Snead, Donald et al (2003) examined the effectiveness of concept mapping on the science achievement of African American middle grades science students distributed into eight different classes by ability level. Results of this quasi, non-randomized, control-treatment group, pretest-posttest study found no significant overall effects of treatment on science achievement. There was a statistically

significant effect between concept mapping and student achievement among the average ability (lower) level students.

Snead & Snead (2004) studied the concept mapping and science achievement of middle grade students. The subjects were 182 eighth-grade students, distributed into eight intact earth science classes by ability levels. The ability level variable also was examined as a possible effect on student achievement. Two teachers were involved in teaching a unit on weather for nine weeks. An objective weather test and six performance assessment items were used to measure achievement. For this group of students, analyses indicated no significant overall effects of treatment on science achievement. A statistically significant effect was found between concept mapping and student achievement among the average students, as measured by combined performance assessment items.

The influence of concept mapping on achievement, self-regulation, and self-efficacy in students of English as a second language was studied by **Chularut and DeBacker(2004)**. Seventy-nine ESL students participated in the study. Variables of interest were students' achievement when learning from English-language text, students' reported use of self-regulation strategies (self-monitoring and knowledge acquisition strategies), and students' self-efficacy for learning from English-language text. A randomized pre-test–post-test control group design was employed. The findings showed a statistically significant interaction of time, method of instruction, and level of English proficiency for self-monitoring, self-efficacy, and achievement. For all four outcome variables, the concept mapping group showed significantly greater gains from pre-test to post-test than the individual study group. The findings have implications for both practice and research.

Ahlberg, Mauri et al (2004) while investigating the use of ICT-based concept mapping techniques on creativity in literacy tasks concluded that ICT-based concept mapping provides a reliable framework from which to structure writing and that ICT enhances learning and use of this representational technique and

provides opportunities for developing innovative and educationally valid practices. The key research question in this small-scale study focuses on the effects that an ICT (information and communications technologies)-based concept mapping intervention has on creativity and writing achievement in 10-11-year-old primary age pupils. The data shows that pupils using a concept mapping intervention significantly improve their NFER non-verbal reasoning age-standardized scores over a control group with a higher baseline whose scores remain constant. Correlation studies showed that writing achievement and creativity are linked and that writing achievement and concept mapping connectivity are linked.

The influence of teaching note-taking and information mapping on learning and recalling in science was experimented upon by **Mehmet Arslan (2006)**. 24 lesson hours were given over a study period of 4 weeks (6 hours per week) corresponding to 4 units. The research was carried out with 135 students in three classes at grade 5 of Arif Eminoglu Primary School located in the District of Kayseri in Central Anatolia, Turkey. As the three groups were seen to be equal regarding their pre-learning status, the differences between their averaged post-test scores were examined to measure their recognition level. The same differences of the delayed post-test were analyzed to measure their recognition level again. Obtained results from the experiment indicated that note taking can help students to improve their levels of knowledge and maybe application. But this is not the case for concept mapping, where no significant differences between control and study groups were observed.

Chiou (2008) worked on the effect of concept mapping on students' learning achievements and interests. The participants were 124 students from two classes enrolled in an advanced accounting course at the School of Management of a university in Taiwan. The experimental data revealed two important results. First, adopting a concept mapping strategy can significantly improve students' learning achievement compared to using a traditional expository teaching method. Second, most of the students were satisfied with using concept mapping

in an advanced accounting course. They indicated that concept mapping can help them to understand, integrate and clarify accounting concepts and also enhance their interests in learning accounting.

Greene and Paulette (2009) examined concept mapping and the science achievement of third grade students. The research questions addressed in this study examined whether a significant difference exists between the concept mapping (treatment) and the traditional (control) groups on posttest scores and on test scores across time and group. A one way analysis of covariance (ANCOVA) was used to determine if there was a significant difference on posttest scores from 70 third grade students after controlling for pretest scores. Results of the ANCOVA analysis revealed the homogeneity of regression slopes assumption was not met. A two way repeated measures mixed factorial analysis of variance (ANOVA) was used to determine if there were differences on participants' test scores by time and group. A statistically significant effect was found within subjects' main effect across time and between subjects main effect by group.

Kevin Oliver (2009) carried an investigation of concept mapping to improve the reading comprehension of science texts. The study investigated how well 74 sixth grade students represented text structures from a 900 word textbook. Findings suggested that the students were more successful at classifying pre-selected terms under given subordinate categories than they were at fully understanding relevant concept sets and articulating three different relationship types between them. About two third of the students indicated that they enjoyed concept mapping and would prefer to both read and map rather than just read without mapping.

Paper-based and computer-based concept mappings: the effects on computer achievement, computer anxiety and computer attitude, an experimental research carried by **Erdogan and Yavuz (2009)** compared the effects of paper-based and computer-based concept mappings on computer hardware achievement,

computer anxiety and computer attitude of the eight grade secondary school students. The students were randomly allocated to three groups and were given instruction on computer hardware. The teaching methods used for each group were the conventional method, paper-based concept mapping and computer-based concept mapping. At the end of a 4-week instruction, posttests were administered to assess computer hardware achievement, computer anxiety and computer attitude of the students. The findings indicated that paper-based and computer-based concept mapping strategies produce better results than the conventional method. However, the effects of paper-based and computer-based concept mapping strategies were not significantly different.

Okoye, Nnamdi et al (2010) observed the effect of concept-mapping and problem-solving teaching strategies on achievement in biology among Nigerian secondary school students. The method used for the study was a quasi-experimental pre-test treatment design. One hundred and thirteen senior secondary three (S.S. 111) students randomly selected from three mixed secondary schools located in Delta North Senatorial District of Delta State, Nigeria were used as subjects for the study. The experimental group was taught selected topics in Genetics using concept-mapping and problem-solving strategies while the control group was taught using the traditional lecture method. The result of the study showed that the experimental group performed significantly better in Genetics than the control group and that gender does not affect student's achievement in biology in general.

The effects of image-based concept mapping on the learning outcomes and cognitive processes of mobile learners was experimented upon by **Yen, Chuan et al (2012)**. The purpose of this study was to investigate the effects of different teaching strategies (text-based concept mapping vs. image-based concept mapping) on the learning outcomes and cognitive processes of mobile learners. 86 college freshmen enrolled in the "Local Area Network Planning and Implementation" course taught by the first author participated in the research. Students in the experimental group used image-based concept mapping to finish

assigned tasks and those in the control group used text-based concept mapping to complete the same tasks. The results showed that there was no significant difference in students' learning achievements, the group using image-based concept mapping showed higher level than the text-based group in the dimension of understanding and creating and the image-based concept mapping strategy was more complete and diverse than the text-based concept mapping strategy.

Fatoku and Eniayeju (2014) examined the effect of concept mapping-guided discovery integrated teaching approach on chemistry students' achievement and retention. The sample comprised 162 Senior Secondary two (SS 2) students drawn from two Science Schools in Nasarawa State, Central Nigeria with equivalent mean scores of 9.68 and 9.49 in their pre-test. Five instruments were developed, validated and used by the investigator for the study; namely; Chemistry Achievement Pre-Test (CAPE), Chemistry Achievement Post-Test (CAPO), Chemistry Achievement Retention Test (CART), Lesson Plans for the Control Group (LPCG) and the Lesson Plan for the Experimental Group (LPEG). Pre-test / post-test control group design was employed. Results of the Scheffe's test for multiple comparisons revealed that boys in the experimental group performed better than girls in the experimental group. The results of the t-test analysis of the retention test showed that the mean score of the experimental group was significantly better than that of the control group ($p < 0.05$).

Palmer, Jessica, Boon et al (2014) observed the effects of concept mapping instruction on the vocabulary acquisition skills of seventh-graders with mild disabilities as a replication study. A dictionary approach versus a concept mapping model, on the learning of vocabulary words among 4 students with mild disabilities (i.e., emotional and/or behavioral disorders and other health impairments) attending a middle school was used. An, A-B-A-B design was used to assess the efficacy of both instructional models (i.e., the dictionary approach and concept mapping model). During the dictionary instruction phases, each student looked up a vocabulary word in the dictionary, defined the word, and then wrote the word in a sentence on his or her notebook paper. In the concept

mapping phases, the students completed a concept map (i.e., Frayer model) to display the definition of a word, wrote the word in a sentence, described what the word reminded them of based on their prior knowledge, and then drew a picture related to the vocabulary word. Results revealed marked improvements for all 4 of the students in their learning of the content area related vocabulary words associated with the use of the concept mapping model over the dictionary approach. Recommendations for classroom practice and future research directions are discussed.

The effects of using concept mapping for improving advanced level biology students' lower- and higher-order cognitive skills was experimented upon by **Lalor, Sharon et al (2014)**. Using a mixed methods approach, the study employed a pre-test/post-test quasi-experimental design involving 156 students and 8 teachers from intact classes. Qualitative data were collected through interviews and students' personal documents. The data showed that the participants utilized concept mapping in various ways and they described positive experiences while being engaged in its use. The students in the concept mapping experimental groups performed significantly better than their peers in the control group on both the lower-order ($F_{(1)}=21.508$; $p<0.001$) and higher-order ($F_{(1)}=42.842$, $p<0.001$) cognitive items of the biology test. A mean effect size of 0.56 was calculated representing the contribution of treatment to the students' performance on the test items.

2.2.0. Research Studies related to Collaborative Concept Mapping

Kwon, So Young et al (2009) observed the comparative effect of individually-constructed vs. collaboratively-constructed computer-based concept maps. The researchers investigated the comparative effects of individually-constructed and collaboratively-constructed computer-based concept mapping on middle school science concept learning. One hundred and sixty one students completed the entire study. Using prior science performance scores to assure equivalence of student achievement across groups, students were assigned to three groups: a self-selected study strategy group, an individual-concept mapping group, and a

collaborative pairs--concept mapping group. Collaboratively and individually-constructing computer-based concept maps had equally positive effects on seventh grade middle school science concept learning as measured on a comprehension test. However, the students who collaboratively constructed concept maps created significantly higher quality concept maps than those who individually constructed concept maps indicating deeper conceptual understanding.

The impact on incorporating collaborative concept mapping with co teaching techniques in elementary science classes was observed by **Jang, Syh-Jong (2010)**. Two fourth-grade science teachers and four classes with a total of 114 students were involved in the study. This study used a mixed method design, incorporating both quantitative and qualitative techniques. The findings showed that the two teaching methods obtained significant difference with respect to students' test scores. Using collaborative concept mapping to learn science could increase the opportunity of discussion between peers, thus fostering better organization and understanding the content. In addition, co-teaching could enable teachers to share their expertise with one another.

Haugwitz, Marion et al (2010) in their research cognitive ability and the instructional efficacy of collaborative concept mapping gathered data from 248 secondary students (14 years old, 56% female) who learned about the circulatory system in 77 self-selected collaborative groups. The learning outcomes of biology students who summarized by collaborative concept mapping were compared with those of students who summarized by collaborative writing. Learning groups randomly assigned to construct concept maps instead of conventional summaries generated more relations in the summary task and their members obtained higher individual scores on a post-test.

2.3.0 Critical Appraisal

In the light of the review of related literature it is concluded that there is a considerable amount of work done on various dimensions of concept mapping. Okoye, Nnamdi et al (2010) observed the effect of concept-mapping and problem-solving teaching strategies on achievement in biology among Nigerian secondary school students. The influence of teaching note-taking and information mapping on learning and recalling in science was experimented upon by Mehmet Arslan (2006). Wheeler, Susan and Collins, (2003) observed the influence of concept mapping on critical thinking in baccalaureate nursing students. Concept mapping technique has been integrated with other resources such as ICT and its effect have been tested (Ahlberg, Mauri et al, 2004). Also experimentation on the effectiveness of concept mapping in teaching students with special needs have been performed (Palmer, Jessica, Boon et al , 2014). It has been empirically proved that concept mapping technique is found to be significantly effective in enhancing the interest, achievement and understanding of the students. The previous researches have been conducted in abroad under controlled conditions by the researchers. The sampling used in the researches is randomized. Different designs have been utilized by different researchers so as to get as authentic results as possible. Some of the researches are conducted on single group design. The present study seeks to rectify its methods in the light of above researches

2.4.0 Conclusion

Since it was found that the prior researches have not touched the area of collaborative concept mapping to a greater extent the present research is a piece of work enhancing this particular dimension of science teaching.