Mind Mapping Based Instructional Strategy Delivery And Student's Academic Achievement in Science Subject in Secondary Schools in ITU Local Government Area of Akwa Ibom State, Nigeria.

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Abstract: The research is out to investigate mind mapping instructional delivery strategy and student academic achievement in science subject in secondary schools in Itu local Government area. Review of related literature was done on mind mapping based instructional delivery strategy and students' academic achievement, review was also made on gender and students achievement taught with mind map instructional strategy. Quasi experimental design was used for the study. The population of the study was eight hundred and six and a sample size of 100 SS1 students was used. Intact classes were the study sample size. Chemistry achievement test (BAT) was the instrument for data collection. The data collected was analyzed using independent t-test statistical method. The result of the statistical method showed that mind map enhances student achievement in chemistry than lecture method. It was concluded that there is a significant difference in the mean achievement scores of students taught science subject (chemistry) using mind mapping based instructional strategy than those taught using lecture method. Also, there is a significant difference in the mean achievement scores of male and female students taught chemistry with mind map instructional strategy.

Keywords: Mind Mapping, Instructional Strategy, Student's Academic Achievement, Science, Subject, Secondary Schools, Itu Local Government Area, Akwa Ibom State and Nigeria.

Background to the Study

Chemistry is a compulsory science subject taught and offered in secondary schools across the globe. In Nigerian secondary school curriculum, it focuses on the study of atom, elements, compounds and properties and its general applications.

Brain (2023) opined chemistry as a branch of science which has to do with virtually all areas or aspect of life example there's nothing around us that is not chemistry, the water we drink, the air we breath, the food we eat, the cloths we wear and the hydrocarbon compounds we use as fuel, even our modern technology is chemistry. Brain (2021) went further to say that the development of heavy weapon's in developed nations across the continent of the world is made possible from chemistry.

Mind-mapping, popularized by a psychologist Ton Buzan in 1974, in the simplest sense is a vital tool that is used to organize information. It was first developed over 30 years ago as a note taking and summarization method that maximized on the different functionalities of the two halves of the brain. The left side of the brain is responsible for words, logic, sequences and analysis while the right side carries out tasks that are associated with colors, emotions, shapes and imagination. Mind mapping teaching strategy is an instructional approach that uses both sides of the brain and so that processing productivity will be increased which translates into greater retention (Buzan, 2018). Polsen (2015) defined it as a pedagogical strategy that

uses links, sequences, shapes and colours to connect ideas on a concept. Hence, mind mapping instructional strategy may be defined as a learning method that uses different maps to connect information on a concept.

Academic Achievement is an important and a special issue upon which all teaching and learning activities are measured using standard of Excellence. Melirafrouz, and Shahraray (2017) defined it by stressing its importance as one of the most important and most objectives criteria to evaluate the effectiveness of training system that is, the extent to which a student, teacher or institution has achieved her educational goals. Academic achievement is a fundamental premium upon which all teaching/learning activities are measured using some criteria of excellence example good academic performance, poor academic performance and academic failure (Adeyinka, Adedeji and Olufemi, 2019). Hence, it is an outcome of education which has a special importance, for the students, teachers, institutions, and the people around him or her as well as the attainment of success of a student in his schoolwork among his classmates, irrespective of gender. In recent times, gender related issues in science education have generated serious concerns for science educators judging by the number of studies done to that effect. Still, there is no consensus as to whether it influences students' academic achievement in biology or not.

Statement of the Problem

Academic achievement of students in science subject generally and in chemistry in particular had witnessed a deplorable trend in the past decades. Observation shows that from 2021-2022 we have consistently witness poor achievement in chemistry in senior secondary school certificate examination organized by West African Examination Council. A lot of research work has been carried out on students' poor academic performance in chemistry. Many researchers such as Grace (2019) have attributed this unsatisfactory performance of student in chemistry to many factors that relates with the influence of teaching and learning process such as students personal variables (self-efficacy, lost of control, interest, creativity, communication skills, critical thinking ability and environmental variables like teacher-related environment, non availability of instructional materials for teaching, absence of equipped chemistry laboratories in schools, inadequate science equipment for practicals lessons, high student teacher ratio and wide content of secondary school chemistry curriculum).

Therefore, the problem of this study is to find out if the use of mind map based instructional strategy delivery improves students academic achievement in chemistry is secondary school in Itu Local Government Area of Akwa Ibom State.

Purpose of the Study

The purpose of this study was to examine mind mapping based instructional delivery strategy and students academic achievement in chemistry in secondary schools in Itu Local Government Area. Specifically, the study intends to examine the following:
1. The difference in the mean achievement scores of students taught chemistry using mind mapping based instructional strategy delivery (MMISD) and those taught using lecture method (LM).
2. The difference in the mean achievement scores of students taught chemistry using mind mapping based instructional strategy delivery.

Research Questions

The following research questions guide the study:
1. What is the difference in the mean achievement scores of student taught chemistry using mind mapping based instructional strategy delivery (MMISD) and those taught using lecture method (LM)?
2. What is the difference in the mean achievement scores of student taught chemistry using mind mapping based instructional strategy delivery?

Research Hypotheses

The following null hypotheses were formulated by the researcher to guide the study:
1. There is no significant difference in the mean achievement scores of students taught chemistry using mind map instructional strategy and those taught using lecture method.

2. There is no significant difference in the mean achievement scores of male and female students taught chemistry with mind map instructional strategy.

Significance of the Study

This study will prove to the Government, students, parents, teachers etc. the need to use mind mapping instructional strategy delivery in improving students' academic achievement in Itu Local Government Area.

The Government: The study would be of benefit to the government since it would reveal to them the role of mind map instructional strategy in improving students' academic achievement in Chemistry.

School Administrators: School administrators would be aware of the online learning and physical learning which will improve the learning of chemistry.

Parents: The study will motivate parents to provide and engage their children in mind map learning materials.

Teachers: The study would create awareness among classroom teachers in order for them to evaluate their own teaching strategy to incorporate mind map instructional strategy in teaching chemistry. Also the study would provide feedback to teacher trainers in charge of training teachers in order for them to test their programs and improve their methodological training.

Researchers: It would assist other researchers in using these findings as a foundation for further research in the area.

Definition of Terms

The following terms were defined in the study.

Chemistry: Chemistry has the scientific operational definition to be the branch of science that studies elements, atom, compounds as well as their physical and chemical properties as it effect the environment.

Mind Map: Mind map is a graphical way of representing ideas and concepts. It is a visual thinking tool that helps in structuring information for better analysis, comprehension, recall and generation of new ideas.

Academic Achievement: Academic achievement is the ability or grade obtained in test and examination by students after series of examination.

LITERATURE REVIEW

This section focused on the review of related literature to this work. The review is done under the following sub-headings.

Concept of Mind Map

Mind map is a graphical way of representing ideas and concepts. It is a visual thinking tool that helps in structuring information for better analysis, comprehension, recall and generation of new ideas. A mind map is a diagram used to represent words, ideas tasks or other items linked to and arranged around a centralized key words or ideas (Kenesha, Eddia and Natalie 2016 and Martins, 2018). It is also a graphical way to represent ideas and concepts, a visual thinking tool that helps in structuring information, helping a person to better analyze, comprehend, synthesize, recall and generate new tools. Mind map was developed and introduced by Tony Buzan as a way of helping students make notes by using only keywords and images (Kenesha, 2016). The techniques involve using line thickness, colours, pictures, and diagrams to aid knowledge collection (Martins, 2018).

Mind mapping has practical values in science education and Chemistry teaching in particular because they help in improving classroom efficiency, helping students to integrate scattered knowledge, stimulating students' interest in studying physics and cultivating students' divergent thinking ability (Bo-Jang and Li-Wang, 2019). Mind mapping is beneficial to both teachers and learners alike in that they help in summarizing

concepts to be learned and taught. Based on the teaching mode of mind mapping, it is a good teaching technique that motivates students. It is a good means of compacting ideas, notions into a piece of paper during teaching-learning process, summarizing them into a colourful picture-the mind map. The use of mind maps in teaching and learning process has gained prominence and showed positive effect over the years. Concept mapping is a constructivism-based method which emphasizes that students take charge of their learning with the instructor being a facilitator. Also, concept mapping strategies under constructivism have its root from Ausubel's assimilation theory of cognitive learning (Cheema and Mirza, 2018).

Like all constructive approaches, concept mapping flourishes in building learners to work on their own and in group in arriving at the knowledge of the concept being learned. Concept mapping is a tendency of representing visually the structure of concepts and information and establishing their relationship (Cheams and Mirza 2017). It is the use of diagrams to represent the conceptual structure of a subject discipline in a two-dimensional form which is analogous to a road map (Ogonnaya, Okafor, Abonyi and Ugama, 2018). Concept mapping is a systematic diagram that begins with they key concept on top and flows downward in two dimensions; for every concept is fully represented. It can be likened to a flow chart.

All linked branches provide enough information about what they capture. It helps in developing critical thinking embedded in creativity that ensures effective learning and increased academic achievement (Auta, 2015). Novak and Godwin in Ajaja (2017) stated that a standard concept map begins with defining the topic, listing the important concepts, arranging them hierarchically, forming preliminary concept and reviewing the map.

Mind Map and Students' Academic Achievement in Chemistry

Mind maps have been applied in the teaching learning process extensively, either as a means of note taking or teacher's summary of a particular concept to show relationships. Ibrahim (2017) showed that mind maps improved the achievement of students significantly. Also, Zvezdan, Sonja, Branka, Maja and Olivera (2019) showed that the implementation of mind maps increased students' motivation for learning Chemistry and, lowered their mental efforts. Swestyani, Masjkuri, Prayituo, Rinanto and Widoretno (2018) concluded that mind mapping makes logical thinking visible so that the quality of learning that has occurred can be explored. Madu and Metu (2016) showed that mind mapping as a note taking approach enhanced students' achievement in Chemistry.

According to Katcha, Orji, Ebele, Abubakar and Mohammed (2018) a group taught using mind map instructional approach performed better than the group taught using conventional teaching method. Also, the result showed no significant difference in gender.

Gender and Academic Achievement

Research found that the gain in academic performance of students with mind map was across gender (Nwuba and Osuafor, 2021). Furthermore, Cheema and Mirza (2018) established a significant difference in the achievement of male and female students taught using concepts maps in favor of the male students. Therefore, in this study, gender differences in academic achievement among secondary school students' taught chemistry using mind mapping instructional strategy was also investigated.

Research Methodology
This section is organized under the following subheadings:
Area of Study
Research Design
Population of the Study
Sample and Sampling Technique
Instrument of Data Collection
Administration of the Instruments
Method of Data Analysis
Area of the Study

Area of Study

This study was conducted in Itu Local Government Area of Akwa Ibom State. Itu Local Government Area occupies a large landmass. It situates between latitude 60° 40'N and longitude 70° 20'E in the West and North. It is bounded in the West by Odukpani Local Government Area in Cross River State, in the South by Uruan Local Government Area, in the North by Uyo and Ikot Ekpene Local Government Areas, which is in the East.

Its population, according to the 2006 Census, is 118,300. There are 52 villages in Itu Local Government Area. There are creeks, rivulets, rivers, and streams, some of such empty into the Atlantic Ocean. This makes the area rich in fishes, shrimps, lobsters, crabs, periwinkles, oyster, etc. Lying in the rain forest belt with an extensive arable land, the region abounds with the wild life, raffia palm and timber. The rich coastal plains support the cultivation of crops such as cassava, maize, etc.

The people of Itu are largely fishermen, farmers and traders. In the colonial days, they were engaged in business with multinational commercial outfits like John Holt. The Area also specializes in canoe building and production of fishing inputs. Investment opportunities exist in the Area of Agriculture (including livestock and fish farming).

Research Design

The research design adopted for this study was a quasi- experimental research design. This was adopted because it enables the researcher to conduct pretest posttest non-randomized control group experiment.

Population of the Study

The population of the study was 806 secondary school students in Itu Local Government Area that offer Chemistry.

Sample and Sampling Technique

The study sample size was one hundred (100) SS 1 students from four schools in Itu Local Government Area. The sampling technique in this study was intact class of four.

Instrument for Data Collection

The instrument that was used for data collection was an achievement test. The instrument was titled "Chemistry achievement test (CAT). The achievement test consisted of a twenty five (25) items multiple-choice question with four options namely A-D.

Administration of the Instrument

The researcher visited the selected schools personally and sought for the principal's permission for the research to be conducted in their schools. After the school principals had granted permission, the principal introduced the researcher to Chemistry teachers. The researcher sought for the cooperation of the subject teachers. The class teachers helped the researcher to administer the research instrument to the students in their respective classes. After the instrument administration the researcher with the help of the class teachers collect the instrument, the same number as was administered to the students for data analysis.

Method of Data Analysis

The data collected was analyzed using independent t-test to test the hypotheses in order to compare the difference.

Analysis of Data and Discussion of Findings

This section deals with data analysis and discussion of findings in line with the research questions and hypothesis.

Data Analysis

Research hypothesis 1: There is no significant difference in the mean achievement scores of students taught chemistry using mind map instructional strategy and those taught using lecture method.

Table 1: Independent t-test statistical analysis of the difference in the mean achievement scores of students taught Chemistry using mind map instructional strategy (MMISD) and those taught using lecture method (LM)

Variable	N	Mean ($\bar{x}$)	SD	Df	t-cal	t-crit	Decision
MMISD	54	46.85	7.14				Ho_1 rejected
				98	8.24	2.01	
LM	46	32.48	7.10				

Table 1 reveals that mean achievement scores of students taught chemistry using mind map instructional strategy (MMISD) is 46.85 while those taught using lecture method (LM) is 32.48. The mean score of students taught chemistry using mind map instructional strategy is greater than that of those taught using lecture method. Since the t-calculated value of 8.24 is greater than the t-critical value of 2.01 the research hypothesis 1 which stated that there is no significant difference in the mean achievement scores of students taught Chemistry using mind map instructional strategy and those taught using lecture method is rejected. This means that there is a significant difference in the mean achievement scores of students taught Chemistry using mind map instructional strategy and those taught using lecture method.

Research hypothesis 2: There is no significant difference in the mean achievement scores of male and female students taught Chemistry with mind map teaching strategy.

Table 2: Independent t-test statistical analysis of the difference in the mean achievement scores of male and female students taught Chemistry using mind map instructional strategy (MMISD).

Gender	N	Mean ($\bar{x}$)	SD	Df	t-cal	t-crit	Decision
Male	24	44.25	6.33				Ho_2 rejected
				52	2.54	2.01	
Female	30	48.93	7.16				

Table 2 shows the mean achievement scores of 44.25 for male and 48.93 for female students taught Chemistry using mind map instructional strategy. This shows that the mean achievement score of female students taught Chemistry using MMISD is greater than those of their male counterparts. Similarly, the t-calculated value of 2.54 is greater than the t-critical value of 2.01 then, the research hypothesis 2 which stated that there is no significant difference in the mean achievement scores of male and female students taught Chemistry with mind map instructional strategy is rejected. This implies that there is a significant difference in the mean achievement scores of male and female students taught Chemistry with mind map instructional strategy.

Discussion of Findings

From the analysis in Table 1 showed that there is a significant difference in the mean achievement scores of students taught Chemistry using mind map instructional strategy and those taught using lecture method. This finding is in support of Katcha (2018) who found that students taught using mind map instructional strategy (experimental group) performed better than students taught with lecture method which is the control group. The finding of the study further indicated a significant difference existed between the mean achievement scores of students taught Chemistry using mind map instructional strategy and those taught using lecture method. The finding of the study is corroborated by the findings of Adamu, Zayum and Abdullai (2017) that students taught with mind map instructional strategy significantly achieved higher than those taught using lecture method.

Result in table 2 shows that there is a significant difference in the mean achievement scores of male and female students taught Chemistry with mind map instructional strategy. The finding of the present study is in agreement with the observations of Ojekwu (2019) that females' academic achievement was higher than of their male counterparts on exposure to mind map instructional strategy in Basic Science.

Conclusion

Based on the findings, it was concluded that:

There is a significant difference in the mean achievement scores of students taught Chemistry using mind map instructional strategy and those taught with lecture method. It could also be concluded that there is there is a significant difference in the mean achievement scores of male and female students taught Chemistry with mind map instructional strategy.

Recommendations

Based on the findings from the study, the following recommendations were made:

1. School administrators should as a matter of necessity organizes seminars and workshops for Chemistry teachers on the need to adopt mind map instructional strategy delivery for the enhancement of students' academic achievement in Chemistry.
2. Chemistry teachers should mindfully implement the use of mind map strategy delivery in order to promote students' academic achievement in Chemistry.
3. Guidance counsellors should schedule counselling sessions for male students with a view to bridging the gaps in achievement between them and their female counterparts in Chemistry.
4. Curriculum planners should make requisite revisions in the curriculum so as to capture the use of mind-mapping strategy for the enhancement of students' academic performance in Chemistry.

References

1. Auta, A. (2015). Effects of concept mapping and inquiry strategies on achievement and creativity among colleges of education Physics students in North-East Nigeria. (M. Ed unpublished Dissertation) Ahmadu Bello University, Zaria.
2. Bo-Jang, J. and Li-Wang, H. (2019). Effective Physics Teaching Based on Mind Mapping. 9 International Conference on Education and Social Sciences (ICESS2OJ9).
3. Brain, S. (2021). Influence of schools environmental factors on chemistry student academic achievement in Akwa Ibom State. Unpublished M.Sc (Ed) Thesis work (2021).
4. Grace, (2019) Think pair instructional teaching method in organic chemistry M.Sc (Ed) unpublished work (2019).
5. Kenesha, W., Eddia, C. and Natalie, G. (2016). A preliminary study on the use of Mind Mapping as a Visual-Learning Strategy in General Education Science class for Arabic speakers in the United Arab Emirate. *Journal of Scholarship of Teaching and Learning*. 16(1),31-52.
6. Madu, B. C. and Metu, I. C. (2018). Effect of mind map as a note-taking approach on students' achievement in Economics. *Journal of Emerging Trends in Economics and Management Sciences*. 3(3), 247-251.
7. Martins, D. (2018). Concept Mapping, Mind Mapping and Argument Mapping: What are the Difference and Do They Matter? *Higher Education*. 62(3), 279-301.
8. Nwuba, I. S. and Osuafor, A. M. (2021). Effect of experiential learning approach on secondary school students' academic achievement in biology in Awka Education Zone. *South Eastern Journal of Research and Sustainable Development*. 4(2); 1-15.
9. Zvezdan, Z. G., Sonja, J. S., Branka, N. R., Maja, M. S. and Olivera, G. (2019). The implementation of mind maps in teaching physics: Educational efficiency and students' involvements. *Journal of Baltic Science Education*, 18(1), 117-131.