# Effects of Concept Mapping (CM) And Teacher's Sex (TS) On Students' Achievement in Biology in Delta State (DS)

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Abstract: The study looked at how CM and TS affected students' performance in Biology in DS adopting quasi-experimental design. 12,163 SSII Biology students were included in the study. The sample size consisted of 30 students. Data were gathered using the Biology Achievement Test (BAT), which has a 0.83 reliability coefficient obtained using Kuder-Richardson formula 21. Data were analysed with Mean, standard deviation and t-test. The findings showed statistically considerable differences between the Biology achievement of students taught with CM and LM, favouring CM; and that there was no statistically considerable primary influence of TS on students' Biology achievement. The study comes to the conclusion that CM enhances students' Biology achievement more than the lecture technique (LM). Therefore, it was advised that CM be used during Biology instruction.

# Keywords: Concept-mapping, Lecture Method, Biology Achievement

#### Introduction

One of the disciplines taught in Nigeria's Senior Secondary Schools is Biology. Biology is a crucial science subject that offers content for students training in fields like medicine, nursing, pharmacy, forestry, fisheries, and others. For science-related disciplines, a credit pass or higher in Biology is required. In the Senior School Certificate Examinations administered by the West African Senior School Certificate Examinations, the majority of senior secondary school students pick Biology. Additionally, some Senior Secondary School students choose Biology as their first-choice topic because they think it to be an intriguing subject that is more closely tied to nature.

Biology education emphasize acquisition of meaningful and relevant knowledge in Biology. However, judging from the subpar performance of students in Biology based on the evidence gathered from WAEC Chief Examiner's report on WASSCE from 2015 to 2019, one may conclude that students have not acquired meaningful knowledge in Biology. One of the students' weaknesses is that Biology principles are poorly understood by students. Because they were not actively engaged during instruction, students may not have understood fundamental biological principles. There are numerous elements militating against students' active involvement during instruction among which is the instructional method adopted by the teacher. Therefore, to facilitate students' active involvement and ensure meaningful learning during instruction requires the adoption of appropriate instruction method by the teachers.

From personal observation, Biology teachers widely use the lecture method (LM) during instruction in Nigeria's schools. LM is a teaching method whereby information, facts and knowledge are passed to students by the teacher in the final form (Ajaja, 2013). Majority of students today learn Biology passively, as their teachers organise and convey the knowledge (Moyer, Hackett & Everett, 2007). The authors mentioned that "often, the teacher pays little attention to what students already know about science. In LM, the information transmitted by the teacher and curriculum materials is assumed to make sense and seem reasonable to the students".

This model has a constrained understanding of Biology. LM use encourages students' passivity during instruction. The students find it very challenging to fully comprehend Biology subjects since they are passive. In the WASSCE, students' poor academic performance in Biology may have been explained by this. There is a good incentive to investigate alternative teaching methods, such as concept mapping, given the growing emphasis on making lessons clear, the encouragement of self-activity, high retention rates, and lifelong learning (CM).

According to Lawal (2017), students utilise CM as a type of graphic organiser to arrange and present their comprehension of a subject. The author continued by stating that concept maps begin with a broad notion and then spread out to demonstrate how that broad notion may be divided into more manageable pieces. In a concept map, the secondary concepts are frequently developed from the primary concept or notion. On the other hand, this type of visual organiser permits ongoing customization and the inclusion of new ideas. They are made up of concepts, which are typically encased in various types of circles or boxes, and relationships between concepts, which are represented by a connecting line connecting two concepts. The relationships between concepts are shown graphically in concept maps. CM is ued for organising and presenting information graphically. CM representation uses implied plain language statements to encode claims identifying two or more concepts and their relationships.

CM activities have been used in educational settings to help students develop a conscious concepts' understanding and connections within their subjects of interest (Ahmad & Munawar, 2013). CM was created to assist the student's effort by externalising ideas and asserts that students have already grasped concepts and makes them visible to aid in their connection with recently learned ideas. Teachers have employed CM to evaluate their students' comprehension, and collaboratively update their understanding, and by experts to demonstrate and impart their knowledge. When properly and thoroughly implemented, CM can assist students in achieving high levels of cognitive performance.

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A concept map is a fantastic tool for both learning and evaluation for instructors who want to track and assess their students' progress. Students rephrase ideas in their own words and assist educators detect faulty concepts and ideas. Teachers can identify concepts that students struggle with, providing a precise, objective method to assess the conceptual gaps in students' knowledge. CM is a helpful visual aid for students' learning and thinking in comprehending and communicating a concept, as well as the links between examples and concepts. CM, according to Ajaja (2013), aid ideas' comprehension, showing linkages to more ideas. CM has evolved into a highly beneficial instrument for education and learning. In a number of studies (Ajaja, 2013; Wang, Wu, Kirschner & Spector, 2018), CM has been found to boost students' achievement in a variety of subject areas. Therefore, the major rationale for the study is to find out if CM facilitates students' understanding of Biology concepts more than the LM.

Scholars have encouraged teachers to use CM, irrespective of their sex, because they believed that it ensures the active participation of students. TS in this study simply relates to both male and female educators in the school setting. It has also been speculated in some quarters that TS affects the achievement of students. Dee (2006) discussed two theories that claimed TS was a factor in student achievement. One idea, claims that the TS affects how the teacher and students communicate, while another claims that the instructor always serves as a sex-specific role model. The second notion, according to the author, held that when a teacher had the same sex as their students, the students were more engaged, behaved better, and did better.

However, the results of research on the impact of TS on student achievement seem to be ambiguous. According to certain authors, such as Dee (2006), there is a significant correlation between school accomplishment and TS. Additionally, according to Krieg (2005), there is no proof that the sex interactions between students and teachers have an impact on test results. The researcher deemed it worthwhile to conduct this study to discover whether TS impact students' progress in Biology because the results seemed to be inconclusive based on information from the literature.

Academic achievement is the ability of a student to achieve short- or long-term educational objectives. Academic achievement, according to Nwanze (2016), is a result of learning that demonstrates the degree to which learning objectives have been met. It is a student's performance indicated by a score on a benchmark test. Academic success can also be defined as a person's outstanding performance in a particular academic subject. A student has excelled in the academic field of Biology if they receive honours or high grades in the subject. Numerous factors, including TS, affect students' academic success. In light of this, this study looked into how CM and TS affect Biology students' achievement in DS.

#### **Statement of the Problem**

Biology contains ideas that are highly abstract based on perception of students. It is necessary to utilise a teaching strategy that makes it simple for students to understand the concepts they have learned in order to reduce these abstractions in biological concepts. Today's students learn Biology in classrooms in a passive manner as their instructors use LM to arrange and deliver the material to them. Thus, there is good reason to investigate other teaching methods, such as CM, in Biology instruction, given the growing emphasis on active learning, lesson clarity among others.

Students' learning and achievement is known to be influenced by TS. For the instructor to effectively communicate Biology curriculum materials to students and ensure effective teaching and learning, TS expertise is a requirement. Therefore, the goal of the study was to determine how CM and TS affected Biology students' achievement.

# **Purpose of the Study**

The purpose of the study was to investigate how CM and TS affect the achievement of Biology students' achievement. The specific purposes of the study include finding out the difference:

- 1. between male and female students taught Biology using CM and LM;
- 2. between male and female Biology students taught with CM by female teachers; and
- 3. between male and female students taught with CM by male teachers..

# **Hypotheses**

- 1. The mean achievement scores of students taught Biology using CM and LM did not differ significantly.
- 2. There is no discernible difference in the mean achievement scores of male and female students taught Biology using CM.
- 3. There is no discernible difference in the mean achievement scores of male and female students taught Biology using CM.

# Methodology

This study used quasi-experimental design. The experimental group received their Biology instruction using CM, while the control group received their instruction using LM. Table 1 shows how the design is expressed:

# Table 1

Design of the Study			
Group	Pre-test	Treatment	Post-test
CM (exp)	<b>O</b> <sub>1</sub>	X <sub>CM</sub>	O <sub>2</sub>
LM (ctrl)	O <sub>3</sub>	X <sub>LEC</sub>	$O_4$

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Data were gathered using the Biology Achievement Test (BAT), which had been properly vetted by three specialists. The Kuder-Richardson formula 21 was utilised to evaluate the BAT's reliability (0.83). Before the treatment and after the treatment, BAT was given as a pretest and a posttest. The acquired scores were compiled and examined using the mean, standard deviation, and ttest.

# Results

~ The mean achievement scores of students taught Biology using CM and LM did not differ significantly.

Table	2
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t-test Summary Comparing Achievement Scores of Students in CM and LM Group							
Group	Ν	$\bar{x}$	SD	df	t-cal.	Sig. (2-tailed)	Decision
СМ	157	57.45	11.84	200	9.453	0.000	
LM	144	45.71	9.45	299			$HO_2$ is rejected

The achievement mean scores of students taught Biology using CM and LM differ significantly, as shown in table 2, at t = 9.453 and P(0.000) < 0.05. Thus, the null hypothesis disproved. The mean achievement scores of students taught Biology using CM and LM varied significantly, favouring CM.

√ There is no discernible difference in the mean achievement scores of male and female students taught Biology using CM.

# Table 3

t-test Summ	ary Com	paring Achi	evement Sco	res of M	lale and	Female Students in C	CM Group Taught by Male Teachers
Sex	Ν	$\overline{x}$	SD	df	t-cal.	Sig. (2-tailed)	Decision
Male	29	56.00	10.18	74	0.972	0.334	HO <sub>4</sub> is not rejected
Female	47	58.51	11.37				

The average success levels of students taught Biology with CM from male teachers are not significantly different, according to table 3 (t = 0.972, P(0.334) > 0.05). Thus, the null hypothesis not disproved. As a result, there is no discernible difference in the mean achievement of male and female students studying Biology with CM.

 $\checkmark$ There is no discernible difference in the mean achievement scores of male and female students taught Biology using CM. Table 4

t-test Summ	nary Com	paring Achi	evement Sco	res of M	lale and l	Female Students in (	CM Group Taught by Female Teachers
Sex	Ν	$\overline{x}$	SD	df	t-cal.	Sig. (2-tailed)	Decision
Male	43	56.74	12.30	79	0.460	0.647	HO <sub>5</sub> is not rejected
Female	38	58.05	13.29				

Table 4 shows no considerable differences in achievement scores between male and female students taught Biology with CM by female teachers (t = 0.460, P(0.647) > 0.05). The null hypothesis is, therefore, not refuted. Thus, there is no obvious difference between male and female students who took CM Biology classes in terms of mean success.

# **Discussion of Results**

The study found substantial difference in achievement scores, in favour of CM, between students taught Biology using CM and LM. This finding is consistent with that of Aziz and Rahman (2014), who found that utilising CM was more successful than using LM in raising students' performance in genetics classes. This conclusion concurs with that of Otieno (2015), who discovered that students in the CM group participated in class more and achieved a statistically significant greater mean gain on the Physics test as compared to the lecture group.

The disparities in teaching strategies used in each group, which may have affected students' performance scores in Biology, may be the cause of the variances in achievement scores between the groups. The results of the study showed that students taught via CM performed better than those taught using the lecture technique. This shows that students in the CM group may have engaged in more active learning, which helped them understand Biology ideas better than students in the lecture group. The better accomplishment results of students in the CM could be attributed to this. This is predicated on the idea that participation in the learning process enhances learning (Ajaja, 2013). Additionally, CM offered more effective methods of summarising the lesson's principles, making it easier to revisit the lessons and report or emphasise their essential points as needed.

The research also found no statistically significant difference between male and female students who took CM Biology classes given by male instructors in terms of mean success. The survey also showed no discernible difference in the mean achievement of male and female students taking CM Biology classes taught by female lecturers. The results of Okoro, Ekanem and Udoh (2012), who demonstrated that teacher-student gender interactions do significantly affect students' academic performance as evidenced by the differences in the performance of boys taught by male teachers and boys taught by female teachers, as well as between the performance of girls taught by female teachers and girls taught by male teachers, are in line with the findings of this study. The basis for this observation may be found in the fact that, regardless of the sex of the teacher who taught the instructional method, any adequate method of instruction that is successfully implemented would effectively raise the achievement of both male and female students. Therefore, regardless of the gender of the Biology teacher who used CM, its use increased both the academic performance of male and female students who were studying Biology.

### Conclusion

The study's findings led the researcher to the following conclusion: CM improves Biology students' achievement than LM. In addition, the effect of CM on students' achievement in Biology is not dependent on TS.

### Recommendations

The researcher recommended the following:

- 1. Biology teachers' adoption of CM during instruction to help reduce the abstraction in Biology concepts.
- 2. Biology teachers should provide useful information to students during the use of CM in actual classroom setting.

#### References

- Ahmad, B. C., & Munawar, S. M. (2013). Effect of concept-mapping on students' academic achievement. *Journal of Research and Reflections in Education*, 7(2), 125 -132.
- Ajaja, O. P. (2013). Which strategy best suits Biology teaching? Lecturing, concept-mapping, cooperative learning or learning cycle?ElectronicJournal of Science Education, 17(1) 1-37.
- Aziz, T., & Rahman, A. (2014). Effect of concept-mapping strategy on students' achievement in science at secondary level. Retrieved 20<sup>th</sup> April, 2022 from <u>https://www.researchgate.net/publication/281848894\_Effect\_of\_Concept\_Mapping\_Strategy\_onStudents'\_Achievement\_i</u> <u>n\_Science\_at\_Secondary\_Level/link/55fb296308aec948c4afab5a/download</u>.
- Dee, T. S. (2006). The why chromosome: How a teacher's gender affects boys and girls. Retrieved on 19th April, 2022, from <a href="http://www.thefreelibrary.com/The+why+chromosome%3a+how+a+teacher's+gender+affects+boys+and+girls.php">http://www.thefreelibrary.com/The+why+chromosome%3a+how+a+teacher's+gender+affects+boys+and+girls.php</a>.
- Krieg, J. M. (2005). Student gender and teacher gender: What is the impact on high stakes test scores? *Current Issues in Education* [Online], 8(9), 123-129.
- Lawal, N. I. (2017). Effects of concept-mapping method on the academic performance of agricultural science in senior secondary schools in Kaduna State. *International Journal of Topical Educational Issues, 1(2),* 14-26.
- Moyer, R. H., Hackett, J. K., & Everett, S. A. (2007). *Teaching science as cycle lessons*. New Jersey: Pearson Merrill? Prentice Hall.
- Nwanze, A. C. (2016). Effect of multimedia synchronized instructional strategy on students' achievement and retention in secondary school chemistry in Onitsha education zone (Unpublished master dissertation). Nnamdi Azikiwe University, Awka.
- Okoro, C. C., Ekanem, I. E., & Udoh, N. A. (2012). Teacher gender and the academic performance of children in primary schools in Uyo Metropolis, Akwa Ibom State, Nigeria. *Journal of Educational and Social Research*, 2(1), 267-273.
- Otieno, W. V. (2015). Effects of concept-mapping based instruction on students' achievement in Physics in public secondary schools, Nairobi County, Kenya. Retrieved 20<sup>th</sup> April, 2022 from https://pdfs.semanticscholar.org/c87b/ebfe18b80f5029557066bc0d92d5009dec2a.pdf.
- Wang, M., Wu, B., Kirschner, P.A., & Spector, J.M. (2018). Using cognitive mapping to foster deeper learning with complex problems in a computer-based environment. *Comput. Hum. Behav.*, 87, 450–458.
- West African Examination Council. (2015-2020). WAEC Chief Examiner's reports on students' performance in Biology. Retrieved 05/04/2022 from <a href="http://waeconline.org.ng/">http://waeconline.org.ng/</a>.