

## MODEL-AIDED AND THINK-PAIR-SHARE: COMPARING EFFECTIVENESS OF MODES OF COLLABORATIVE STRATEGIES ON STUDENTS' EMOTIONAL INTELLIGENCE IN BIOLOGY IN MAKURDI, NIGERIA

<sup>1</sup>Jackson Ochigbudu Ode, <sup>2</sup>Comfort M. Chafa and <sup>3</sup>Msuur Tofi

<sup>1&3</sup> Department of Science and Mathematics Education, Benue State University, Makurdi

<sup>2</sup> Postgraduate Student, Department of Science and Mathematics Education, Benue State University, Makurdi

[odejackson90@gmail.com](mailto:odejackson90@gmail.com), [chafacomfort78@gmail.com](mailto:chafacomfort78@gmail.com), [tmsuur@gmail.com](mailto:tmsuur@gmail.com)

### Abstract

*This study compared effect of model-aided and think-pair-share collaborative instructional strategies on secondary students' emotional intelligence in Biology in Makurdi, Benue State, Nigeria. The study adopted a non-equivalent pre-test post-test control group design known as quasi experimental design. Three research questions and three hypotheses guided the study. The population of the study consisted of 1700 senior secondary II students in 24 public senior secondary schools in Makurdi Metropolis in the 2021/2022 academic session. The study sample was 80 senior secondary II students who offer Biology in two intact classes located in three Public secondary schools in Makurdi Metropolis of Benue state obtained using multi-stage sampling. Two instruments were used to collect data. Emotional Intelligence Scale (EIS) was adapted by the researchers. The Emotional Intelligence Test (EIS) was validated by three experts in Department of Science and Mathematics Education, Benue State University, Makurdi. The instrument was trial-tested on 20 Senior Secondary II students offering Biology but were not to be part of the main study. The scores obtained were subjected to analyses using Cronbach alpha to determine the reliability index of the instrument. Reliability coefficient for EIS was 0.86. Data collected were analysed using mean and standard deviation to answer the research questions. The hypotheses were tested at 0.05 level of significance using Analysis of covariance (ANCOVA). No significant difference was found between the mean emotional intelligence scores of students taught Biology using model-aided collaborative instructional strategy and those taught using Think-pair-share collaborative instructional strategy ( $F_{(1, 78)} = 0.012, p = 0.913$ ). It was recommended among others that both model-aided and think-pair-share collaborative instructional strategies should be used by Biology teachers to improve students' emotional intelligence.*

**Keywords:** Model-Aided, Think-Pair-Share, Biology, Emotional Intelligence, Collaborative Strategy

### Introduction

Science education encompasses the teaching of science concepts, methods of teaching and addressing misconceptions held by learners regarding science concepts. Science education therefore is the key to the development of any nation and many of the developed nations were able to achieve so much because of science education. Biology

is one of core science subjects offered at the Secondary School level. It is significant to man's successful living. Biology is introduced to students at the senior secondary school level in Nigeria in preparation for human development, where career abilities are groomed, potentials and talents discovered and energized (Federal Republic of Nigeria, 2014). It is a cardinal science

subject required for further learning of a number of science related professional courses such as Medicine, Agriculture, Zoology, Botany, Pharmacy among others.

In contemporary Nigeria, greater emphasis is placed on science and technological development. As a result, students are being encouraged to take up science-related subjects. Knowledge of Biology helps in every day's living and touches almost every aspect of existence. It is the study of living organisms which include their structure both gross and microscopic, functioning, origin, evolution, classification, inter-relationships and distribution. As a science, Biology began as man started to observe his environment and look for cause and effect relationship. Not satisfied with only observation, many early biologists wanted to manipulate or test predictions based on their observations. The pioneers in this field of experimental biology include William Harvey, Anthony Von Leeuwenhoek, Louis Pasteur, Gregor Mendel, Alexander Fleming and Charles Darwin. Today, Biology has grown from the familiar areas of Microbiology, Biochemistry, Zoology, Botany and Genetics to new specializations that include Neurology, Endocrinology, Limnology, Electrophysiology and Biotechnology. The field of Biology has become a beehive of activities. The general role of Biology is to equip the learner with basic knowledge, skills and attitude that will enable one to live an independent and useful life both to herself/himself and the larger community where one lives (Ogunleye, 2016).

The common teaching method employed by some Biology teachers is the lecturing method (Ode & Ogah, 2021). This is a conventional method of teaching where the teachers talk and students listen and take notes. In some schools, students only visit the laboratory only when the Biology

practical external examination is two or three weeks away. Factors responsible for poor performance in science as stated by Ode, Akpohol and Otor (2020) are the use of defective instructional strategies, lack of instructional materials and unqualified teachers. However, prominent among these factors is the use of defective instructional strategies (Ode & Tartenger, 2021). There is need to move away from the conventional way of teaching and learning which is the transmission of knowledge, to innovative instructional strategies in which the learners build their own understanding or construct knowledge.

Innovative teaching strategies are favoured by the Federal Republic of Nigeria (FRN, 2013) to ensure that teaching is practical, activity-oriented and student-centered. The aim is to facilitate active participation of learner during teaching and learning processes. Research on students' understanding of science concepts, performance and emotional intelligence have been conducted using the following innovative instructional strategies inquiry/discovery learning, concept mapping, hands-on minds on, advanced organizers, 5Es and 7Es learning strategy and collaborative strategy among others (Achor, Aligba & Iloaksia, 2021; Ode & Tartenge, 2022).

In this research, focus is on collaborative learning strategy. The reason for the choice of this strategy is that the Nigerian child learn in a collaborative setting during informal education as part of the cultural in Nigeria and research reports indicate that it may facilitate students' emotional intelligence Collaborative learning strategy is a method of learning in which students' team together to explore a significant question or create a meaningful project (Danjuma, 2015). Collaborative learning provides the driving force for social constructivism where students are in control of their own learning

and ultimately, the outcome of their learning. Collaborative learning is best suited to an arrangement of groups where students can freely interact with one another and construct their ideas together. Collaborative involves two or more students learning together.

In the collaborative instructional strategy, groups assume almost total responsibility for answering the question. The students determine if they had enough information to answer the question. If not, they identify other sources such as journals, books, videos and the internet, to name a few. The work of obtaining the extra source material would be distributed among the group members by the group members. The group would decide how many information they could identify. The collaborative teacher would not specify a number but would assess the progress of each group and provide suggestions about each group's approach and the data generated. It might also occur to the students to list the reasons in order of priority. The teacher would be available for consultations and would facilitate the process by asking for frequent progress reports from the groups, facilitate group discussions and group dynamics, help with conflict resolution, among others (Danjuma, 2015). The efficacy of collaborative learning in promoting understanding, performance and emotional intelligence have been proved in other locations (Danjuma, 2015; Achor, Aligba & Iloaksia, 2021). However, most of these studies reported a moderate effect size indicating that the strategies could still be improved. Furthermore, due to the fact that Biology deals with nature, students' may benefit more if they utilize models in a collaborative learning environment. It should be noted that learners are individuals with different learning needs. Therefore, there is need to seek for a teaching strategy or strategies that will address the individual learners' needs such as Model-Aided and

Think-Pair-Share collaborative learning instructional strategies.

Olarewaju (2012) opined that models are media that enhances teaching and learning processes and include concrete objects through which realities are represented, communicated and appreciated in educational instruction. A model is a systematic description of an object or phenomenon that shares important characteristics with the object or phenomenon. The use of models is aimed at making a particular part or feature of a thing easier to understand, define, quantify, visualize or simulate by referencing it to existing and usually commonly accepted knowledge. Thus, models are used by Biologists in nearly every facet of scientific inquiry, research, and communication. Models are helpful tools for representing ideas and explanations and are used widely by scientists to help describe, understand, and predict processes occurring in the natural world. Models forms integral part and can aid interpretation and understanding of a complex world (Hoskinson et al., 2014). Models may help students organize information, identify patterns and processes, as a result, aid in refining students' understanding over time with improved emotional intelligence.

Think-Pair-Share is a collaborative learning strategy developed by Frank Lyman and his colleagues in Maryland. It gets its name from the three stages of students' action, with emphasis on what students are to be doing at each of those stages. Think-Pair-Share (TPS) is a collaborative learning strategy where students work together to solve a problem or answer a question about an assigned task. This strategy requires students to think individually about a topic or answer to a question, discuss with a partner or seat mate; and share the ideas with the entire classmates (Akanmu, 2019). Think-pair-share is a model

of collaborative learning strategy in pairs and gives students more time to think, respond and to help each other. As stated by Jumanta (2014), think-pair-share is a simple technique with great advantages. In think-pair-share collaborative learning strategy, students help each other to resolve the issue with the capabilities of each. Due to the importance of Biology to human and societal development, there is the need for effective teaching and learning strategies that would enhance students' emotional intelligence so that students can fully participate in science subjects like Biology.

Another variable of interest in this study is emotional intelligence. Bradberry and Greares (2014) states that emotional intelligence is one's ability to recognized and understand one's emotions and manage behaviour and relationship. Emotional intelligence also refers to the ability to understand, use, and manage your own emotions in positive ways to relieve stress, communicate effectively, empathize with others, overcome challenges and diffuse conflict. Emotional intelligence has been found to have significant influence in one's success or failure. It can also be described as the capacity to process emotional information accurately and efficiently, this processing includes the capacity to perceive, assimilate, understand, and manage emotions. It is important to examine emotional intelligence of students because research has shown that inability to effectively deal with stress, anxiety and relate effectively with peers can hinder learning and performance (Mukolwe, 2015).

Patel (2017) identified four domains of emotional intelligence which are self-awareness, self-management, social awareness and the relation management. Emotional Intelligence could help students become more successful at managing

behaviour and navigating changes, new trends, and social complexities. People with high emotional intelligence succeed in a task even difficult ones. Thus, they could develop skills associated with high performance, making personal decisions, achieving results and increasing productivity (Patel, 2017).

Literature evidence on emotional intelligence of students have been revealed to be low (Patel, 2017). Moreover, research has shown that studies on emotional intelligence as it affects students in biology is scarce, a gap that makes this study imperative. As earlier stated, Biology is an important science subject that is activity-oriented; therefore, the learning strategy adopted or adapted during teaching and learning the subject may determine students' emotional intelligence. These necessitated the conduct of this study on effect of model-aided and think-pair-share collaborative instructional strategies on secondary students' emotional intelligence in Biology in Makurdi LGA of Benue State, Nigeria.

### **Statement of the Problem**

Biology plays an important role in the development and foundation laying in the field of science in Nigeria. Unfortunately, there is evidence from literature that students' low emotional intelligence in the subject. The worry about emotional intelligence is that a student who has dysfunctional characteristics such as lack of confidence, lack of stress management, low self-esteem, lack of self-control and have a high anxiety are said to have a low emotional intelligence, and this may affect the students' performance. This problem if not addressed, students' ability to eagerly engage in the process of science, think critically and develop sound emotional intelligence may not be realized. This may lead to persistent underperformance in Biology with resultant decline in academic standard and inability of

male and female students to further their education at post-secondary education level. Specifically, the implication of is that students who intend to advance their studies in biology-related courses like Botany, Zoology, Pharmacy, Medicine, Biochemistry, Environmental Sciences among others cannot do so as admission into higher institutions to study such courses requires students to pass Biology with at least a credit. This calls for intervention by adopting innovative instructional strategies which are learner-centered strategies such as model-aided and think-pair-share collaborative instructional strategies that actively engage students and provide real life learning experiences. The problem of this study is therefore: What is the effect of model-aided and think-pair-share collaborative instructional strategies on secondary students' emotional intelligence in Biology in Makurdi Metropolis, Benue State?

### **Purpose of the Study**

The purpose of this study is to determine the effect of model-aided and think-pair-share collaborative instructional strategies on secondary students' emotional intelligence in Biology in Makurdi LGA of Benue State. Specifically, the study determined:

1. The difference in emotional intelligence scores of students taught Biology using model-aided collaborative instructional strategy and those taught using think-pair-share collaborative strategy.
2. The difference in emotional intelligence scores of students taught Biology using model-aided instructional strategy and those taught using conventional strategy.
3. The mean emotional intelligent ratings of students taught Biology using think-pair-share collaborative instructional strategy

and those taught using conventional strategy.

### **Research Questions**

The following research questions guided the study.

1. What is the difference in the mean emotional intelligence ratings of students taught using model-aided collaborative strategy and those taught using think-pair-share collaborative strategy in Biology?
2. What is the difference in the mean emotional intelligence ratings of students taught Biology using model-aided collaborative instructional strategy and those taught using conventional strategy?
3. What is the difference in the mean emotional intelligence ratings of students taught Biology using think-pair-share collaborative instructional strategy and those taught using conventional strategy?

### **Hypotheses**

These null hypotheses guided the study and were tested at 0.05 level of significant.

1. There is no significant difference in emotional intelligence ratings of students taught using model-aided collaborative instructional strategy and those taught using think-pair share collaborative instructional strategy in Biology.
2. There is no significant difference in the emotional intelligence ratings of students taught using model-aided collaborative instructional strategy and those taught using conventional instructional strategy in Biology.
3. There is no significant difference in the emotional intelligence ratings of students taught using think-pair-share collaborative instructional strategy and those taught using conventional instructional strategy in Biology.

## **Research Method**

The researchers adopted a non-equivalent pre-test post-test control group design known as quasi experimental design. The reason for the choice of quasi experimental design is because school schedule cannot be disrupted or classes reorganized, for the conduct of this study therefore, intact classes will be used. Emaikwu (2015) supports the use of non-equivalent control group design when it is not possible to randomize subjects as in true experiments. The population of this study consisted of 1700 senior secondary II students in 24 public senior secondary schools in Makurdi Metropolis in the 2021/2022 academic session (Benue State Teaching Service Board, 2021). The sample consist of 80 senior secondary II students who offer Biology in two intact classes located in three Public secondary schools in Makurdi Metropolis of Benue state obtained using multi-stage sampling. The instrument used to collect data was Emotional Intelligence Scale (EIS) and it was adapted. Furthermore, the researcher developed 9 lesson plans; three for each group, for the purpose of teaching. The EIS was adapted from Mayer-Salovey-Caruso Emotional Intelligence Test for the purpose of this study. The test by Boom etal (2013) has 40-items design to measure four sub areas of emotional intelligence which are self-awareness, self-management, social awareness and relationship management. Word like ‘often’, ‘and’ and ‘or’ in certain items was removed and the items rephrased as it might cause some confusion with the respondents’ ability to process the items. Twenty items were selected from the adapted instrument and moderated to suit the general understanding and cultural context of the respondents in this study. The researcher developed 12 additional items. Several items were rephrased so that the questionnaire contained both positive and negative items. In all, EIS contained 30 items. The 32-items

EIS has two sections. Section A elicits personal information from the respondents, which is gender and name of school while B contains 30- items which measured issues on self-awareness, self-regulation, self-motivation, sympathy, social skills and relationship management. The scoring of the responses mode is Strongly Agree (SA) 4 points, Agree (A) 3 points, Disagree (D) 2 points and Strongly Disagree (SD) 1 point for positive items and reverse for negative items.

Eighteen lesson plans were developed by the researcher on reproduction of animals in Biology which cover sexual and asexual reproduction (fission, budding, fragmentation, and pathogenesis) in accordance with the tenets of Model-Aided Collaborative Instructional strategy and Think-Pair-Share Collaborative Instructional strategy which were used to teach the experimental groups while the control group were taught using lesson plans on the same concepts prepared in line with tenets of the conventional chalk and talk strategy.

The Emotional Intelligence Scale (EIS) was validated by three experts in Department of Science and Mathematics Education, Benue State University, Makurdi. The experts were to thoroughly scrutinize the research instrument and lesson plans to ascertain if they are appropriate, unambiguous and relevant to the purpose of the study which they did and made comments and all observed errors were corrected. To establish the level to which Emotional Intelligence Scale (EIS) is reliable, the instrument was trial-tested on 20 Senior Secondary II students offering Biology in Makurdi who will not be part of the main study. The test scores from EIS were subjected to analyses using Kuder Richardson 20 (K-R 20) Formula to determine the reliability index of the instrument. Reliability coefficient for EIS was 0.86. The instrument was, therefore,

considered reliable for data collection for the purpose of this study as according to Emaikwu (2015), an instrument with reliability coefficient value of 0.55-0.99 is reliable for use in research. Two Biology teachers from the sampled schools who were Biology education (B. Sc.Ed) graduates and have taught for at least five years were trained for one week by the researchers assisted in data collection. Emotional Intelligence Scale (EIS) was administered to all students participating in the study as pre-test ascertain their emotional intelligence in Biology before treatment. The EIS items were reshuffled and administered after treatment as post-test to determine students' emotional intelligence in Biology after teaching. The scores from Emotional Intelligence scale were collated and subjected to analysis to answer research questions and test hypotheses set for this

study. To answer the research questions, mean standard deviation were used. The hypotheses were tested at .05 level of significance using Analysis of covariance (ANCOVA). This is because since intact classes whose equivalence are unknown, the pre-test scores were used as control for any initial differences across groups. Moreover, it also ensured that the observed differences, if any, were mainly due to the effects of the independent variables on the dependent variable (Emotional Intelligence).

**Results**

**Research Question One**

What is the difference between the mean emotional intelligence ratings of students taught using model-aided collaborative strategy and those taught using think-pair-share collaborative strategy in Biology?

**Table 1:** Mean and Standard Deviation on Emotional Intelligence Ratings of Students taught using Model-aided Collaborative Instructional Strategy (MCIS) and those taught using Think-pair-share Collaborative Instructional Strategy (TCIS) in Biology

Group	Sample (n)	Pretest		Posttest		Mean gain
		Mean	Std. D.	Mean	Std. D.	
MCIS	42	1.89	0.41087	3.31	0.30454	<b>1.89</b>
TCIS	39	1.86	0.43860	3.32	0.31068	<b>1.46</b>
<b>Mean Difference</b>		<b>0.03</b>		<b>0.01</b>		<b>0.43</b>
<b>Total</b>	<b>81</b>					

Table 1 reveals the mean emotional intelligence ratings of students taught Biology using MCIS was 1.89 with standard deviation of 0.41 at pre-test. It also shows mean value of 3.31 with standard deviation of 0.30 in post-test. The mean emotional intelligence ratings of students taught Biology using TCIS was 1.86 with standard deviation of 0.44 during pre-test. It also shows mean value of 3.32 with standard deviation of 0.31 in post-test. Table 4 also revealed that the mean gain of students taught

Biology using MCIS was 1.89, while those taught using TCIS had a mean gain of 1.46. The mean difference between the groups was 0.43 in favour of MCIS group.

**Research Question Two**

What is the difference between the mean emotional intelligence ratings of students taught Biology using model-aided collaborative instructional strategy and those taught using conventional strategy?

**Table 2:** Mean and Standard Deviation on Emotional Intelligence Ratings of Students taught Biology using Model-aided Collaborative Instructional Strategy (MCIS) and those taught using Conventional Strategy (CIS) in Biology

Group	Sample (n)	Pretest		Posttest		Mean gain
		Mean	Std. D.	Mean	Std. D.	
MCIS	42	1.89	0.41087	3.31	0.30454	<b>1.42</b>
CIS	45	1.91	0.38290	2.02	0.46302	<b>0.11</b>
<b>Mean Difference</b>		<b>0.02</b>		<b>1.29</b>		<b>1.31</b>
<b>Total</b>	<b>87</b>					

Result in Table 2 reveals the mean emotional intelligence ratings of students taught Biology using MCIS was 1.89 with standard deviation of 0.41 at pre-test. It also shows mean value of 3.31 with standard deviation of 0.30 in post-test. The mean emotional intelligence ratings of students taught Biology using CIS was 1.91 with standard deviation of 0.38 during pre-test. It also shows mean value of 2.02 with standard deviation of 0.46 in post-test. Table 5 also revealed that the mean gain of students taught

Biology using MCIS was 1.42, while those taught using CIS had a mean gain of 0.11. The mean difference between the groups was 1.31 in favour of MCIS group.

**Research Question Three**

What is the difference in the mean emotional intelligence ratings of students taught Biology using think-pair-share collaborative instructional strategy and those taught using conventional strategy?

**Table 3:** Mean and Standard Deviation on Emotional Intelligence Ratings of students taught Biology using Think-pair-share Collaborative Instructional Strategy (TCIS) and those taught using Conventional Instructional Strategy (CIS)

Group	Sample (n)	Pretest		Posttest		Mean gain
		Mean	Std. D.	Mean	Std. D.	
TCIS	39	1.86	0.43860	3.32	0.31068	<b>1.86</b>
CIS	45	1.91	0.38290	2.02	0.46302	<b>0.11</b>
<b>Mean Difference</b>		<b>0.05</b>		<b>1.3</b>		<b>1.75</b>
<b>Total</b>	<b>84</b>					

Table 3 reveals that the mean emotional intelligence rating of students taught Biology using TCIS was 1.86 with standard deviation of 0.44 at pre-test. It also shows mean value of 3.32 with standard deviation of 0.31 in post-test. The mean performance scores of students taught Biology using CIS was 1.91 with standard deviation of 0.38 during pre-test. It also shows mean value of 2.02 with standard deviation of 0.46 in post-test. Table 6 also revealed that the mean gain of students

taught Biology using TCIS was 1.86, while those taught using CIS had a mean gain of 0.11. The mean difference between the groups was 1.5 in favour of TCIS group.

**Hypothesis One**

There is no significant difference in emotional intelligence ratings of students taught using model-aided collaborative instructional strategy and those taught using



think-pair share collaborative instructional strategy in Biology.

**Table 4:** ANCOVA Result on Emotional Intelligence Ratings of Students taught using Model-aided Collaborative Instructional Strategy and those taught using Think-pair share Collaborative Instructional Strategy in Biology

Source	Type III Sum of Squares	df	Mean Square	F	P
Corrected Model	.010 <sup>a</sup>	2	.005	.050	.951
Intercept	43.755	1	43.755	457.348	.000
PreEI1	.008	1	.008	.086	.771
Method	.001	1	.001	.012	.913
Error	7.462	78	.096		
Total	899.622	81			
Corrected Total	7.472	80			

a. R Squared = .001 (Adjusted R Squared = -.024)

Table 4 reveals that  $F_{(1, 78)} = 0.012, p = 0.913 < 0.05$ . Since  $p > 0.05$ , the null hypothesis is therefore, not rejected. It, thus implies that, there is no significance difference in the mean emotional intelligence ratings of male and female students taught Biology using MCIS and TCIS. Thus, based on evidence from data analysis, emotional intelligence ratings of male and female students taught

Biology using MCIS and TCIS improved significantly.

**Hypothesis Two**

There is no significant difference in the emotional intelligence ratings of students taught using model-aided collaborative instructional strategy and those taught using conventional instructional strategy in Biology.

**Table 5:** ANCOVA Result on Emotional Intelligence Rating scores of Students taught using Model-aided Collaborative Instructional Strategy and those taught using Conventional Instructional Strategy in Biology

Source	Type III Sum of Squares	Df	Mean Square	F	P
Corrected Model	37.158 <sup>a</sup>	2	18.579	124.887	.000
Intercept	34.441	1	34.441	231.514	.000
PreEI2	.739	1	.739	4.971	.028
Method	36.040	1	36.040	242.262	.000
Error	12.496	84	.149		
Total	658.335	87			
Corrected Total	49.654	86			

a. R Squared = .748 (Adjusted R Squared = .742)

Table 5 reveals that  $F_{(1, 84)} = 242.262, p = 0.000 < 0.05$ . Since  $p < 0.05$ , the null

hypothesis is therefore, rejected. Thus, it implies that there is significant difference in

the mean emotional intelligence ratings of students taught Biology using MCIS and those taught using CIS. Thus, based on the evidence from data analysis, MCIS significantly improved students' emotional intelligence ratings as compared to CIS.

**Hypothesis Three**

There is no significant difference in the emotional intelligence ratings of students taught using think-pair-share collaborative instructional strategy and those taught using conventional instructional strategy in Biology.

**Table 6:** ANCOVA Result Emotional Intelligence Ratings of Students taught using Think-pair-share Collaborative Instructional Strategy and those taught using Conventional Instructional Strategy in Biology

Source	Type III Sum of Squares	Df	Mean Square	F	P
Corrected Model	36.425 <sup>a</sup>	2	18.212	121.389	.000
Intercept	37.114	1	37.114	247.370	.000
PreEI3	.948	1	.948	6.321	.014
ME3	34.498	1	34.498	229.933	.000
Error	12.153	81	.150		
Total	627.390	84			
Corrected Total	48.577	83			

a. R Squared = .750 (Adjusted R Squared = .744)

Table 6 reveals that  $F_{(1, 81)} = 229.933$ ,  $\rho = 0.000 < 0.05$ . Since  $p < 0.05$ , the null hypothesis was therefore, rejected. Thus, it implies that there was significant difference in the mean emotional intelligence rating of students taught Biology using TCIS and those taught using CIS. Thus, based on the evidence from data analysis, TCIS significantly enhanced students' emotional intelligence than CIS.

**Discussion of Findings**

One of the finding was that no significant difference exists in the emotional intelligence rating mean scores of students taught Biology using model-aided collaborative instructional strategy and those taught using think-pair share collaborative instructional strategy. This finding disagrees with Okeke and Okey (2018), Onu, Anyaegbunam, and Uzoigwe (2020) who found instructional strategies to be effective in enhancing students' emotional intelligence. This Emotional intelligence in the science teaching sphere is highly

instrumental in mutual relations between educator and students, students and students. Understanding and application of emotional intelligence in the forms of self-consciousness, control of feelings, relationship systems and enlightened communication, pave the way to concord and harmony between mind, emotion and behavior. A deeply rooted and inherent correlation exists between emotional intelligence, adaptive abilities and capacity for healthy social behaviors, caring, empathy as well as the tendency to bond and establish quality social relationships as students learn collaboratively while teachers act as facilitators.

It was found that a significant difference exists in the mean emotional intelligence ratings scores of students taught Biology using model-aided collaborative instructional strategy and those taught using conventional instruction strategy. This result corroborates with Eke, Ibebuike and Eziaghighala (2021) whose findings showed significant difference

in emotional intelligence of student taught using collaborative instruction strategy and conventional instructional strategy. The agreement of these findings could be due to the fact that models bring a sense of reality to what is taught. They create memorable impressions and bring life to lessons by actively engaging the senses of the students. Finally, it was found that a significant difference exists in the mean emotional intelligence ratings of students taught Biology using think-pair-share collaborative instructional strategy and those taught using conventional instructional strategy. This finding agrees with Telima, Alamina and Sutiani and Silitonga (2017), Magazi and Uchon (2019) who found out that collaborative instructional strategy significantly improves students' emotional intelligence. This could be as a result of the fact that think-pair-share collaborative learning strategy increases students' motivation for learning, self-esteem, redirecting attributions for success, fostering of positive feelings towards classmates which could increase emotional intelligence. The educational implication of these findings is that if Biology teachers embrace the use of model-aided collaborative instructional strategy and think-pair-share instructional strategy emotional intelligence of students will be enhanced.

### **Conclusion**

Based on the findings of this study, the following conclusions were drawn. Thus: Science students should be exposed to Biology concepts using model-aided collaborative instructional strategy and think-pair-share instructional strategy for enhancement of emotional intelligence. To do this effectively, training and retraining of Biology teachers on model-aided collaborative instructional strategy and think-pair-share instructional strategy lesson

delivery for engendering emotional intelligence in Biology.

### **Recommendations**

Based on the findings of the study, it was recommended that:

1. Both model-aided and think-pair-share collaborative instructional strategy should be used by Biology teachers to improve students' emotional intelligence ratings.
2. Government through the Ministries of Education and teacher training institutions in Nigeria should ensure in-service training and retraining of teachers on model-aided collaborative instructional strategy and think-pair-share instructional strategy lesson delivery for engendering emotional intelligence in Biology.
3. Teacher training institutions in Nigeria should include collaborative teaching strategies such as model-aided and think-pair-share in the teacher training programmes.

### **References**

- Achor, E.E., Aligba, S.O., & Iloaksia, A.O. (2021). Collaborative teaching strategy and academic performance of students of different cognitive styles in basic science. *Journal of the International Centre for Science, Humanities and Education Research*, 5(1), 85-98.
- Akanmu, M.A. (2019). Effects of think-pair-share on senior school students' performance in mathematics in Ilorin, Nigeria. *African Journal of Educational Studies in Mathematics and Sciences*, 15(2), 109-118.
- Bradberry, T., & Greaves, J. (2009). *Emotional intelligence*. San Diego: Talentsmart.

- Danjuma, G. S. (2015). *Effects of collaborative and competitive learning strategies on upper basic students' interest and achievement in basic science*. Unpublished Thesis of University of Nigeria, Nsukka.
- Eke. O., Ibebuike, U.O., & Eziaghighala, H.O. (2021). *Effect of blended smartphone in think-pair-share teaching strategy on year two students' emotional intelligence and academic achievement in Ed 221 (Curriculum Theory and practice)*. A paper presented at Science Educators Association of Nigeria (SEAN) with the Theme: Re engineering the Science Education Curriculum for Sustainable National Development in Post-Covid Era. Held at Alvan Ikoku Federal Collage of Education, Owerri, Imo State. Retrieved from <https://www.researchgate.net/profile>
- Emaikwu, S. O. (2015). *Fundamentals of research methods and statistics*. Makurdi: Selfers Academic Press.
- Magazi, Y., & Uchon, F.U. (2019). Effects of collaborative teaching strategy on the achievement and emotional intelligence of public secondary schools chemistry students in Zaria, Kaduna State. *Journal of Contemporary Issues in Education and Practice*, 8(5), 15-27.
- Mukolwe, A. N. (2015). *Selected correlates of examination anxiety and academic performance of students in public secondary school in Khwisero Sub-county, Kakamega County, Kenya*. Unpublished PhD Thesis, Department of Educational Psychology, School of Education, Kenyatta University.
- Ode, J. O. & Akpoghol, T. V. (2020). Efficacy of blended instructional model in improving basic science students' achievement in Makurdi metropolis. *Journal of International Centre for Science, Humanities and Education Research*, 4(3) 93-99.
- Ode, J. O. & Ogah, S. O. (2020). Analysis of urban and rural biology students' performance as influenced by classroom environment in Oju Local Government Area of Benue State. *Environmental Review Letters*, 5(8), 1-6. Retrievable from: [mindsourcingoa.com](http://mindsourcingoa.com)
- Ode, J. O. & Tartenger, T.T. (2021). Effect of thinking maps and role play instructional strategies on students' performance and retention in Basic Science in Makurdi, Nigeria. *Benue State University Journal of Science, Mathematics and Computer Education*, 2(2), 30-52.
- Ode, J.O., Akpoghol, T.V., & Otor, E.E. (2020). Think-pair-share cooperative learning: A workable strategy for improving achievement of students in chemistry. *BSU Journal of Science, Mathematics and Computer Education*, 1(2), 45-52.
- Ogunleye, A. D. (2016). Prospects and problems in physics education in Nigeria secondary schools. *African Journal of Education*, 1(1), 154-164.
- Okeke, M. N., & Okey, K.O. (2018). Impact of collaborative learning strategy on the academic achievement of senior secondary school chemistry students in Obio-Akpor Local Government Area. *International Journal of Education and Evaluation*, 4(2), 11-18.
- Olarewaju, R.R. (2012). *Effects of cooperative learning strategy with models on academic achievement and retention of biology concepts among*

- pre-national diploma students in Kaduna State. Unpublished Dissertation, Ahmadu Bello University, Zaria.*
- Onu, W. O., Anyaegbunam, N. J. & Uzoigwe, A. U. (2020). Improving biology students' interest and achievement through collaborative instructional strategy. *Journal of Education, Society and Behavioural Science*, 33(2), 9-20.
- Patel, S. K. (2017). Emotional intelligence of college level students in relation to their gender. *The international Journal of Indian Psychology*, 4, 2349-3429.
- Samba, R. M. O., & Kpiranyam, F. S. (2021). Effect of science based puzzles and spaced teaching approaches on students' critical thinking in ecology in Benue State, Nigeria. *Benue State University Journal of Education*, 20(1), 206-217.
- Telima, A, Alamina, J., & Aderonmu, T. (2013). The effects of collaborative learning on problem solving abilities among senior secondary school physics students in simple harmonic motion. *Journal of Education and Practice*, 4(25), 95-100.