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# Effects of Team Teaching and Lecture Method on the Retention of Physics Students in Secondary Schools in Delta State

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**ABSTRACT**

This study investigated the effects of 5E-guided inquiry, team teaching, and lecture methods on physics students' retention in Delta State. To guide the study, two research questions and two hypotheses were raised and tested at a 0.05 level of significance. The study used the quasi-experimental non-randomized pre-test, post-test, and delayed post-test planned variation group design. The population consisted of all mixed public secondary school (SS2) Physics students in Delta State with a population of 476 secondary schools and 31,711 SS2 students. A sample of six (6) secondary schools and 326 students were used for the study. The six (6) schools used for the study were selected using a stratified random sampling technique. The Physics Achievement Test (PAT) was used for data collection. Mean and Standard Deviation were used in answering all the research questions, and collected data were analyzed using analysis of variance (ANOVA) and analysis of covariance (ANCOVA). The results obtained indicated that students taught with the team-teaching method performed better than those taught using the 5E-guided inquiry and lecture method. Furthermore, the result showed that there is no significant effect of interaction between sex and method on the retention of physics students. Based on these findings, it was concluded that students taught with the team-teaching method achieved significantly better than students taught with the 5E-guided inquiry method and lecture method. Results from the study led to many recommendations, that teachers should expose physics students to team teaching methods so as to promote effective and active learning among students.

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**KEYWORDS:**

5E Guided inquiry, Team teaching method, Lecture method, Retention, Physics.

## INTRODUCTION

Learning the concept of physics is a very difficult task for the majority of students. The principal prerequisite for the success of science education which includes physics, and mathematics among others is a clear understanding of how the learner learns the best way (Costillas, 2016; Brown *et al.,* 2023). Earlier studies highlighted that the indistinguishable goal of physics at secondary education levels is to develop critical thinking skills and problem-solving skills (Ogwo and Oranu 2016). Nevertheless, miserable to note that when concern is expressed about the attainment of these goals, physics is usually reported as being a particularly disturbing problem. In recent times, physics can, at its base, be defined as the science of matter, motion, and energy; Its laws are characteristically articulated with economy and precision in the language of mathematics (Brown *et al.,* 2023). It cannot be denied that physics plays a vital role in one's life but the reality is that most students find it difficult to acquire the different theoretical physics/mathematical processes appropriate for their everyday lives (Casinillo, 2020). Conceivably, many students view learning physics as a serious challenge, thus, students perform low in physics. Making inquiries and probing for ideas became less prone to students as they moved from primary to secondary school levels. According to Collier (2015), commitment to memorizing facts is no longer an important skill in today's world because facts change. Learners now need to understand, and how to search things from unknown to known. The importance of teaching using an effective instructional method is essential to assuage difficulties related to teaching and learning physics (Emoefe, and Achufusi-Aka 2021).

The 5E Instructional Model (Turan & Matteson 2021) is a method that fits into the teaching of science. This

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is a cycle that involves cognitive stages of learning that comprise engaging, exploring, explaining, elaborating, and evaluating. The engage stage of the model focuses on prompting of questions from previous knowledge of students and, in progression, to inspire them to learn. Explore stage involves students carrying out the laboratory activity or experiment by gathering data, making observations, etc., and these explorations are formally named in the explained stage. In the elaborate stage, students are permitted to expand their learning to other topics or to satisfy earlier-held questions. Self-explanatory, the evaluation stage offers the teachers and students the chance to both formally and informally reflect upon what was learned. The assertion of Turan, & Matteson 2021, using this approach, stipulates that students redefine, reorganize, elaborate, and modify their initial concepts through self-reflection and interaction with their peers and their environment. The 5E instructional model strategically increases student engagement and participation in the learning process (Lam et al., 2023). lesson and is based on cognitive psychology, constructivist learning theory, and best practices.

Tiinamaija and Antti 2023 reported that team teaching involves a number of instructors (four or five) who share the same subject area and are actively engaging in all aspects of subject development from sequencing of topics in a unit plan or scheme of work and lesson plan, generation of learning activities and development of appropriate evaluation instrument. Furthermore, they elucidated that in team teaching the topics or units and other anticipated activities are divided equitably so that when a member is not teaching, the time taken off teaching could be spent on evaluation, grading, construction of instructional materials, and supporting whoever is teaching by observing his presentation or assisting the practical exercises and demonstrators in small group settings. Mononen et al., 2023, explicitly define team teaching as a group of instructors working decisively, regularly, and supportively to help a group of students of any age learn. The author further clarifies that the teachers involved in team teaching jointly set goals for a course, teach (explain), and evaluate lessons together.

The lecture method, conventionally referred to as the didactic approach is defined as a technique in which one person, normally the teacher, presents a spoken discourse on a particular subject (Macaranas, 2022). The lecture is used for expounding; simplifying, clarifying, and discussing new materials with learners. The materials may include facts or views on issues and problems related to the learners, which provide an aesthetically stimulating experience. The effectiveness of the lecture method depends on the type of student, the circumstances of the class, the subject, educational purposes, and the teacher's own characteristics and skills (Alaagib *et al.*, 2019).

The lecture method is used principally to introduce students to a new subject but it is also a treasured method for summarizing ideas, presenting the relationship between theory and practice, and re-emphasizing main points (Obro & Enayemo 2022). The lecture-demonstration method is a teaching technique that combines oral presentation with doing to communicate the process, concepts ideas, facts, and, observation. It is particularly effective in teaching a skill that can be observed (Obro & Enayemo 2022).

Retention of concepts is an important feature in discerning students' achievement in a given problem or assignment (Borden, & Hall, 2020). Retention is the ability to retain and subsequently remember things experienced or learned by an individual at a later time (Palomillo, 2022). In order to benefit from learning, students should be able to retain knowledge from information obtained from lessons. The teacher's job is not complete until he/she has assisted the learner in retaining knowledge of the ideal learned. The ability to understand, interpret, and apply that which is being learned is an indication that the learners have retained the knowledge of what is learned. The level of knowledge retained by learners is directly impacted by the extent of creative learning and the extent to which students learn initially depends on the instructional approaches used by teachers. This implies that the instructional strategies employed by teachers in passing information across to the students largely determine the knowledge retention ability of the students. If the learners fail to learn concepts properly initially, they will concomitantly fail to retain the knowledge of those concepts properly (Ehsanpur & Razavi 2022). Improved retention and recall of what is learned are accomplished when more sense organs are involved and when students see and do things by themselves. Retention of knowledge in learners is directly proportional to the amount of drill and practices during the learning process (Puente & Kroesen, 2020).

The novelty of the study investigated the method that proves more effective in improving students' retention of their knowledge of physics.

**Research Questions**

The following research questions guided the study:

1. What is the difference in the retention scores of physics students taught with 5E guided inquiry, team teaching, and lecture method?
2. What is the effect of the interaction between sex and method on the retention of physics students?

**Hypotheses**

The following hypotheses were tested at a 0.05 level of significance:

1. There is no significant difference in the retention scores of physics students taught with 5E-guided inquiry, team teaching, and lecture methods.
2. There is no significant effect of interaction between sex and method on the retention of physics students.

## MATERIALS AND METHODS

Quasi-experimental non-randomized pre-test, post-test, and delayed post-test planned variation group design were used for the study. The population of the study consisted of thirty-one thousand, seven hundred and eleven (31,711) SS2 students, all mixed public secondary schools in Delta state. There were three hundred and twenty-six (326) SS2 students in the study sample. Six (6) physics teachers were randomly selected from six secondary schools in Delta state The Physics Achievement Test (PAT) was used to collect data. The design consists of three instructional methods (5E Guided inquiry, Team teaching, and Lecture method), sex (male and female), and repeated testing (pre-test, post-test, and delayed post-test planned variation). The treatment that was administered to the students in the experimental group involved teaching some selected physics topics (vectors, speed, velocity and acceleration, equation of uniform accelerated motion, projectiles, and equilibrium of forces) by using the 5E Guided Inquiry method and team teaching and the control with lecture method. Mean and Standard Deviation were used in answering the research questions, and data obtained were analyzed using analysis of variance (ANOVA) and analysis of covariance (ANCOVA).

## PRESENTATION OF RESULT

The results are tabulated and interpreted immediately after each table according to the research questions and corresponding hypotheses.

**Research Question 1:** What is the difference in the retention scores of physics students taught with 5E guided inquiry, team teaching, and lecture method?

**Table 1: Descriptive statistics of mean and standard deviation comparing the difference in the retention scores of physics students taught with 5E guided inquiry, team teaching, and lecture method**

| Teaching methods | N | Mean | SD |
|---|---|---|---|
| 5E Guided inquiry | 90 | 86.74 | 9.19 |
| Team teaching | 128 | 89.57 | 6.59 |
| Lecture method | 108 | 56.86 | 18.37 |

Table 1 shows the mean and standard deviation of the three instructional methods. The result shows that the mean retention score of students taught using 5E-guided inquiry was 86.74 while the standard deviation was 9.19. With respect to the team-teaching method, the mean score was 89.57 and a standard deviation of 6.59 was obtained. Table 1 also showed that students taught with the lecture method had a mean score of 56.86 and a standard deviation of 18.37. The mean for the three teaching methods showed that students exposed to the team-teaching method had the highest retention score, followed by the 5E-guided inquiry and lecture method which had the lowest mean retention score. Therefore, there is a difference in the retention scores of physics students taught with 5E-guided inquiry, team teaching, and lecture methods. In order to determine if the observed difference is significant, ANOVA statistics were used to test hypothesis 1.

**Hypothesis 1:** There is no significant difference in the retention scores of physics students taught with 5E guided inquiry, team teaching, and lecture method.

**Table 2: ANOVA statistics showing the difference in the retention scores of physics students taught with 5E guided inquiry, team teaching, and lecture method**

| | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between groups | 72268.205 | 2 | 36134.102 | 237.360 | 0.000 |
| Within groups | 49171.398 | 323 | 152.233 | | |
| Total | 121439.605 | 235 | | | |

$P<0.05$

Table 2 shows the retention scores of students between and within groups using ANOVA analysis. The result shows that the calculated sig-value of 0.000 is less than the alpha value of 0.05. Based on this, the null hypothesis 1 is hereby rejected. This indicates that there is a significant difference in the mean retention scores of students taught with 5E-guided inquiry, team teaching, and lecture methods. To indicate the direction of the significance, a scheffe test was carried out and the result is shown in Table 3.

**Table 3: Scheffe**

| Teaching Method | (J)Tm | Mean diff (I-J) | Std Error | Sig | 95 % confidence interval lower bound | upper bound |
|---|---|---|---|---|---|---|
| 5E Guided Inquiry | Team teaching | -2.83795 | 1.69729 | 0.249 | -7.0118 | 1.3359 |
| | Lecture method | 29.87354 | 1.76098 | 0.00 | 25.5430 | 34.2040 |
| Team teaching | 5E Guided Inquiry | 2.83795 | 1.6927 | 0.249 | -1.3359 | 7.0118 |
| | Lecture method | 32.71149 | 1.61211 | 0.00 | 28.7471 | 36.6759 |
| Lecture method | 5E Guided Inquiry | -29.87354 | 1.76099 | 000 | -34.2040 | -25.5430 |
| | Team teaching | -327.1149 | 1.61211 | 000 | -36.6759 | -28.1471 |

Table 3 shows a post hoc analysis of the differences in the mean retention scores of Physics students taught with 5E-guided inquiry, team teaching, and lecture method. The table shows that the difference lies between the lecture method and 5E-guided inquiry and between the lecture method and Team teaching.

**Research Question 2:** What is the effect of the interaction between sex and method on the retention of physics students?

**Table 4: Descriptive statistics of mean and standard deviation showing the effect of the interaction between sex and method on the retention of physics students**

| Teaching methods | Sex | N | % Mean gain | SD |
|---|---|---|---|---|
| 5E Guided inquiry | Male | 49 | 85.19 | 10.35 |
| | Female | 41 | 88.59 | 7.30 |
| Team teaching | Male | 65 | 89.78 | 6.83 |
| | Female | 63 | 89.37 | 6.35 |
| Lecture method | Male | 59 | 55.78 | 18.31 |
| | Female | 49 | 58.17 | 18.55 |

Table 4 shows the mean and standard deviation of the three instructional methods. The 5E guided inquiry teaching method shows that the retention mean gain of male students was 85.19 and the standard deviation was 10.35 that of females was 88.59 while the standard deviation was 7.30 With respect to the team-teaching method, the percentage mean gain of male students was 89.78 and a standard deviation of 6.83 was obtained, for female students the percentage mean score was 89.37 and a standard deviation of 6.35. Table 4 also showed that male students taught with the lecture method had a percentage mean gain of 55.78 and a standard deviation of 18.31 while that of the female students was 58.17 and a standard deviation of 18.55. The mean for the three teaching methods showed that students exposed to the team-teaching method had the highest percentage mean gain, followed by the 5E guided inquiry and lecture method which had the lowest percentage mean gain. Therefore, there is a difference in the effect of interaction between sex and methods on the retention of physics students.

**Hypothesis 2:** There is no significant effect of interaction between sex and method on the retention of physics students

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**Table 5: Summary of ANCOVA Test of Significant effect of interaction between sex and Teaching method on the retention of physics students**

| Source | Type III Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected model | 72683.223 | 5 | 14536.645 | 95.408 | 0.000 |
| Intercept | 1921853.366 | 1 | 1921853.366 | 12613.592 | 0.000 |
| Teaching method | 71522.114 | 2 | 35761.057 | 234.709 | 0.000 |
| Sex | 254.666 | 1 | 254.666 | 1.671 | 0.088 |
| Teaching method* sex | 217.145 | 2 | 108.572 | 0.606 | 0.197 |
| Error | 48756.380 | 320 | 152.364 | 0.713 | 0.491 |
| Total | 2102500.664 | 326 | | | |
| Corrected total | 121439.603 | 325 | | | |

a. R. Squared = .599 (Adjusted R. Squared =.592)

Table 5 shows the result of the analysis of the variance test conducted to show the interaction effect of methods and sex on physics students' retention. The table established that the critical sig value of 0.491 is greater than the alpha value of 0.05 ($p>0.05$). This indicates that the interaction effect is not significant and as a result, $H0_2$ is not rejected. Therefore, there is no significant interaction effect of method and sex on physics students' retention.

## DISCUSSION OF RESULTS

The first finding showed that there is a difference in the mean retention scores of Physics students taught using 5E guided inquiry, team teaching, and lecture method. Physics students in the team-teaching group had the highest mean retention score, followed by physics students in the 5E guided inquiry group while physics students in the lecture method group had the lowest mean retention score. The result from hypothesis 1 in Table 2 showed a significant difference in the mean retention scores of physics students taught using 5E-guided inquiry, team teaching, and lecture methods. This is in line with that of (Ibrahim et al., 2018).

The second finding of the study showed that there was no significant interaction effect of methods and sex on physics students' retention. This indicates that methods and sex did not interact to influence Physics students' retention.

## CONCLUSION/POLICY RECOMMENDATION

The results from this study indicate that the team-teaching method has a greater impact on physics students' retention than the 5E-guided inquiry and lecture method. There was no significant difference in the interaction between sex and method on physics students' retention. teachers should expose physics students to team teaching methods so as to promote effective and active learning among students. The State Ministry of Education should organize seminars and workshops to train Physics teachers about the benefits of team-teaching procedures and methods. Also, teachers should be trained on how to apply team teaching methods that will improve the learning outcomes and retention of physics secondary school students.

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