



## Effect of Reciprocal Peer Tutoring Approach on Attitude of Secondary School Students' Physics in Enugu Education Zone

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### Abstract

The study investigated the effect of reciprocal peer tutoring approach on attitude of secondary school students Physics in Enugu Education Zone. A Pretest-Posttest non-equivalent control group of Quasi-Experimental design was adopted. The population for the study was 3,916 SS2 Physics students in the Zone. Purposive sampling was used to select two public schools comprising 113 students. The instrument for data collection was Physics Attitude Scale (PAS) validated by three experts and tested for reliability using Cronbach alpha with coefficients of 0.86. The data were analyzed using mean, standard deviation and ANCOVA. The findings amongst others showed that students in reciprocal peer tutoring approach group had more attitude scores than their counterpart in conventional lecture method. Based on the findings of the study, it was recommended that physics teachers should adopt reciprocal peer tutoring approach in teaching.

**Keywords:** Reciprocal Peer Tutoring Approach, Attitude, Physics.

### Introduction

Physics is critical for technological development of every nation; this is because it provides the citizenry with the opportunity to interact with the nature and physical system. Physics is defined as the science subject that studies matter, objects, energy and their interaction in a given system or environment (Onah, 2022). Physics is the most fundamental and the root of every field of science (Eryilmaz, 2016). Anyakoha (2016) defined physics as a natural science that involves the study of matter and energy and their interactions. Physics is the study of natural phenomenon at its most fundamental levels and manner (Onah, 2022). Physics studies the laws that determine the structure of the universe with reference to the matter and energy in the universe (Ike, 2014). Physics as the core subject taught in secondary school contributes to the cognitive development of the students. Physics knowledge has contributed immensely to the production of tools and devices of tremendous advantage to the human race (Sani, 2012). This indicates that the enormous role Physics plays in the technological growth of any nation must not be undermined. Physics is the most basic of science and its concepts and techniques underline the understanding of all other branches of science. The knowledge of physics facilitates our understanding of other disciplines; thorough understanding of quantum mechanics is necessary to chemists and material scientists since the structure of every atom in the universe is determined by quantum mechanics (Onah

& Anamezie, 2022). Other branch of Physics includes waves, electricity, heat, mechanics, magnetism, electrodynamics; and modern physics. Wave is defined as a disturbance which travels through a medium transferring energy and momentum from one point to another without transport of matter and does not cause permanent displacement to the medium itself. The study of waves is tremendously important to the development of telecommunication industry. Physics is also a cross-cutting discipline that has applications in many sectors of economic development, including health, agriculture, water, and energy and information technology. The knowledge of sound and acoustic wave results to determination gestation period, pre-natal examination; and other mammographic examinations. Global village of today's science was a product of wave concepts of Physics. According to Onah and Achufusi (2022), the concepts of mobile phones, radio broadcasting; and impart of modern science was built on the principle of waves.

Despite the numerous benefits of wave concepts of physics especially in the development of science and technology; students find wave concepts boring and difficult owing to the composition of mathematical processes. These students especially those in the secondary schools, argue that physics is abstract. Also, abstract concepts such as quantum physics, electricity, magnetism, electromagnetic induction and electromagnetic waves lead to misconceptions in cognitive processes and logical thinking development of students and consequently



cause many problems experienced by students (Yigit, Akdeniz& Kurt, 2012). According Jegede and Adebayo (2013), many students of physics have negative attitude towards Physics. Again, West African Examinations Council (WAEC) chief examiners report (2019) supported the idea that physics students showed negative attitude and consequently resulted to poor achievement in Physics. They continued that the negative attitude could be attributed to the nature of the topic; following its mathematical concepts.

Attitude is a psychological construct or feelings inferred for a given observable. Attitude is referred to as entry characteristics of the students towards a given concept or subject. Attitude is related to thinking, feeling, perceiving, liking and behaving toward a cognitive observable. Attitude is a tendency to react favourably or unfavourably towards a designated subject matter. According to Olasehinde and Olatoye (2014), attitude is the tendency of liking or reacting favourably or unfavourably towards an event of observation. Attitude does not only include the negative attitude such a prejudices biases and dislikes, but also positive attitudes that are sometimes called sentiment, which include our attachment and loyalties to person, objects and ideas (Olasehinde & Olatoye, 2014). Attitude thus seems like a system of ideas with an emotional content. An individual possesses his or her life, he or she acquires not only skills and knowledge, but also definite attitudes, point of views and feelings about his or her experiences. These definite attitudes, point of views and feelings are developed not only due to what kind of experiences the individual passes though, but also how these experiences came across. A person with positive attitude towards a concept will consciously or unconsciously think, demonstrate traits of innate liking for the concept (Olatoye & Aderogba, 2012). Attitude in Physics is viewed under the following factors:

Motivation factor: this represents how much of an effort the student puts in while learning physics. This usually comes from situational construct of classroom instructions. It includes reinforcement, use of suitable teaching pedagogy and serene learning atmosphere. Anxiety about physics factor: this represents how the student feels/ fears when learning physics. It can be linked to teacher's inability to demystify difficult contents of physics. Interest in physics courses factor: this represents what the student likes/ thinks about physics courses. It requires the ability of the students

to have innate liking for physics subject. Self-sufficiency factor: this represents the student's confidence in his/her skills in physics. Anxiety about mathematics factor: this expresses how the student feels when he/she has to use mathematical expressions during physics courses (Sumeyye & Oktay, 2020).

The students' poor attitude in physics in particular and sciences in general has been attributed to many factors. These include; poor methods of physics instruction by the teachers, insufficient number of qualified physics teachers, lack of indigenous textbooks, inadequate apparatus in the physics laboratory, poor classroom management by physics teachers, teacher's belief and attitude towards physics, physics teacher's inability to improvise, inadequate instructional materials and aids, educational background and parental expectations on the learners and finally students' related factors or variables like students' academic anxiety, academic self-efficacy, academic locus of control, academic motivation and more ( Jegede & Adedayo, 2013: pg 80 - 83). Among the factors implicated for poor attitude, the teaching method adopted by the teacher was the most common factor. This is because, physics teachers like to adopt teacher centred methods that could enable them cover large content areas within the duration of time allocated for physics in the term. Since, teaching method is one of the most implicated factors in students' poor attitude in physics, there is need to further examine other innovative teaching methods that have the potentials of improving students' attitude. In order to improve attitude, teachers need the adoption of learner-centred innovative strategies such as the use of reciprocal peer tutorial approach.

Reciprocal peer tutoring is the kind of teaching approach that adopts students' cooperation as tutors and tutees in the cause of instructional delivery. Reciprocal peer tutoring is a strategy that capitalizes on the benefits students received from preparing to tutor one another (Luzale, 2012). In this technique, students function equally both as tutor and tutee. Tutors are providers of instruction, while tutees are recipients of instruction. Additionally, a well-designed Reciprocal Peer Tutorial (RPT) procedure provides students with essential feedback and informs teachers about the quality of their teaching by identifying concepts that students have and have not mastered. Reciprocal Peer Tutoring (RPT) is a collaborative technique of instruction where students of the same class and age bracket alternate between the role of student (tutees) and teachers (tutors) and may follow a



structural format to help team members make academic progress (Ojo, 2019). Students alternate roles while in their groups or pairs. RPT enables each member in a group to participate in the group as a tutor and tutee. In RPT, students gain from the preparation and instruction in which the tutors engage in, and also from the instructions that the tutees receive (Ephraim, 2021). RPT has a structured format where students teach, monitor, evaluate and encourage each other.

Many researchers (Ephraim, 2021; Alegra, Molina & Moronto, 2020 & Constantine, 2015) are of the view that RPT strategy could enhance teaching and learning. Ephraim, (2021) noted that Peer tutoring is useful in encouraging educational gains in course content, and is successful for students of elementary and secondary level classes which helps to improve students learning achievement and was evident in their academic achievement. Studies by Ezeanya and Okigbo (2021) and Alemu (2020) opined that reciprocal peer tutoring helped in significantly improving the achievement of secondary school students. Similar studies by Agu (2018) also revealed that that peer tutoring instructional strategy had a significant effect on students' academic achievement. These potentials of reciprocal peer tutoring incite the need for further investigation into the use of this approach to know whether it could improve the attitude of male and female students in physics irrespective of gender.

Gender has been noted by researchers over the years as having an impact on achievement in Physics and its related disciplines. Akumah, (2013) stressed that science, technology, and their related disciplines are male-reserved while Art and Humanities are female reserved. This belief makes boys appear to have a naturally positive attitude towards science and technical subjects while girls show more inclination to Arts and Humanities. The problem is even compounded by the fact that most science educators give masculine outlook to science subjects such as chemistry and physics, this discrepancy was evident in the students' achievement in Chemistry (Ezeano, 2013); encouraging females to go rather for biology, agricultural science and home economics which they consider to be more female-friendly science subjects. Some other researchers (Nwankwo & Okoye, 2015; Orefor, 2016) opined that gender has no influence on students' achievement in the sciences. All these and related treatments make girls have phobia for science and science-related subjects which definitely affect their future career-choice and eventual achievement.

Due to lack of consensus regarding the issue of gender and science and more importantly to capture the interest of girls, and consequently improve their achievement in physics and other science-related carriers, there is a need therefore, to try such innovative strategies as reciprocal peer tutorial approach to see what effect it will have on attitude of male and female students in the sciences especially Physics.

In line with the problem of the study, the study investigates the effect of reciprocal peer tutorial approach on students' attitude in physics in Enugu Education Zone of Enugu State.

Specifically, the study sought to find the:

1. Difference between the mean attitude scores of students taught physics using reciprocal peer tutorial approach and those taught using conventional lecture method.
2. Difference between the mean attitude scores of male and female students taught physics using reciprocal peer tutorial approach and their counterpart taught using conventional lecture method.
3. Interaction effect of teaching approaches and gender on students' attitude in physics.

Based on the purpose of the study, the following research questions were designed to guide the study

1. What is the difference in the attitude mean scores of physics students taught using reciprocal peer tutorial approach and those taught using conventional lecture method?
2. What is the difference in the mean attitude scores of male and female students taught Physics using reciprocal peer tutorial and those taught with conventional lecture method?

Also in line with the research questions, the following null hypotheses were formulated for the study; which was tested at 0.05 level of significance

1. There is no significant difference in the attitude mean scores of physics students taught physics using reciprocal peer tutorial approach and those taught using conventional lecture method of teaching.
2. There is no significant difference in the mean attitude score of male and female students taught physics using reciprocal peer tutorial

approach and those taught using conventional lecture method.

3. There is no significant interaction effect of gender and teaching methods on students mean attitude scores in physics.

### Method

A pretest – posttest quasi-experimental research design, specifically non-equivalent control groups design was used for the study. A quasi-experiment is an experiment where randomization assignment of subjects to experimental and control groups is not possible (Nworgu, 2015). The design was considered appropriate for the study because intact classes were used to avoid disruption of normal class lesson. The study was carried out in Enugu Education Zone, located Central of Enugu State, Nigeria. Enugu State has six Education zones which include: Enugu, Awgu, Agbani, Nsukka, Obollo-Afor and Udi. Enugu Education zone consists of three local government areas; namely: Enugu North, Enugu East and Isi-Uzo local government area. The area has the first indigenous tertiary institution which is University of Nigeria Nsukka Enugu Campus. The area is predominantly urban in nature with basic amenities such as good road, hospitals, electricity, schools and markets. Most people living in the zone were civil servants, students, traders and few farmers. The researcher chose Enugu Education Zone due to the fact that most of the secondary schools have qualified physics teachers, laboratories and instructional materials and yet students experience difficulties in answering questions in physics in their external examinations hence the need for the study in the area. The population for the study was 3,916 SS2 Physics students in the Zone. One hundred and thirteen (113) SS 2 physics students (72 males & 41 females) drawn through purposive sampling approach from two co-educational secondary schools in Enugu North Local Government Area of Enugu State were used for the study. In stage one, simple random sampling technique by lucky dip was used to select Enugu North Local Government Area. In second stage, purposive sampling was used to select two co-educational schools in the local government area based on the existence in those schools of well-equipped physics laboratories and experienced physics teachers with teaching qualification. Simple random sampling technique (precisely balloting) was next used to assign experimental and control treatments to the schools. The technique was used so as to provide classes where

boys and girls work together under the same classroom environment. Intact classes were used in the sampled schools so as not to disrupt the normal school activities. Four weeks were used for the experiment. Each week had two periods (double periods each) of 40 minutes per period. The lesson notes for the two groups were developed by the researcher on the topic “Waves”. The physics teachers were trained on how to use their respective approaches. For the experimental group, the teacher was taught how to use kick off test to ascertain the students’ level of understanding of the topic. These students were later grouped according the outcome of the test. For the control group, the teacher was also taught the etiquettes of lecture method. For experimental group was taught using Reciprocal Peer Tutorial Approach. From the exercise, the teacher identified the students who understood the topics and the slow learner who are yet to understand. The students were then grouped according to the number they are in the class considering the fast and slow learners among them. They were also allowed to teach themselves in turns within the group while the researcher monitored their teaching. Each group worked independently within a timeframe and corrections were given to various groups. The researcher regrouped the students at the end of the lesson and assessed them in order to know the extent they have understood the lesson. Take home assignments were also given to the students as a follow up of what they have learnt.

The control group was equally being taught by their class teacher using conventional lecture method of instruction. The conventional lecture method was content-rich activities such as demonstrations, lecture, experiments and quantitative problem-solving. Regular physics teachers were used to deliver the instructions in the sampled schools after training to ensure extraneous variables were controlled. The instruments used for data collection was the Physics Attitude Scale (PAS) adapted from Sumeyye and Oktay (2020). PAS comprises 20 items adapted from a 21-item Physics Attitude Scale developed by Sumeyye and Oktay (2020). Originally, the scales are for students’ general attitude scale for physics students but were modified because one item repeated itself. It is a four point scale, ranging from 1 = strongly disagree to 4 = strongly agree, which was used for all items in this instrument. 5 question items had negative cue in the instrument, precisely 5, 6, 7, 20; and 21. These negatively cued items were reverse-scored before the scores were computed at the analysis stage.



The instrument (PAS) was face validated by three experts and tested for reliability using Cronbach alpha which yielded a coefficient of 0.86. The instrument was first administered as pre-attitude, scored and kept without any feedback to the students. After the treatment, the same attitude scale with the same contents was reshuffled and given as post-attitude. Both attitude scales were scored by the researcher to avoid bias. The PAS was administered in the intact class in the course of the instruction to ensure ethical compliance. The research questions and hypotheses

were answered/ tested using mean, standard deviation and analysis of covariance (ANCOVA). If the p-value is less than 0.05, then the null hypothesis will be rejected and accept alternative hypothesis but if it is greater than 0.05, the null hypothesis will not be rejected.

**Results**

Answer to Research question 1 is presented in Table 1

**Table 1: Mean and Standard deviation of attitude scores of students taught physics using reciprocal peer tutorial approach and those taught using convectional lecture method.**

Approach	Pre-attitude			Post-attitude			Mean Gain
	N	Mean( $\bar{x}$ )	SD	N	Mean( $\bar{x}$ )	SD	
RPT	53	45.00	14.57	53	68.28	8.20	23.28
CLM	60	46.20	10.32	60	56.00	9.11	9.80

Table 1, shows that the mean gain scores of students taught Physics using Reciprocal peer tutorial approach was 23.28. Their counterpart taught using conventional lecture method, on the other hand, had gain in mean scores as 9.80. This shows a 13.48

difference in gain in mean scores between the two groups in favour of the students taught with the reciprocal peer tutorial approach.

Answer to Research question 2 is presented in Table 2

**Table 2: Mean and Standard deviation of attitude scores of male and female students taught physics using reciprocal peer tutorial approach and those taught using convectional lecture method.**

Gender	Pre-attitude			Post-attitude			Mean Gain
	N	Mean( $\bar{x}$ )	SD	N	Mean( $\bar{x}$ )	SD	
Male	72	45.64	12.20	72	61.17	10.06	15.53
Female	41	45.63	13.03	41	62.80	11.60	17.17

Table 2 shows the mean gain of male students was 15.53 while that of the female counterpart was 17.17. This indicates a mean difference of 1.64 in favour of the female students.

**Table 3: Summary of Analysis of Covariance of effect of Reciprocal peer tutorial approach on students' attitude in physics by Treatment and Gender**

Dependent Variable: PostAttitude

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Decision
Corrected Model	5538.586 <sup>a</sup>	4	1384.646	21.062	.000	
Intercept	19324.742	1	19324.742	293.955	.000	
Pre-Attitude	1181.164	1	1181.164	17.967	.000	
Approach	4305.121	1	4305.121	65.487	.000	S
Gender	17.456	1	17.456	.266	.607	NS
Approach * Gender	37.024	1	37.024	.563	.455	NS
Error	7099.963	108	65.740			
Total	443669.000	113				
Corrected Total	12638.549	112				

a. R Squared = .438 (Adjusted R Squared = .417)

Table 3 shows that at .05 level of significance, there was a significant main effect of the teaching method

on students' attitude in Physics,  $F(1, 108) = 65.487, P(.000) < .05$ . Therefore, the null hypothesis was



rejected. Thus, there is significant difference in mean attitude scores of students taught Physics using reciprocal peer tutorial approach and those taught using conventional lecture method.

Table 3 shows that at .05 level of significance, there was no significant main influence of gender and the effect of teaching method on students' attitude in physics,  $F(1,108) = .266$   $P(.607) > .05$ . Therefore, the null hypothesis was accepted. Thus, gender has no significant influence on the attitude of students in physics.

Table 3 further showed that at .05 level of significance, there was no significant interaction effect of gender and the teaching method on students' academic attitude in Physics,  $F(1, 108) = .563$ ,  $P(.455) > .05$ . Therefore, the null hypothesis was accepted. Thus, there is no significant interaction effect of gender and the teaching method on students' academic attitude in physics.

### Discussion

The finding revealed that the mean attitude scores of students taught physics using reciprocal peer tutorial was higher than those taught using the conventional lecture method. Students developing more attitude in reciprocal peer tutorial approach model than their counterpart taught using the conventional lecture method could be as a result of the learning activities and creativity involved in teaching which involves the students providing structures, materials for instructional delivery and guided the teacher through problem-solving to discover answers to instructional topics at hand. This finding was in tandem with the finding of Ojo (2019), Olasehinde and Olatoye (2014) and Luzale (2012) that students' attitude scores taught physics using reciprocal peer tutorial approach is higher than those taught using the conventional lecture methods in physics. This finding also agreed with the finding of Bowman (2013), Constantine (2015) that the experimental group achieved significantly better than the control group in using reciprocal peer tutorial approach on achievement. The findings of Alemo (2020) supported that reciprocal peer tutorial have a positive effect on attitude of students.

The finding revealed that mean attitude scores of male and female students taught physics using reciprocal peer tutorial approach and their counterpart taught using conventional lecture method is insignificant. This means that the use of reciprocal

peer tutorial approach does not affect any gender differently and it was effective and has the potential of improving both male and female students' attitude in physics. This finding agreed with the finding of Alemo (2020), Ojo (2019), Olasehinde and Olatoye (2014) and Luzale (2012) mean attitude scores of male and female students taught physics using reciprocal peer tutorial approach is not significantly difference. On the other hand, the study disagrees with Nworgu, Ugwuanyi and Nworgu (2013) and Nwankwo and Madu (2014) who noted a gender difference with a teaching method.

Findings also showed that there is no significant interaction between instructional approach and gender on students' attitude scores in Physics was observed. This result agreed with the findings of Nwankwo and Madu (2014), whose discovery showed no significant interaction between gender and instructional analogy on students' conceptual change in physics, agreed with the present finding. On the other hand, Baser and Durmus (2010) noted a significant interaction between gender and instructional treatment on students' academic achievement and interest in current electricity. It is obvious that there is no agreement in the research community concerning the interaction effect of gender and instructional strategies on students' conceptual understanding of science especially physics concepts. The differences in observation by different researchers could be attributed to the influence of location and some other extraneous threats to the experiment. There is therefore a great need to embark on more studies in order to shed further light on this issue.

### Conclusion/ Recommendations

Use of Reciprocal peer tutorial approach in physics instruction is effective in increasing Physics students' attitude. This is because, the students performed significantly better in posttest scores, when taught physics using reciprocal peer tutorial approach than when taught same concepts using conventional lecture method. The study however, showed there is no significant gender difference in students' attitude scores of students taught physics.

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

1. Teacher educators in Universities and Colleges of education should be focused on preparing Physics teachers to acquire appropriate skills and competence needed to encourage reciprocal peer tutorial approach.



2. Federal Ministry of Education should incorporate a reciprocal peer tutorial approach based on the information collected here as a basis for deciding on the best instructional approaches to be adopted in the Nigerian secondary school physics curriculum as opposed to using lecture teaching approach.
3. Teacher-training programme designers should include in their curriculum a course on the reciprocal peer tutorial approach, while practicing teachers should be re-trained in the approach through seminars, workshops, conferences, in-service trainings, annual teacher vacation courses, and refresher courses.
4. Curriculum should be reviewed by curriculum planners to reflect the approach while textbook authors should be encouraged to incorporate the approach in Physics textbooks.

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