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IMPROVING THE ACADEMIC ACHIEVEMENT OF LOW ACHIEVING SECONDARY SCHOOL STUDENTS IN PHYSICS USING PEER TUTORING LEARNING STRATEGY: IMPLICATIONS FOR ENGINEERING CAREER

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ABSTRACT

As a result of reported cases of poor performance of students in Physics examinations in Nigeria, the researchers sought the effectiveness of peer tutoring of low-achieving students in Physics. A quasi experimental design was adopted for the study, using 166 senior secondary 2 low achieving physics students as study sample. A properly faced and content validated as well as trial tested Physics Achievement Test (PAT) was used to collect data for the study. Mean was used to analyse the data in order to answer the research questions, while the hypotheses were tested using analysis of covariance. The findings revealed that there was a significant (p< .05) effect of peer tutoring on low achieving students' achievement in physics. Also, it was evident from the study that gender was not a significant factor on the low achieving students' academic achievement in Physics. These findings have implications for students' engineering career in that effective use of peer tutoring learning strategy will increase the students' quest for engineering career through the promotion of their achievement in Physics. Based on the findings of the study, it was recommended that physics teachers should adopt the use of peer tutoring learning strategy in their lessons in order to enhance students' academic achievement in physics.

KEYWORDS: Academic Achievement, Low achieving Students, Peer Tutoring Learning Strategy, Physics

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Original Article

INTRODUCTION

In spite of place of physics in national development and human endeavours all over the world, the achievement of students in the subject and related subjects especially in external examination still remains poor (Ikeh, Ugwuanyi & Orji, 2016; Ugwuanyi et al., 2019a; Ugwuanyi et al., 2019b; Ugwuanyi & Okeke, 2020; Agboeze et al., 2020; Ugwuanyi, Okeke & Njeze, 2020; Ugwuanyi, Okeke, & Ageda, 2020; Onah et al., 2020; Njoku et al., 2020; Benson et al., 2020; Inyama, Nwagbo & Ugwuanyi, 2020). This is evident in the West African Examination Council (WAEC) Chief Examiner's report in May/June 2010-2014. According to Chief examiner's report (May/June), the pass rate at credit level recorded are; 43.19%, 48.26%, 47.83%, 51.27% and 40.27% in 2010, 2011, 2012, 2013 and 2014 respectively. However, the failure rate of 54.61%, 50.07%, 47.57%, 44.57 and 48.21% were recorded in 2010, 2011, 2012, 2013 and 2014 respectively.

On the other hand, a preliminary survey of the Mark Sheets and Form Order records of schools in Enugu South LGA for 2015/2016 SS11 Physics students first and second terms results, revealed that out of 1,895 SS11 students who sat for the first term examination, only 855 students representing 45.12% scored the pass mark of 50% and above, while 1040 students representing 54.88% failed with scores below 50%. Also, in the second term of the same session, 704 students representing 37.25% scored 50% and above out of 1,890 SS11 physics students who participated in the examinations, while 1186 students representing 62.75% failed to score up to the benchmark of 50%. In view of these statistical data reviewed above, it is evident that students' achievement in physics has not been encouraging.

Regrettably, the percentage of students who achieved below average in their academic pursuit is on the increase. These low achieving students could have resulted from the method teachers adopt in teaching the physics as a subject (conventional method). Many conventional strategies have been employed in some studies in addressing the academic achievement of students towards the teaching and learning of physics. Unfortunately, those strategies have not been able to address the problem of students' achievement in physics in its totality. Among the innovative strategies used by researchers all over the world, that have been proven to enhance achievement in science subjects including physics is peer tutoring strategy.

Peer tutoring is a mediated instructional strategy that involves students working in partnerships with others during teaching and learning session (Topping, 2018). It is normally implemented in pairs comprising of both high and low achieving students (Topping, Buchs, Duran & Van Keer,2017).This approach uses high achieving peers to tutor the low achieving ones in order to acquire problem-solving skills and the learning of difficult concepts in science (Williams, Wiebe, Yang, Ferze & Miller, 2006). In this context, the teacher is seen as a facilitator of the group activities. Based on the foregoing, the researchers sought the effect of peer tutoring learning strategy on the academic achievement of low-achieving students in physics.

A study carried out by Mbia and Nsungo (2019) revealed that students taught with the peer tutoring, problem-based learning, discovery learning and cooperative methods achieve significantly higher than those taught using the conventional method. Active role of cross age peer tutoring was found crucial in the enhancement of achievement in physics (Korner & Hopf, 2015). Also, past studies by other researchers have indicated that peer tutoring helped in improving physics achievement of secondary school students. (eg. Alemu, 2020; Abdul Raheem, Yusuf & Adesegun, 2017; Achuonye, 2014; Moliner & Alegre, 2020; Ullah, Tabassum & Kaleem, 2018).Thus, in this study peer tutoring is the grouping of students of physics into two to five groups where each member of the group could stand as the tutor or tutee of the group. Meanwhile, this study will also look at gender differences of low achieving students in achievement in senior secondary school physics.

The relationship between physics achievement and gender has been a focus of research. The difference in academic achievement due to gender differences is crucial to the educationists. Alldred (2013) indicated that female students are more efficacious in nature. Evidences of some research works have indicated that boys had superiority over girls in academic areas, especially areas related to science courses (Misigo, 2014). Kola (2013) revealed that significant gender difference exists in academic achievement of students in physics practical. While Baron, (2016) and Amedu (2015) reported that boys performed better in physics. Mbaba (2010) found out no significant difference in the performance of boys and girls in Business Education, introductory technology, and physics respectively using peer tutoring strategy. Obafemi (2015) reported a significant difference between male and female in the application of light waves, but males

were found performing higher than female in the application of light waves in physics class. Recent studies that used peer tutoring strategy and found male achievers higher than female (eg: Agu & Azih, 2019; Abdul Raheem,Yusuf & Adesegun, 2017; Ullah, Tabassum & Kaleem, 2018).A study by Filgona and Sababa (2017) on gender and physics achievement indicated that female students achieve higher than their male counterpart. It is important, therefore, to investigate the influence low achieving students, gender on their achievement in physics because of the controversy and inconclusive results found from various studies.

Gaps in Literature

Literature tends to reveal that peer tutoring learning strategy has the possibility of helping students to understand physics subject better than the conventional method, which has been in use for some time now. However, major problem evident from the empirical studies reviewed is that those studies were carried out in foreign countries. Besides, to the best knowledge of the researchers, there is dearth of empirical studies on the effect of peer tutoring on physics achievement in Nigeria, especially, in the area of study. Therefore, the differences between the cultures in which these studies were conducted and Nigerian environment and the subject area motivated the need for this study. Thus, this study sought the efficacy of peer tutoring on achievement of low-achieving students in physics. Hence, the following null hypotheses were tested at 5% probability level:

Ho_1: Mean achievement scores of low achieving students in physics exposed to peer tutoring learning strategy and those not exposed do not differ significantly.

Ho_2: Mean achievement scores of male and female low achieving students in physics do not differ significantly.

Ho_3: The interaction effect of strategies and gender on the achievement of low achieving students in physics is not statistically significant.

METHOD

Design of the Study

The research design adopted for this study is quasi-experimental design. Specifically, it is a non-equivalent pretest-posttest control group design. This kind of experimental design does not permit randomization of subjects to treatment groups. This design has been adopted in recent studies by Adene et al (2021), Ejimonye et al. (2020a, b), Njoku et al. (2020).

Participants

Out of a population of 804 SSII low achieving physics students,166 of the students were purposively selected and used as the study participants. This sample was drawn from the six government secondary schools in Enugu South Local Government Area of Enugu State. Purposive sampling technique was used because, the highest number of low achieving physics students in one intact class from each of the six schools were selected.

Instrument

A40-item PAT was used for data collection. The items were constructed based on the new senior secondary physics curriculum for SS II as designed by the curriculum Development Centre (CDC) and approved by the Federal Ministry of Education. The topics from where the items were drawn include; Graph of a wave, Wave equation, Wave properties (refraction), Factors determining speed of sound, Reflection of sound (echo) and Resonance (Mechanical). These topics

were chosen because of their calculative and abstract nature. In developing this instrument, a test-blue print was designed and used as a guide to ensure an effective content coverage of the learning skills covered in the topics. PAT was face validate by five experts in Educational Psychology, and Measurement & Evaluation Units for validation. To ascertain the content validity of PAT, the test was constructed using a table of specifications. The experts' comments and suggestions helped in modifying the items to suit the problem under investigation.

Thereafter, a trial testing was carried out by the researchers in order to determine the reliability of the instrument. The researchers did this by administering the instrument to 20 SS II students from a public secondary school in Enugu North Local Government Area of Enugu State. The students' responses to PAT were used to establish its internal consistency reliability using Kuder-Richardson (K-R 20) formula. This yielded internal consistency reliability estimate of 0.81. Kuder-Richardson {K-R 20} formula was used because the items of the instrument were dichotomously scored. To ensure the estimate of temporal stability of PAT, the instrument was administered to the students twice and the scores obtained were correlated using the Pearson Product Moments correlation statistics, and it yielded a coefficient of 0.72.

Procedure

To identify potential participants, a preliminary survey of the schools' 2017-2018 SS1 termly and annual results and 2018-2019 SS II first and second terms' results were collected and used for the study. From preliminary survey, students who scored below 50 were considered as low achievers. This is in accordance with the Federal Ministry of Education Annual and termly report sheet or teacher's grade book for item scoring, which stipulated that from 50% to 100% should be regarded as pass while 0-49% when scored by a student in an examination, the student is seen as having failed or achieved poorly (Odike, 1998). The eligible participants were randomly allocated to control and treatment groups respectively. Both high and low achieving students participated in the study, but the scores of the low-achieving students were only used during the analysis. After pre-testing both groups using PAT, the intervention package was delivered to the treatment group while withheld from the control group. The pretest which served as a covariate in the study assisted the researchers in ascertaining the pre-treatment entry points of the students involved in the study. The treatment lasted for twelve weeks. This implies that a lesson was scheduled for each week with a lesson period of 80 minutes per session. The lesson period of 80 minutes (double science period) was chosen by the researchers to ensure meaningful learning at the end of each session. This double period of 80 minutes is specifically provided for science classes in Enugu State education system. A total of twelve lesson plans on six topics in graph of a wave, equation of a wave, wave properties, factors determining speed of sound, echo and resonance which are concepts in physics were designed, six of which were based on Peer-Tutoring strategy of learning while the other six were based on the conventional learning method, for each group.

Intervention

During treatment, 84 students from the three intact classes of the schools in the experimental group were divided into 21 groups, with each group consisting of four students, one of whom was the trained peer tutor. This gave rise to a total of 21 trained peer tutors. The number of trained peer tutors in each school was subject to the number of students in the selected intact class, and the seating arrangement was such that, in each group of four students, the peer tutor sat in the middle flanked by the other students. This made for easy communication, interaction, help delivery, understanding and accessibility between the group members and the peer tutors and vice versa. The group peer tutors introduced the learning stimulus to their group members and lead their group through the sessions. They demonstrated or showed their tutees some

simple approaches to breakdown difficult concepts in order to gain understanding so that they can increase academic achievement in the classroom as shown in the lesson plans. They also helped the tutees to gain enough knowledge on how to recognize important patterns which made it easier for them to solve problems. The tutors also ensured that the tutees received positive feedbacks on their classroom interaction which improve their achievement in physics. This is a great intrinsic motivator that keeps students working hard.

At the end of each session, the teacher who served as the research assistant summarized the lesson by conducting the general evaluation with resounding feedbacks of praises and applauding of students with correct responses. The teacher also awarded points for each correct response and advice the peer tutors to post same in their score sheets for the tutees to take note of. At the end of each week, the group with the highest points was identified and applauded and had their scores added to their termly cumulative. This encouraged the other groups to prepare better for the next week's session. The teacher simply facilitated the sessions to ensure that students maintained conducive classroom learning environment during the exercise.

On the other hand, the control group was instructed by their regular class teachers with the usual conventional learning approach. The researcher continued to interact with the teachers to ensure smooth conduct of the treatment in each group. The researchers immediately dealt with any resulting practical or implementation difficulties through their meetings with the teachers every week, for instance, at Anglican Girls Secondary Awkunanaw, an intact class of 48 students which was involved in the treatment was divided into 9 groups of 5 students each leaving 3 students. A similar situation was encountered at Mary Land Secondary School Enugu where 2 students were left after dividing the 47 students in the intact class into 9 groups of 5 students. The teachers who were confused about what to do with these excess students were immediately advised by the researchers to attach them to any of the other groups making some groups six in number. The researchers also documented the fidelity of the treatment as they observed some classes.

Finally, at the end of the experiment, the PAT was administered to the students in both experimental and control groups. The scores obtained from the students at this stage serve a posttest score. It should be noted, however, that the students were exposed to the same testing conditions during the administration of the tests. The researcher then compared the results of the pre-test with that of the post-test in order to ascertain what difference the exposure to the new teaching technique has created on students' achievement.

DATA ANALYSIS

Mean was used to analyse the purpose of answering the research questions while analysis of covariance was used to test the null hypotheses 5%probability level.

RESULTS

The results were presented based on the hypotheses formulated for the study

Table 1: Mean and Standard Deviation of Low Achieving Students in Physics

Groups		Pretest		Posttest		Gain Scores
	n	Mean	SD	Mean	SD	
Experimental Group	84	17.52	4.74	24.95	4.53	7.43
Control Group	82	17.51	4.38	21.62	5.32	4.11

Table 1 shows the low achieving students who were exposed to peer tutoring had mean achievement scores of 17.52 with standard deviation of 4.74 and 4.38 at the pretest while those not exposed had mean achievement score of 17.51 with standard deviation of 4.38. However, at the post-test, the mean achievement scores of 24.95 and 21.62 with standard deviation of 4.53 and 5.32 were recorded for experimental and control groups respectively.

Ho_1: Mean achievement scores of low achieving students in physics exposed to peer tutoring learning strategy and those not exposed do not differ significantly.

Table 2: Analysis of Covariance (ANCOVA) of Effect of Peer Tutoring Learning Strategy on Achievement of Students in Physics

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	570.378[a]	4	142.594	5.900	.000
Intercept	4331.509	1	4331.509	179.229	.000
Pretest	92.174	1	92.174	3.814	.053
Gender	8.525	1	8.525	.353	.553
Method	427.032	1	427.032	17.670	.000
Gender * Method	9.189	1	9.189	.380	.538
Error	3890.954	161	24.167		
Total	94637.000	166			
Corrected Total	4461.331	165			
a. R Squared = .128 (Adjusted R Squared = .106)					

Table 2 shows that mean achievement scores of low achieving students in physics exposed to peer tutoring learning strategy and those not exposed differed significantly; F (1,161) = 17.670, p = .000. Therefore, peer tutoring learning strategy had significant effect on the achievement of low achieving students in physics.

Table 3: Mean and Standard Deviation of Male and Female Low Achieving Students' Achievement in Physics

Gender		Pretest		Posttest		Gain Scores	
	n	Mean	SD	Mean	SD		
Male	98	17.60	4.86	23.43	5.71	5.83	
Female	68	17.40	4.10	23.13	4.39	5.73	

Table 3 revealed that at the post-test, the mean achievement score of the male students was (M = 23.43, SD = 5.71) while their female counterpart had M = 23.43, SD = 5.71).

Ho_2: Mean achievement scores of male and female low achieving students in physics do not differ significantly.

Table 2 showed that the mean achievement scores of male and female low achieving students in physics do not differ significantly,F (1, 161) = .353, p = .553. Thus, the results indicated that gender is not a significant factor in the mean achievement scores of male and female low achieving students in physics.

Ho_3: There is no significant interaction effect of learning strategies and gender on the achievement of low achieving students in physics.

Table 2 showed that learning strategies do not significantly interact with gender to affect the low achieving students' achievement scores in physics, F (1, 161) = .380, p=.538).

DISCUSSION OF THE FINDINGS

The findings of this study showed that peer tutoring learning strategy had significant effect on the achievement of low achieving students. This implies that low achieving students' achievement in physics can be enhanced using peer tutoring learning strategy. The result was not surprising because, peer tutoring learning strategy allows the students to take active part in constructing their own knowledge. In support of this assertion, Williams, Wiebe, Yang, Ferze and Miller (2006) opined that peer tutoring learning strategy focuses on peers to solve problems, and is most effective in fostering creativity, experimentation, problem-solving skills and the learning of difficult concepts in science and technology. The teacher only serves as a facilitator in using peer tutoring instructional method. No wonder why Peer tutoring learning is often referred to by educators as a strategy that increases the learning rate, contribute to social skill development, develop a range of other skills, and provide emotional benefits to the students (Ayvazo & Aljadeff-Abergel, 2014).

The findings of the study is in consonance with the findings of the following past studies by other researchers that indicated that peer tutoring helped in improving physics achievement of secondary school students are as follows: Okoye (2013) found that peer tutoring instructional methods significantly enhanced students' achievement in Home Economics. The study of Korner and Hopf, (2015) found peer tutoring proved significantly effective in enhancing students' physics achievement. Also, in agreement was the finding of Ezenwosu and Nworgu (2013) found significant effect of peer tutoring on improving students' Biology Achievement test (BAT). Uroko (2010) found that reciprocal peer tutoring strategy significantly improved the achievement of students in reading comprehension. Also, the findings of the study are also in line with that of Igbo (2004),Jibrin and Zayum (2012).Serap and Elif (2016) reported a significant effect of peer tutoring on mean achievement scores of students. Other recent studies that found students taught with the peer tutoring method who achieve significantly higher than those taught using the conventional method (eg. Alemu, 2020; Alegre, 2020; Abdul Raheem, Yusuf & Adesegun, 2017; Moliner & Alegre, 2020; Ullah, Tabassum & Kaleem, 2018, Mbia & Nsungo, 2019).

Uroko (2010) found that gender grouping was not a significant factor in the achievement of students in reading comprehension. Peklay (2003), Uwameiye and Ogunbameru (2005), Omirin (2005), Ogunkola and Fayombo (2009), Nwosu and Azih (2011),Onah (2011) reported no significant gender difference in the achievement of students in various subjects. Recent studies that used peer tutoring strategy and found male achievers higher than female (eg: Agu & Azih, 2019; Abdul Raheem, Yusuf & Adesegun, 2017; Ullah, Tabassum & Kaleem, 2018). However, this study disagreed with the study conducted by Filgona and Sababa (2017) on gender and physics achievement indicated that female students achieve higher than their male counterpart.

The result also showed that the achievement of low achieving students across gender was consistent. The study is in agreement with findings of Uroko (2015) who reported that the interaction effect of reciprocal peer tutoring strategy and gender on students' achievement in reading comprehension was not significant. The findings of Omebe and Omiko (2015) found no significant interaction effect of treatment and gender on students' achievement in physics. Uroko (2015) found no significant interaction effect of reciprocal peer tutoring strategy and gender on students' achievement in reading comprehension These findings have implications for students' Engineering career in that effective use of peer tutoring

learning strategy will increase the students' quest for Engineering career through the promotion of their achievement in Physics.

CONCLUSION AND RECOMMENDATIONS

The findings showed that peer tutoring had significant effect on the achievement of low achieving students in physics. Further analysis showed no significant influence of gender as well as no significant interaction effect of strategies and gender on achievement of low-achieving students in physics. From the findings of the study, one can therefore conclude that the achievement of low achieving students can be enhanced by incorporating peer tutoring learning strategy into the teaching and learning of physics. It was recommended, thus, Physics teachers should adopt the use of peer tutoring learning strategy in their lessons in order to enhance students' academic achievement in physics as a science subject.Government agencies should incorporate and emphasize the use of peer tutoring learning strategy in teaching physics in senior secondary schools.

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