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Effects of Guided Inquiry and Peer Tutoring Teaching Strategies on Achievement of Physics Students' in Delta State

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ABSTRACT

Effects of guided inquiry and peer tutoring teaching strategies on achievement of students' in physics in Delta State was investigated. Quasi-experimental design, specifically non-equivalent pre-test, posttest, control group design was adopted. A sample size of 289 SS II Physics students, randomly selected from six secondary schools was used. The reliability of the instrument was done using Kuder-Richardson Formula 21 which yielded a coefficient of 0.86. The treatment involved exposing students in experimental groups to Physics concepts with the use of guided inquiry and peer tutoring strategy, and the control group with lecture method. Pretest was administered before the treatment and posttest after the treatment. The scores obtained were analyzed using mean and standard deviation for the research question and analysis of covariance (ANCOVA) for testing the hypothesis. It was found in the study that peer tutoring strategy and lecture method have significant effects on students' achievement in physics than guided inquiry teaching strategy; there was no significant difference in the mean achievement scores of Physics students taught with guided inquiry and lecture method. It was recommended among others that both guided inquiry, peer tutoring strategies and lecture should be adopted by physics teachers during classroom instruction.

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KEY WORDS:

Guided Inquiry, Peer Tutoring, Lecture, Students Achievement, Physics

INTRODUCTION

Physics is the study of the basic laws of nature, their applications to the real world and the relationships among the laws (Akpokiniovo, 2022). It is concerned with the study of mechanics and the various forms of energy e.g. heat, light, sound, electricity, magnetism, nuclear, etc. (Ajewole, 2017). Indeed, Physics deals with matter and energy and how they interact to make things in nature work. Today, the knowledge of physics and the application of physics concepts and principles have contributed largely to making the society relatively comfortable and enjoyable. Therefore, a sound grounding in physics strengthens many of the skills that people use every day, like solving problems, creativity, thinking critically, working cooperatively in teams, using technology effectively and valuing life-long learning (Oruc & Arslan, 2016). It is therefore imperative that a sound and relevant physics education programme be designed and adopted for the citizens especially some aspects of physics which include reflection on plane and curved mirrors, refraction through rectangular, triangular prism and lenses where students appear to experience difficulty in comprehending during instructions. This has become known from the consistent report by WAEC and NECO Physics Chief Examiners in recent years that students do not answer questions relating to these concepts with scientific reasoning

The reports of these researchers also show that enrolment of candidates in physics for the ordinary level examinations is least when compared to enrolments in other basic sciences. These problems of poor achievement and low enrolment are widely attributed (by Nigerian society) to a number of factors including the ways physics concepts are presented to students during instructions and students' attitude towards physics (Akpokiniovo, 2018). This trendy movement towards the direction of low achievement in physics learning could likely suggest that tomorrow's physics education practitioners may be bereft of techno-scientific

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competencies, required for future development and the applications of physics in achieving the goals of science (physics) education,(Ijeh, 2013). Poor achievement according to McLeod, Barr & Welch, 2015 is due to inability of classroom instructional experience to provoke the innate potentials of learners. The classroom instructional experience presented most often to learners is through the use of lecture method of instruction.

The lecture method of instruction is a teacher-centred approach in which the teacher passes on knowledge in its ultimate form to the students. The students pay attention to the teacher and are rarely given the opportunity to ask questions as the course develops. However, students' passive involvement and lack of student-student connection, as well as students' interaction with the learning content, are important drawbacks of the lecture method, according to Ijeh and Onwu (2012). Passivity on the part of students during the teaching and learning process does not help them understand physics ideas. As a result, student-centred approaches to teaching that encourage active participation and interaction among students during the learning process may be a viable alternative to the teacher-centred approach to teaching (lecture method) in improving low students' achievement in physics concepts. Among these teaching strategies, this research only looked at guided inquiry teaching and peer tutoring strategies.

The guided inquiry strategy is described by Akerson, Hanson, and Cullen, (2017) as a student –centered, activity – oriented teaching strategy in which the teacher directs students through problem – solving approach to discover answers to instructional topic at hand. In fact, Nwanze (2016) in his opinion described guided inquiry as a style or method of teaching where the learner with minimum guidance from the teacher seeks to discover and create answer to a recognized problem through procedure of making a diligent search. Some researchers such as Jacinta (2011) conducted a study on inquiry method and students academic achievement in biology in Ogba/Egbema/Ndoni Local Government Area of Rivers State, Nigeria. The author shows that inquiry method has a significant effect on students' achievements in biology. Ekomaye (2019) carried out a study to determine the effect of guided inquiry teaching method (GITM) on secondary school students' achievement in light and sound waves in Abuja, Nigeria. The author revealed that he experimental group significantly scored higher in post-test than the control group. Another student-centred approach examined in this study is peer tutoring

Peer tutoring is an instructional strategy that consists of pairing students together to learn or practice an academic task. According to Olulowo, Ige and Ugwoke (2020) 'the pairs of students can be of the same or differing ability and/or age range. Peer tutoring encompasses a variety of instructional approaches including Cross-Age Tutoring, Peer-Assisted Learning Strategies (PALS), and Reciprocal Peer Tutoring (RPT). Variations exist among' peer instructional approaches. However, the underlying theory is based among others on Vygostky socio-cultural theory of learning occurring as a result of interaction of learners with peers. "Peer interaction can have a powerful influence on academic motivation and achievement" (Ijeh, 2012). Peer-tutoring refers to a situation where one child provides instructional assistance and guidance to another child (Okeke, Ezegbe, Okwugha, Ome, Ejah and Panden, 2019). Empirically, Olulowo, Ige and Ugwoke (2020) carried out a study using peer tutoring to improve students' academic achievement in financial accounting concepts in Ondo North Senatorial District of Ondo State, Nigeria. Results affirmed that the peer tutoring instructional strategy is more effective in improving students' academic achievement in financial accounting concepts than the conventional lecture method. Okeke, Ezegbe, Okwugha, Ome, Ejah and Panden (2019) carried out a study on the effect of peer tutoring instructional strategy on students' achievement and interest in Economics in Awka education zone, Anambra state. The results of the findings indicated among others that students taught Economics in senior secondary schools with peer tutoring had better achievement and interest than their counterparts taught using the lecture method.

STATEMENT OF THE PROBLEM

From the introduction, the deplorable trend of poor performance among students have drew attention of physics educators to designed some instructional strategies over the years to curb the problem of under achievement in the subject. However, with the various instructional methods used by the science educators, student academic achievement in Physics is still very low. While some researchers recommend student centered method such as guided inquiry and peer tutoring teaching strategy, the use of lecture method appears to be dominant on teachers. Consequently, the approaches used by many physics teachers appear not to give room for students to develop their intuition, imagination and creative abilities. As a result of this, physics educators are constantly interested in how and when to optimally adopt different physics instructional strategies in order to achieve the stated physics education objectives.

Despite the adoption of these instructional strategies in the teaching and learning of physics, students have continued to record poor achievement in the subject. One wonders whether a change in instructional strategies could solve the problem of poor achievement of students in the subject. The major questions are: Can the use of another method enhance the academic achievement scores of students in physics? Will guided inquiry and peer tutoring teaching strategies improve the achievement of students in physics? These questions present the problem that motivated the study.

Research Questions

One research question guided the study.

What are the differences in the mean achievement scores among Physics students taught with guided inquiry, peer tutoring strategy and lecture method?

Hypotheses

The hypotheses stated below was tested at the 0.05 level of significance:

There is no significant differences in the mean achievement scores among Physics students taught with guided inquiry, peer tutoring strategy and lecture method.

RESEARCH METHODOLOGY

This study employed quasi-experimental non-randomized pretest posttest control group design. There was no randomization of subjects in this study. Intact classes were randomly assign to the experimental and control groups. The independent variables are Instructional methods. The dependent variable is the achievement score of physics students. The population of study consists of all public secondary schools 2 (SS2) Physics students' of the eight Local Government Areas in the Delta Central Senatorial District with a population of 4,642 SS2. A sample of 289 SSII Physics students selected from six (6) public mixed senior secondary schools in Delta Central Senatorial District made up the sample size for this study. The six (6) public mixed senior secondary schools were selected using simple random sampling technique.

This study used one major instrument and three different lesson plans (Instructional package). The research instrument is the Physics Achievement Test. This Physics Achievement Test (PAT) was developed by a selection and compilation of test items on the topics of Reflection on plane mirror, Reflection on curved mirror, Refraction through prism and Refraction through lenses drawn from 2019- 2021 West Africa Certificate Examination (WASSCE) and National Examination Council (NECO) question papers. The three different lesson plans (instructional packages) are comprehensive lesson plans drawn from first term scheme of work topics for senior secondary II (SSII) Physics were taught using Guided inquiry, Peer Tutoring and Lecture method for six (6) weeks. The Physics Achievement Test (PAT) was a 40 item multiple choice Physics Achievement Test (PAT) based on the selected topics for this study.

In establishing the reliability of the PAT, it was pilot tested using 50 students in a school in Ethiope East Local Government Area of Delta State, which has similar characteristics as the sampled schools. The test reliability coefficient was calculated using Kuder – Richardson formula 21 (KR-21). When the KR-21 formula was used, the calculation yielded a reliability coefficient (r) of 0.858. The treatment administered to the students involved teaching the concept of Light by the researcher using:

(a) The guided inquiry strategy adapted from Bybee, Taylor, Gardner, Van, Powell, Westbrook and Landes (2006) for the experimental group
(b) Training of Peer Tutors also for the experimental group and
(c) Lecture method for the control group.

The research question was answered using means and standard deviations. If the value of standard deviation (SD) was small, there was little variability and the majority of the scores were tightly clustered around the mean. The hypothesis was tested at 0.05 alpha levels, using Analysis of Covariance (ANCOVA).

RESULTS AND DISCUSSION

The results are tabulated, interpreted and discussed immediately after the research questions and corresponding hypothesis.

Research Question One: What are the differences in the mean achievement scores among Physics students taught with guided inquiry, peer tutoring strategy and lecture method?

Table 1: Differences in the Mean Achievement Scores of Physics Students in Guided Inquiry, Peer Tutoring Teaching Strategy and Lecture Method

		Academic Achievement				
Groups		**Pretest**		**Posttest**		**Mean Gain**
	N	*M*	*SD*	*M*	*SD*	
Guided Inquiry	146	26.73	7.89	54.63	11.52	27.90
Peer Tutoring	146	27.49	10.09	56.04	12.74	28.55
Lecture Method	142	25.44	8.42	53.92	10.19	28.48

Table 1 showed the mean and standard deviation of achievement scores of students in the three groups. The mean scores indicated that the peer tutoring had highest posttest mean score followed by the lecture method. The group with the least mean score is the guided inquiry. This shows that students in peer-tutoring and lecture method achieved more than those in guided inquiry.

Hypothesis One: There is no significant differences in the mean achievement scores among Physics students taught with guided inquiry, peer tutoring strategy and lecture method.

Table 2: ANCOVA on the Effect of Guided Inquiry Teaching Strategy, Peer Tutoring Strategy and Lecture Method on the Achievement Scores of Physics Students

Source	Type III Sum of Squares	Df	Mean Square	*F*	Sig.
Corrected Model	2941.799[a]	3	980.600	7.692	.000
Intercept	97301.654	1	97301.654	763.206	.000
Pretest	2603.791	1	2603.791	20.423	.000
Method	190.964	2	95.482	.749	.473
Error	54820.976	430	127.491		
Total	1364460.000	434			
Corrected Total	57762.774	433			

a. R Squared = .051 (Adjusted R Squared = .044)

Table 2 shows that there is no significant main effect of treatment in the posttest achievement of students in the experimental groups and the control group F (2, 434) = .749, $p > 0.05$. This means that there was no significant difference in the mean achievement scores of students in experimental and control groups. Therefore, the hypothesis that there is no significant mean difference in the achievement of students taught with guided instruction, peer tutoring and the control groups is therefore accepted. This finding is at variance with the work of This finding is similar to that of Akerson, Hanson, and Cullen, (2017) who carried out a study on the effect of influence of guided inquiry and explicit instruction on k-6 teachers' views of nature of science. The learning outcome investigated included cognitive achievement, attitude to science, scientific process and practical skills achievement. The result indicates that: There is a significant difference between students exposed to the guided inquiry and expository methods in favour of the guided inquiry method. All the various ability groups in the guided inquiry class out-performed their counterparts in the expository class in the process and practical skills.

The finding from table 2 in the study is also at parallel with the work of Ashiq, Mohammad and Azra (2011) compared scientific inquiry method and traditional lecture method of teaching in Zaria, Nigeria. They adopted a pretest post-test control experimental design. 175 male physics students from 10th grade students of public institutions in Faisalabad District, Lahore, Pakistan were used. "The research explored that there is significant effect of guided, unguided and combination scientific inquiry on the students' achievement than traditional physics teaching method and their proficiency to apply physics in real life situation".

On the area of peer tutoring, this study corroborates the work of Olulowo, Ige and Ugwoke (2020) who carried out a study on using peer tutoring to improve students' academic achievement in financial accounting concepts in Ondo North Senatorial District of Ondo State, Nigeria. Results affirmed that the peer tutoring instructional strategy is more effective in improving students' academic achievement in financial accounting concepts than the conventional lecture method. The finding from Table 2 shows that students peer tutoring teaching out perform other group. This concur with the study of Okeke, Ezegbe, Okwugha, Ome, Ejah and Panden (2019) carried out a study on the "effect of peer tutoring instructional strategy on students' achievement and interest in Economics in Awka education zone", Anambra state. The results of the findings indicated among others that students taught Economics in senior secondary schools with peer tutoring had better achievement and interest than their counterparts taught using the lecture method. Basically, there was significant difference in the mean achievement and interest scores of students taught Economics using peer tutoring strategy and those taught using lecture method in favour of the peer tutoring strategy.

CONCLUSION/POLICY RECOMMENDATIONS

Based on the findings from the study, it was concluded that guided inquiry teaching strategy did not augments students' achievement in physics students' more than the lecture method. Peer tutoring strategy seems to enhance the performance of students in physics more than the lecture method. The researcher therefore recommends that both Guided inquiry, peer tutoring strategies and lecture should be adopted by physics teachers during classroom instruction at the secondary school level. However, there should be adequate timing and preparation to ensure the effective implementation of the treatment. This will help to boost students' achievement in physics. Also, physics teachers should attend workshops to get acquainted with innovative instructional strategies relative to guided inquiry and peer tutoring teaching to students' achievement in physics.

REFERENCES

1. Ajewole, G. A. (2017). Effects of discovery – expository instructional methods on the attitude of students to biology. *Journal of Research in Science Teaching*, 28 (5) 127 – 132. http://dx.doi.org/10.1002/tea.3660280504
2. Akerson, V.L., Hanson, D. L., and Cullen, T. A. (2017). The influence of guided inquiry and explicit instruction on k-6 teachers' views of nature of science. *Journal of Science Teacher Education, 18*, 751-772.
3. Akpokiniovo, S.R. (2018). Science and technology of education: panacea for ensuring peace, national unity and sustainable development in the 21st century Nigeria. *European Journal of Education Studies*, 6(1):128-140. doi:http://dx.doi.org/10.46827/ejes.v0i0.2086
4. Akpokiniovo, S.R. (2022). Effects of self-instruction and guided inquiry teaching strategies on secondary school physics students' achievement' *Rivers State University Journal of Education*. 25(1), 156-165
5. Ashiq, H, Mohammad, A and Azra, S (2011). Physics teaching methods: scientific inquiryvs traditional lecture. *International Journal of Humanities and Social Science*.1(19): 269-276.
6. Bybee, R.W, Taylor, J.A, Gardener, A, Van Scotter, P. Pouell, J.C, Westbrook A; Landes, N (2006). The BCCS SE instructional model: origin, effectiveness, and applications. Colorado Spring: BSCS.
7. Ekomaye, D.G (2019). Effect of guided inquiry teaching method on secondary school students' achievement in light and sound waves in Abuja, Nigeria. *Journal of Education and e-Learning Research* 6 (2): 82-87
8. Ijeh, S. B and Onwu G. O. M. (2012) Using PCK to deal with learner's conceptions (Misconceptions and Preconceptions) in statistics teaching, *University of Africa* 215 – 225
9. Ijeh, S. B. (2013) Analysis of Davids' classroom practice: In search of a teacher demonstrated Pedagogical Content Knowledge in statistics teaching. *Mediterranean journal of social science*, 4(3):735 – 742
10. Jacinta A.O (2011) Inquiry method and student academic achievement in biology: lessons and policy implications. *American-Eurusion Journal of Scientific Research* 6(1):28-31.
11. Nwanze, A. C. (2016). Effect of multimedia synchronized instructional strategy on students' achievement and retention in secondary school chemistry in Onitsha education zone. Unpublished M. Ed Dissertation, Nnamdi Azikiwe University, Awka.
12. Okeke, J.N, Ezegbe, B.N, Okwugha, C.N.A, Ome, S.O, Ejah, A, and Panden, P.E (2019). Effect of peer tutoring instructional strategy on students' achievement and interest in Economics in Awka Education Zone, Anambra State. *International Journal of Studies in Education*. 16 (1):122-138
13. Olulowo, T.G, Ige O.A, and Ugwoke, E.O (2020). Using peer tutoring to improve students' academic achievement in financial accounting concepts. *Hindawi Education Research International. Available at https://downloads.hindawi.com/journals/edri/2020/8871235.pdf*
14. Oruc, A., & Arslan, A. (2016). The impact of self-regulated learning on reading comprehension and attitude towards Turkish course and metacognitive thinking. *Educational Research and Reviews, 11(8),* 523-529.doi:10.5897/ERR2016.2692.