



Effect of Peer Collaborative Learning Strategy on Motivation and Academic Performance in Physics among Public Senior Secondary School Students in Katsina State, Nigeria

Yahaya Yusuf Maina, Solomon Moses
Educational Psychology Department,
Federal College of Education, Zaria

ABSTRACT

This research examined the effect of peer collaborative learning strategy on motivation and academic performance in physics among public senior secondary school students in Katsina State, Nigeria. The study aimed to investigate how peer collaborative learning strategy will influence students' motivation and academic performance in physics among public senior secondary schools in Katsina State. Two research questions were formulated with their corresponding null hypothesis. The study adopted a quasi-experimental pre-test post-test control group design which compared the control group using a conventional teaching method with an experimental group using a peer collaborative learning strategy to identify its effect on students' motivation and academic performance in physics subject. The study population comprises 96 S.S II students from two public secondary schools in Kastin State. The participants were distributed equally into the control and experimental groups of 48 students each. Two instruments were used for data collection. Academic Motivation Questionnaire (A.M.Q) and a 20-item Physics Achievement Test (PAT) based on the S.S II Physics subject contents. Experts validated the instruments and have a reliability coefficient of 0.76 and 0.89, respectively. The experimental process took six weeks. The data was analysed using Analysis of Covariance (ANCOVA) statistics at a 0.05 level of significance. The result showed that there was a significant difference in the mean scores of students taught Physics with peer collaborative learning and those taught with the conventional method ($F = 484.027, p = 000$) and there is a significant effect of Peer Collaborative Learning of Public Senior secondary school student's Motivation in Physics ($F = 208.466, p = 002$). Based on the findings, it was recommended among others that Physics teachers should adopt a peer collaborative learning strategy during instructions since it was discovered to be more effective than the conventional method and that seminars, workshops and conferences can be organized by either school administrators or Ministry of education on understanding peer collaborative learning strategy and how to use it during instruction.

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INTRODUCTION

Many nations including Nigeria are striving to develop technologically and scientifically (Adejoh, Amali & Omega, 2013). Education has been identified as a key factor to

ensure any country develop scientifically and technologically. This is only possible for education if there is a good teaching and learning of science at the secondary school level. Relatively, science related subjects or causes such as physics,

Corresponding author: Yahaya Yusuf Maina

✉ yusufmaina09@gmail.com

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chemistry and physics have received national emphasis on the Nigeria's bid to move at par with other science oriented and technologically advanced nations. To achieve this goal, there is need to improve teaching methodology in science in secondary school (Eriba & Anchor, 2018)

This quest has led to radical departure from or modification of such conventional methods of teaching sciences more effective method of instruction that is activity-based strategy which tend to improve students' academic performance in science subject like Physics. (Eriba & Anchor, 2018). According to Achor and Kalu (2014), the achievement of students in sciences in Nigeria has remained consistently poor. In-fact, a survey of the achievement in Upper Basic School (UBS) Basic science and technology in Nigeria over the years reveals a discernible decline. Anekwe (2008) hit the nail on the head when he attributed the problem of poor performance among science students to inappropriate teaching strategies and non-availability of necessary facilities for the teaching of sciences among other things. Eriba and Anchor, (2018) in their studies pointed out that using the conventional method such as, demonstration method, teaching method and chalk and talk methods, the teacher talks most of the time while the students listen passively and watch as the teacher demonstrates and reads about the content. This makes the classroom teaching environment teacher dominated, textbook bond and examination oriented without recognizing the need for the development of science process skills in the students. They asserted that science teaching must be done through appropriate strategy which fosters understanding for applicability. Good quality teaching gives rise to functional learning.

The transition from traditional teaching method or conventional classroom setting to a more collaborative and interactive learning environment is gaining attention due to its potential impact on student outcomes. Samuelson, (2010) have suggested that peer collaboration is a more effective method of teaching science at Secondary School level. And it has been approved by many educational researchers for the past decade for its positive role

in classroom-based learning, which has been evaluated positively in the outcome of learning among distance educational learners. The conventional teaching method commonly used in instruction is teacher centered. This implies that the teacher becomes the center of attraction rather than the students. Students are passive listener with little or no control over their learning experience. This often affect their motivation to participate in teaching and learning activities. Conventional teaching method constitutes a loss both for the teachers who apply it in teaching science subjects like physics and the students.

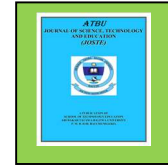
Peer collaborative learning is an instructional approach that promotes interaction among students and shared responsibility for learning. Laal and Laal (2012) defined collaborative learning as an educational approach to teaching that involves groups of learners working together to solve a problem. In collaborative learning, students take responsibility for their learning which leads to better performance. It helps students to have active control over their own learning and create both academic and social relationships to accomplish common goals. Science related subjects or causes such as physics, chemistry and physics have received national emphasis on the Nigeria's bid to move at par with other science oriented and technologically advanced nations. To achieve this goal, there is need to improve teaching methodology in secondary school (Eriba & Anchor, 2018). This quest has led to radical departure from or modification of such conventional methods of teaching sciences more effective method of instruction that is activity-based strategy which tend to improve students' academic performance in science subject like Physics (Eriba & Anchor, 2018).

According to Achor and Kalu (2014), the achievement of students in sciences in Nigeria has remained consistently poor. In-fact, a survey of the achievement in Upper Basic School (UBS) Basic science and technology in Nigeria over the years reveals a discernible decline. Anekwe (2008) hit the nail on the head when he attributed the problem of poor performance among science students to inappropriate teaching strategies and

Corresponding author: Yahaya Yusuf Maina

✉ yusufmaina09@gmail.com

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non-availability of necessary facilities for the teaching of sciences among other things. Eriba and Anchor, (2018) in their studies pointed out that using the conventional method such as, demonstration method, teaching method and chalk and talk methods, the teacher talks most of the time while the students listen passively and watch as the teacher demonstrates and reads about the content. This makes the classroom teaching environment teacher dominated, textbook bond and examination oriented without recognizing the need for the development of science process skills in the students. They asserted that science teaching must be done through appropriate strategy which fosters understanding for applicability. Good quality teaching gives rise to functional learning.

Samba and Eriba, (2012) have researched into method combination, and modifications that can bring about effective teaching and learning of science subjects in secondary schools which motivate learners and also encourage active participations in teaching and learning such as peer collaboration. Peer collaborative learning refers to a teaching and learning approach where students work together in groups or pairs to achieve common learning goals. This method emphasizes active participation, shared responsibility, and mutual engagement among students. Through peer collaborative learning, individuals can benefit from diverse perspectives, collective problem-solving, and the development of social and cognitive skills. (C.T.I, 2023)

Collaborative learning can occur peer-to-peer or in larger groups. Peer learning, or peer instruction, is a type of collaborative learning that involves students working in pairs or small groups to discuss concepts or find solutions to problems. Similar to the idea that two or three heads are better than one, educational researchers have found that through peer instruction, students teach each other by addressing misunderstandings and clarifying misconceptions. (Centre for Teaching Innovation, 2023).

Collaborative learning is a learning environment that allows active participation in the learning process (Oludipe et al., 2010).

Collaborative learning helps learners to learn by collaborating with others and working together to achieve a common goal. According to Fakomogbon and Bolaji (2020), collaborative learning is viewed as an approach employed by teachers for facilitating learning and improving students' performance. Collaborative learning helps learners to share their understanding and learning experiences and helps to promote their learning performance as well as for both groups and individuals. Samuelson (2010) have suggested after his study that peer collaboration is a method in which 4 or more students work together face-to-face in a classroom setting towards achieving a mutual goal of learning from a particular task. He further suggested that it is a more effective method of teaching science at the Junior Secondary School level. And it has been approved by many educational researchers for the past decade for its positive role in classroom-based learning, which has been evaluated positively in the outcome of learning among distance educational learners.

To further explain the relevance of peer collaborative learning, the constructivist theory of learning as proposed by Piaget, Vygotsky and Bruner is based around the idea that learners are active participants in their learning journey; knowledge is constructed based on experiences. As events occur, each person reflects on their experience and incorporates the new ideas with their prior knowledge. This theory emphasized the learner-centred, learner-directed, and collaborative style of teaching and learning. Knowledge is created through the interaction between teacher and learner, and within students themselves. Thus, in the context of this study, the theory of constructivist learning, instructors act as facilitators (Dagar, 2016).

Motivation plays a crucial role in collaborative learning, influencing how individuals engage, contribute, and benefit from the collaborative process. Collaborating with peers can create a positive and supportive learning environment, fostering a sense of belonging and motivation. A Healthy competition among peers can motivate students to perform better. Cooperative learning fosters a sense of teamwork

Corresponding author: Yahaya Yusuf Maina

✉ yusufmaina09@gmail.com

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and shared goals, enhancing motivation. It also collaborative activities can make learning more engaging and enjoyable, thereby increasing motivation to participate. A Study by Garton and Fawcett (2001) on effect of peer collaboration on children's problem-solving ability. Participants were 100 Year 2 children (aged between 6 and 7 years), from schools in high socio-economic areas. It was found that children who collaborated collectively obtained a significantly higher number of correct sorts than children who worked individually. However, post-testing indicated that only those children of lower sorting ability who collaborated with higher sorting ability peers showed a significant improvement in sorting ability from pre-test scores.

Samuel (2010) also investigated the effect of peer collaboration on children's arithmetic and self-regulated learning skills. 7th grade, age 13 years students were used for the study. Peer collaboration groups were compared to two different structured teaching methods, traditional and independent teaching. The result showed that Peer collaboration is more effective than traditional and independent work for students' internal motivation. Knof et' al (2023) established that there is a significant correlation between the use of collaborative learning strategies and the ability for realistic self-assessment when they carried a study on influence of collaborative learning and self-organisation on medical students' academic performance in anatomy using 146 students. In similar study, Hui-Chuan (2005) concluded on her study on effects of cooperative learning on motivation, learning strategy utilization, and grammar achievement of English language learners in Taiwan that cooperative learning was found to have large positive effects on motivation and strategy use, and medium-to-large positive effects on grammar achievement. The overall, the findings indicated a consistent pattern in favour of cooperative learning over whole-class instruction in teaching the Taiwanese learners' English grammar.

Christiana et al (2018) also carried out a study on effect of Peer Collaboration Learning Strategy on Students' Achievement in basic

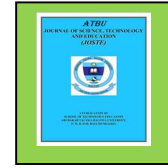
science among Upper Basic 2 in Makurdi Local Government Area of Benue State. The results of their study showed that, peer collaboration learning strategy enhanced students' achievement in basic science better than conventional method. There is a significant difference between the mean achievement scores of students taught basic science using peer collaborative learning strategy and those taught using demonstration method. Johnson and Johnson (2009) asserted that healthy interaction among students expectedly, will lead to higher academic achievement. Thus, with well-coordinated collaborative learning, students are not only in groups, but they work together in groups, playing a significant role in each other's learning. Niyonsaba et al (2022) also asserted that Collaborative learning helps students to have active control over their own learning and create both academic and social relationships to accomplish common goals.

A study by Chad (2022) on the the effect of collaborative learning on academic motivation among students from 17 institutions throughout the United States. The result showed that Ccollaborative learning exerted a statistically significant and positive influence on students' academic motivation levels across four years of undergraduate education. Tests for the presence of interaction effects on Chad study suggested that the relationship between collaborative learning and academic motivation is similar for all students, regardless of racial or ethnic background. Johnson et al (2014) opined that working with peers can boost motivation by creating a sense of accountability and competition. Positive interactions with peers can inspire individuals to set and achieve higher goals. Social interactions and a supportive peer environment contribute to the development of intrinsic motivation. When individuals find personal value and enjoyment in their learning, they are more likely to stay motivated. To further established relevance of collaborative learning, Slavin's model of cooperative learning (1995), state that cooperative learning ultimately results in gains in learning because the process of

Corresponding author: Yahaya Yusuf Maina

✉ yusufmaina09@gmail.com

Educational Psychology Department, Federal College of Education, Zaria
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cooperation prompts motivation and consequential cognitive activities.

Relevance peer collaborative learning cannot be overemphasized. Relevant studies that established the place of peer collaborative learning in academic performance but there remains a gap as to understanding the full potential of peer collaborative learning among public senior secondary school students in Katsina State. The existing body of literature has explored the impact of peer collaboration on academic performance and the role of motivation in educational settings. However, the specific dynamics of how peer collaboration strategy influences student motivation and, subsequently, how this combined impact affects academic achievement among senior secondary school students remain insufficiently explored. Therefore, this study seeks to investigate the impact of peer collaborative learning strategy on motivation and academic performance among Public Senior Secondary School Student in Katsina State with the goal of providing actionable insights for educators, policymakers, and stakeholders invested in the holistic development of students in the senior secondary education systems.

Objectives of the Study

The objective of the study was to determine

1. The difference in the mean scores of students taught Physics with peer collaborative learning strategy and those taught with conventional method among public senior secondary school students in Katsina State.
2. The effect of Peer Collaborative Learning strategy of public senior secondary school student's Motivation in Physics in public senior secondary school students in Katsina State.

Research Questions

The following research questions guided study

1. What is the difference in the mean scores of students taught Physics with

peer collaborative learning strategy and those taught with conventional method among public senior secondary school students in Katsina State?

2. What is the effect of Peer Collaborative Learning strategy of Senior secondary school student's Motivation in Physics in public senior secondary school students in Katsina State?

Hypothesis

The following hypotheses guided the study,

- H₀₁** There is no significant difference in the mean scores of students taught Physics with peer collaborative learning strategy and those taught with conventional method among public senior secondary school students in Katsina State.
- H₀₂** There is no significant effect of Peer Collaborative Learning strategy of Senior secondary school student's Motivation in Physics in public senior secondary school students in Katsina State.

METHODOLOGY

The study adopted quasi-experimental pre-test post-test control group design which compared control group using conventional teaching method with an experimental group using peer collaborative learning strategy to identify the influence of peer collaborative learning strategy on students' motivation and academic performance in physics subject. The target population of S.S II comprises of 4,366 students. The sample size consisted of 96 students from two schools. The participants were distributed equally into the control and experimental groups of 48 students each. Two instruments were used for data collection. Academic Motivation Questionnaire (A.M.Q) and a 20-items Physics Achievement Test (PAT) based on the S.S II Physics subject contents. The instruments were validated by experts and have the reliability coefficient of 0.76 and 0.89 respectively after pilot testing.

During the experiment, a pretest was given to both groups which served as bases for comparison. After the pretest, intervention was



introduced to the experimental group; physics was taught using peer collaborative learning strategy for six weeks and another Physics Teacher was also assigned to teach the control group using conventional method of teaching. After six weeks, a post-test was given, and the scripts marked and

scored. The data was analysed using Analysis of Covariance (ANCOVA) statistics at 0.05 level of significance.

RESULTS

Table 1: ANCOVA Analysis of difference in the mean scores of students taught Physics with peer collaborative learning strategy and those taught with conventional method

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	8167.008 ^a	2	4083.504	1241.140	.000	.964	
Intercept	210.353	1	210.353	63.935	.000	.407	
Group	1592.510	1	1592.510	484.027	.000	.839	
PRETEST	6574.498	1	6574.498	1998.252	.000	.956	
Error	305.982	93	3.290				
Total	91017.000	96					
Corrected Total	8472.990	95					

a. R Squared = .964 (Adjusted R Squared = .963)

Table 1 shows that $F = 484.027$, $df 1$, $p = 0.000$ is less than the alpha level of 0.005. Therefore, the null hypothesis which state that there is no significant difference in the mean scores of students taught Physics with peer collaborative learning strategy and those taught

with conventional method is rejected. This mean that there is a significant difference in the mean scores of students taught Physics with peer collaborative learning strategy and those taught with conventional method.

Hypothesis 2

Table 2: ANCOVA Analysis on effect of Peer Collaborative Learning of Senior secondary school student's Motivation in Physics

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Squared	Eta
Corrected Model	2178.666 ^a	2	725.601	241.140	.000	.873	
Intercept	1568.901	1	1568.901	63.935	.000	.307	
Achievement	988.493	1	988.493	28.996	.000	.534	
Group	419.671	1	307.402	208.466	.000	.566	
PRETEST	734.232	1	734.232	7.234	.002	.956	
Error	295.862	93	4.287				
Total	81017.00	96					
Corrected Total	7472.990	95					

a. R Squared = .964 (Adjusted R Squared = .963)

Table 2 shows that $F = 208.466$, $df 1$, $p = 0.002$ is less than the alpha level of 0.005. Therefore, the null hypothesis which state that there is no significant effect of Peer Collaborative

Learning strategy of senior secondary school student's Motivation in Physics is rejected. This implies that there is a significant effect of Peer

Corresponding author: Yahaya Yusuf Maina

✉ yusufmaina09@gmail.com

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Collaborative Learning of Public Senior secondary school student's Motivation in Physics.

DISCUSSION

The findings of this study revealed that there was a significant difference in the mean scores of students taught Physics with peer collaborative learning strategy and those taught with conventional method. This means that the students that were taught using peer collaborative learning perform more than those taught with conventional method. By implication, peer collaborative learning strategy was more effective in teaching and learning Physics among senior secondary school in Katsina State. This study corresponds with a study conducted by Christiana et al (2018) who discovered that peer collaboration learning strategy enhanced students' achievement in basic science better than conventional method among Upper Basic 2 in Makurdi Local Government Area of Benue State.

Samuelson (2010) also asserted that peer collaborative learning is more effective method of teaching science at the Junior Secondary School level. Johnson and Johnson (2009) further asserted that healthy interaction among students expectedly, will lead to higher academic achievement. Thus, with well-coordinated collaborative learning, students are not only in groups, but they work together in groups, playing a significant role in each other's learning.

The study also revealed that there was significant effect of Peer Collaborative Learning strategy of Senior secondary school student's Motivation in Physics. This study agrees with the study of Hui-Chuan (2005) who concluded that cooperative learning was found to have large positive effects on motivation and strategy use, and medium-to-large positive effects on grammar achievement of English language learners in Taiwan. The researcher observed that Motivation plays a very significance role is learners' engagement in teaching and learning as it was discovered among public senior secondary school in Katsina State. Johnson and Smith (2014) opined that working with peers can boost motivation by creating a sense of accountability

and competition. They further state that positive interactions with peers can inspire individuals to set and achieve higher goals. Social interactions and a supportive peer environment contribute to the development of intrinsic motivation. When individuals find personal value and enjoyment in their learning, they are more likely to stay motivated, as discovered among public senior secondary school in Katsina State.

CONCLUSION

The study has been able to show that peer collaborative learning strategy is more effective teaching strategist in science than conventional teaching method among public senior secondary school in Katsina State. Peer collaborative strategy is also more effective in improving and sustaining academic motivation of students in Physics when compare with conventional method as the study revealed. Reviewed literatures suggested peers can boost motivation by creating a sense of accountability and competition. Positive interactions with peers can inspire individuals to set and achieve higher goals. Social interactions and a supportive peer environment contribute to the development of intrinsic motivation. When individuals find personal value and enjoyment in their learning, they are more likely to stay motivated.

RECOMMENDATIONS

Based on the findings and the conclusion reached, the following recommendations are made

1. Physics teachers should adopt peer collaborative learning strategy during instructions since it was discovered to be more effective than conventional method.
2. Using conventional method of instructions is no longer able to sustain high performance among students. Therefore, schools and ministries of education should encourage the use of peer collaborative learning strategy.
3. Seminars, workshops, and conferences can be organized by either school administrators or ministry of education

Corresponding author: Yahaya Yusuf Maina

✉ yusufmaina09@gmail.com

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on understanding peer collaborative learning strategy and how to use it during instruction.

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Corresponding author: Yahaya Yusuf Maina

✉ yusufmaina09@gmail.com

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