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**EFFECT OF PROBLEM-BASED LEARNING METHOD WITH COOPERATIVE  
LEARNING STRATEGY ON ACADEMIC PERFORMANCE AMONG PHYSICS  
SECONDARY SCHOOLS STUDENTS IN KATSINA STATE, NIGERIA**

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**EFFECT OF PROBLEM-BASED LEARNING METHOD WITH COOPERATIVE LEARNING STRATEGY ON ACADEMIC PERFORMANCE AMONG PHYSICS SECONDARY SCHOOLS STUDENTS IN KATSINA STATE, NIGERIA**

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**Abstract**

*This study examined the impact of problem-based learning method with cooperative learning strategy on electricity concept of physics student's academic performance among secondary school students in Katsina state, Nigeria. The research work was guided by two research objectives, two research questions and two hypotheses. Quasi-experimental research design involving two groups (one experimental and one control) were used. The population of the study consist of 12,853 Physics students from twenty-five public senior Secondary School in Katsina Zonal Education Quality Assurance. The sample of students for the study consist of 149 students from intact classes selected from two schools. Physics Performance Test (PPT) was used for data collection. The reliability coefficient of the PPT was obtained using Pearson Product Moment Correlation which was 0.845. The null hypotheses was tested at  $P \leq 0.05$  level of significance using t-test independent sample by the aid of SPSS (version 23). The results of the finding shows that there was significant difference in the mean academic performance between experimental and control group. The research concluded that problem-based learning methods with cooperative strategy is effective teaching method that can be explored as alternatives to the lecture method in teaching electricity concept of physics. Moreover, problem-based learning method with cooperative strategy is gender friendly teaching method. Based on the findings, it is recommended that teachers should employ the use of problem-based learning method with cooperative strategy as alternative to lecture method in teaching physics to enhance students' performance.*

## **Introduction**

Education the key process of facilitating learning, the acquisition of knowledge, skills, values, morals, beliefs, habits, and personal development, it is also the way of cultural transmission and renewal which brings about development of knowledge, mind, character and ability in learners to improve as well as the community they live in (Aliero & Usman, 2019). This shows that education is the bedrock of every country's development, a pathway of fostering nation's economy and a way of sustaining people's culture. Secondary education in Nigeria is comprehensive and has core curriculum areas designed to broaden students' knowledge and outlook. Its broad aim as stated in the national objectives is to prepare students for useful living within the society and for higher education. The importance of science and technology in the lives of individuals, development of mankind and the society at large cannot be over emphasized. Scientific literacy which is the gateway to achieve scientific and technological advancement and economic survival is achievable through science education. Science education is well recognised as a distinct field within education and is concerned with the teaching and learning of science and the discrete science disciplines which include sub-fields such as chemistry, biology, geography and physics education.

Taber (2014) stated that Physics is among the science secondary school Students core subject in Nigeria. Physics as a subject discipline is guide popular at all level of Nigeria education, even though it is not the subject with large student enrolment among the science subjects especially at the upper basic levels of the Nigeria education (Ofoegbu, 2013), Physics is the branch of science that deal with the study of nature and how the fundamental constituents of the universe interact among sciences, physics is a fundamental science subject this is because it enable learners to have systematic thinking and supplies the theories necessary for understanding the universe, physics provide student with analytical, problems solving and fundamental skills which are important for many sciences. Physics prepares students to understand and analyze data to present their findings in understandable formats. Regarding the physics process skills acquisition, the process of the scientific problems solving technique is employed which link physics and other sciences so as to continues to expand tremendously in the contemporary world (Spreedharan, 2015)

However, physics education has been undergoing problems this is because the students' enrolment in physics courses at all levels is low in many African countries. Reasons for this range from: inadequate lower-level preparation, lack of Physics background, lack of job opportunities outside the teaching profession, inadequate teacher qualification as well as possession of below standard

pedagogical content knowledge (Semela, 2020). Physics as a subject is considered devoid for application in the day life where many students find the subject boring and unenjoyable (Hirschfeld,2017).

The effectiveness of teaching method or instructional program is measured by its importance, while the value of learning depends upon its application in the daily life. Inappropriate method of teaching among other reasons results in students not being able to explore the natural environment; inability of the students to see, feel and touch science resources that will bring about creative thinking and learning of science in their natural state. Physics being among the subfields in science is a natural science that deals with the study of matter in relation to energy, it is explaining the natural phenomena, teaching and learning are interrelated processes in the classroom. However, the methods of teaching physics had been going through changes over time because of research in teaching instructional strategies, evolution of learning theories as well as advancement of information and communication technology ICT (Meenu, 2016). Hence getting the right teaching strategy has always been central factor in teaching and learning process, it is therefore important for physics teachers to consider and implement suitable innovative teaching strategies that will improve students understanding and appreciation of the subject thereby increasing its popularity and acceptance.

The main idea of problem-based learning is that physical problems capture the interest of the students and provoke serious thinking as the students acquire and apply new knowledge in a problem-solving context (Meenu, 2016). The teacher serve the role of facilitator, working with students to frame worthwhile questions, structuring meaningful tasks, coaching both knowledge development and social skills, and carefully assessing what students have learned from the experience. The teacher must consider the students ability to work collaboratively, be self-directed, and to think critically. The rationale for using this approach in Physics teaching lies in the fact that if, students are involved in activities they are challenged to come out with results, which are more likely to learn more than if they were simply told or presented with outcome of experiments. This method de-emphasizes rote memorization of scientific concepts and principles while emphasizing knowledge and skill acquisition through hand-on-mind on scientific activities under the guidance of the science teacher (Neji & Meremikwu, 2016).

Cooperative learning is among the teaching-learning technique where students achieve learning goals by helping each other in a social setting. Literature shows four main approaches to

cooperative learning: structural approach (Kagan, 2015). The structural approach is based on using content-free ways of managing classroom interaction called structures which are relatively easy to implement and can be categorized into team and class building.

In 21<sup>st</sup> century, students' performance in Physics in secondary schools has become worrisome as expressed by WAEC Chief Examiner (2019) for which it stated that among the weakness exhibited in WAEC Physics examination, include inability of the students apply physics principles correctly, or identify principle/concepts for solving problems among other weaknesses. WAEC chief examiner recommended that, teachers should rise to their responsibilities and make learning interactive.

There are various teaching strategies that could make learning interactive and foster students' positive interdependence. Problem solving strategy is a process in which students solve a problem using the scientific approach to collect and analyze data. The data collected are used to arrive at a prove solution rather than a guessed solution. John Dewey was one of the philosophers who emphasized the use of this method in recent times. Problem solving strategy is a prominent feature in the learning of science and its neglect could have negative effect on leaning outcome in science. This no doubt has made science enterprise more problem based in comparison with other fields of human endeavor. Problem solving has been an aspect of Physics teaching and learning that has attracted the attention of chemical educators. The reasons are that physicist function best in problem solving (Danjuma, 2017). Science is seen as a dynamic and objective process of seeking knowledge, and an enterprise that involves people searching, investigating and seeking verification of natural phenomena. Since science is both an organized body of knowledge and a process of finding out knowledge, it therefore demands that it should be targeted through hand on method approach. This implies placing them in problem solving situation and surrounding them with appropriate material (Ibe & Nwosu, 2018), which problem-based learning method with cooperative learning strategy is all about.

The influence of gender on academic performance has for long time been matter of concern to many researchers, but no consistent result has been established. For instance, Iyang & Jegede (2019), Aluko (2017) reported that gender has no effect on achievement in science. Shuaibu and Mari (2017) explained that female students are significantly better than their male counterparts and that there is a significant difference between male and female students in their ability to solve scientific problems. Some instructional strategies are gender biased while some are gender

friendly. However, the degree of gender related differences in learning vary from one method of instruction to the other.

The search for effective learning strategies to help improve students' academic performance in Physics has been a matter of serious research. It has been asserted that, problem-solving and learning through cooperative method might be a good alternative to the traditional teaching methods in classrooms. A cross utilization of varieties of students' abilities in heterogeneous group may help the so-called weak students achieve better. Based on this background, this study investigates the impact of problem-based learning with cooperative learning strategy on academic performance among Physics secondary schools' students in Katsina state.

### **Statement of the Problem**

The issue of poor performance among Physics students in secondary schools has continued to affect the performance of Physics students despite the usefulness attached to it in the society. Learners' performance in the subject at the end of Secondary School National Examinations has remained low. Scholars such as Okwu and Charles (2018) asserted that secondary school Students performance is less than Fifty percent in Physics external examinations for the past decade which is below average. Also, the Chief Examiners Reports for WAEC and NECO (2020) expressed worries over the low performance of students in Physics which they attributed to weakness and difficulty in understanding physics concepts, lack of confidence and poor teaching methods.

The persistent poor performance in Physics is also recorded in Katsina state where the study will be carried out. The underachievement and gender differences in learners' Physics performance is attributed to ineffective teaching methods employed in Physics classrooms, among other factors. Problem-Based Learning method is the highest form of learning, the effective teaching implies productive, purposeful, result oriented, qualitative, meaningful and realistic teaching. The essence of being an effective teacher views on what to do to foster student learning. Physics teachers should therefore adopt teaching methods that will enable the students to understand whatever concepts topic or principles being taught. Against this statement, the study is sought to investigate on the Effect of Problem-Based Learning Method with Cooperative learning strategy on Academic Performance among Physics Secondary Schools Students in Katsina State, Nigeria.

### **Objectives of the Study**

The study main objective is to determine the effect of Problem Based Learning Strategy with cooperative learning strategy on Performance among electricity Secondary schools Students in Katsina state. The specific objectives are to:

1. Determine the effect of problem-based learning method with cooperative learning strategy on students' performance in electricity among secondary schools in Katsina state;
2. Determine the effect of problem-based learning method with cooperative learning strategy on performance of male and female students in electricity among secondary school in Katsina state.

#### **1.4 Research Questions**

Based on the outlined research objectives, the following research questions were developed for the study:

1. What is the difference between the mean performance scores of students taught electricity using problem-based learning method with cooperative learning strategy and those taught using lecture method?
2. What is the effect of problem based learning method with cooperative learning strategy on academic performance among male and female electricity secondary school Students in Katsina state.

#### **1.5 Research Hypotheses**

The following research hypotheses guided the study and were tested at 0.05 level of significance.

**H<sub>01</sub>:** There is no significant difference between the mean performance scores of students taught electricity using problem-based learning method with cooperative learning strategy and those taught using lecture method.

**H<sub>02</sub>:** There is no significant difference between the mean scores performance scores among male and female electricity secondary school Students in Katsina state.

#### **Methodology:**

The research design for this study is quasi-experimental design, there are two groups in this study; the first group is the experimental group (EG) was expose to Problem-Based Learning method with cooperative learning strategy the second is the control group was expose to Conventional teaching strategy. All the two groups were pre-tested to ensure that selected participants will not be significantly different in terms of Academic Performance. The treatment and teaching periods

lasted for six (6) weeks. Immediately after the treatment, posttest was administered to both groups to determine the effect of treatment on Students' Performance.

The population of this study comprises of all the senior secondary school students at year two (SSII) in Katsina Zonal Education Quality Assurance of Katsina State. The Zone consists of three Local Government Area; Katsina, Kaita and Jibiya Local Government Area. Katsina Local Government has 12 schools, Kaita has seven and Jibiya has six schools making a total of 25 schools in the Zone. At the time of conducting this study, there are a total of twelve thousand eight hundred and fifty-three (12,853) students spread 25 secondary schools in the zone, out of which 6,774 (52.7%) are males and 6,079 (47.3%) are females. This cohort was chosen because they have get acquainted with the school environment unlike the year one (SS I) students who are still novice and year three (SS III) students who are preparing for exit exams. Two schools were randomly selected for the study through balloting. The researcher wrote the names of all twenty five (25) public schools on pieces of papers then divided them according to their local government and balloting at random to select one experimental group and one control group. The name of the school picked at the first instance represented the experimental group and the second school picked was to represent the control group.

The Instruments for data collection for this study was Physics Performance Test (PPT) which comprises of 20 multiple choice items that falls within Electric cells, Electrolysis and capacitor & capacitance which are in line with the National physics syllabus for SS II. The items were obtained from a collection of West African Examination Council (WAEC) and National Examination Council (NECO) past questions. The adoption of the items was made by the researcher after consultation with the researcher's supervisors, physics lecturers in the Department of physics Umaru Musa Yar'adua University and Secondary School physics teachers were also consulted because of their vast experience.

## **Result and Discussion**

**HO1: There is no significant difference between the mean performance scores of students taught electricity using problem-based learning method with cooperative learning strategy and those taught using lecture method.**

**Table 1: t-test Analysis of Academic Performance of experimental and control groups**



Group	N	Mean	Std. Dev.	t	Df	P-Value	Decision
Experimental	77	73.32	6.23	31.99	147	.000	Significant
Control	72	48.21	2.48				

Table 1 presented t-test Analysis of Academic Performance of experimental and control groups. From the results, t-value recorded is 31.99 and p-value observed at degree of freedom of 147 is .000. which is less than alpha (0.05), therefore null the hypothesis is rejected therefore concluded that there is significant difference between the mean performance scores of students taught using problem-based learning method with cooperative learning strategy and those taught using lecture method, in favour of experimental group.

**H02: There is no significant difference between the mean performance scores among male and female electricity secondary school Students in Katsina state.**

**Table 2: t-test Analysis of Performance of Male and Female of experimental**

Gender	N	Mean	Std. Deviation	T	Df	P-Value	Decision
Males	44	35.40	73.12	-0.316	75	.753	Not Sig.
Females	33	33.88	73.57				

Table 2 presented t-test Analysis of academic performance of male and female students in experimental. From the results, t-value record is -.316 and p-value observed at degree of freedom of 147 is .753 p-value observed is greater than alpha (0.05), therefore the hypothesis is accepted which concluded that there is no significant difference between the mean performance scores among male and female secondary school Students since P-value of .753 is greater than significant level of 0.05 (P-value .753 > 0.05).

The findings revealed that significant difference exist between the mean performance scores of students taught using problem-based learning method with cooperative learning strategy and those taught using lecture method, the finding is in line with Gulsum and Semra (2017) on the Effect of Problem-Based Learning Strategy on the elementary schools' students' Performance in Genetics. Quasi experimental Design was used with four classes randomly assigned as experimental and control groups. Findings indicate that students in control group received an instruction based on

teacher explanation and text books. Therefore, PBLS appeared to be better compared to conventional method using relevant information in addressing the problem, articulating, organizing concepts and interpreting information.

There is no significant difference between the mean performance of male and female students. The finding agree with the findings of Yusuf 2016), whose finding revealed that no significant difference between male ( $me=11.74$ ,  $se=1.92$ ) and female ( $me=8.48$ ,  $se=0.47$ ),  $t(59)=1.30$ ,  $P>.05$ . It was therefore recommended that problem based learning strategy should be encouraged by the ministry of education to be adopted by the secondary schools teachers in the classrooms.

#### **5.4 Recommendations**

From the findings of this study, the researcher recommends that:

1. The use of problem based learning method with cooperative learning strategy in teaching electricity concept of physics in schools should be encouraged by stake holders in the education industries such as Federal Ministry of Education, State Ministries of Education, NERDC among others through periodic seminars and workshops to teachers on how to use it as an innovative teaching strategy
2. The Federal Government of Nigeria through its agencies such as the State Ministries of Education, Teacher Training Institutions and professional bodies such as NTI and STAN, to organize a special re-training, workshops, and seminars to teachers on using problem based learning method with cooperative learning strategy for teaching electricity concept of physics.
3. Similarly. Stake holders and Partners in the education industries such as Federal Ministry of Education, State Ministries of Education, NERDC, Parent Teachers Association, NUT, UNICEF, UNESCO, should encourage teachers in secondary school to acquire instructional materials through improvisation or purchase
4. Curriculum planners and curriculum development bodies in Nigeria like NERDC should design programme and policies that will incorporate the use of problem based learning method with cooperative learning strategy in teaching and learning physics at Secondary School level.

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