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Effects of Individualized and Cooperative Learning Strategies on Students' Achievement in Physics among Public Secondary Schools in Mkpat Enin Local Government Area of Akwa Ibom State, Nigeria

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ABSTRACT

This study examined the effects of individualized, cooperative learning strategies on students' achievement in physics in public secondary schools in Mkpat Enin local government area of Akwa Ibom State. The population was all the Senior Secondary One (SS1) Physics students for the 2020/2021 session in the 16 Public Secondary Schools in Mkpat Enin Local Government Area of Akwa Ibom State. Three research hypotheses that guided the study were tested at a 0.05 level of significance. The study adopted a quasi-experimental using a pretest and posttest non-randomized design. A purposive sampling technique was used to select a sample of 100 students. The instrument for data collection was Physics Achievement Test (PAT). PAT has a reliability index of 0.83. It was validated by a panel of three experts from the Department of Science Education, Akwa Ibom State University, Mkpat Enin. Two learning packages (one each for individualized and cooperative learning strategy groups) were used to guide the students on the concept of motion. The data were analyzed using descriptive statistics and Analysis of Covariance (ANCOVA), using pretest and posttest scores as covariates. The findings revealed the effectiveness of individualized learning over cooperative learning strategy on students` achievement in the concept of motion in Physics. It is concluded that individualized learning strategy should be used by the students in learning of motion in Physics.

Keywords: *Physics, individualized, cooperative learning strategies, students' achievement*

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1.1 INTRODUCTION

Physics as a subject in senior secondary school in Nigeria is an important component of science and technology. Physics is a branch of science that deals with the study of energy, matter, and their interactions (Utibe & Onwioduokit, 2019). It is a natural science subject that studies matter, its motion and behaviour through space and time, and the related entities of energy and force. The goals of Physics are to provide the student with a broad understanding of the physical principles of the universe, help them develop critical thinking and quantitative reasoning skills, empower them to think creatively and critically about scientific problems and experiments, and provide training for students planning careers in physics and the physical sciences (Adolphus, Lawton & Dye, 2015).

It is one thing to teach Physics in schools and another important thing for students is to learn it. Learning is very imperative to students. It is because their achievement in Physics depends on how they learn it. Learning has been the subject of exhaustive investigations by psychologists. Agbi (2004) defines learning as the change or modification of behaviour or response to some forms of experience. The basic elements in learning are the learner, the learning process, and the learning situation. The learner is the most important of the three elements because without the learner the other two will not exist. Learning is a mental process by which knowledge, skills, habits, and attitudes are acquired, retained, or sustained and finally utilized. It is a relatively permanent change in behaviour that occurs as a result of practice.

The performance of candidates in the physics examination conducted by the West Africa Examinations Council (WAEC) is usually not systematic as shown in the WAEC results from 2009 to 2019. The performance of students ranges from 40.5 to 55.6%. These inconsistencies can be linked to the learning styles of the students (Simsek, 2013).

The inconsistencies in the performance of students motivate this study on two main types of learning (individualized and cooperative learning strategies). Learning is the process of acquiring new or modified existing knowledge behavior, skills, values, or preferences.

Individualized learning is a process of learning which allows the learner to pursue learning as a person without consulting any other learner. This process of learning was borne out of deeper psychological knowledge of individual differences (Anih, 2007). Igwe (2017) identified the gains from individualized learning to include the learner can progress at the pace best suited to the learner, allows the bright child to accelerate ahead and the slow learner is prevented from

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being pursued too fast, helps the learner with special difficulties whether physical, psychological, emotional or cultural to develop initiative and independence in the learner, gives the teachers a clear idea of each learner's progress.

Individualized learning is a strategy designed to provide the student with a highly flexible system of learning, which is geared to individual life and learning styles. In such a strategy, the teacher and the institution play supportive rather than central roles. The learner concentrates on processes and retains new information without recourse to anybody.

A cooperative learning strategy is learning within a group and by the group. It is learning generated by the people to solve a problem or tackle problems given to them (Akinbobola, 2008). Cooperative learning can further be explained as a learning strategy in which small groups of students with different levels of academic ability use a variety of learning activities to improve their understanding of a subject. Here, each member of a group is responsible not only for learning what is taught but also for helping group members learn, thus creating an atmosphere of achievement. It creates excellent opportunities for students to engage in problem-solving with the help of their group members (Effandi & Zanaton, 2007).

The key elements of cooperative learning include positive interdependence where each student must believe that they have a role to play in the group; individual accountability where each student within a group must be accountable for mastery of the instructional content presented, group rewards that entail sufficient incentives for the group to work together; and group training where students cannot be placed together in a group situation and expected to cooperate without being taught the social skills needed for collaboration (Chukwumah, 2008).

This study used the concept of motion to experiment the effect of learning strategies. Motion is the changes in the position of a body with time. A body that does not move is said to be at rest, motionless, or stationary. An object's state of motion or rest cannot change unless it is acted upon by a force. Motion is described in terms of time, velocity, and displacement. The Motion requires force to cause that change. It is the process of moving, changing place, or position (Utibe, Adigwe & Akpeke, 2019).

In this study, the researchers also consider the role of gender in achievement in Physics. Gender equity is an issue in the reform programs embarked by the Federal Government of Nigeria to address the gender imbalance in education (Salman, 2009).

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Gender is one of the factors influencing students' achievement in sciences at the senior secondary school level. Olson (2002) reported that females performed better than male students when taught mathematics using cooperative learning. Khairulanuar, Nazre, Sairabanu, and Norasikin (2010) found gender differences in favour of male students. Yusuf and Afolabi (2010) reported that gender did not affect the academic performance of students in cooperative learning. These contradictory findings have caused for inclusion of gender as one of the moderating variables of this study.

This study investigated individualized, cooperative learning strategies and students' achievement and retention in physics (using the concept of motion) in public secondary schools in Mkpat Enin Local Government Area, Akwa Ibom State.

1.2 Statement of the Problem

Physics is considered the foundation of other science subjects in senior secondary school. It is important technology is also seen in the introduction to this study. The inconsistencies in students' performance in physics in WASSCE results from 2009 to 2019 motivated this study to test the effect of learning strategies on students' achievement in physics and the influence of gender.

1.3 Purpose of the Study

The purpose of this study was to determine the effect of individualized and cooperative learning strategies on students' achievement in Physics in public secondary schools in Mkpat Enin Local Government Area, Akwa Ibom State. The study is conducted to achieve the following specific objectives:

1. Compare the mean achievement scores of Physics students in the concept of motion using individualized and cooperative learning strategies in public secondary schools in Mkpat Enin Local Government Area.
2. Compare the mean achievement scores of male and female students in the concept of motion in Physics.

1.4 Research Questions

The following research questions were to guide the researchers in the study:

1. What is the difference in the mean achievement scores of Physics students in the concept of motion using individualized and cooperative learning strategies in public secondary schools in Mkpat Enin Local Government Area?

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2. What is the difference in the mean achievement scores of male and female students in the concept of motion in Physics?

1.5 Hypotheses

The following null hypotheses were tested at a 0.05 level of significance to guide the researchers in the conduct of the study:

H_o1. There is no significant difference between the mean achievement scores of Physics students in the concept of motion using individualized and cooperative learning strategies in public secondary schools in Mkpat Enin Local Government Area.

H_o2. There is no significant difference between the mean achievement scores of male and female students in the concept of motion in Physics.

1.6 Method

This study adopts a quasi-experimental design using a pretest and posttest non-randomized design. Students from two purposively selected schools were selected to form the two experimental groups (experimental group 1 and experimental group 2). According to Nworgu (2015), the design is a type that contains different levels of factors and can be used in an investigation to establish the combined effects of two or more independent variables. An important characteristic of this design is that several hypotheses can be tested at the same time. The design is illustrated below:

Groups	**Pretest**	**Treatments (x)**	**Post test**
Experimental groups (E_I)	O_1	X_1	O_2
Experimental groups E_2	O_1	X_2	O_2

Where E_1 = Experimental Group 1 (Individualized Learning Strategy)
E_2 = Experimental Group 2 (Cooperative Learning Strategy)
O_1 = Pretest for all groups
X_1 = Treatment given to E_1 (Students using Individualized Learning Strategy)
X_2 = Treatment given to E_2 (Students using Cooperative Learning Strategy)
O_2 = Post-test for all groups

This study was conducted in Mkpat Enin Local Government Area of Akwa Ibom State. It has 16 public secondary schools (Statistics Department, Mkpat Enin LGA, 2022).

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The population comprised all the Senior Secondary One (SS1) Physics students for the 2020/2021 school session. The population is 1,791 students (Local Education Committee Mkpat Enin LGA, 2022).

A total of 100 students (54 students in the first and 46 students in the second experimental groups) constitute the sample for the study. A purposive sampling technique was used to select the schools. The criteria were:

i. Schools that have at least one professional physics teacher and have been teaching physics consistently for the past two years
ii. Schools which the concept of motion has not yet been taught to the SS1 2020/2021 session students and
iii. Schools with functional Physics laboratory and trained Laboratory staff.

From the preliminary survey, only five schools met the criteria. Two schools that met the criteria were selected by simple random sampling technique. All physics students in the two selected schools were used in the study. The researchers used a flip of a coin to determine which of the schools' intact classes become experimental group one and experimental group two.

Researchers made an instrument entitled: Physics Achievement Test (PAT) for this study.

PAT consists of two sections, A and B. Section A consists of information on demographic variables such as gender and learning strategies. Section B consists of 25 multiple choice questions lettered A – D with only one correct option and three distracters. The test was used to gather scores of students that learn Physics using individualized and cooperative learning strategies. Two learning packages were designed for use in guiding the students to learn the concept of motion in physics for both groups. The contents of the learning packages were similar but the main difference was in the area of students' learning strategies. The teacher's role in this context was to guide the students and encourage them to adopt an individualized learning strategy for the individualized learning strategy group and a cooperative learning strategy for the cooperative learning strategy group.

The Physics Achievement test (PAT) was subjected to face validation. This was done by a panel of three experts consisting Physics lecturer, a Physic teacher, and a Research, Measurement, and Evaluation lecturer in the Department of Science Education, Akwa Ibom State University, Mkpat Enin. The evaluators were expected to read through the test for the correctness of tenses and the ability of the contents to help in providing a solution to the study. In the learning packages, the valuators were expected to read through and see if they would be able to guide the students in learning the concept of motion. The

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suggestions from the three evaluators were incorporated into the final production of the instrument and learning packages. The content validation was done by the researchers using the table of specifications.

To further strengthen the validity of the above instrument, the instrument was administered to a trial testing group of 30 students who were not part of the main subjects for the study but were found to be equivalent in all respects to the subjects in the study.

The researchers used the two schools that met the criteria for sampling but were not for the main study. The internal consistency of the Physics Achievement test (PAT) was determined using KR20 Statistics. The instrument was adopted for use in the study with a value of 0.85.

The following procedures were followed during the students' learning and administration of the instrument:

i. The Director of schools in the area was informed about the study. The Principals of the selected schools were contacted for a proper arrangement for use of the Physics teachers, students, and relevant facilities in the school for the conduct of the study, having briefed them on the purpose and the benefit of the study to the students, school and the Ministry of Education.
ii. At least two professional physics teachers from each of the four selected secondary schools were recruited and briefed on the learning package, test administrations, and evaluations. They were used as research assistants in the four selected schools for the proper conduct of the study.
iii. To predict the effects of the learning strategies pretest was administered to the students (intact classes) at the beginning of the study and the result was used to test a possible effect of the treatment and as covariates in subsequent analysis.
iv. The actual guiding of the students on the concept of motion was done by the research assistants under the supervision of the researchers using the standardized learning package developed by the researchers for two weeks. The use of a standardized or pre-prepared learning package by the team was to standardize the contents and quality of learning strategies used by the students.
v. At the end of the guidance for two weeks the students were given the posttests. The data collected in the course of the study were analyzed using descriptive statistics and Analysis of Covariance (ANCOVA), using pretest and posttest scores as covariates. All hypotheses were tested at a 0.05 alpha level of significance.

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1.7 Results and Discussion

Table 1: Pretest/Posttest of the effect of individualized and cooperative learning strategies on mean achievement scores of Physics students in the concept of motion in public secondary schools in Mkpat Enin local government area.

		Pretest		Posttest		
Learning Strategies	**N**	$\bar{x}$	**SD**	$\bar{x}$	**SD**	**Mean Difference**
Individualized	54	14.44	4.29	66.92	10.71	52.48
Cooperative	46	12.56	3.28	60.72	9.92.	48.16.

Table 1 shows the pretest and post-test mean scores of the effects of individualized and cooperative learning strategies on the mean achievement scores of Physics students in the concept of motion in public secondary schools in Mkpat Enin local government area. From the result, the group exposed to individualized learning had a pretest mean score on the concept of motion of ($\bar{x}$ =) 14.44, SD = 4.29 and a post-test mean score of ($\bar{x}$ =) 66.92, SD = 10.71. The mean difference was 52.48. On the other hand, the cooperative learning group had a pretest mean score of ($\bar{x}$ =) 12.56, SD = 3.28) and post-test mean score of ($\bar{x}$ =) 60.72, SD = 9.92. The mean difference was 48.16. The mean difference of 52.48 and 48.16 for those exposed to individualized and cooperative learning groups respectively shows that the individualized strategy was more effective in increasing the mean achievement scores of students in the concept of motion in Physics than the cooperative strategy.

Table 2: Influence of gender on the mean achievement scores of students in the concept of motion in Physics in public secondary schools in Mkpat Enin local government area

		Pretest		Post-test		
Gender	**N**	$\bar{x}$	**SD**	$\bar{x}$	**SD**	**Mean Difference**
Male	50	14.14	3.54	68.92	6.80	54.14
Female	50	12.86	4.19	58.72	11.55	45.86

Table 2 shows the pretest and post-test mean scores of the influence of gender on the mean achievement scores of students in the concept of motion in Physics. The result showed that the male students had a pretest mean achievement score of ($\bar{x}$

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=) 14.14, SD = 3.54 and a post-test mean score of ($\bar{x}$ =) 68.92, SD = 6.80. The mean difference was 54.14. The result also showed that the female students had a pretest mean achievement score of ($\bar{x}$ =) 12.86, SD = 4.19 and a post-test mean score of ($\bar{x}$ =) 58.72, SD = 11.55. The mean difference was 45.86. From the result, the mean difference of 54.14 and 45.86 for male and female students respectively showed that the mean achievement scores of male students on the concept of motion in Physics increased during the treatment period more than their female counterparts.

Table 3: Analysis of Covariance (ANCOVA) of the effect of individualized and cooperative learning on the mean achievement scores of Physics students in the concept of motion

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5083.172[a]	8	635.396	9.152	.000	.446
Intercept	17520.962	1	17520.962	252.376	.000	.735
Pretest	759.130	1	759.130	10.935	.001	.107
Learning Strategies	527.527	1	527.527	7.599	.007	.077
Gender	2021.031	1	2021.031	29.111	.000	.242
Learning Strategies* Gender	214.358	1	214.358	3.088	.082	.033
Error	6317.588	91	69.424			
Total	418700.000	100				
Corrected Total	11400.760	99				

a. R Squared = .446 (Adjusted R Squared = .397)

Table 3 shows the ANCOVA of the effect of individualized and cooperative learning strategies on the mean achievement scores of Physics students in the concept of motion in the Mkpat Enin local government area. The result shows that an f-ratio of *(F)* 1, 91 = 7.599, $p < 0.05$, $\eta^2_p = 0.077$ was obtained. Since the associated probability value of 0.007 is less than 0.05 set as the level of significance, the null hypothesis that there is no significant difference between the mean achievement scores of Physics students in the concept of motion using individualized and cooperative learning strategies in public secondary schools in Mkpat Enin local government area was rejected. Thus, the inference drawn is that there is a significant difference between the mean achievement scores of Physics students in the concept of motion using individualized and cooperative learning

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strategies in public secondary schools in Mkpat Enin Local Government Area. Individualized learning significantly increased the mean achievement scores of Physics students in the concept of motion than the cooperative strategy. The result further showed an effect size of ($\eta^2_p = 0.077$), indicating that a 7.7% variance of the increase in the mean achievement scores of students in the concept of motion in Physics was due to the treatments.

Table 3 shows the ANCOVA of the influence of gender on the mean achievement scores of students in the concept of motion in Physics. The result showed that an f-ratio of (F) 1, 196 = 29.111, $p < 0.05$, $\eta^2_p = 0.242$ was obtained. Since the associated probability value of 0.000 is less than 0.05 set as the level of significance, the null hypothesis that there is no significant difference between the mean achievement scores of male and female students in the concept of motion in Physics was rejected. Thus, the inference drawn is that there was a significant difference between the mean achievement scores of male and female students in the concept of motion in Physics. The result further showed an effect size of ($\eta^2_p = 0.242$), which means that only a 24.2% variance of the increase in the mean achievement scores of students in the concept of motion in Physics was due to the influence of gender.

Table 3 further shows a significant difference between the mean achievement scores of Physics students in the concept of motion using individualized and cooperative learning strategies in favour of individualized learning strategy. The initial difference in the mean achievement scores between those exposed to individualized and cooperative learning strategies are significant when subjected to hypothesis testing. The finding of this study collaborated with the work of Christian and Pepple (2012), which investigated the effects of cooperative and individualized learning strategies on students' achievement in chemistry in Rivers State. Their results showed a statistically significant effect of learning strategies on students' achievement in chemistry. The result further shows that both strategies are student-based and do not yield the same result in a practical situation of learning physics.

Table 3 also shows a significant difference between the mean achievement scores of male and female students in the concept of motion using individualized and cooperative learning strategies in favour of male students. The initial difference in the mean achievement scores between male and female students exposed to individualized and cooperative learning strategies are significant in favour of males when subjected to hypothesis testing. The finding of this study contradicts the position of Oludipe (2012) in a study that investigated the influence of gender on Junior Secondary students' academic achievement in basic science using a

cooperative learning strategy. Unlike the finding of this study, learning strategy is a strong determinant of the achievement of students in physics. This result shows further that both strategies improved the mean achievement scores of male students on the concept of motion in Physics more than their female counterparts.

1.8 Conclusion and Recommendations

Both Individualized and cooperative learning strategies improved achievement in the concept of motion in Physics, but students in individualized learning outperformed their counterparts in cooperative learning strategies. Students could learn individually before participating in group exercise. It was discovered that male students significantly achieved more than the female students in the concept of motion in Physics. Teacher of Physics needs to have good understanding of these learning strategies so as to use them maximizing male achievement. In order not to disadvantage female students in the class, it is pertinent that other forms of learning strategies that will make female students perform at maximum should be explored.

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

1. Due to the effectiveness of individualized learning strategy over cooperative learning strategy on students` achievement in the concept of motion in Physics it is recommended for use by the students in the learning of the concept of motion in Physics.
2. Individualized and cooperative learning strategies should be used in male schools in the learning of the concept of motion in Physics. This is because it helps them to achieve more than the female counterparts.

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