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EFFECTS OF TEACHER-MODIFICATION PACKAGE ON UPPER BASIC II STUDENTS' ACHIEVEMENT IN BASIC SCIENCE AND TECHNOLOGY IN LERE, KADUNA, NIGERIA

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Abstract

The study investigated the effects of teacher-modification package on Upper Basic II Students' Achievement in Basic Science and Technology in Lere Kaduna State Nigeria. Three research questions were posed and three hypotheses were formulated to guide the study. Quasi experimental research design was adopted to guide the study. The population of the study is made of 19211 Basic Science and Technology Students and 49 Basic Science and Technology Teachers in Lere LGA. Multistage sampling procedure was used to compose the sample size which involved simple random sampling and purposive sampling techniques. 27 Basic Science and Technology Teachers and 53 Basic Science and Technology Students were selected as sample size for the study. The instrument for data collection was Basic Science and Technology Achievement test (BSTAT). The instrument was validated by two experts in science education. After scrutiny of the experts, the kendall's coefficient value of 0.74 was obtained. Kuder-Richarson method of reliability was used during pilot study outside the study area to establish the internal consistency of BSTAT items and the coefficient index of 0.89 was obtained. Descriptive statistics of mean and standard deviation were used to

answered research questions. Inferential statistics of T-test was used to test the null hypotheses at 0.05 level of significant. Findings of the study revealed that teacher-modification package improved students' achievement in Basic Science and Technology in Lere, Kaduna State. This study among others recommends that Kaduna state government under ministry of education should organize a capacity building training for in-service teachers on the use of teacher-modification package in order to improve the students' achievement in Basic Science and Technology in Kaduna state.

Keywords: Teacher-Modification, Package, Students' Achievement, Upper Basic II, Basic Science.

INTRODUCTION

The World is rapidly changing as a result of science and technology. These changes of the world had been witnessed in every aspect of human life such as health, communication, finance, agriculture, transportation, shelter, among others. These rapid changes call for effective teaching of Science and Technology. There is no doubt that every Individual needs functional education to be able to cope with the rapidly developing World. Science is a systematic enterprise that builds an organized knowledge in the form of explanations and predictions about nature and the universe (Jorge, 2017). Furthermore, he alluded to the fact that, Technology on the other hand is the collection of techniques, methods or processes used in production of goods or services or in the accomplishment of objectives such as scientific investigation. Modernization in every aspect of life is the greatest example of the impact of science and technology, such as, the use of computers, medicine, engineering, space science and so on. With the introduction of modern technology, life has become very simple even though with dear consequence when man mismanage the technology. A nation without technology can never sustain the lives of its citizens and such a nation may have to depend solely on other nations for its basic requirements.

Basic Science and Technology (BST), formally known as Integrated Science, is the science that is taught at the lower, middle and upper basic level of education otherwise known as Junior Secondary School (JSS) (FRN, 2014). Basic Science principally refers to the scientific discipline of physics, Chemistry, Biology, and Mathematics

(Jorge, 2017). It is therefore among science subjects which express the fundamental unity of scientific thought. BST therefore, provides students with the initial theoretical and practical framework which are inevitable pre requisites for their future study of core science subjects at the senior secondary level. BST enables students to understand science concepts, principles, theories and laws which are further elaborated in the core science. This subject, prepare students at the Junior Secondary School level for the study of core science subjects at the Senior Secondary level. This shows that for a student to be able to study science subjects at the Senior Secondary School level successfully, such a student must be well grounded in BST. Indeed, the Federal Government of Nigeria in her National Policy on Education (FRN, 2013) emphasizes that science and technology education curriculum is a foundation for the nation's socio-economic emancipation and proper integration into prevailing global culture of science and technology.

It is expected that when BST is taught to students, the students will possess the basic knowledge in Science and Technology and the innovations that are taking place around them (FRN, 2014). This blends with the objectives of science and technology teaching such as: (1). To produce individuals who will be able to live effectively in the modern age of science and technology. (2). Develop creative problem solving ability, (3). Appreciate the beauty of nature, (4). Learn how to preserve and improve their environment, (5). Help children apply their scientific and technological knowledge and skills to solve societal problems and contribute to the development of the nation and help prepare Nigerian school children for further studies in Science and Technology (FRN, 2013). As children grow up in an increasingly technologically and scientifically advanced world, they need to be scientifically literate to succeed (Steven, 2017).

Teaching is one of the oldest professions in history (Johnson, 2016). Indeed teaching is the source of other professions such as Engineering, Law, Pharmacy, Medicine, Communication, among others. All these professions are made possible through the teaching profession. History has shown that teachers occupied the position of great honour and have influenced the society (Mohammed, Mustapha,& Gana, 2015). Therefore, the training for on the job delivery have become very important, especially the teaching of BST which is very essential in technological development. Several observations have shown that most teachers fail to deliver on the job. For instance,

studies by Sherry, (2014) have found that teachers have poor skills in lesson planning and delivery.

Teacher- modification package refers to the techniques used to change teachers, approach in teaching and learning process so that students achievement can be improve to help them function better in everyday life (Rosmadi, 2018). Teacher- modification package focuses on using a principle of learning through understanding and change people's approach to learning. Swanson (2017) outlined that the major goals of teacher- modification is to replace undesirable practices with an acceptable one. Teacher- modification is of the idea that good teaching and learning processes should lead to positive outcome and poor teaching and learning processes should lead to negative outcome, hence the need for modification. The teacher- modification techniques include: classroom principles, Micro-teaching, interaction analysis, programme instruction, creativity, and reinforcement. The teacher therefore, has a key role to play in providing and encouraging learning environment for effective learning outcome (Rashid & Zaman, 2018). Teacher-modification package play an important role in academic achievement of students. A competent teacher therefore is the one who has mastery of subject matter and has gained power in communicating pedagogy. Academic achievement represents performance outcome that indicates the extent to which a person has accomplished specific goals that were the focus of activities in instructional environment (Ricarda, Anja, Weidinger, & Wirthwen, 2017). Literature shows that students' achievement in Basic Science and Technology has been poor. This is evident from the work of Enemarie, Ogbeba. & Victor, 2019, which shows low academic achievement in Junior Secondary School Certificate Examination (JSCE) from 2016-2017. Similarly, the Junior Secondary School Certificate Examination results in Basic Science and Technology in Kaduna State, particularly in Lere Local Government Area reveals low academic achievement from 2014 to 2018 (Education Resource Centre, 2019). There is therefore, the need to address this.

STATEMENT OF THE PROBLEM

The major goal of Basic Science and Technology programme as derived from the National Policy on Education (FRN, 2014) is to give the learners opportunity for developing skills in science and technology, skills that will enable them function effectively. One factor in learning Basic Science and Technology is the teacher factor in which Basic Science and Technology teachers tend to rely on the teacher centered

method of instruction. The consequence of the application of such teaching technique is low achievement in Basic Science and Technology, now notably in Lere Local Government of Kaduna State. If this strategy of teaching is not changed, the consequence is that students will not be able to progress in science and technology. Several techniques have been introduced in teaching of science subjects, one of which is teacher-modification package. Teacher- modification is anchored on student - centered learning. Teacher-modification utilizes principle of learning such as programme instruction, classroom principles, micro-teaching, interaction analysis creativity, reinforcement. These techniques have been used with positive results (Yadav, 2014; Rosmadi, 2018). Therefore, if teacher- modification package is applied in teaching Basic Science and Technology, is expected that it could improve students' achievement and consequently expand the chances of advancing in various fields in science and technology.

Continuous use of teacher-centered strategy in teaching Basic Science and Technology is not good for learners. The problem of this study is the non utilization of an appropriate and result oriented teaching strategy that could improve students' achievement in Basic Science and Technology in Lere Local Government Area of Kaduna, Nigeria. There is therefore, the need to address this.

AIM AND OBJECTIVES OF THE STUDY

The aim of this study is to determine the effects of teacher- modification package on students' achievement in Basic Science and Technology in Lere, Kaduna State. The objectives of the study are to:

1. Find out the pre-test achievement level of JSS II students in Basic Science and Technology before the treatment in Lere, Kaduna state.
2. Find out the post-test achievement level of JSSII students in Basic Science and Technology in Lere Kaduna State.
3. Find out the pre-test and post-test achievement mean scores of JSS11 students whose teachers were exposed to the teachers'- modification package in Lere, Kaduna State.

RESEARCH QUESTIONS

1. What are the pre-test achievement mean scores of Basic Science and Technology JSSII students before the treatment in Lere, Kaduna State?

2. What are the post-test achievement mean scores of Basic Science and technology JSSII students in Lere, Kaduna State?
3. What are the pre-test and post-test mean achievement scores of students whose teachers were exposed to teacher- modification package in Lere, Kaduna State?

HYPOTHESES

The following null-hypotheses are formulated and were tested at 0.05 level of significance

- H0₁:** There is no significant difference between the pre-test achievement mean scores of Basic Science and Technology JSS11 students in the experimental and control groups in Lere, Kaduna State.
- H0₂:** There is no significant difference between the post-test mean achievement scores of students taught by the teachers whose behaviour has been modified and those taught by the teachers who have not been exposed to teacher-modification package in Lere, Kaduna State.
- H0₃:** There is no significant different between the pre-test and post-test mean achievement scores of students whose teacher were exposed to the teacher-modification package in Lere, Kaduna State.

METHODOLOGY

The research design for this study was quasi-experimental research design, specifically the non randomized pre-test, post-test control group design. The population for the study was comprised of all JSS2 students and Basic Science and Technology Teachers in the 43 government junior secondary schools with the population of 19211 Students and 49 Basic Science and Technology Teachers in Lere LGA. The sample for the study was consisted of 27 Basic Science and Technology Teachers and 53 Basic Science and Technology Students. The experimental group comprised 19 teachers while the control group had eight (8) teachers. Total number of students in two intact classes of two schools was used as the sample. The experimental group was made up of 27 male and female students while the control group was made up of 26 male and female students. Simple random sampling technique was used to select the sample teachers and the sample schools. Purposive sampling technique was used to select the two intact classes. Instrument for data collection was Basic Science and Technology

Achievement Test (BSTAT). The instrument was validated by two experts in science education. After the scrutiny of the experts, kendall's coefficient of concordance was used to judge the agreement among the expert, the kendell's coefficient value of 0.74 was obtained, which showed that the agree between experts in their judgments was strong, therefore the instruments was considered valid for used. Kuder-Richarson method of reliability was used to establish the internal consistency of BSTAT items and a coefficient of 0,89 was obtained. Descriptive statistics, that is mean and standard deviation was employed to answered research questions and t-test statistics was employed in testing the null hypotheses.

RESULTS AND DISCUSSION

Research Question One

What is the achievement level of Basic Science and Technology JSSII students before their exposure to teaching in Lere, Kaduna State?

To ascertain the achievement level of Basic Science and Technology JSS11 Students before the treatment programme, Basic Science and Technology Achievement Test was administered to the students in experimental and control group respectively Descriptive statistics that is mean and standard deviation was employed to obtained the achievement level of the two groups as presented in table 1.

Table 1.

Achievement Level of Basic Science and Technology Students in the Experimental and Control Groups before their exposure to teaching

Group	N	X	SD	X-diff.
Experimental	27	13.81	4.92	5.19
Control	26	19.00	7.62	

Table 1 reveals the mean and standard deviation score of pre-test achievement mean of BST students in the experimental and control groups. The result for experimental group yielded a mean score ($\bar{X}$ = 13.81, SD = 4.92) and control group had a mean score of 19.00 and standard deviation of 7.62 before treatment. It means that the control group achieved better than the experimental group with a mean difference of 5.19.

This could be because initially those in the control group had good lesson preparation and delivery competencies.

Research Question Two

What is the post-test achievement mean score of Basic Science and technology JSSII students in experimental and control group in Lere, Kaduna State?

This research question was answered using the mean and standard deviation of score obtain from students taught with the teacher- modification package (experimental group) and those taught using discussion method of teaching (control). Table 2 presents the post-test mean achievement level and standard deviation of experimental and control group.

Table 2

Post-test Achievement Mean Score of BST Students in the Experimental and Control Groups

Group	N	X	SD	X-diff.
Experimental	27	75.48	10.15	17.1
Control	26	58.38	9.15	

Table 2 revealed the post-test achievement mean scores of students in BST in the experimental and control groups. The result for experimental group yielded a mean score of 75.48 and standard deviation of 10.15 while the control group had a mean score of 58.38 and standard deviation of 9.15 after giving treatment to the experimental group. It shows that the experimental group performed better than the control group with a mean difference of 17.1. It then means that teacher- modification package of teachers has helped in improving the achievement of BST students in Lere, Kaduna State.

Research Question three.

What are the pre-test and post-test mean achievement scores of students whose teachers were exposed to the teacher- modification in Lere, Kaduna State?

This research question was answered by comparing the mean achievement score of students in experimental group before the treatment and after the treatment as presented in table 3

Table 3
Results of Analysis between Pre-test and Post-test Mean Achievement Scores in the Experimental Group

Experimental Group	N	X	SD	X-diff.
Pre-test	27	13.81	4.92	
				61.67
Post-test	27	75.48	10.15	

Table 3 revealed the pre-test and post-test mean achievement scores of BST students whose teachers were exposed to teacher- modification package. The result indicates that the pre-test mean score (Mean =13.81; SD =4.92) was lower than the post-test mean score (Mean =75.48; SD = 10.15). It means that students' achievement mean scores increased after exposure of teachers to teacher- modification package.

Hypothesis one

There is no significant difference between the Pre-test achievement mean score of Basic Science and Technology JSSII students in the experimental and control groups in Lere, Kaduna State

To test the null hypothesis one, the pre-test achievement mean score of Basic Science and Technology JSS11 Students in the experimental and control group were compared to ascertain any significant difference between the mean score of the two groups. T-test statistics was employed in testing the null hypothesis and the results is presented in table 4

Table 4: Difference between pre-test Achievement Mean Score of the Experimental and Control Groups

Group	N	X	SD	Df	T	p-value	Decision
Experimental	27	13.81	4.92				
				51	-2.96	.005	Significant
Control	26	19.00	9.62				

Table 4 reveals the result of t-test result of the pre-test achievement mean score of Basic Science and Technology students in the experimental and control groups. In the experimental group, the pre-test mean score was 13.81 with SD = 4.92 while the control group had a mean score of 19.00 with SD = 9.62. The result also yielded $t(25) = -2.96$, $P < 0.05$. Since the P-value of 0.005 is less than the 0.05 level of significance, the null hypothesis was rejected. It was concluded that there was a significant difference between pre-test mean achievement scores of the experimental and control groups in favour of the control group. The result therefore, shows that the pre-test achievement mean score of Basic Science and Technology students in the control group was higher, than that of the experimental.

Hypothesis two

There is no significant difference between the post-test achievement mean scores of students taught by the teachers that were exposed to treatment package and those taught by the teachers who have not been exposed to the treatment package in Lere, Kaduna State.

To test hypothesis two, the post-test mean achievement score of students taught by the teachers that were exposed to TMP and those taught by the teachers who have been exposed to TMP were compared to ascertain any significant difference between the mean of the two groups. The Analysis of Covariance (ANCOVA) was employed in testing the null hypothesis two and the result is presented in Table 5.

Table 5

Summary of ANCOVA Results of Post-test Achievement Mean Scores of Students in the Experimental and Control Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3873.119	2	1936.560	20.293	.000	.448
Intercept	30607.506	1	30607.506	320.739	.000	.865
Pre-test	1.486	1	1.486	.016	.901	.000
Group	3252.318	1	3252.318	34.081	.000	.405
Error	4771.409	50	95.428			
Total	247232.000	53				
Corrected Total	8644.528	52				

a. R Squared = .448 (Adjusted R Squared = .426)

Table 6

Result of Sidak Post hoc Comparison of Difference between the Post-test Achievement of Students in the Experimental and Control Groups

I	J	X-diff.	Std. Error	p value
Experimental	Control	(I - J)		
75.41	58.46	16.96	2.91	0.000

P<0.05

Analysis of Covariance (ANCOVA) was conducted to determine if a significant difference existed in the post-test achievement mean scores of Basic Science and Technology students in the experimental and control groups. Table 5 shows that $F(1,50) = 34.08$, $p < 0.05$, partial $\eta^2 = .405$, since the p value of 0.000 is less than 0.05 level of significance with an effect size of 41%, the null hypothesis was rejected, indicating that there was a significant effect of teacher- modification package on students' achievement. The result further reveals an adjusted R squared value of .448 which means that 44.8 percent of the variation in the dependent variable which is students' achievement is explained by variation in the treatment, which is teacher-modification package, while the remaining is due to other factors not included in this study. The Sidak post hoc test in Table 6 confirms that the corrected difference between experimental group and control group was statistically significant, $(I - J) = 16.96$. Hence, it could be said that teacher- modification package do improve students' achievement in Basic Science and Technology.

Hypothesis three

There is no significant difference between the pre-test and post-test mean achievement scores of students whose teachers were exposed to the teacher- modification package in Lere, Kaduna State.

To test this null hypothesis, the pre-test and post-test mean achievement score of students whose teachers were exposed to the Teachers -Modification package were compared to ascertain any significant difference between the pre-test and post-test mean score of the same group. T-test statistics was employed in comparing the mean score of this group and the results is presented in Table 7 below.

Table 7.**Results of t-test Analysis between Pre-test and Post-test Mean Achievement Scores in the Experimental Group**

Experimental Group	N	X	SD	Df	T	p-value	Decision
Pre-test	27	13.81	4.92				
				26	-26.82	.000	Significant
Post-test	27	75.48	10.15				

The t-test for dependent sample was used to determine if any significant differences exist between the pre-test and post-test mean achievement scores of the experimental group. Table 22 reveals that the pre-test mean score (Mean =13.81; SD =4.92) was lower than the post-test mean score (Mean =75.48; SD = 10.15). The result also yielded $t(26) = -26.82$, $P < 0.05$. Since the P-value of 0.000 is less than the 0.05 level of significance, the null hypothesis was rejected. It was concluded that there is a significant difference between pre-test and post-test mean score of the experimental group. It shows that students' achievement mean scores increased after exposure to teachers' - modification programme.

DISCUSSION OF MAJOR FINDINGS

This study investigated the effects of Teacher-Modification Package on JSSII students' achievement in Lere, Kaduna State Nigeria.

Finding from research questions showed that with pre-test, students in experimental and control groups had poor achievement mean scores in Basic Science and Technology and were almost at the same level. This finding is corroborated by that of Enemarie, Ogbeba and Victor (2019) that revealed low academic achievement in Basic Education Certificate Examinations. This finding is also consistent with the report of Education Resource Centre Kaduna (2018) that revealed low achievement in Basic Science and Technology. These findings may be related to lack of effective intervention package to enhance teacher teaching competencies that could improve students' achievement.

The finding of post-test revealed that the experimental group achievement was better than the control group. It could be deduced that teacher- modification package improved students' achievement in Basic Science and Technology in Lere, Kaduna

State. This finding corroborated the finding of Usendia and Ime (2015) that revealed a significant improvement on students' academic achievement in Basic Science and Technology when classroom interaction pattern of teachers was influenced by the teachers training programme. The finding is also consistent with that of Fatokun and Omenese (2015) that revealed a significant difference in the achievement of the experimental and control groups in favour of experimental group when the authors investigated the effects of prior knowledge and classroom interaction on students' achievement in Chemistry.

Conversely, finding by Hafeez (2021) indicated that students' academic achievement and interest were not improved before and after the training of the teachers using three different methods. This means that teacher training programme on the use of three different methods did not show any significant effects on students' achievement.

Finding from hypotheses indicated that there was a significant effect of teacher-modification package on students' achievement in Basic Science and Technology in Lere, Kaduna State. This mean that teacher- modification package do improve students achievement. Thus, this finding is in consonance with the finding of Obiekwe and Azubuike (2021) who found that teachers training programme impact positively on academic achievement of students in secondary school, and improved teachers' productivity. The finding also concurs with the findings of Paul and Robert (2018) which revealed that students' post-test achievement mean scores improved in experimental groups than the control group when the teachers were trained in questioning strategy.

The similarity of previous findings to the present one could be due to the effectiveness of intervention programme of TMP that improved students' achievement. In a contrary view different from the present finding, Azkiya, Simone and Bert,(2014) found that the effects of intervention programme on teaching quality and students achievement revealed no improvement in students achievement during the post-test administration in Jarkarta Indonesia. This variation of opinion could be traced to context in which the approach was employed

CONCLUSION

The study showed that teacher-modification package improves students' achievement in basic science and technology. The students taught by teachers that were trained using the intervention treatment of teacher-modification package improved in their

achievement than the students taught by the teachers that were exposed to the treatment. Teacher-modification package has demonstrated its effectiveness in improving students mean achievement scores in Basic Science and Technology in Lere LGA of Kaduna state

RECOMMENDATIONS

The following recommendation was made

1. Teachers should adopt the use of teacher-modification package in teaching and learning in all level of education.
2. Teachers should use the package to arouse students' readiness in the classroom learning process.
3. Government should organize capacity building training for in-service teachers on the use of the treatment package.

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