Effects of Transformation Learning Strategy on Academic Achievement of Junior Secondary Three Students in Basic Science and Technology in Jaba-Kaduna State, Nigeria

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ABSTRACT

Basic Science and Technology students need to be grounded well in the subject to enable them develop interest and become prepared for further studies in all branches of science, applied science and social sciences. Therefore, the purpose of this study was to investigate the effects of transformation learning strategy on academic achievement of junior secondary three students in basic science and technology in Jaba-Kaduna state, Nigeria. Quasi-experimental research design was used and. The population for this study was 1,920 (915 males and 1,005 females) junior secondary three (JS3) students offering Basic Science and Technology in all the 22 public junior secondary schools. A total of 136 (69 female and 67 male) junior secondary three students in two public junior secondary schools was used as the sample using purposive sampling technique. Two research questions and two research questions guided the study. The instrument used for data collection was Basic Science and Technology Achievement Test (BSTAT) and scrutinised using two experts; the reliability of the instrument was established using Cronbach Alpha method and found to be 0.891. Findings revealed that the mean scores of experimental group achievement improved more than that of the control group after exposure to treatment d that male students had slightly higher achievement mean scores than female students. Among the recommendations that Basic Science and Technology teachers should adopt the use of transformation learning strategy to enhance students' achievement in Basic Science and Technology subject and all students offering basic science and technology should be given equal opportunity of encouragement irrespective of their gender in learning the subject

INTRODUCTION

Science is a viable tool for the socio-economic and technological development of any nation. Nations of the world have been described as developed or underdeveloped depending on their science and technology prowess. Science according to Cermik and Fenli-Aktan (2020) is defined as a collection of empirically supported, systematic and objective information that removes people from preconceived notions. The proper definition of science teaching would also have to include attitudes and methods through which this body of knowledge is formed; relevant instructional materials and students' activities often provided. These innovative and creative ways are necessary in the science class to help students achieve the set goals. The first objective of the junior secondary education stated in the national policy on education (FRN 2013) is that the child should be provided with diverse basic knowledge and skills for entrepreneurship and educational advancement. For effective teaching and learning of science and technology, the teacher should include all the three domains of Bloom taxonomy in the classroom for higher retention and achievement of students in the Basic Science and Technology. To support this statement, Arop, Umanah and Effiong (2015) state that no science teacher is capable of teaching Basic Science and Technology effectively without employing relevant instructional materials in the science classroom. Animba and Edeh (2021) opine that any teacher who is deprived of instructional materials in the basic science and technology classroom must likely experience stress and anxiety in the science class in every lesson. This is because instructional materials aid both the teacher and the learners to use the three domains through manipulation and communication with class members to achieve the lessons' objectives and also achieve higher in the subject.

Basic science and technology formerly Integrated Science, is the first form of science students come across at the junior secondary school level of education; hence basic science and technology prepares students at the junior secondary school level for further studies in science and technology subjects at the senior secondary school (Obioma (2012). This implies that for a student to be able to study single science subject at the Senior Secondary School level successfully, such student must be well grounded in basic science and technology at the junior secondary school level. Derez (2021) notes that Basic Science and Technology is a core subject that embraces some other core science subjects, namely: biology, chemistry, physics and mathematics that cuts across the school curriculum and also needed in. Despite the importance of Basis Science and Technology as a foundation laying ground for further sciences, students' underachievement in the subject in both local and public examinations (Ani, Obodo, Ikewueze & Festus (2021). The authors posit that the achievement of students in Basic Science and Technology is poor compared to other subjects at the Basic Education Certificate Examination (BECE) year in year out irrespective of their gender.

The Basic Science and Technology students need to be grounded well in the subject to enable them develop interest and become prepared for further studies in all branches of science, applied science and social sciences. Therefore, the teaching and learning of Basic Science and Technology at the junior secondary school should be done in such a way as to relate what students learn in the classroom with what they experience outside the classroom by using relevant instructional strategies, engaging students' in activities and the teacher as a facilitator should guide the students to experience the learning on their own as well as valuing what they are learning. The

under achievement of students in Basic Science and Technology could be an indicator that Basic Science and Technology teachers are using ineffective methods/strategies in science teaching which among other factors have contributed to the student's poor achievement in the subject at the junior secondary school level. On the issue of gender Ani, Obodo, Ikwueze and Festus (2021) in their study on effect of gender on basic science students' achievement in secondary schools, the result showed that there is significant interaction effect of treatment and gender on students' academic achievement in Basic Science and technology. Most researchers reported that there was no significant difference between male and female students' achievement in each of the science subjects (Oludipe 2014; Sakayau & Taiwo 2016; Godpower-Echie, G. & Ihenko, S. 2017). Therefore, students should be given equal opportunity and the same level of encouragement irrespective of their level and gender in the science classroom. The implication is that gender gap in science and technology teachers need to use effective and interactive methods of teaching such as problem-based methods, concept mapping method and transformation teaching method to reverse the students' achievement irrespective of their gender.

Transformation teaching and learning method enables basic science and technology teachers and learners to remain active, sharing ideas with peers and teachers, connecting experiences with new learning in the classroom (Nerstrom, 2014). According to the Singleton (2015) that transformation learning strategy is a method of teaching that enable students and the teacher communicate with nature as an effective tool in reducing stress, creating a more enjoyable learning environment, building relationships between students and the learning resources, sustaining students interest in the science and technology classroom and makes students achieve better. However, Ayebatonye (2020) observes that the teacher is at the center of the teaching and learning activities in the Basic Science and Technology classroom because the teacher is the chief implementer of the curriculum and at the same time the facilitator that guides the students to achieve the set objectives. The author continues that the significance of teacher, in the students' achievement is indisplaceable. Hence, the teacher and the teaching method determine the students' achievement as well as, creating and sustaining students' interest in the subject. Therefore there is need to change the way basic science and technology should be taught using innovative strategies to enable teachers enhance the dignity of being facilitators. The consequences of not addressing students' underachievement in Basic Science and Technology include not meeting the 60:40 ratio mandated by the federal government for admission of students into science-based courses. This study therefore, investigated the effects of transformation learning strategy on junior secondary two students in basic science and technology in Jaba-Kaduna state.

Purpose of the Study

This study examined the effects of transformation learning strategy on junior secondary 2 students in basic science and technology in Jaba-Kaduna, Nigeria. Specifically, the objectives were to:

1. determine the achievement mean scores of JS3 students in Basic science and technology in the experimental and control groups in Jaba-Kaduna State.
2. determine the achievement mean scores of male and female JS3 students in Basic Science and Technology after exposure to transformation learning strategy in Jaba-Kaduna State.

Research Questions

The following research questions were stated answered in this study:

1. What are the achievement mean scores of JS3 students in Basic science and technology in the experimental and control groups?
2. What are the achievement mean scores of male and female JS3 students in Basic Science and Technology after exposure to transformation learning strategy?

Hypotheses

1. There is no significant difference between the post-test achievement mean scores of JS3 students in Basic Science and Technology in the experimental and control groups
2. There is no significant difference in the achievement mean scores of male and female JS3 students in Basic Science and Technology after exposure to transformation learning strategy

Methodology

The research design employed in this study was quasi-experimental pre-test/post-test non-equivalent control group. The population for this study was 1,920 (915 males and 1,005 females) junior secondary three (JS3) students offering Basic Science and Technology in all the 22 public junior secondary schools in Jaba-Kaduna State. A total of 136 (69 female and 67 male) junior secondary three students in two public junior secondary schools constituted the sample for this study and they were used in their intact classes. Purposive Sampling Technique (PST) was used to draw the two sampled schools from the twenty two schools in the public junior secondary schools in Jaba-Kaduna State. The experimental group had 65 JS3 students while the control group had 71

The instrument used for the data collection was a Basic Science and technology Achievement test (BSTAT). The BSTAT which consisted of three sections namely, section A,B and C. Section A consisted of was personal information of the participants, Section B consisted of multiple choice questions with options A-D and had 20 items in all requiring the students to answer all the questions. Each topic had five multiple choice questions with their options and Section C is essay type questions containing four questions and each question had “a” and “b” requiring students to answer any three questions. The instrument was developed using procedures which included determination of the purpose of the test, outlining of content coverage, outlining of the instructional objectives, developing of the table of specifications, selection of items format, assessing of the test items and trial testing of the instrument. The instrument was subjected to the scrutiny of two experts; one from Science and Technology Education and one from Research, Measurement and Evaluation, all from University of Jos. The comments of the experts were taken into consideration in preparing the final instrument for the study. The reliability of BSTAT items was established using Cronbach Alpha method and found to be 0.891.

The pre-test administration of the instrument (BSTAT) was done in the two sampled schools within one day. The instrument was administered face to face to the respondents by the researchers. The data collected was marked to determine the level of their achievement in the subject. This provided baseline data for administering the treatment to the experimental group for 6 weeks 5 topics from the first term syllabus of basic science and technology derived from the curriculum of JS3 While, the control group was taught the same topics using conventional method of teaching. The teaching in the experimental group was done by relating what students learnt in the classrooms with what they experience outside the classroom by given them opportunities to manipulate learning materials and communicating with themselves, performing different learning activities to their satisfaction to experience the learning for purpose of improve their achievement while, the

teacher served as a guide/facilitator. After the administration of the treatment, post-test was administered immediately to the respondents again at the end of week six by the researchers in the experimental and control groups in order to ascertain the possible change of the students' achievement. The statistics used in answering the research questions were descriptive statistics namely, mean and standard deviation, while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significant.

Results

Research Question One: What are the achievement mean scores of students in Basic science and technology in the experimental and control groups?

Table 1 Basic Science and Technology Achievement mean scores before and after exposed to Transformation Learning Strategy (TLS).

Group		Before		After			
	N	Mean	SD	Mean	SD	Mean Gain	X-difference
Experimental	65	38.53	10	72.59	13.15	34.06	30.34
Control	71	38.32	7.23	42.04	9.71	3.72	

Table 1 reveals the achievement mean scores of JS3 students in Basic Science and Technology before and after exposure to transformative learning strategy and lecture method respectively in Jaba-Kaduna. From the result, the pre-test achievement mean scores of experimental group was 38.53 with a standard deviation of 10.00, the post-test mean score was 72.59 and a standard deviation of 13.15 with a mean gain of 34.06, indicating that there was improvement in the achievement of students after treatment. Also, for the control group the mean score was 38.32 and a standard deviation of 7.23 in the pre-test. However, in the post-test the mean score of students rouse to 42.04 and a standard deviation of 9.71 with a mean gain of 3.72. The findings showed that students in the experimental group had a higher mean score (72.59) after treatment, using transformation learning strategy than those in the control group (42.04) who were not given treatment with a mean difference of 30.34. This means that transformation learning strategy improves the achievement of students in Basic Science and Technology. R**esearch Question Two:** What are the achievement mean scores of male and female students in Basic Science and Technology after exposure to transformation learning strategy?

Table 2

Mean and Standard Deviation Scores of Male and Female Students Achievement after exposure to Treatment

Gender				
	N	**Mean**	**SD**	**X-difference**
Male	31	74.42	11.79	3.29
Female	34	71.13	14.11	

Table 2 shows the mean and standard deviation of the post-test achievement mean scores of male and female students in the experimental group. The mean scores for male students was 74.42 and standard deviation of 11.79, while female students had a mean score of 71.13 and standard deviation of 14.11. The results indicated that male students had slightly higher achievement mean scores than female students with a mean difference of 3.29. This shows that transformation learning strategy improved the achievement mean score of female students than that of male students.

Hypothesis One

There is no significant difference between the post-test achievement mean scores of students in Basic Science and Technology in the experimental and control groups.

Table 3: ANCOVA of Post-test Achievement Mean Scores of Students in the Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	p-value	Partial Eta Squared
Corrected Model	33128.519[a]	2	16564.260	123.759	.000	.640
Intercept	21175.615	1	21175.615	158.213	.000	.532
Post-test	15.760	1	15.760	.118	.732	.001
Group	33041.612	1	33041.612	246.869	.000	.640
Error	18604.100	139	133.842			
Total	514688.000	142				
Corrected Total	51732.620	141				

a. R Squared = .640 (Adjusted R Squared = .635)

In table 3 ANCOVA was used to determine the difference between post-test achievement mean scores of students in Basic Science and Technology in the experimental and control groups. The main effect of experimental group yielded ($\bar{X}$= 72.59; SD = 13.15) and control group ($\bar{X}$= 42.04; SD = 9.71); F (1, 139) = 246.87 P < 0.05. Since the p-value of .000 is less than the 0.05 level of significance, the null hypothesis was rejected. This indicated that the achievement mean score of students in the experimental group significantly different from that of the control group. The result revealed that the experimental group had a higher achievement mean score than the control group. The result further revealed an adjusted R squared value of .635 which means that 63.5% of the variation in the dependent variable which is students' achievement is explained by variation in the treatment using transformation learning strategy, while the remaining is due to other factors not included in this study. Hence, transformation learning strategy does increase students' achievement in Basic Science and Technology.

Hypothesis Two

There is no significant difference in the achievement mean scores of male and female students in Basic Science and Technology after exposure to transformation learning strategy.

Table 4: Post-test Analysis of Covariance of Basic Science and Technology Achievement by Gender

Source	Type III Sum of Squares	Df	Mean Square	F	P-value	Partial Eta Squared
Corrected Model	526.413[a]	2	263.207	1.547	.220	.044
Intercept	25513.947	1	25513.947	149.969	.000	.691
Post-test	339.335	1	339.335	1.995	.162	.029
Gender	358.149	1	358.149	2.105	.151	.030
Error	11398.572	67	170.128			
Total	380733.000	70				
Corrected Total	11924.986	69				

a. R Squared = .044 (Adjusted R Squared = .016)

Table 4 shows the Post-test Analysis of Covariance of Basic Science and Technology achievement by Gender. The main effect of male students yielded ($\bar{X}$ = 74.42; SD = 11.79 and female students ($\bar{X}$ = 71.13; SD = 14.11); F (1, 67) = 2.11, P > 0.05. Since the p-value of .151 is greater than the 0.05 level of significance, the null hypothesis was retained. This indicated that the achievement mean score of male students in Basic Science and Technology did not significantly differ from those of female students. It means that students' achievement in Basic Science and Technology was not affected by gender.

Discussion

Findings from research question one revealed that the mean scores of experimental group achievement improved more than that of the control group after exposure to transformation learning strategy. This is in agreement with the findings of Okagbare (2022) who found out that students taught with cooperative learning and problem-solving strategy achieved higher than their counterpart in the control group. Findings from research question two also revealed that males had slightly higher achievement mean scores than females with a mean difference of 3.29. This result also agrees with the findings of Abdulwaheed (2023) found that there was an insignificant difference in the achievement of male and female students taught with cooperative learning strategy. The analysis of hypothesis one indicated that the null hypothesis was rejected meaning that achievement mean score of students in the experimental group was significantly higher than that of the control group. Therefore, the finding agrees with the findings of Libata, Ali and Ismail (2023) who discovered that students taught with process skill constructivist-based strategy achieved higher than the control group. The findings of hypothesis two also revealed that there was no significant difference between the achievement mean scores of male and female students in basic science and technology after exposure to the treatment. This result also is in agreement with the result of Ani, Obodo, Ikwueze and Festus (2021) who found in their study that there was no significant difference in the achievement mean scores of male and female students in Basic Science and Technology.

Conclusion

In view of the findings of this study, it was concluded that transformation learning strategy improved the achievement of students in Basic Science and Technology. Also the findings of the study revealed that gender (male/female) had no significant effect on students' achievement in Basic Science and technology.

Recommendations

1. Based on the findings of the study it was recommended that Basic science teachers should adopt the use of transformation learning strategy to enhance students' achievement in Basic Science and technology subject.
2. All students offering basic science and technology should be given equal opportunity of encouragement irrespective of their gender in learning the subject.
3. The government should provide enough learning materials in junior secondary schools to encourage the teachers teaching basic science to continue using transformation strategy
4. Basic science and technology textbooks writers to include relevant activities for both the teachers and the students to carry out transformation learning strategy in teaching the subject.

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