Lesson Study: An Innovation for Inspiring Lifelong Learning among Basic Science and Technology Teachers' in Nigeria

By

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Abstract

To enhance classroom teaching, every teacher ought to keep up with the latest trends in education and teaching practices. Teachers are required to adopt the mind-set of lifelong learning and one of the approaches is through the Lesson Study model. Lesson Study is a teaching improvement and knowledge building process; it has been propagated as an innovative and effective model of teacher professional development. The aim of the current study therefore, is to explore the effect of Lesson Study as an innovation for lifelong learning among basic science and technology teachers. To achieve this, a quasi experimental design was employed. Six classes including 6 teachers and 240 pupils were randomly assigned into experimental and control group. The data was collected by applying the two instruments Basic Science and Technology Achievement Test (BSTAT) and Classroom Lesson Observation Checklist (CLOC). The result indicates a significant improvement in lesson delivery skills of teachers exposed to Lesson Study model comparing to those in the control group. In addition, the pupils in the experimental group showed more commitment and higher achievement in learning science than the control group. Therefore, Lesson Study model is suggested to be adopted by head teachers and principals to improve basic science and technology teachers' innovation and lifelong learning.

Introduction

Basic Science and Technology (BST) are taught at basic education level in Nigeria to help build a solid foundation for productive employment or for secondary and post-secondary education (FME, 2008). BST plays an important role in the economic and social development of the world in general and Nigeria in particular. However, it is on record (Adeyemi, 2011) that in spite of the large money invested in science and technology sector over the years, performance of students is not commensurate with huge amount of government spending.

SMASE (2006) Baseline survey in Kaduna, Niger and Plateau also showed poor performance of pupils in Basic Science and Technology, the result indicates that most teachers use the teacher-centred content- based approach and do not relate what they teach to the immediate environment of the pupils. However, the finding of studies from some researchers (Okebukola, 2009, Danjuma & Shuaibu, 2015) tends to suggest that a lot need to be done in order to improve the quality of lesson delivery and pupils understanding of science concepts. These studies indicate that there is a gap between lesson delivery and pupils understanding of science concepts, hence the need for intervention strategy that could fill that gap by having access to sustainable, high quality professional development in order to improve teaching and student learning.

Literature Review

Innovation for Learning Science

Innovation, according to the United Nations Education Science and Cultural Organization (UNESCO) in Okoye (2012) is a general change that is deliberate and must never be regarded as simple adjustment. Innovations in Education therefore are new, creative ideas which are meant to bring effectiveness and change to the educational sector. They can simply be said to be the new things in the educational sector meant to bring more efficiency and effectiveness. Meanwhile, research studies have shown that students' academic achievement in the three core science subjects (Biology, Chemistry and Physics) have been very poor with little or no appreciable improvement over the years (Olorundare, 2014). It is believed that innovative practices in science education can help to enhance the students' academic achievement in the science subjects.

Lifelong leaning for Science Teachers

The necessity to cope with the rapid changes in science and technology in the 21st century and the necessity to adjust to the prerequisites of the knowledge society brought about the need for lifelong learning.

Lifelong learning is a continuous process in which individuals retain and develop their life-based conduct, knowledge and skills. The main aim of lifelong learning is to reinforce and improve the life quality of individuals by enabling them to bring their own potential to the utmost level. According to Reinsch (2007), lifelong learning can be defined in these three terms:

- The entire educational system should focus on raising lifelong students.
- In addition to the educational system; industries, business and organizations will also need lifelong learning processes.
- Individuals, within this respect, should be self-directed learners.

In this case lifelong learning refers to formal (sponsored) and informal (unsponsored) learning. Formal learning includes but is not limited to participation for, post high school education provided by colleges and universities; community, state, military or occupationally sponsored programs; Professional counseling and proprietary schools. Informal learning includes, but is not limited to, seeking advice from an expert, experienced peer or adult; using a library or other resource centre and setting up a self-directed learning project -leading toward valuing lifelong learning.

Following are the necessary activities for strengthening lifelong learning skills: developing positive attitudes toward learning, reading, writing, speaking and listening, research and independent learning, study skills and learning strategies, higher-order thinking skills and thinking about thinking.

Lesson Study in relation to Innovation and lifelong learning

At the basic education level, teachers who teach Basic Science and Technology (BST) need to be confident with what they are teaching, they need to have appropriates teaching techniques, different strategies for motivating the pupils; that really means having a good professional development system in place(Brain, 2008). Stigler and Hiebert (1999) suggest that teachers must be the driving force behind improvements in the education system as they are in

the best position to understand and propose solutions to problems faced by students. Teachers must have access to sustainable, high quality professional development in order to improve teaching and student learning.

A key aim of professional development in recent years internationally has been to develop sustainable networks of teachers who engage in developing effective pedagogy (Dana, & Yendol-Silva, 2003). This kind of practice is synonymous to Lesson Study. In this study; it is the interest of the researcher to explore the effect of Lesson Study as an innovation for life-long learning among basic science and technology teachers in Nigeria.

Statement of the Problem

An impact survey on Strengthening Mathematics and Science Education (SMASE) programme conducted in 2018 by the National Teachers' Institute and SMASE stakeholders revealed the prevailing factors in mathematics and science classrooms among others are knowledge-based teaching and teacher-centred lessons.

The impact survey concluded that Nigerian teachers need to acquire more skills on how to plan and deliver a learner-centred activity based lessons in mathematics and science, through exposure to activities that enhances understanding of concepts and production of improvised materials. They also stated that teachers' attention need to be drawn for them to re-examine their instructional approach for the benefit of their learners. Therefore, a strong need exists for teachers to experience sustainable high-quality professional development in order to improve student learning and teacher instruction (SMASE Baseline Survey, 2006; Danjuma and Shuaibu, 2015; SMASE impact survey, 2018.).

Research Question

1. What are the differences in the observed classroom lesson delivery skills among Basic Science and Technology teachers exposed to Lesson Study model?
2. What is the effect of teachers' exposure to Lesson Study model on pupils' achievement in Basic Science and Technology?

Research Hypotheses

Ho_1: There is no significant difference in the rating of observed Classroom Lesson delivery skills among teachers exposed to School-Based Professional Development using Lesson Study model.

Ho_2: There is no significant difference in pupils' achievement in Basic Science Technology taught by teachers exposed to Lesson Study model and those teachers not exposed to Lesson Study model

METHODOLOGY

Research Design

The mixed method design employed was an explanatory approach with a quasi-experimental design. The quantitative method was quasi-experimental between-subjects approach utilizing a pre- and posttest group design. Qualitative data was collected at two time points post intervention.

Sample and Sampling Technique

Two schools were selected at random using the simple random sampling technique involving balloting with replacement in Bauchi state, it was also used to select the experimental and control groups. For the teacher's selection, the middle basic (Primary 5 teachers) of the schools were sampled purposively for the study the pupils in the teacher's class were used for the study.

Instruments for Data Collection

For the purpose of this study, the following instruments were used for data collection:

1. Basic Science and Technology Achievement Test (BSTAT) for to the pupils developed by the researcher.
2. Classroom Lesson Observation Checklist (CLOC) was adapted from SMASE, (2013).

The two instruments were subjected to content and face validation by experts and a reliability coefficient of 0.6825 was obtained for the BSTAT instrument.

Methods of Data Collection

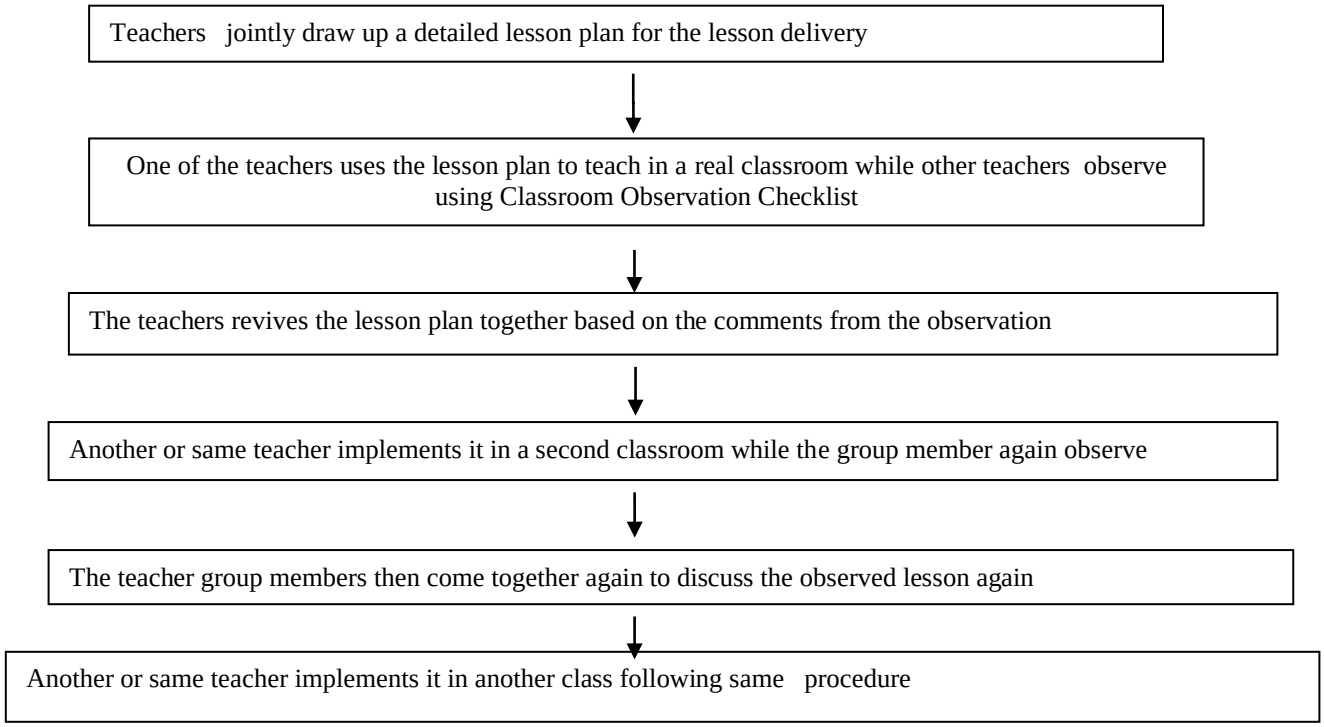
The Basic Science and Technology Achievement Test (BSTAT) for the pupils were administered to both experimental and control groups before the commencement of the treatment. The raw scores of the pretest were analyzed to determine if there is any difference in pupil's achievement between the experimental and control. The result of the two groups showed that the pupils are equivalent in their achievement in Basic Science and Technology concepts.

Experimental Group

The pupils of the experimental group were taught with Learner-centred lesson plans developed by teachers exposed to the Lesson Study Model for Seventy two (72) periods of thirty five (35) minutes lessons for 12 weeks.
The teachers undergo the stages and procedure of the lesson study model as presented below:

Stages of Lesson Study Model

The Lesson Study Model



The Classroom Lesson Observation Checklist (CLOC) was used to assess the aspect of lesson delivery and innovation with rating scale 1-5 with following response types:- Poor(1), Fair(2), Good(3), Very Good(4) and Excellent(5).

Control group

The control group teachers was not exposed to lesson study or training and they taught the same topics used in the experimental to teach their pupils using the conventional lecture method alone.

Immediately after the twelve (12) weeks period of treatment, a posttest was administered to both experimental and control groups with BSTAT and data collected was subjected to analysis.

Method for Data Analysis

Description statistics in form of mean and standard deviation and graphically illustrations using bar charts and line graphs was used to answer research questions. Kruskal-wallis one way analysis of variance was used to test hypothesis one and analysis of Covariance (ANCOVA) was used to test hypotheses two.

Results and Discussion

Three major variables were assessed in the observation by raters during the experiment. These were teaching procedure, Fundamental techniques/methodology and Class management. The mean scores are graphically illustrated

for the 12 week period in bar charts for the rated means of the components of teaching procedure while line graph was used for the rated Fundamental techniques/methodology and bar chart was used for the Class management and their respective components.

Figure 1 : Observed teaching procedure and appropriateness of lesson over 12 weeks period

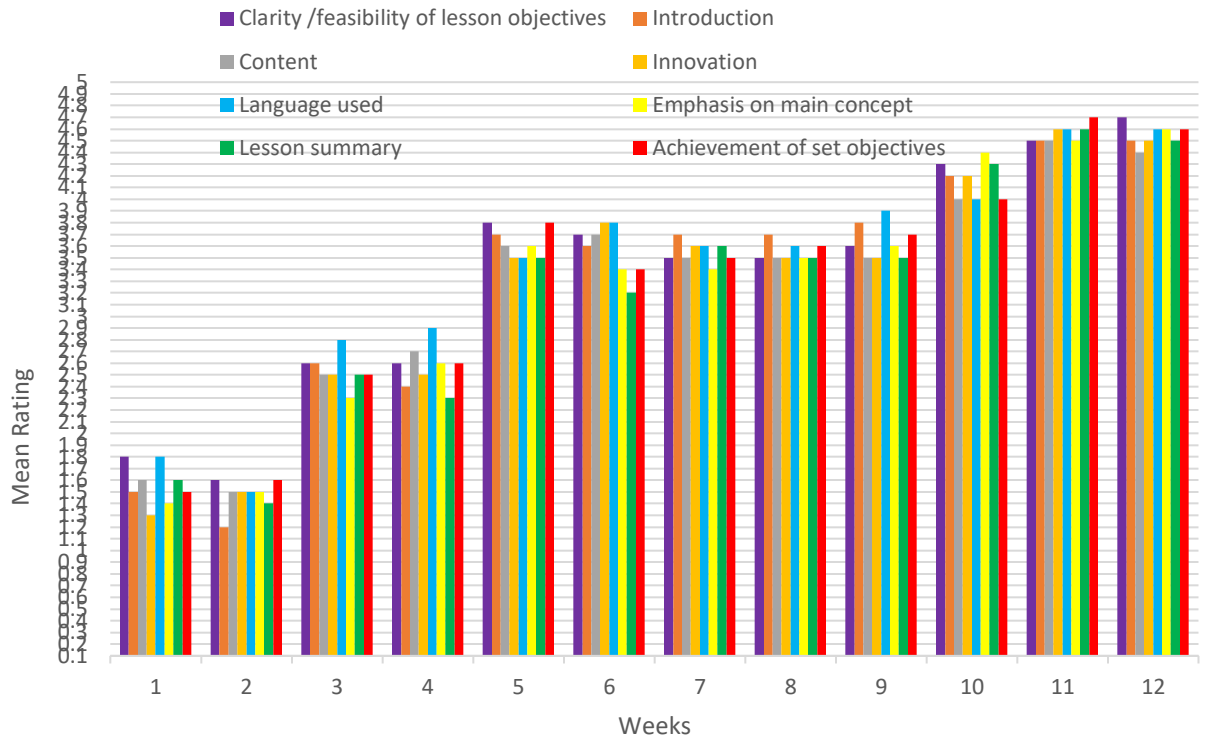
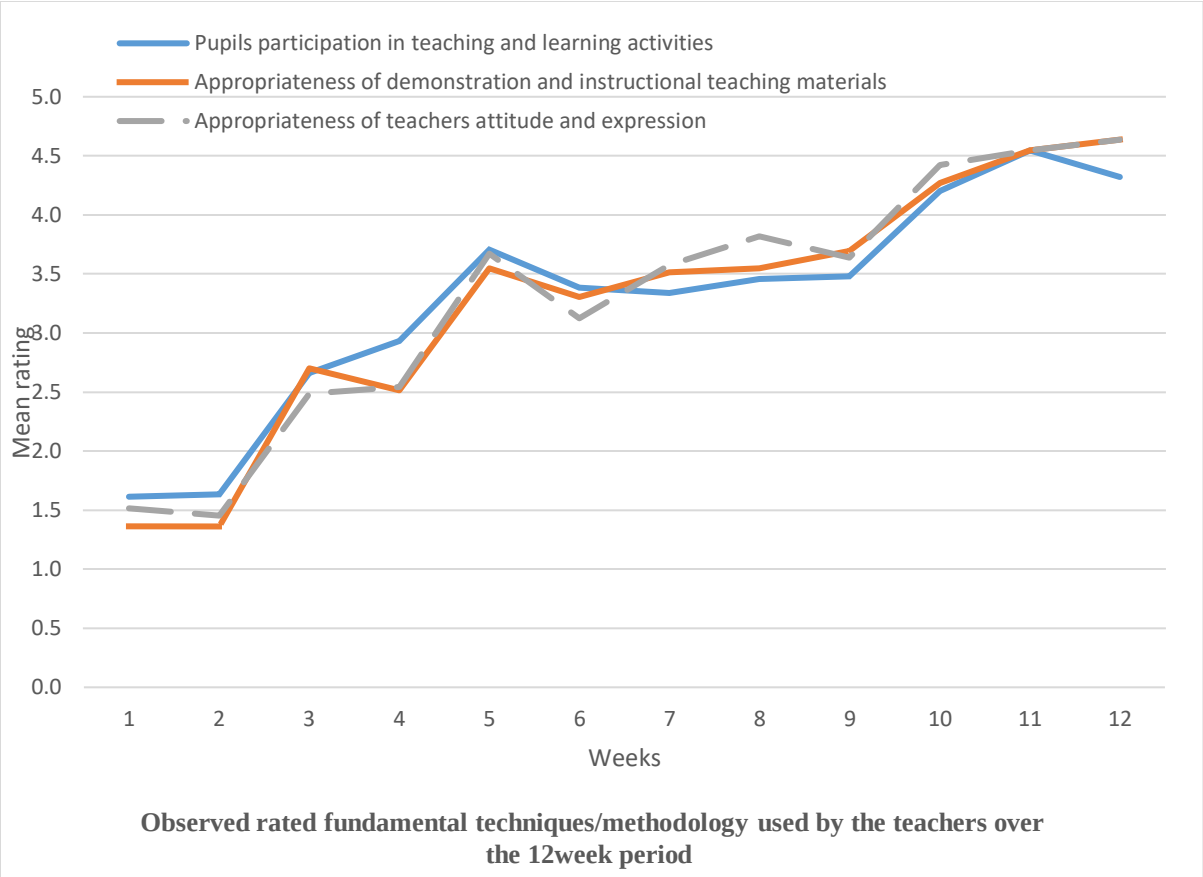


Fig. 1: Oberved teaching procedure and appropriateness of lesson over the 12week period

The mean rating in Figure 1 shows that the teachers had a progressive increase in their effectiveness of the various teaching procedures from the first week till the 12th week of the experiment. This was the case for Clarity /feasibility of lesson objectives, appropriateness of lesson introduction, emphasis on main concept and achievement of set objectives. For appropriateness of lesson content, innovation, Language used and lesson summary, optimum effectiveness was achieved in the eleventh week of the experiment. There were observed difference in the mean rating between the first four weeks, and the subsequent weeks but mean rating increased to 'very good' based on the five point scale at the 9th week of the experiment and remain till the 12th week for the Teaching procedures used by the teacher participants.

Figure. 2 Observed rated fundamental techniques/methodology used by the teachers over the 12 week period.



The data in figure 2 shows use of fundamental techniques/methodology by the teacher participants rose in the second week of the experiments. All the three components of the variable were observed to follow this trend of progress among the teacher participants. The observation revealed that effective usage achieved in the 5th week was dramatic because a slight decline was observed in the 6th week. But progress was again accelerated in the 7th week till the 11th week when optimum effective usage of the methodologies (pupil's participation in teaching and learning activities, appropriateness of demonstration and instructional teaching materials and appropriateness of teachers' attitude and expression) were achieved. The ratings of the methodologies are generally very low in the first three weeks and attained highest rating in the 11th week. Though continuous increase was observed for appropriateness of demonstration and instructional teaching materials and appropriateness of teachers' attitude and expression but the observation for pupil's participation in teaching and learning activities did not increase proportionately.

Figure 3: Observed rated classroom management/control by the teachers over the 12weeks period

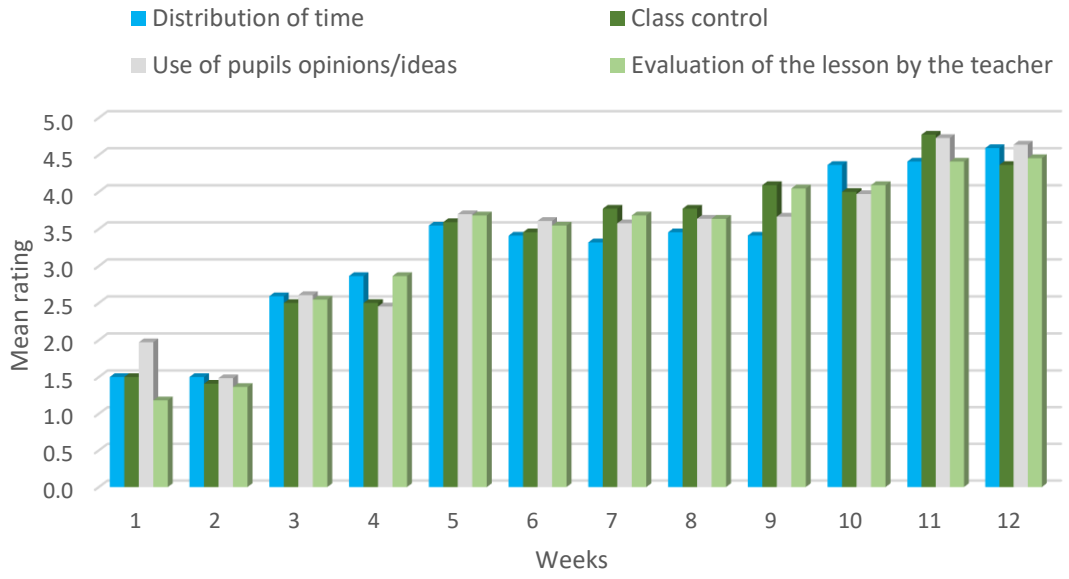


Fig. 3: Observed rated classroom management/control by the teachers over the 12weeks period

The observed ratings of the class management by the teacher participants were generally low in the first two weeks. Though there was better rating of the use of pupils' opinions/ideas, it could be said to be a random development since it was not replicated in the subsequent weeks. Like all the improvements, optimum class control was achieved by the teacher participants in the 11th week for the distribution of time, class control, use of pupils opinions/ideas and evaluation of the lesson by the teacher participants. From the observations, it could be concluded that there were differences in the ratings of observed classroom lesson delivery skills among Basic Science and Technology (BST) teachers exposed to Lesson Study model at the middle basic education level over the 12week period.

Table 4: Mean achievement of pupils before and after their teachers' exposure to the use of Lesson Study model

Level	**Type**	N	Mean	Std. Deviation	Std. Error	Mean difference
Pre-test	Control	205	13.45	3.081	0.215	
	Experimental	219	13.12	2.639	0.178	-0.33
Post-test	Control	205	13.87	2.431	0.170	
	Experimental	219	33.00	5.133	0.347	19.13

The mean scores of pupils who were taught by the teachers in the two groups before the experiment were basically the same. The score of pupils taught by teachers in the control group was 13.45±3.081 while that of those in the experimental group was 13.12±2.639. The mean difference was -0.33 against pupils taught by teachers in the experimental group. After the teachers in the experimental group were exposed to Lesson Study model, their pupils' performance rose from 13.12±2.639 to 33.00±5.133 while the scores of pupils taught by teachers in the control group only improved from 13.45±3.081 to 13.87±2.431 with a mean difference of 19.13.

Test of hypotheses

The tests were carried out at a probability level of 0.05 as follows:

Table 5: Kruskal-Wallis one way analysis of variance on classroom lesson delivery skills among teachers exposed to Lesson Study model.

Ratters	N	Teaching procedure Mean Rank	Methodology Mean Rank	Class management Mean Rank
1	12	76.58	71.79	71.96
2	12	68.00	69.38	70.92
3	12	68.04	63.50	63.21
4	12	64.83	70.67	68.88
5	12	65.58	70.75	70.46
6	12	60.96	57.50	63.25
7	12	67.83	65.96	62.25
8	12	63.75	67.08	64.88
9	12	63.67	58.75	60.75
10	12	67.33	64.42	65.08
11	12	64.92	71.71	69.88
Chi-square		1.323	2.085	1.308
DF		10	10	10
P-value		0.999	0.996	0.999

The result for Ho_1 in the table showed that the ratters or observers did not differ significantly in their rating of the effectiveness of teachers in their usage of the classroom lesson delivery skills when exposed Lesson Study model.
For Ho_2, the test was conducted with the Covariance analysis (ANCOVA) procedure with the type of group as the independent variable and their pre-test score as the covariate factor.
The result revealed that the observed variability in achievement of the pupils taught by teachers in the experimental and control groups is statistically significant (F-value of 2798.671, df 1, 42, P <.05). Though the covariate factor was significant which indicated the role played by the pre-test in the experiment as it transcends all the variables but the observed difference could also be associated with the previous knowledge of the pupils in the pre-test. By these observations, there is sufficient evidence to reject the null hypothesis that there is no significant difference in pupils' achievement in BST taught by teachers exposed to School-Based Professional Development using Lesson Study model and those teachers not exposed to School-Based Professional Development using Lesson Study model is therefore rejected.

A post hoc test was conducted on the mean examined using the Least Significant difference procedure as summarized in Table 7. The result showed the achievement of pupils taught by teachers who were exposed to the use of the Lesson Study model was significantly higher than that of pupils who were taught by teachers in the control group

Table 6: Analysis of covariance on Pupils' Achievement in Basic Science and Technology taught by teachers exposed to Lesson Study Model and those taught by teachers not exposed to it

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	39785.889	2	19892.944	1414.777	.000
Intercept	4896.815	1	4896.815	348.259	.000
Pretest	1029.833	1	1029.833	73.241	.000
Type	39351.645	1	39351.645	2798.671	.000
Error	5919.611	421	14.061		
Total	284868.000	424			

(F-critical at 1, 421 df = 3.84 at 0.05)

Table 7: Pairwise Comparisons of Pupils' Achievement in Basic Science and Technology taught by teachers exposed Lesson Study Model and those taught by teachers not exposed to it

(I) TYPE	(J) TYPE	Mean Difference (I-J)	Std. Error	Sig.(a)	95% Confidence Interval for Difference(a)	
Experimental	Control	19.309(*)	.365	.000	18.592	20.027

* The mean difference is significant at the .05 level.

Discussion on Findings

It was found out that there is great improvement in teacher's classroom performance and pupils' participation during exposure to the intervention, the raters of the classroom observation checklist did not differ in their rating and there was great improvement in teaching procedure, innovation, and classroom management by teachers over the period of the intervention.

There was also great improvement in pupils' achievement due to their teacher's exposure to Lesson Study model. The result shows Lesson Study model positively impacted teaching ability of teachers which revealed the great improvement in pupils' achievement. This result agrees with the findings of (Danjuma & Shuaibu 2015) that students' performances in subjects depend on their teachers' ability to deliver.
The result of the test revealed that achievement of pupils' taught by teachers who were exposed to the model was significantly higher than the achievement of pupils taught by teachers who were not exposed to the model.

Conclusion
Based on the findings, the researcher wishes to conclude that the use of Lesson Study model has a significant effect on teachers' classroom lesson delivery skills and will serve as an innovation for lifelong learning among Basic Science and Technology teachers in Nigeria

Contribution to Knowledge

The study was able to establish the fact that Lesson Study model was an effective professional development package for teachers because it is very reliable and provide consistent retraining of teachers in lesson delivery and planning and could serve as an innovation for lifelong learning among Basic Science and Technology teachers in Nigeria .

Recommendation

Based on the findings of this study, Lesson Study model is suggested to be adopted by head teachers and principals to improve basic science and technology teachers' innovation and lifelong learning. However, the study was limited to Bauchi state due to financial constraints.

The study is suggested to be replicated covering more than one geographical zone of the state, and to be conducted longer in time duration to investigate other effects including retention and attitudes of pupils to Basic Science and Technology concepts when their teachers are exposed to Lesson Study model.

To find out the long term impact and effectiveness of the study, a return to the subjects is recommended in 6 to 12 months.

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