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Effects of Field Trip and Peer Tutoring Instructional Strategies on Students' Science Process Skills Acquistion in Basic Science and Technology in Junior Secondary Schools in Osun State

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Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

The study investigated the effects of field trip and peer tutoring instructional strategies (as against the conventional method of teaching) on secondary school students' science process skills (observation, classification, communication, measurement, inference and prediction) acquisition in Basic Science and Technology in Junior Secondary Schools (JSS) in Osun State. These were with a view to provide information on usability of the strategies to enhance the students' development of science process skills through Basic Science and Technology lesson in Osun State classrooms. The study employed the pretest, post-test control group quasi experimental research design. The population for the study comprised all junior secondary school students in Osun State. The study sample consisted of 315 Junior Secondary II (JS II) students in nine intact classes selected from nine schools using simple random sampling technique. The instrument used for data collection was Science Process Skills Performance Test (SPSPT). Data collected were analysed using mean, standard deviation and Analysis of Covariance (ANCOVA). The results of the study showed that there was significant effect of the treatment (use of field trip and peer tutoring) on science process skills of secondary school students as follow: Observation ($F=1.030$, $p<0.05$), classification

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(F=3.529, p<.05), communication (F=1.326, p<0.05), measurement (F=6.623, p<0.05), inference (F=12.310, p<0.05) and prediction (F=21.210, p<0.05); with peer tutoring leading in observation, classification, communication and measurement skills of students in Basic Science and Technology with $\bar{x}$=30.6000, $\bar{x}$=31.3429, $\bar{x}$=24.9429 and $\bar{x}$=25.3714 while students exposed to field trip strategy, exhibited higher students' inference and prediction skills in Basic Science and Technology with $\bar{x}$=22.9714 and $\bar{x}$=27.4847 respectively. The study concluded that field trip and peer tutoring instructional strategies are effective and innovative teaching methods in improving students' science process skills acquisition in Basic Science and Technology in secondary schools in Osun State, Nigeria.

Keywords: Science process skills; field trip; peer tutoring; acquisition; basic science and technology; junior secondary schools.

1. INTRODUCTION

Science is the study of knowledge which can be made into a system and which depends on evaluative facts. Technology, on the other hand, is the practical application of scientific knowledge. Science is a universal subject that spans the branch of knowledge that examines the structure and behaviour of the physical and natural world through observation and experiment. Science education is most commonly broken down into the following three fields: Biology, Chemistry and Physics.

Science and technology are basic tools in every sector of any society. A nation lacking in science and technology will forever depend on those who claim to be the custodians of scientific and technological knowledge, even if such a country has crude oil [1]. Furthermore, science and technology helps in the area of employment. The rate of unemployment is high in Nigeria simply because many graduates of science are unemployed.. Nigeria can join the giant nations of the world if our government spends more money on science and technology [2]. Science is actually a magic wand that can transform a nation into what the nation aspires to be. The importance of science and technology in a given society cannot be under-estimated. It is a well-known fact that no nation can develop without advancing in the areas of science and technology [3,4]. Science and technology are essential tools in every sector of a society.

It is obvious that science subjects are necessary for development of science and technology. Science education is one of the most important subjects in school due to its relevance to students' lives and the universally applicable problem-solving and critical thinking skills it uses and develops. These are lifelong skills that allow students to generate ideas, weigh decisions intelligently and even understand the evidence behind public policy-making. Engaging young learners with exciting material and experiences motivates them to learn and pursue the sciences throughout school. Teaching technological literacy, critical thinking and problem-solving through science education gives learners the skills and knowledge they need to succeed in school and beyond [5,1,6].

Science process skills are central to the acquisition of scientific knowledge which is useful in solving problems in society. Science and the teaching of students about science mean more than scientific knowledge but include the content of science, which is the basic concepts, and the scientific knowledge, the processes of doing science and scientific attitudes [4]. The processes of doing science are the Science Process Skills (SPS) that scientists use in the process of learning science. Science process skills are the thinking skills that scientists use to construct knowledge in order to solve problems and formulate results. Since science is about asking questions and finding answers to questions, these are actually the skills (SPS) that scientists use in their daily lives as they try to figure out everyday questions [7,3]. When students are taught to use these skills in science, they are also being taught skills they will use in the future and in every area of their lives. SPS include skills for observing, communicating, classifying, measuring, inferring and predicting. These basic skills are integrated together when scientists design and carry out experiments or in everyday life when they carry out fair test experiments. The integrated skills are the higher order SPS which include formulating hypotheses, naming and controlling variables, making operational definitions, investigating, experimenting, using models and interpreting data.

Every human being is involved in one activity or the other every day, either physically or mentally. All the various activities involve processes because from the beginning to the end of the activity, certain actions take place. Sometimes, the actions are pre-planned while at the other times, they are accidental. Whatever nature it takes, the sum of the actions make up the process that is involved in achieving or reaching an end [7].

Yockey [8] said that science begins with observations. A good scientist observes phenomena and asks questions to which he or she finds answers through experimentation. Observation is a fundamental science process skill. We observe objects and events using all our five senses and this is how we learn about the world around us. The ability to make good observations is also essential to the development of the other science process skills; classifying, communicating, measuring, inferring and predicting [7,3].

As important as science is, students' performance in science subjects and as well as the level at which they possess SPS at both the junior and senior secondary levels of education in Nigerian schools have been consistently poor both in internal and public examinations. It is expected that students' learning of science through Basic Science and Technology using realistic instructional techniques should enhance the inculcation of the generic skills of inquiry, reasoning, conceptualizing, problem solving and communicating. By applying these skills, students are not only expected to construct their knowledge but also to establish confidence and positive attitudes towards science.

Despite the role of science and technology to nation building, the performance of students in science and technology subjects has been poor over the years at standardized examinations at all level of education in Nigeria [9,10,11,5,1]. The Nigerian Educational Research and Development Council (NERDC, 2010) reported that the performance of students in public examinations has been poor in junior school Mathematics and sciences (Mathematics, Basic Science and Basic Technology). This was also affirmed by the findings of Omorogbe and Ewansiha [2]. Many factors have been identified to be responsible for this malady. These include learning difficulty, poor methodology, teachers' factor, students' factors, anxiety and fear for the subject among others, [12,13,5]. There is therefore the need to improve the teaching and learning of science and technology in Nigeria schools if we are to compete successfully in technology-intensive global markets as the world is rapidly moving to the age where without investing in science and technology there will be no development and less emphasis has been made in improving the teaching of science and technology in Nigerian secondary schools.

The content of the curriculum is most important in helping teachers to use innovative teaching approaches. Programme content should be related to students' environment and knowledge so as to provide a context for new knowledge, skills, and attitudes. The focus of instruction should be in-depth study rather than a breadth of topics. Science Process Skills should be instilled in all students, especially during the elementary education [14], which is not just for students anticipating careers in science and engineering. Achieving scientific literacy requires more than simply understanding major concepts, but also acquisition of SPS which are highly valuable skills like creativity, adaptability, critical reasoning, and so on.

In the National Policy on Education (FGN, 2013), there has been a radical shift in views of primary and secondary schools' teaching and learning of science. New curricula have been developed that emphasized the development of autonomous learning capabilities in students which can help them to learn by developing their generic skills and interests [9]. This aligns with the constructivism paradigm, the focus of which is on the learner rather than the teacher. As the learners interact with their environment, they gain an understanding of its features, construct their own conceptualizations and find solutions to problems, master autonomy and independence. In constructivism, learning is seen as a result of individual mental construction in which learners match new information against any given information in order to establish meaningful connections.

When it comes to fostering Science Process Skills (SPS) in the classroom, integrated study is an extremely effective approach, helping students to develop multifaceted expertise and grasp the important role interrelationships can play in the real world. The future of any nation does not lie in mere acquisition of knowledge, but the ability to generate new knowledge and use it innovatively, which depends upon having a scientifically literate population [15]. Though

people learn throughout their lives, good science education in schools is a vital preparation for scientific literacy in later life. For teaching to be effective in promoting learning, it should involve interaction between the teachers and the students since the aim of teaching any school subject should always be directed towards achieving the aims of education in general [11]. This means that whatever subject is taught to the learners, the ultimate aim is to educate the child. Thus, science teaching should not just impart instruction for the sake of the subject but serve as an efficient medium for properly educating the child. One-way delivery of instruction from a teacher does not work for the vast majority of pupils. In the context of a fixed set of curricular demands, variation in the style and pace of instruction may be perceived as only a way to accommodate what are regarded as equally hard and fast individual differences. In the same way that scientists develop their knowledge and understanding as they seek answers to questions about the natural world, students can develop an understanding of the natural world when they are actively engaged in scientific inquiry with others and coupled with other teaching and learning strategies such as field trip and peer tutoring strategies. The decisions about content and activities that teachers make, their interactions with students, the selection of assessments, the habits of mind that teachers demonstrate and nurture among their students, and the attitudes conveyed wittingly and unwittingly all affect the knowledge, understanding, abilities, and attitudes that students develop [16].

Field trips mean learning outside the classroom. A field trip is a visit to an area outside of the normal classroom where students can try new things, have different experiences, and learn valuable life lessons. Students can see new sights and have hands-on opportunities in a wide variety of experiences. Field trip is a teaching strategy that provides concrete experiences to learners to aid their understanding of content, ideas, and concepts [17]. Students are more likely to retain information. being immersed in information and being involved in visual and practical experiences will help students remember, learn and understand subjects taught more better. Going on field trip offers students a unique cultural learning experience, since it allows them to be involved in new environments, which is a key to encouraging curiosity about a given subject. It is also valuable as an exercise in broadening a students' understanding of the world and their place in it since educational trips encourage the development of social, personal and study skills [1].

Peer tutoring is an instructional strategy that consists of student partnerships, linking high achieving students with lower achieving students or those with comparable achievement.

It is an effective educational strategy for classrooms of diverse learners because it promotes academic gains as well as social enhancement. Level of engagement influences student motivation to achieve classroom goals [18]. Peer tutoring gives teachers the capability to accommodate a classroom of diverse learners to improve academic achievement across ability levels and content areas [19,20,21]. It Improves confidence and interpersonal skills as well as Increased comfort and openness. Students generally identify more easily with peer helpers than with adult authority figures, and this helps create an environment in which students are more comfortable to ask questions and work through challenging problems in an environment free from classroom ridicule. Lots of ideas can lead to lots of fun for students.

1.1 Statement of the Problem

Studies have shown that students' performance in science subjects in Nigeria secondary schools have been consistently poor over the years especially in Senior School Certificate Examinations Aladejana 2008; [10,2,16,5]. Scholars have attributed these poor perfomances to poor handling of the subjects by teachers who are not well versed in the subjects as well as in classroom dynamics. Alots of innovative instructional strategies have been used to teach science subjects at the elementary and high schools in the developed countries of the world, among which are field trip and peer tutoring instructional strategies, and proved effective because they are self- regulated learning strategies. However, the extent to which these instructional strategies could enhance students' acquisition of science process skills (observation, classification, communication, measurement, inference and prediction) in order to improve their perfomance in junior secondary schools in Osun State calls for investigation, hence this study.

1.2 Purpose of the Study

The study aimed at investigating the effects of field trip and peer tutoring instructional strategies

on junior secondary school students' acquisition of science process skills in Basic Science and Technology. Specifically, the objectives of the study are to;

(i) investigate the effects of field trip and peer tutoring instructional strategies on Science observation skills of Junior Secondary Schools (JSS) students in Basic Science and Technology in Osun State;
(ii) examine the effects of the two strategies on Science classification skills of JSS students in Basic Science and Technology in Osun State;
(iii) assess the effects of the strategies on Science communication skills of JSS students in Basic Science and Technology in Osun State;
(iv) determine the effects of the strategies on Science measurement skills of JSS students in Basic Science and Technology in Osun State;
(v) assess the effects of the strategies on Science inference skills of JSS students in Basic Science and Technology in Osun State;
(vi) determine the effects of the strategies on Science prediction skills of JSS students in Basic Science and Technology in the study area.

1.3 Hypotheses

Ho1: There is no significant effect of field trip and peer tutoring instructional strategies and teacher expository method on science observation skills of students in Basic Science and Technology.

Ho2: There is no significant effect of the two strategies and teacher expository method on science classification skills of students in Basic Science and Technology.

Ho3: There is no significant effect of the two strategies and teacher expository method on science ccommunication skills of students in Basic Science and Technology.

Ho4: There is no significant effect of the two strategies and teacher expository method on science measurement skills of students in Basic Science and Technology.

Ho5: There is no significant effect of the two strategies and teacher expository method on science inference skills of students in Basic Science and Technology.

Ho6: There is no significant effect of the two strategies and teacher expository method on science prediction skills of students in Basic Science and Technology.

2. METHODOLOGY

The study adopted the pretest, posttest control group quasi experimental research design. In the design, two independent variables (field trip and peer tutoring strategies) were used on junior secondary school students to investigate the level at which they possess science process skills in Basic Science and Technology. The design for the study is shown structurally as follows

y1	X1	y2
y3	X2	y4
y5	X3	y6

Where

y1, y3 and y5 represent the pretest in the three groups,

y2, y4, and y6 represent the post-test in the three groups and

X1 is the experimental treatment group for field trip,

X2 is the experimental treatment group for peer tutoring, while

X3 is the teacher expository method that serve as the control group.

The population for the study comprised all students of Basic Science and Technology in Junior Secondary Schools (JSS) in Osun State. The sample for the study consisted of 315 Junior Secondary School two (JSSII) students. The sample was selected using multi-stage sampling procedure. Three Local Government Areas (LGAs) were used for the study. One Local Government Area (LGA) was selected from each of the three senatorial districts in the state using simple random sampling technique. From each LGA, three schools were selected using simple random sampling technique and from each school, one intact class of JSSII students was selected through simple random sampling technique to take part in the study. The schools were randomly assigned into two experimental groups and one control group in each LGA's. Experimental group A was taught Basic Science and Technology using field trip strategy, and

group B was taught using peer tutoring strategy. The control group was taught using the teacher expository method. One self designed instrument was used to collect data for the study and it is titled ''Science Process Skills Performance Test'' (SPSPT). The instrument consisted of thirty test items which served as pre-test to ascertain the ability level of science process skills inherent in students and also as post- test to determine the effects of the treatments on students' science process skills acquisition. The treatments lasted ten weeks. Topics taught in each school are environmental pollution, change in matter, drug abuse, energy, wood veneer and information and communication technology (ICT). Data collected were analysed using mean, standard deviation, and analysis of covariance (ANCOVA). All these were achieved with the use of Statistical Package for Social Sciences (SPSS).

3. RESULTS AND DISCUSSION

Hypothesis One: There is no significant effect of field trip and peer tutoring instructional strategies and teacher expository method on Science observation skills of students in Basic Science and Technology.

The Table 1 shows the descriptive statistics of the effect of science observation skills on students taught with the two strategies and teacher expository method. It can be deduced from the table that the mean scores of the students' science observation skills in Basic Science and Technology, having been exposed to Field Trip, Peer Tutoring and Teacher Expository Method are $\bar{x}$=24.8857, $\bar{x}$= 30.6000, and $\bar{x}$= 21.08577 respectively. The results implied that students exposed to Peer Tutoring instructional strategy with the highest mean score of ($\bar{x}$= 30.6000) had the best science observation skills more than those taught with Field Trip and Teacher Expository Method indicating that those students exposed to Peer Tutoring are good observant in Basic Science and Technology. However, the table does not point out the significant effect of science observation skills on students taught with the two strategies and teacher expository method. The effect was revealed using Analysis of Covariance (ANCOVA) as presented in Table 2.

Result in the Table 2 showed that there is significant effect of field trip and peer tutoring instructional strategies on Science observation skills of Junior Secondary School (JSS) students in Basic Science and Technology in Osun State ($F=1.030$; $p< 0.05$). Therefore, the null hypothesis that states that there is no significant effect of field trip, peer tutoring and teacher expository method on Science observation skills of Junior Secondary School (JSS) students in Basic Science and Technology in Osun State is hereby rejected. A partial eta squared value of 0.487 showed that 48.7% of the variance in the posttest scores of the students' science observation skills is accounted for by the treatments as the effect size.

Table 1. Descriptive statistics of the effect of science observation skills on students exposed to field trip, peer tutoring and teacher expository method in basic science and technology

Strategies	N	Minimum	Maximum	Mean	Std. Deviation
Field Trip	105	15.00	37.00	24.8857	6.45241
Peer tutoring	105	17.00	37.00	30.6000	4.94796
Teacher Expository	105	10.00	25.00	21.0857	7.10693
Valid N (listwise)	315				

Table 2. Analysis of Covariance (ANCOVA) of the effect of science observation skills on students taught with field trip, peer tutoring and teacher expository method in basic science and technology. Dependent variable: Post-test of students' bst observation skills

Source	Type III Sum of squares	Df	Mean square	F	Sig.	Partial Eta squared
Corrected Model	412.806[a]	20	20.640	1.034	.485	.581
Intercept	778.896	1	778.896	39.001	.000	.502
Pre-test of BST	121.573	1	121.573	6.087	.127	.302
Strategies	390.802	19	20.569	1.030	.001	.487
Error	279.594	14	19.971			
Total	11534.000	35				
Corrected Total	692.400	34				

a. R Squared = .596 (Adjusted R Squared = .019)

Hypothesis Two: There is no significant effect of the two strategies and teacher expository method on Science classification skills of students in Basic Science and Technology.

Results in the Table 3 shows the descriptive statistics of the effect of science classification skills on students taught with the two strategies and teacher expository method. It was observed from the table that the mean scores of the students' science classification skills in Basic Science and Technology, having been exposed to Field Trip, Peer Tutoring and Teacher Expository Method are $\bar{x}$= 25.4571, $\bar{x}$= 31.3429, and $\bar{x}$= 22.5714 respectively. The results implied that students exposed to Peer Tutoring with the highest mean score of ($\bar{x}$= 31.3429) had the best science classification skills over those taught with Field Trip and Teacher Expository Method, indicating that those students exposed to Peer Tutoring have the best classification skills in Basic Science and Technology. However, the table does not indicate the significant effect on science classification skills of students taught with the two strategies and teacher expository method. The effect was revealed using Analysis of Covariance (ANCOVA) as presented in Table 4.

Result in the Table 4 showed that there is significant effect of field trip and peer tutoring instructional strategies and teacher expository method on Science classification skills of Junior Secondary School (JSS) students in Basic Science and Technology in Osun State ($F=3.529$, $p<0.05$). Therefore, the null hypothesis that states that there is no significant effect of field trip, peer tutoring and teacher expository method on Science classification skills of Junior Secondary School (JSS) students in Basic Science and Technology in Osun State is hereby rejected. A partial eta squared value of 0.236 showed that 23.6% of the variance in the posttest scores of the students' science classification skills is accounted for by the treatments as the effect size.

Hypothesis Three: There is no significant effect of the two strategies and teacher expository method on Science communication skills of students in Basic Science and Technology.

Results in Table 5 showed the descriptive statistics of the effect of science communication skills on students taught with the two strategies and teacher expository method. It was observed from the table that the mean scores of the students' science communication skills in Basic Science and Technology, having been exposed to Field Trip, Peer Tutoring and Teacher Expository Method are $\bar{x}$= 24.5714, $\bar{x}$= 24.9429, and $\bar{x}$= 21.1714 respectively. The results implied that students exposed to Peer Tutoring Strategy with the highest mean score of ($\bar{x}$= 24.9429) had the best science communication skills over those taught with Field Trip and Teacher Expository Method, indicating that those students exposed to Peer Tutoring have the best communication skills in Basic Science and Technology. However, the table does not indicate the significant effect on science communication skills of students taught with the two strategies and teacher expository method. The effect was revealed using Analysis of Covariance (ANCOVA) as presented in the Table 6.

Results in Table 6 showed that there is significant effect on science communication skills of students taught with Field Trip, Peer Tutoring and Teacher Expository Method in Basic Science and Technology ($F=1.326$, $p<0.05$). Thus, the null hypothesis that states that there is no significant effect of the two strategies and teacher expository method on science communication skills of students in Basic Science and Technology is rejected. A partial eta squared value of 0.337 showed that 33.7% of the variance in the posttest scores of the students' science communication skills is accounted for by the treatments as the effect size.

Hypothesis Four: There is no significant effect of the two strategies and teacher expository method on Science measurement skills of students in Basic Science and Technology.

Table 3. Descriptive statistics of the effect of science classification skills on students exposed to field trip, peer tutoring and teacher expository method in basic science and technology

	N	Minimum	Maximum	Mean	Std. Deviation
Field Trip	105	20.00	35.00	25.4571	6.56794
Peer tutoring	105	15.00	37.00	31.3429	5.09869
Teacher Expository	105	16.00	32.00	22.5714	7.50019
Valid N (listwise)	315				

Table 4. Analysis of Covariance (ANCOVA) of the effect of science classification skills on students taught with CMLS, CLS, ILS and TEM in basic science. Dependent variable: Post-test of students' BST classification skills

Source	Type III sum of squares	Df	Mean square	F	Sig.	Partial Eta squared
Corrected Model	327.543[a]	15	21.836	1.665	.146	.445
Intercept	316.978	1	316.978	24.168	.000	.406
Pre-test of BST	22.833	1	22.833	1.741	.203	.242
Strategies	312.507	14	22.322	3.529	.001	.236
Error	249.200	19	13.116			
Total	10590.000	35				
Corrected Total	576.743	34				

a. R Squared = .568 (Adjusted R Squared = .227)

Table 5. Descriptive statistics of the effect of science communication skills on students exposed to field trip, peer tutoring and teacher expository method in basic science and technology

	N	Minimum	Maximum	Mean	Std. Deviation
Field Trip	105	15.00	34.00	24.5714	6.03073
Peer tutoring	105	16.00	37.00	24.9429	5.98500
Teacher Expository	105	15.00	26.00	21.1714	5.15344
Valid N (listwise)	315				

Results in the Table 7 showed the descriptive statistics of the effect of science measurement skills on students taught with the two strategies and teacher expository method. It can be drawn out from the table that the mean scores of the students' science measurement skills in Basic Science and Technology, having been exposed to Field Trip, Peer Tutoring and Teacher Expository Method are $\bar{x}$=25.3143, $\bar{x}$= 26.3714 and $\bar{x}$= 20.1112 respectively. The results implied that students exposed to Peer Tutoring Learning Strategy with the highest mean score of ($\bar{x}$= 26.3714) had the best science measurement skills over those taught with Field Trip and Teacher Expository indicating that those students exposed to Peer Tutoring had good measurement in Basic Science and Technology. However, the table does not point out the significant effect of science measurement skills on students taught with the two strategies and teacher expository method. The effect was revealed using Analysis of Covariance (ANCOVA) as presented in the Table 8.

Result in the Table 8 showed a significant effect of field trip and peer tutoring on Science measurement skills of Junior Secondary School (JSS) students in Basic Science and Technology in Osun State ($F=6.623$, $p<0.05$). Therefore, the null hypothesis that states that there is no significant effect of the two strategies and teacher expository method on Science measurement skills of students in Basic Science and Technology is thus rejected. A partial eta squared value of 0.421 showed that 42.1% of the variance in the posttest scores of the students' science measurement skills is accounted for by the treatments as the effect size.

Table 6. Analysis of Covariance (ANCOVA) of the effect of science communication skills on students taught with fied trip, peer tutoring and teacher expository method in basic science and Technolgy. Dependent variable: Post-test of students' BST communication skills

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	277.943[a]	18	15.441	1.272	.001	.445
Intercept	486.125	1	486.125	40.046	.000	.406
Pre-test of BST	6.021	1	6.021	.496	.191	.242
Strategies	273.740	17	16.102	1.326	.001	.337
Error	194.229	16	12.139			
Total	8742.000	35				
Corrected Total	472.171	34				

a. R Squared = .589 (Adjusted R Squared = .126)

Table 7. Descriptive statistics of the effect of science measurement skills on students exposed to field trip, peer tutoring and teacher expository method in basic science and technology

	N	Minimum	Maximum	Mean	Std. Deviation
Field Trip	105	20.00	34.00	25.3143	7.32751
Peer tutoring	105	17.00	37.00	26.3714	6.32030
Teacher Expository	105	13.00	23.00	20.1112	8.32030
Valid N (listwise)	315				

Table 8. Analysis of Covariance (ANCOVA) of the effect of science measurement skills on students taught with field trip, peer tutoring and teacher expository method in basic Science and technology. Dependent variable: Post-test of students' BST measurement skills

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	222.647[a]	16	13.915	.593	.000	.581
Intercept	305.686	1	305.686	13.038	.002	.502
Pre-test of BST	2.294	1	2.294	.098	.358	.292
Strategies	219.267	15	14.618	6.623	.001	.421
Error	422.039	18	23.447			
Total	10456.000	35				
Corrected Total	644.686	34				

a. R Squared = .345 (Adjusted R Squared = -.237)

Hypothesis Five: There is no significant effect of the two strategies and teacher expository method on Science inference skills of students in Basic Science and Technology.

Results in the Table 9 showed the descriptive statistics of the effect of science inference skills on students taught with the two strategies and teacher expository method. It was observed from the table that the mean scores of the students' science inference skills in Basic Science and Technology having been exposed to Field Trip, Peer Tutoring and Teacher Expository Method are $\bar{x}_{=}$22.9714, $\bar{x}_{=}$ 20.8857 and $\bar{x}_{=}$ 17.6000 respectively. The results implied that students exposed to Field Trip Strategy with the highest mean score of ($\bar{x}_{=}$22.9714) had the best science inference skills over those taught with Peer Tutoring and Teacher Expository Method, indicating that those students exposed to Field Trip have the best inference skills in Basic Science and Technology. However, the table does not indicate the significant effect on science inference skills of students taught with the two strategies and teacher expository method. The effect was revealed using Analysis of Covariance (ANCOVA) as presented in Table 10.

Results in the Table 10 showed that there is significant effect of field trip and peer tutoring on Science inference skills of Junior Secondary School (JSS) students in Basic Science and Technology in Osun State ($F=12.310$, $p<0.05$). Thus, the null hypothesis that states that there is no significant effect of the two strategies and teacher expository method on Science inference skills of students in Basic Science and Technology is rejected. A partial eta squared value of 0.339 showed that 33.9% of the variance in the posttest scores of the students' science inference skills is accounted for by the treatments as the effect size.

Hypothesis Six: There is no significant effect of the two strategies and teacher expository method on Science prediction skills of students in Basic Science and Technology.

Table 9. Descriptive statistics of the effect of science inference skills on students exposed to field trip, peer tutoring and teacher expository method in basic science and technology

	N	Minimum	Maximum	Mean	Std. Deviation
Field Trip	35	10.00	34.00	22.9714	6.01217
Peer tutoring	35	12.00	32.00	20.8857	6.63667
Teacher Expository	35	10.00	26.00	17.6000	4.64758
Valid N (listwise)	35				

Table 10. Analysis of Covariance (ANCOVA) of the effect of science inference skills on students taught with field trip, peer tutoring and teacher expository method in basic science and technology. Dependent variable: Post-test of students' BST inference skills

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	249.425[a]	17	14.672	2.174	.000	.445
Intercept	358.196	1	358.196	53.068	.000	.406
Pre-test of BST	6.587	1	6.587	.976	.001	.242
Strategies	249.425	16	15.589	12.310	.001	.339
Error	114.747	17	6.750			
Total	5721.000	35				
Corrected Total	364.171	34				

a. R Squared = .685 (Adjusted R Squared = .370)

Results in the Table 11 showed the descriptive statistics of the effect of science prediction skills on students taught with the two strategies and teacher expository method. It was observed that the mean scores of the students' science prediction skills in Basic Science and Technology, having been exposed to Field Trip, Peer Tutoring and Teacher Expository Method are $\bar{x}$=27.4857, $\bar{x}$= 25.1714 and $\bar{x}$= 17.4286 respectively. The results implied that students exposed to Field Trip Strategy with the highest mean score of ($\bar{x}$= 27.4857) had the best science prediction skills over those taught with Peer Tutoring and Teacher Expository Method, indicating that those students exposed to Fied Trip exhibited the best prediction skills in Basic Science and Technology. However, the table does not indicate the significant effect on science prediction skills of students taught with the two strategies and teacher expository method. The effect was revealed using Analysis of Covariance (ANCOVA) as presented in Table 12.

Results in Table 12 showed that there is a significant effect of field trip and peer tutoring on Science prediction skills of Junior Secondary Schools (JSS) students in Basic Science and Technology in Osun State ($F=21.210$, $p<0.05$). Thus, the null hypothesis that states that there is no significant effect of the two strategies and teacher expository method on science prediction skills of students in Basic Science and Technology is hereby rejected. A partial eta squared value of 0.476 showed that 47.6% of the variance in the posttest scores of the students' science classification skills is accounted for by the treatments as the effect size.

Table 11. Descriptive statistics of the effect of science prediction skills on students exposed to field trip, peer tutoring and teacher expository method in basic science and technology

	N	Minimum	Maximum	Mean	Std. Deviation
Field Trip	105	15.00	35.00	27.4857	4.82257
Teacher Expository	105	11.00	23.00	25.1714	2.88491
Peer tutoring	105	11.00	24.00	17.4286	3.66450
Valid N (listwise)	315				

Table 12. Analysis of Covariance (ANCOVA) of the effect of science prediction skills on students taught with field trip, peer tutoring and teacher expository method in basic science and technology. Dependent Variable: Post-test of students' BST prediction skills

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	224.144[a]	13	17.242	1.120	.396	.215
Intercept	320.251	1	320.251	20.796	.000	.109
Pre-test of BST	.034	1	.034	.002	.263	.212
Strategies	223.694	12	18.641	21.210	.001	.476
Error	323.399	21	15.400			
Total	7719.000	35				
Corrected Total	547.543	34				

a. R Squared = .409 (Adjusted R Squared = .044)

The results of the study had shown that field trip and peer tutoring instructional strategies had a significant effect on sudents' science process skills acquisition in junior secondary schools in Osun State. This means that the two strategies are suitable and most effective in the facilitation and development of science process skills among junior secondary school students. The result is in line with the findings of Omorogbe and Ewansiha [2] when they found out that students performed better when they were taught with the appropriate strategy that is innovative and learner-centred than the teacher expository method. The results of the study further showed that there is highly positive significant effect of the two strategies on science process skills acquisition of junior secondary school students. Students that were exposed to the two strategies exhibited higher science process skills than those taught with teacher expository method. This result supports the findings of Salami [7], Olajide and Aladejana [13] when they reported that students' science process skills improved when they are taught with innovative strategies meant for learning in the 21st century such as field trip and peer tutoring.

Moreover, the results of the study showed that the two strategies used in the study had a significant effect on students' science process skills acquisition. This implied that the two strategies are suitable and most effective in the facilitation and development of science process skills among junior secondary school students. This is a confirmation of what Novak and Cañas [22] found when they used concept mapping to ascertain its effect on students' science process skills acquisition at Cornell University.They observed that concept mapping had a positive significant effect on students' science process skills. The result supports the fact that concept mapping is an innovative teaching strategy of the 21st century education.

4. CONCLUSION

The study concluded that field trip and peer tutoring instructional strategies are effective and innovative teaching methods that teachers could use in improving students' science process skills acquisition in Basic Science and Technology classrooms for better performance in science subjects in our jumior secondary schools in Nigeria.

5. RECCOMMENDATIONS

Based on the conclusion of findings of this study, it is hereby recommended that:

1. Curriculum planners should include innovative methods of teaching Basic Science and Technology concepts such as field trip and peer tutoring instructional strategies in the junior secondary school curriculum.
2. Government should ensure that education policy statements are translated into reality.
3. Workshops, seminars and conferences should be organised for science teachers on the new innovative methods of teaching science subjects in schools on regular basis.
4. Teacher training institutions should train prospective teachers on effective and innovative teaching strategies.

CONSENT

As per international standard or university standard, students' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Author has declared that no competing interests exist.

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