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Impact of Virtual Laboratories and Field Trip Learning Strategies on Academic Achievement and Retention in Basic Science Among Students in Bonny Island, Rivers State, Nigeria

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ABSTRACT
The study investigated the effect of virtual laboratory and field trip strategies on students' achievement and retention in Basic Science concepts in Bonny Local Government Area, Rivers State. Two objectives guided the study, two research questions were answered and two hypotheses were tested at 0.05 significance level. Quasi-experimental research design was adopted for the study. The population for this study comprised eight hundred and ninety-two (892) junior secondary II students (JSS2) in all the six public junior secondary schools in Bonny Local Government Area of Rivers State. The sample size comprised 151 Junior Secondary School II students (JSS2) drawn from intact classes in three selected public junior secondary schools. The purposive sampling procedure was adopted to select the sample for this study. The instruments used for data collection were researcher-made achievement tests titled: Basic Science Achievement Test (BSAT) and Basic Science Retention Test (BSRT). The BSRT is a reshuffled BSAT. The instruments were validated by five experts. The reliability of the instruments was determined using Kuder-Richardson Formula 21 which yielded reliability coefficients of 0.92. Data collected were analyzed using descriptive statistics of mean and standard deviation to answer the research questions while Analysis of Co-variance was used to test the hypotheses at 0.05 level of significance. Findings revealed that students taught Basic Science concepts using virtual laboratory performed significantly better than those taught using the fieldtrip or discussion method. Students taught with the field trip strategy had better retention than their counterparts. The study concluded that field trip strategy still holds value in providing hands-on experiences that cannot be replicated in a virtual setting, and as such, improves the retention of scientific concepts and fosters a deeper understanding of the subject matter. It was recommended, among others that teachers should incorporate virtual laboratory and field trip in the teaching of Basic Science concepts.
Keywords: Virtual Laboratory, Field Trip Strategies, Students' Achievement, Retention, Basic Science**.**

INTRODUCTION

Virtual laboratory is one of the recent technology-led interventions in science education. It addresses situations where physical reality cannot be reached such as when conducting experiments involving materials that are expensive, explosive, or out of reach (Ndukwe & Obafemi 2023). The approach not only enhances learners' capacity, capabilities, and understanding of science concepts but also possesses a

variety of benefits in science education. Akpan (2016) opined that teacher-centered teaching strategies that have defined learning processes ever since the dawn of formal education are no longer adequate to prepare learners for productive participation in an era of a knowledge-based society. Billah and Widiyatmoko (2018) found that the virtual lab method, where theoretical material is combined with graphics, animations, and videos, allows for independent learning, particularly among students with a passion for computer-related studies (Eden, et al., 2023).

Zhao et al. (2019) pointed out that the virtual laboratory approach complements traditional laboratory sessions and enhances understanding. It also tends to augment problem-solving skills (Gunawan et al., 2018), foster creativity (Gunawan et al., 2018), offer fresh learning perspectives inaccessible through a traditional laboratory (Jiménez et al., 2021), and offer comparable learning outcomes with those of practical laboratories (Wästberg et al., 2019). With a clear appreciation of the necessity to integrate Information and Communication Technology (ICT) into the teaching of science, Akpan (2016) advocated for the application of activity-based, minds-on, hands-on, student-centred methods of instruction that facilitate total learning. This will help students at basic to senior secondary levels in science attain a deeper conceptual mastery of science and technology interfaces as well as scientific processes.

The application of the virtual laboratory model in schools is said to promote access to additional students compared to traditional physical schools. The model not only simplifies the change of object properties but also reshapes the pragmatic and theoretical form of science instruction. Besides that, it is student-centered and rekindles students' enthusiasm for the course (Nwagbo & Ugwuanyi, 2015). Dyrberg et al. (2017) reported that students have more mature discussions upon the completion of lessons taught via the virtual laboratory pedagogy, thereby being better equipped to carry out lab work.

Field trips are an instructional method that involves taking students outside the classroom to allow them to make relevant observations about living organisms in their natural habitats. These may be within school farms, national parks, zoos, industrial estates, forests, or game reserves in the neighborhood. Field trips were recognized by Bajah (2002) as an important component of science instruction. Furthermore, Obeka (2010) explained fieldtrips as outdoor laboratory classes or fieldwork practice exercises undertaken by students and teachers on specific topics of a subject, through which students are exposed to acquire pertinent knowledge of organisms in their habitats. Aliyu (2008) added that field trips involve taking students out of the classroom to where they can observe concrete explanations of classroom theories. These offer first-hand observation and interpretation in naturalistic settings. Students in the field have to practice basic scientific competencies, including participation in group work, interaction with people, collaboration, problem-solving, and handling chemicals and organisms in the natural world. Fieldtrip is a vital component of science teaching, not an extracurricular activity, but a direct extension of classroom instruction. This is why a proper science curriculum extends outside the classroom. Field trips are at the heart of Basic Science which derives most of their momentum from interconnections of living organisms with one another and their environment. The field trips are one of the most enjoyable and thrilling experiences for students studying science-related courses which have a lot to do with living organisms and the environment. This is because; it provides the learners direct experience of real things which cannot be provided in the classroom setting contextually. Field trips by students are carried out to accomplish the main purpose of requesting more information or knowledge directly as a result that will culminate in active learning and doing something tangible.

The concept of field trip instruction includes field work, school excursions and garden tours. Some positive benefits derived from field trips are hands-on, real-world experiences, quality education, positive attitudes to science, motivation towards the subject, development of rapport between teachers and students and many more. Through field trips, students can witness a real-life location and view their topic subject of learning within the everyday context and these visits enable students to gain knowledge and perhaps a different perspective on their topic. It provides an opportunity for students to view information for themselves and use their senses to touch or feel materials that they had previously only heard about. This immediacy and accessibility are a key feature of field trips and one of their redeeming features.

Leaving the school premises provides a social experience and offers a change of tempo and scenery for students. Field trips expose students to novel experiences and can increase interest and engagement in science, regardless of prior interest in a topic (Omeodu & Abara, 2018). During field trips, learners refine their skills of observation, perception, and objective reporting by utilizing all their senses (Shakil, Faizi & Hafeez, 2011). This approach encourages students to become more imaginative and inquisitive observers. However, some disadvantages should be considered before planning a field trip. These include a lack of chaperones, potential student misbehaviour, budget constraints, safety concerns, and time management challenges. While a field trip may be an exciting opportunity for students and teachers, these challenges may result in an unpleasant experience, potentially undermining the learning objectives if not properly managed by Basic Science teachers and their students.

Studies have demonstrated that secondary school students are exhibiting diminished interest in Basic Science (Abimbola, 2008). This reduced interest has been attributed to poor achievement in examinations. In the pursuit of scientific and technological advancement, proficient achievement in Basic Science at all levels of education is imperative. The instructional approach employed by educators may significantly influence students' interest in learning Basic Science. This implies that students are likely to learn effectively and achieve higher standards in Basic Science if the instructor is capable of stimulating their interest. Consequently, the development and maintenance of students' interest in Basic Science may necessitate an instructional approach that is adept at arousing students' motivation to learn.

Gender is often seen to have considerable effects on students' academic achievements especially in science subjects. Gender is the range of physical, biological, mental and behavioural characteristics about and differentiating between the feminine and masculine (female and male) population. The importance of examining achievement about gender is based primarily on the socio-cultural differences between girls and boys. Gender, as defined by Okeke (2008), refers to the social or cultural characteristics, roles, or behaviours that society associates with males and females. Okeke further distinguishes that sex is universal and biologically determined. Onyegebu (2008) characterizes gender as the aggregate of cultural values, attitudes, roles, practices, and characteristics based on sex. Nnaka (2008) reported that girls often do not receive encouragement in science classes from teachers; rather, they encounter negative comments regarding the types of work or courses they should pursue. Some researchers (Nbina & Wagbara, 2012) have reported that girls outperformed boys in their conceptual understanding of force and motion and that girls demonstrated a more positive attitude towards chemistry than boys. Conversely, Madu (2004) and Iweka (2006) found that boys achieved better results than girls in sciences. Other researchers, such as Okeke (2007) and Onimisi (2006), concluded that gender has an insignificant effect on science achievement.

Okoro (2011) argued that the instructional approach used in the classroom can influence gender and students' interest and academic achievement in science. Okoro further supported the argument that females perform better than males when a cooperative learning strategy is employed. Conversely, when competitive or individualized learning strategies are used, males outperform females. The inconsistent results regarding gender necessitate further study. Additionally, the literature available to the researcher does not indicate any definitive conclusions on the influence of gender on students' achievement, and retention in Basic Science. This underscores the need for continuous verification of such effects over time and across different societal contexts. Based on the foregoing, this study investigated the effects of virtual laboratory and field trip strategies on students' interest, achievement, and retention in Basic Science in Bonny Local Government Area, Rivers State. The study also examined the interaction effect of gender and teaching approach on the identified variables.

The reason for this poor achievement may vary but could be adduced to the poor teaching methods adopted in the teaching of Basic Science. Since effective teaching is characterized by the ability to elicit desirable changes in learners' behavior, evidenced by improved achievement and retention of taught content in the subject matter. To enhance students' achievement and retention, it is essential to implement more efficient and appropriate teaching methodologies, such as virtual laboratory and field trip strategies. These innovative instructional approaches are being explored by educators to assess their effects on

teaching and learning outcomes. However, there is a paucity of studies reporting their use in schools and their effects on academic achievement and retention especially in science-related subjects. This raises the question: Will the implementation of virtual laboratory and field trip strategies positively influence students' achievement and retention in Basic Science? There is a need to apply these strategies to Basic Science education and evaluate their effectiveness, particularly in comparison to conventional teaching methods. This necessity forms the foundation of the present study. Consequently, this research aims to investigate the effects of virtual laboratory and field trip strategies on students' achievement, and retention in Basic Science within Bonny Local Government Area, Rivers State.

Aim and Objectives of the Study

This study was aimed at investigating the effect of Virtual Laboratory and Field Trip Strategies on students' achievement and retention in Basic Science concepts in Bonny Local Government Area, Rivers State. The specific objectives of the study were to:

1. investigate the effect of instructional strategy (Virtual Laboratory (VL), Field Trip (FT) and Discussion Method (DM)) on students' achievement in Basic Science concepts.
2. ascertain the effect of instructional strategy (VL, FT and DM) on students' retention of Basic Science concepts.

Research Questions

The following two research questions were raised and answered in this study:

1. What difference exists among students taught using Virtual Laboratory (VL), those taught using Field Trip Strategy (FT) and those taught using Discussion Method (DM) in their achievement in Basic Science concept?
2. What difference exists among students taught using VL, those taught using FT and those taught using DM in their retention of the knowledge of Basic Science concepts?

Hypotheses

The following two understated null hypotheses were formulated to guide the study and were tested at a 0.05 level of significance:

$H0_1$: No significant difference exists among students taught using VL, those taught using FT and those taught using DM in their achievement in Basic Science concepts.

$H0_2$: There is no significant difference among students taught using VL, those taught using FT and those taught using DM in their retention of the knowledge of Basic Science concepts.

METHODS AND MATERIALS

This study investigated the effect of Virtual Laboratory and Field Trip Strategies on students' achievement and retention in Basic Science concepts in Bonny Local Government Area, Rivers State. This study adopted a quasi-experimental design using a non-randomized, non-equivalent, pre-test and post-test experimental group design. The population for this study comprised eight hundred and ninety-two (892) junior secondary II students (JSS2) in all the six public junior secondary schools in Bonny Local Government Area of Rivers State. The sample for this study consisted of 151 Junior Secondary School II students (JSS2) drawn from intact classes in three selected public junior secondary schools in Bonny LGA. Three public junior secondary schools were purposively chosen from Bonny LGA for this study. The schools were chosen based on the following criteria: (a) they are co-educational; since gender is a moderating variable (b) they have at least one professional Basic Science (Chemistry, Physics and Biology) teacher with either a B.Ed or B.Sc (Ed) qualification, (c) schools that are well-equipped with ICT facilities, (d) schools within Bonny town since it will be difficult to move students out of the creeks, (e) administrative consent. The research instrument used for data collection was a researcher-developed and validated instrument titled Basic Science Achievement Test (BSAT) which was restructured into Basic Science Retention Test (BSRT) with reliability coefficients of 0.91 obtained using the Kuder Richardson-21 (KR-21) formula. BSAT has two sections: A and B. Section A was used to obtain the respondents' biodata, while section B contains 50 questions on Ecosystem and Biodiversity to be answered by the respondents. The questions have multiple options of A, B, C, and D. Each correct answer

attracts 2 marks, while a wrong answer will attract 0 mark. The maximum score obtainable is 100%, while the minimum score obtainable is 0%. BSRT was a reshuffled version of BSAT. It was used to measure the students' retention of the knowledge of Basic Science concepts. The method of data collection procedure of this study was done in stages. The researcher identified the sampled schools for the study and solicited permission from the principals of the selected public schools to use their students as well as some facilities. This was followed by the training of Basic Science teachers who were professional Basic Science teachers in the participating schools with either a B.Ed or B.Sc (Ed) qualification who served as research assistants to the researcher. The research assistants administered the Basic Science Achievement Test (BSAT) as a pre-test to the groups and handed over the scripts to the researcher for marking and grading. The students were subjected to a four-week teaching period after which a post-test was administered. Retention test using the Basic Science Retention Test (BSRT) was administered two weeks after the post-test. The research assistant in each school helped to collect the data under the supervision of the researcher. The researcher afterwards marked the scripts followed by grading, recording, and analyses. The data for this study were gathered through the administration and scoring of Basic Science Achievement Test (BSAT) and Basic Science Retention Test (BSRT). Descriptive statistics of Means and Standard Deviation were used to answer the research questions while Analysis of Co-variance (ANCOVA) was used to test the hypotheses at a 0.05 level of significance.

RESULTS

Research Question One: *What difference exists among students taught using Virtual Laboratory, those taught using Field Trip Strategy and those taught using Discussion Method in their achievement in Basic Science concepts?*

Table 1: Mean and standard deviation values of students' achievement classified by instructional strategy.

Instructional Strategy	n	Pretest		Posttest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Virtual Laboratory	46	43.87	11.92	68.37	8.56	24.50
Field Trip Strategy	43	42.51	8.66	58.37	10.94	15.86
Discussion Method	62	39.21	9.48	46.84	10.51	7.63

Table 1 shows the difference that exists among students taught using the virtual laboratory, those taught using the field trip strategy and those taught using the discussion method in their achievement in Basic Science concepts. The result indicated that students taught Basic Science concepts using virtual laboratory had a pretest mean score of 43.87 (SD = 11.92) and a post-test mean score of 68.37 (SD 8.56) which resulted in a mean gain of 24.50. Students taught Basic Science concepts using the field trip strategy had a pretest mean score of 42.51 (SD = 8.66) and a post-test mean score of 58.37 (SD = 10.94) with a resultant mean gain of 15.86. Students taught using the discussion method had a pretest mean score of 39.21 (SD = 9.48) and a post-test mean score of 46.84 (SD = 10.51). This resulted in a mean gain of 7.63. These results indicate that students taught Basic Science concepts using virtual laboratory performed better than their counterparts taught using the field trip strategy and those taught using the discussion method.

Research Question Two: *What difference exists among students taught using virtual laboratory, those taught using field trips and those taught using discussion method in their retention of the knowledge of Basic Science concepts?*

Table 2: Mean and standard deviation values of students' retention classified by instructional strategy.

Instructional Strategy	n	Posttest		Post-posttest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Virtual Laboratory	46	68.37	8.56	71.93	6.98	3.56
Field Trip Strategy	43	58.37	10.94	61.98	11.69	3.61
Discussion Method	62	46.84	10.51	47.65	11.01	0.81

Table 2 shows the difference exists among students taught using the virtual laboratory, those taught using the field trip strategy and those taught using the discussion method in their retention of the knowledge of Basic Science concepts. The result indicates that students taught Basic Science concepts using a field trip strategy had a post-test mean score of 58.37 (SD = 10.94) and a post-post-test mean score of 61.98 (SD = 11.69) which resulted in a mean gain of 3.61. Also, students taught Basic Science concepts using virtual laboratory strategy had a post-test mean score of 68.37, (SD = 8.56) and a post-post-test mean score of 71.93 (SD = 6.98) with a resultant mean gain of 3.56). Students taught using the discussion method had a post-test test of 46.84 (SD = 10.51) and a post-post-test mean score of 47.65 (SD = 11.01) with a mean gain of 11.01. These results indicate that students taught Basic Science concepts using a field trip strategy had the best retention score than their counterparts. This was followed by those taught Basic Science concepts using virtual laboratory and least by those taught using discussion methods.

Hypothesis 1: No significant difference exists among the students taught using Virtual Laboratory Strategy, those taught using Field Trip Strategy and those taught using Discussion Method in their achievement in Basic Science Concepts.

Table 3: Summary of Analysis of Covariance of students' achievement classified by Instructional Strategy using Pretest as Covariate

Tests of Between-Subjects Effects

Dependent Variable: Post Test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	12424.244[a]	3	4141.415	40.439	0.000
Intercept	26092.400	1	26092.400	254.780	0.000
Pretest	10.653	1	10.653	0.104	0.748
Instructional Strategy	11792.297	2	5896.148	57.573	0.000
Error	15054.498	147	102.412		
Total	512621.000	151			
Corrected Total	27478.742	150			

a. R Squared = 0.452 (Adjusted R Squared = 0.441)

Table 3 reveals a value of $F_{2,147} = 57.573$, $p = 0.00$ ($p < 0.05$) for the effect of Instructional Strategy on students' achievement in Basic Science Concepts. The null hypothesis is therefore rejected, indicating that a significant difference exists among the students taught using Virtual Laboratory Strategy, those taught using Field Trip Strategy and those taught using Discussion Method in their achievement in Basic Science Concepts.

Table 4: Least Significant Difference Post Hoc Analysis of students' achievement classified by Instructional Strategy

Pairwise Comparisons

Dependent Variable: Post Test

(I) Instructional Strategy	(J) Instructional Strategy	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound
Virtual Lab Strategy	Field Trip Strategy	9.961*	2.150	0.000	5.713	14.209
	Discussion Method	21.407*	2.007	0.000	17.441	25.372
Field Trip Strategy	Virtual Lab Strategy	-9.961*	2.150	0.000	-14.209	-5.713
	Discussion Method	11.445*	2.027	0.000	7.440	15.451
Discussion Method	Virtual Lab Strategy	-21.407*	2.007	0.000	-25.372	-17.441
	Field Trip Strategy	-11.445*	2.027	0.000	-15.451	-7.440

Based on estimated marginal means

*. The mean difference is significant at the 0.05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 4, which shows the Least Significant Difference Post hoc analysis of students' achievement classified by Instructional strategy, reveals the highest mean difference of 21.407 and a p-value of 0.00 ($p < 0.05$) between the effect of Virtual Laboratory Strategy and Discussion Method on students' achievement in Basic Science Concepts. This indicates that the students taught Basic Science Concepts using Virtual Laboratory Strategy contributed most to the significant difference between the effects of the instructional strategies used on students' achievement.

Hypothesis 2: There is no significant difference among the students taught using Virtual Laboratory Strategy, those taught using Field Trip Strategy and those taught using Discussion Method in their retention of the knowledge of Basic Science Concepts.

Table 5: Summary of Analysis of Covariance of students' retention classified by Instructional Strategy using Pretest as Covariate

Tests of Between-Subjects Effects

Dependent Variable: Post-Post Test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	21946.228[a]	3	7315.409	113.863	0.000
Intercept	2595.112	1	2595.112	40.392	0.000
Posttest	5877.593	1	5877.593	91.484	0.000
Instructional Strategy	1831.698	2	915.849	14.255	0.000
Error	9444.382	147	64.247		
Total	559266.000	151			
Corrected Total	31390.609	150			

a. R Squared = 0.699 (Adjusted R Squared = 0.693)

Table 5 reveals a value of $F_{2,147} = 14.255$, $p = 0.00$ ($p < 0.05$) for the effect of Instructional Strategy on students' retention of the knowledge of Basic Science Concepts. The null hypothesis is therefore rejected, indicating that there is a significant difference among the students taught using Virtual Laboratory Strategy, those taught using Field Trip Strategy and those taught using Discussion Method in their retention of the knowledge of Basic Science Concepts.

Table 6: Least Significant Difference Post Hoc Analysis of students' retention classified by Instructional Strategy

Pairwise Comparisons

Dependent Variable: Post-Post Test

(I) Instructional Strategy	(J) Instructional Strategy	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b] Lower Bound	Upper Bound
Virtual Lab Strategy	Field Trip Strategy	3.713*	1.821	0.043	0.114	7.313
	Discussion Method	10.841*	2.100	0.000	6.691	14.991
Field Trip Strategy	Virtual Lab Strategy	-3.713*	1.821	0.043	-7.313	-0.114
	Discussion Method	7.128*	1.760	0.000	3.649	10.606
Discussion Method	Virtual Lab Strategy	-10.841*	2.100	0.000	-14.991	-6.691
	Field Trip Strategy	-7.128*	1.760	0.000	-10.606	-3.649

Based on estimated marginal means

*. The mean difference is significant at the 0.05 level.

b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

Table 6, which shows the Least Significant Difference Post hoc analysis of students' retention classified by Instructional strategy, reveals the highest mean difference of 10.841 and a p-value of 0.00 ($p < 0.05$) between the effect of Virtual Laboratory Strategy and Discussion Method on students' achievement in Basic Science Concepts. This indicates that the students taught Basic Science Concepts using Virtual Laboratory Strategy contributed most to the significant difference between the effects of the instructional strategies used on students' retention.

DISCUSSION OF FINDINGS

The findings of this study have revealed that the students taught Basic Science Concepts using the Virtual Laboratory Strategy had the best achievement when compared with the achievement of those taught using the Field Trip Strategy and those taught using the Discussion Method. A significant difference exists among the students taught using Virtual Laboratory Strategy, those taught using Field Trip Strategy and those taught using Discussion Method in their achievement in Basic Science Concepts, in favour of the students taught using Virtual Laboratory Strategy. This finding may be due to the interactive and engaging nature of virtual laboratories, which allow students to conduct experiments in a simulated environment, enhancing their understanding and retention of scientific concepts. Additionally, virtual labs provide flexible access to resources and immediate feedback, which can contribute to improved learning outcomes. This finding is in agreement with the finding of Lawal (2023), which revealed that significant differences exist between the achievement of students taught using the virtual field trip strategy and those exposed to the traditional field trip strategy. These findings also match studies of Dohn et al., (2016); Ernita et al., (2021), Koehler, (2021), Sari et al., (2019) and Son, (2016) which reported a positive effect of virtual laboratories on students' motivation and achievement. The findings however are incongruent with the study of Abdul, Oyeronke and Adunni (2015) which reviewed that field trip improved the achievement of junior secondary students in basic technology. Also, Ogbuluijah (2014) found out that field trip broadens knowledge expose students to modern methods of farming and enhance knowledge of agricultural processing methods.

The findings of this study further revealed that the students taught using Field Trip Strategy had the best achievement when compared with the achievement of those taught using Virtual Laboratory Strategy and those taught using Discussion Method in their retention of the knowledge of Basic Science Concepts. However, there is a significant difference between the students taught using Virtual Laboratory Strategy, those taught using Field Trip Strategy and those taught using Discussion Method in their retention of the knowledge of Basic Science Concepts in favour of the students taught using Virtual Laboratory Strategy. This finding may be due to the interactive and immersive nature of virtual laboratories, which provide students with continuous and readily accessible learning experiences. These virtual environments allow students to repeatedly review and engage with the material at their own pace, enhancing their long-term retention. In contrast, while fieldtrips offer rich, real-world learning experiences, they are limited in duration and frequency, which might not be as conducive to long-term retention as the repeated and varied exposure offered by virtual labs. Moreover, virtual laboratories often include features such as instant feedback and interactive simulations, which can further reinforce learning and retention of concepts. This finding is in agreement with the finding of Alaku and Mankilk (2016), who revealed that the students taught Physics using multimedia instruction performed significantly better with high retention ability than those taught Physics using conventional methods of instruction. The finding of this study is also in agreement with the studies of Ukor and Abdulbajar (2019), Aromosole and Filgona (2016) and Zumyil (2019). These studies revealed that students taught using field trip method achieved significantly higher than those taught using the conventional teaching method. The finding however is in disagreement with the finding of Eze and Asogwa (2016) who reported that students taught with field trip had slightly lower scores on the achievement test than those with video instruction.

CONCLUSION

This study investigated virtual laboratory and fieldtrips on students' achievement and retention in Basic Science in Bonny Local Government Area of Rivers State. Consequently, the findings of this study showed that students who were exposed to the virtual laboratory instructional strategy demonstrated higher levels of achievement, while those exposed to the field trip instructional strategy had slightly higher levels of retention as compared to their counterparts taught using the virtual laboratory strategy.

RECOMMENDATIONS

Considering the findings, discussion and conclusions of this study, the following recommendations are made:

1. The Rivers State Ministry of Education should consider incorporating virtual laboratory simulations into the curriculum to enhance students' understanding of Basic Science concepts.
2. Teachers should incorporate more hands-on and experiential learning opportunities, such as field trips, into their curriculum to improve student retention of Basic Science concepts.

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