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Comparative Effectiveness of Virtual Field Trip Strategy and Traditional Fieldtrip on Academic Performance and Motivation of Students in Conservation Concepts of Biology in Northwest, Nigeria

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Abstract

This study compares the effectiveness of virtual and traditional field trip strategies on academic performance and motivation of students in conservation concepts of biology in North-West Nigeria. The study developed 2 research objectives one of which is to: compare the effectiveness of virtual and traditional field trip strategies on academic performance of students in conservation concept. The study was guided by 2 research questions and 2 null hypotheses. A Quasi-experimental research using test-retest method of pretest and post-test was adopted for the study. A sample of 120 N.C.E II biology students comprising of 81 males and 39 females were randomly selected from the population of 357 students of which 213 are males and 114 are females. The study developed 2 instruments namely: Conservation Concepts Performance Test (CCPT) and Conservation Concepts Motivation Questionnaire (CCMQ) which are validated and found reliable with $r=0.65$. At the end of the treatment data was collected and analyzed using Means and standard deviations to answer the research question while t-test and Mann-Whitney Statistics were used to answer the null hypotheses. The results obtained showed that: significant differences exist between the performance of students taught using virtual field trip strategy and those exposed to traditional field trip strategy. From the findings recommendations were made one of which is: the Ministry of Education/ colleges should provide a biology Virtual environment to serve each school in the region as technology is seen to help improve the performance and raise the level of motivation in biology concepts, moreover it will help to overcome problems faced by teachers from a lack of real field trips which leads to ignorance of some abstract concepts such as conservation concepts biology.

1. Introduction

Students' familiarity with technology has made it possible to develop virtual reality tools as computers are used more frequently in educational settings. Mahmood and Zoltan 2009 believed that "in science and engineering education, virtual laboratories have emerged as alternative or supplementary tools of the hands-on laboratory education, for instance, using them for preparing for the real laboratory task". "At different levels of education, starting with senior secondary school to the university level, Science laboratories are designed with certain goals, which includes to enhance the understanding of scientific concepts, interests and motivations, practical skills, and problem solving abilities" (Russell & Weaver, 2008).

In order to give students, the tools they need to succeed in the modern world of science and technology, the Federal Government of Nigeria, emphasizes the importance of science education which is the cornerstone of any country's technological advancement and taught at all educational levels thereby making it mandatory at both primary and junior secondary schools. As a discipline, Science covers a wide range of areas such as biology, chemistry, and physics. In schools it can be taught as a combined subject as it is in elementary school, or as a subject matter class as it is in later years, like biology. "At tertiary level, biology is one of the important subjects that, formed part of the requirement for admission especially in pure and social sciences programs and it is part of general studies (science technology and society) for students in many fields of studies in Nigerian colleges of [Education, Polytechnics and universities" (Bichi 2019). There are different strategies and methods adopted in teaching different biological aspects, one of which is field trip method which is mostly applied to concepts such as conservation of natural resources concepts, ecology, plants adaptation etc. conservation concepts as one of the abstract aspect in biology teaching is more meaningful if students have the chance to engage with the environment as a class. (Wong and Wong 2008).

According to Wong (2002) "this field trip method can indirectly improve students' cognitive processes and thinking skills leading to a better understanding of concrete Biology concepts. Also the implementation of teaching learning using this method is also seen to be fundamental to the success of educational development goals". Furthermore, Students need to interact with the environment and nature, they need to see natural resources in their real habitat and examine them to enable them to understand the abstract conservation concepts. Fieldtrips do, however, have many restrictions one of which is proximity or location. According to Whitesell, (2016), "teachers admit that there are many obstacles that prohibit them from taking their classes on field trips including geographic, financial, logistical, and time constraints". When considering these challenges, finding suitable alternatives is unavoidable, thus using a virtual field trip to assist field trip approaches can be a logical one.

"Virtual field trip (VFT) is a collection of technology-based resources used together to give students the learning experiences gained from an actual field trip" (Khotima, Krisnawati and Budi 2021). Newsome, (2013) defined Virtual Field Trip "as a live, interactive program taught by a content provider to a classroom through the use of video conferencing technology". "VTFs are used both as a supplement to field trips as well as to provide an alternative when an actual field trip experience is not possible" (Tuthill & Klemm, 2002). "Virtual field trips may be comprised of images, animations, audios and videos. With the advances in technology over the years, we now have alternative options for traditional field trips" (Stoddard, 2009). Also Opalewski & O'Leary, 2019 found that, "many cultural institutions utilize technology to provide distance learning opportunities or virtual field trips for students". "When used effectively, technology can open students to new experiences and places and many of the obstacles that teachers face with a traditional field trip no

longer apply” (Cassady 2014). Teachers do not need to worry about money, getting permission, scheduling chaperones, taking medical risks, or skipping out on important classroom instruction time. Thus when tradition field trips are not possible, virtual field trips offer a viable alternative.

“Through technology, teachers are able to provide their students with new experiences, such as connecting with people and places through videoconferencing or using the internet to access websites” (Zanetis, 2010). The potential benefits of a virtual environment for Biology cannot be underestimated in the contemporary world. Mahya, 2017 opined that “ Even though the use of technological tools such as educational games, online simulations, and virtual learning environments have increased in the field of education over the years, educational researchers need to better understand how these technological tools like virtual environments can affect learning”.

Another issue of concern is this study is the performance and motivation of students towards virtual field trip strategy,” the recent attention received by educational technology has therefore turned educators, practitioners, and researchers” focus towards the effects that technological tools may have on students” performance, both academically and behaviorally” Garrett, (2015) also, Pyatt and Sims (2012) explain that “using a virtual laboratory increases motivation and desire for the lectures and laboratory in the process of learning”. Additionally, it offers a working atmosphere that is optimal, inexpensive, safe, and simple. Students motivation is thought to be just as crucial as any other variable circumstance. For instance, Ali, Ismail, and Sedef (2010) believe that “motivation is a key factor in keeping students in their learning process, and has been found to be the most significant factor that influences academic success”.

The theoretical concept of motivation is used to explain behavior and denotes the drivers of peoples activities, needs, and desires. Haider and Rehman (2013) defined motivation as “psychological forces that determine the direction of a person’s behavior, person's level of effort, and a person’s level of persistence in the face of obstacles. Also, Badola (2013) has found achievement to be a joint result of an ability to motivate”. Moreover, a technologically advanced atmosphere would considerably boost students’ motivation and help them adopt a favorable mindset toward the subject matter and therefore improving academic performance.

Considering these challenges makes the use of a field trip avoided, therefore looking for alternatives is inevitable, and hence, the use of virtual field trip in supporting the field trip method might be logical. Therefore the study compares the effects of Virtual Field Trips and Traditional Field Trip on academic performance and motivation of students in conservation Concepts of Biology in Northwest-West Nigeria.

2. Statement of the Research Problem

Despite the fact that the field trip method of teaching is a crucial component of understanding biology courses, previous research has shown that it cannot be successfully incorporated into biology curricula for a number of reasons, including safety concerns, a lack of self-confidence, and the excessive time and effort required to conduct accurate field trips. According to Whitesell, (2016), “teachers admit that there are many obstacles that prohibit them from taking their classes on field trips including geographic, financial, logistical, and time constraints”. Research studies showed that several factors such as lack of motivation, anxiety, poor methods of teaching, family background, school/classroom environment, peer group, overloaded biology syllabus, difficulty of topic and some concept as well as absence of dedication and resourcefulness on the part of the teachers among others were found to be some of the reasons why

performance of Senior Secondary School students (including biology students) falls below what might ordinarily be expected of individuals of similar intellectual capacities (Vogel & Collins, 2010).

“Despite the popularity of biology among Nigerian students, performance at senior secondary schools level had remained poor” (Ahmad 2014). “The lack of innovative teaching methods in the science classroom has contributed to the low numbers of students opting for the science stream when entering the upper level in high school” (Haris & Osman 2015). The necessity for tried and true traditional teaching methods is still present despite the necessary modifications and changes. Teachers will be able to meet the demands for new and innovative teaching skills that are required in modern day Nigeria and enable its students to acquire them so that the country is able to face an increasingly challenging global environment by being aware of the diverse possibilities that new technologies offer to educators.

On the issue of motivation, a researcher like Badola (2013), has found out that motivational level of Biology students in learning ecology concepts(of which conservation concepts is an aspect of ecology) is not encouraging which may be another source for students’ low performance in Biology in general. Also Chuang & Cheng, (2005) believed that “implementation of a non-interactive learning process in conventional teaching cause’s students to pay less attention to the teacher leading to a poor student understanding and motivation”. Moreover, whilst students’ motivation to laboratory work was seen positively, the evidence is “equivocal” at the moment, thus more study in this area would be advantageous. When considering these challenges, looking for alternatives is unavoidable, thus the employment of educational technologies, notably the use of computers to support laboratory procedures, can be considered a natural choice among various choices.

3. Research Objectives

This following objectives guide the study. To compare:

1. The effectiveness of virtual and traditional field trip strategies on academic performance of students in conservation concept.
2. The effectiveness of virtual and traditional field trip strategies on students motivation in conservation concept.

3.1 Research Questions

The following research questions are formulated for answering:

1. What is the difference in the academic performance of students exposed to virtual and traditional field trip strategies in conservation concepts?
2. What is the difference in the level of motivation of students taught conservation concept with virtual and traditional field trip strategies?

3.2 Research Hypotheses

The following hypotheses are developed for testing at $P \leq 0.05$:

H01: There is no significant difference between the academic performance of students taught conservation concept with virtual field trip strategy and those taught with traditional field trip.

H02: There is no significant difference between the level of motivation of students exposed to virtual field trip strategy and those exposed to traditional field trip.

4.0 Methodology

The study's research design is quasi-experimental one that includes pretests and posttests for each experimental group. The experimental groups I and II were pre-tested (O₁) prior to the administration of treatment. Treatment for experimental group I was teaching conservation of natural resources concepts using a virtual field trip strategy and treatment for experimental group II was teaching of conservation of natural resources concepts using a field trip method, which was administered to the Experimental groups (EG₁ and EG₂). Post tests (O₂) were administered after administering the treatments to determine the student's performance in the course taught. The population of the study included all N.C.E. III Biology student in North-West Nigeria which comprised 357 students of which 213 are males and 114 females. Out of the 5 federal colleges of education in the north-west Nigeria, two were chosen using purposive sampling technique. The colleges were selected as experimental I, and II using simple random sampling technique of balloting system (the first to be chosen was labeled experimental I and second to be chosen was labeled experimental

II). To determine the number of students, a stratified sampling technique was utilized. Thus, a sample of 120 students with an average age of 24 was used, consisting of 81 male and 39 female students. Both experimental Group I and II are made up of 60 sample size each. The instruments used for this study are Conservation Concepts Performance Test (CCPT) to determine the academic performance of student and Conservation Concepts Motivation Questionnaire (CCMQ) for students' motivation towards the conservation of natural resource concepts in virtual field trip strategy. Due to the instruments adaptation, it was validated by experts with PH.D.s and at least senior lecturer status in the field of science education. Given that the instruments reliability was found to be $r=0.65$, it was utilized for the study. A total of 125 questionnaires were administered and 120 were collected back for analysis. Research questions were addressed by means and standard deviations, while null-hypotheses were addressed using t-test and Mann Whitney statistics.

5. Results

Research Question 1: What is the difference in the academic performance of students exposed to virtual and traditional field trip strategies in conservation concepts?

Table I: Mean and Standard Deviation of Post-test Scores of Experimental Groups I and II.

Variable	N	Mean	SD	Mean diff
Experimental I	60	25.13	3.58	2.05
Experimental II	60	23.08	3.31	

The result in Table I showed that Experimental group I exposed to the virtual field trip strategy has a mean value and standard deviation of 25.13 and 3.58 while experimental group II taught using the field trip method has a mean value and standard deviation of 23.08 and 3.31 respectively implying a mean difference of 2.05 in favor of those taught using virtual laboratory strategy.

Research Question Two: What is the difference in the level of motivation of students taught conservation concept with virtual and traditional field trip strategies?

Table II: mean rank on Difference in the Level of Motivation of Students in Experimental Groups I and II.

	Variables	N	Mean Rank	Sum of Ranks
Motivation	Experimental I	60	58.84	3530.50
	Experimental II	60	62.16	3729.50
	Total	120		

$p > 0.05$

Results of non-parametric tests in Table II revealed that there is no difference between the level of motivation of students exposed to the virtual field trip and those exposed to traditional field trip method. The computed mean rank of the level of motivation is 58.84 and 62.16 while their compound sum of rank scores are 3530.5 and 3729.50 by students exposed to virtual laboratory strategy and those exposed to outdoor laboratory strategy respectively. This implies that both virtual field trip strategy and traditional field trip strategies have the same level of motivation in students.

Table III: Summary of t-test Analysis of Post-test Scores of Experimental groups I and II.

Group	N	Mean	STD	Mean diff	Df	t computed	t critical	P	Remark
Experimental I	60	25.13	3.58	2.05	118	3.26	1.96	0.001	Significant
Experimental II	60	23.08	3.31						

$P = 0.001 < 0.05$, $t_{\text{computed}} = 3.26 > 1.96$ at df 118

According to the findings in Table III, a t-value of 2.18 was calculated and a p-value of 0.001 was observed for the degree of freedom of 118 respectively. The critical p-value of 0.001 is less than the p-value of $p > 0.05$. This shows that there is substantial disparities between student's performance when taught using a virtual

field trip strategy and those exposed to traditional field trip strategy. Therefore the null hypothesis which state that, there is no significant difference between the academic performance of students taught conservation concept with virtual field trip strategy and those taught with traditional field trip is hereby rejected.

Hypothesis Two: There is no significant difference between the level of motivation of students exposed to virtual field trip strategy and those exposed to traditional field trip.

Table IV: Summary of Man Whitney Tests on Difference in the level of Motivation of Experimental Groups I and II.

	Sum of Mann Whitney	Z	P value	Remark	Group	N	Mean Rank	Ranks
Experimental I	60	58.84	3530.50	1700.50	0.52	0.60	Not sig.	
Experimental II	60	62.16	3729.50					
Total	120							

P > 0.05

Results in Table IV shows that the calculated p-value of 0.60 is higher than the 0.05 alpha level of significance and the computed Z score value of 0.52 is lower than the Man Whitney scores of 1700.500. The Mean rank Motivational level of students exposed to the virtual field trip strategy and those exposed to the traditional field trip strategy, respectively, is 58.84 and 62.16, indicating that both groups have the same level of motivation. Therefore the null hypothesis which states that there is no significant difference between the level of motivation of students exposed to the virtual laboratory strategy and those exposed to the outdoor laboratory strategy is hereby accepted and retained.

7. Discussion

The result of the analysis presented in Tables I and III showed that experimental group I who are taught the conservation concept of biology with virtual field trip strategy performed significantly better than experimental group II students taught traditional field trip method. This finding conforms to that of Haris and Osman (2015) who found that “the achievement of students taught using the Virtual Field Trip (VFT) is higher than students taught using conventional field trip methods. In addition, the use of VFT could provide an opportunity for students to explore the mangrove ecosystem not in their area. Students can see a graphical display and video clearly which help to improve their achievement in the topic of Colonization and Succession in Mangrove Ecosystems” The finding gains further support from the work of Gambari (2017) who reveals that “students exposed to physics practical’s using a virtual laboratory package performed better than those with conventional laboratory methods”. Gilman (2006) found that “students’ written responses about the use of a virtual laboratory in teaching cell division noted the

convenience of virtual laboratories and going at your own pace while the negative comments remarked on the lack of collaboration and hands-on experience”.

The general explanation for this could be that the virtual laboratory package is more conducive than the traditional laboratories (indoor and outdoor) method since they are task structured (i.e. going through the pre-laboratory instruction; watching the video demonstration on computers, and practicing as many times as possible by varying the parameters in a simulated platform while simultaneously achieving of the concept taught. The virtual demonstrations, according to the majority of studies, are a novel approach to the teaching of biology because they add a new dimension to visual learning and are based on activities that engage students. They are also stress free because virtual materials, facilities and equipment are easily accessible.

The findings in Tables II and IV shows that the difference between students exposed to virtual field trip strategy and those exposed to traditional field trip method is however not significant which implies that both virtual field trip strategy and traditional field trip method have the same level of motivation in the conservation of natural resource concepts. This is in line with the research of Sari and Harun (2019) who found that “both virtual and Physical (indoor and outdoor) laboratory methods had positive motivation effects”. Also, the work of Glynn et al., (2011) revealed that “in comparing several studies utilizing the Science Motivation Questionnaire found no difference in total motivation to learn science between different laboratories in high schools”. In this case, it can be said that both virtual and traditional field trip strategies have a favourable impact on students motivation to learn biology this could be due to their similarities and some presumably influential factors like effectiveness in the delivery of biology through proper instructions.

8. Conclusion

The following conclusions were drawn from this research:

1. Exposure to virtual laboratory strategies improves biology students’ academic performance in the conservation of natural resource concepts.
2. Both virtual and outdoor laboratory strategies have the same level of motivation.

9. Recommendations

The following recommendations have been made in light of the study’s findings:

1. Experienced biology teachers should help students improve their academic performance because it is important to use virtual field trips in the classroom to teach students about conservation concepts and because this technology is thought to increase students’ motivation to learn biology concepts.
2. The Ministry of Education should offer a biology virtual environment to each school in the area to help instructors overcome the challenges posted by a dearth of genuine field trips, which results in a lack of understanding of many biological concepts.
3. Non-governmental organizations (NGOs) and stakeholders in education should be encouraged to provide adequate financial and material resources for effective teaching/ learning of conservation of natural resource concepts in Colleges of Education using a virtual field trip strategy.

4. Heads of Departments in schools of Sciences should encourage the use of a virtual field trip strategy since it has a visualization and reorganization of science facts in handling abstract courses like conservation of natural resource concepts.
5. Professional organizations like the Science Teachers Association (STAN), Mathematics Association of Nigeria (MAN), Colleges of Education Examination bodies like NCCE, and Research centers like the Nigerian Educational and Research Development Council (NERDC) should integrate virtual learning strategy in their science curricular in Colleges of Education to encourage the use of that by teachers.

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