FIELD TRIP APPROACH TO TEACHING MATHEMATICS: AN EFFECTIVE WAY OF IMPROVING STUDENTS' PERFORMANCE IN MATHEMATICS

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Abstract

This research study investigated the effect of Field Trip instructional strategy on the academic achievement of Senior Secondary School Students in Mathematics in Ile-Ife, Osun State, Nigeria and the composite influence of gender and instructional strategy on the achievement of the students. The study adopted a quasi-experimental non-equivalent pre-test, post-test control group design. The sample was made up of all senior secondary students of Ile-Ife in Osun State. A total of fifty (50) intact classes in two randomly picked schools were used to select a sample of fifty (50) Senior Secondary School One (SS I) students. They were posted to the experimental and control groups with each group having twenty-five students and taught over a four-week period. A Mathematics Achievement Test (MAT) was used to collect data. Mean, standard deviation and Analysis of Covariance (ANCOVA) at 0.05 level of significance were used to analyse the data obtained. The results showed that there was a significant effect of field trip on academic performance of students in Mathematics in the study area ($F = 58.04$, $p < 0.05$). Nevertheless, there was no significant effect of gender and instructional strategy on the achievement of students ($F = 0.029$, $p > 0.05$). The results of the study were that Field Trip strategy is a good teaching method of enhancing academic success of students in Mathematics regardless of the gender. It was hence suggested that Mathematics teachers should consider using field trip strategies in classroom teaching so as to improve the performance and knowledge of students in the subject.

Keywords: Field Trip strategy, Academic achievements, Gender, STEM Education, Mathematics

Introduction

Mathematics is a supporting science that serves as a basis to science, technology, engineering, economics, and numerous other human activities. On top of its academic importance, it builds logical thinking, critical thinking, and problem-solving skills, which are very important in the effective operation in both academic and real-life scenarios. Due to its broad application, Mathematics is studied at all education levels in every country of the world and is one of the key factors in the national development. Although it is very important and widely used, the performance of the students in Mathematics over the years has been generally low especially in the Nigerian secondary schools. A number of studies and examination reports have identified chronic poor performance of the Nigerians in Mathematics. Ekwueme (2006) noted that Mathematics teaching in most schools in Nigeria is characterized with overemphasis on external examination syllabi and strict schemes of work. Consequently, this has seen most teachers scramble to cover the syllabus without much thought on the level of comprehension and assimilation of ideas among the students. The practice has adversely impacted on the understanding of the fundamental mathematical concepts by students. The report released by the Chief Examiner of the West African Senior School Certificate Examination (WASSCE) in Mathematics (2016) indicated that the performance of most of the students was poor in areas like commercial arithmetic, geometry, mensuration, statistics, set theory, inequalities, distances and bearings, and solving linear equations using word problems. On the same note, 2008-2018 WAEC reports also revealed that the topics were mostly taught in a traditional, teacher-centred mode of instruction in the classrooms of Nigerian secondary schools. Such approaches are usually rote learning, memorization and passive listening and there is minimal interaction with mathematical concepts by the students. WAEC and other researchers have come up with some remedial measures in response to these challenges. They are making students study well, exposing

them to facts, concepts, and principles of mathematics, and enabling the students to know how to apply the concepts correctly in solving problems. Educators also have to focus more on conceptual, as opposed to procedural, memorization, and make Mathematics lessons more engaging and meaningful. The implementation of instructional strategies that are hands-on and learner-centred is one of the key ways through which these goals can be attained.

The field trip method is one of the least applied in teaching Mathematics in Nigeria, among the other innovative strategies that can be used. A field trip has been described as a premeditated visit of students out of the classroom and into the community aimed at learning by experience (Oloyede, Ajibade and Bamidele, 2006). Regardless of the fact that it will help in enhancing learning, most Mathematics teachers still stick to traditional teaching strategies due to their familiarity and comfort with the teaching strategies although their drawbacks have been extensively noted. Moreover, the Nigerian Educational Research and Development Council (NERDC, 2013) Mathematics Curriculum does not offer much information on how field trip can be used as a formal method of instruction, and this has further hindered its use. Field trips are also an effective method of teaching a broad variety of mathematical subjects contrary to popular belief. As an illustration, geometry, a subject dealing with shapes, angles, and constructions can be taught by taking students to construction sites where they can see real life examples of geometric concepts in real life. Mensuration may be taught through studying of fields, buildings and other physical areas where students can associate classroom formulas with actual measurements. In the same way, statistics, arithmetic, and measurement could be discussed using visits to farms, markets, banks, factories, and other places of the community meaningfully. Even though field trips are perceived as the unusual mode of teaching Mathematics, it has a lot of benefits, which can greatly increase the knowledge and interest in students. Mathematics is a hierarchical subject in that one should have mastered the basic concepts before being able to comprehend more

advanced concepts. Adequate prerequisite knowledge is a first-order concept which facilitates subsequent concepts learning. This hierarchical form renders the field trip strategy especially effective since by demonstrating one idea during an excursion, it can contribute to the increased learning of a number of related issues by students. Moreover, a field trip properly designed may also meet multiple sections of the mathematics curriculum simultaneously thus saving time and resources of instruction.

Since scientific and technological progress is one of the key requirements of societal progress, and Mathematics is the focal point of science, technology and the development of industries, it is an absolute necessity to teach Mathematics in ways that encourage practical and real-life learning. According to NERDC (2013) and UNESCO (2017), the instructional methods are supposed to encourage practical activities to enhance understanding, memorization, and implementation of mathematical concepts in students. Field trips encourage minds-on learning as well as hands-on learning. This is because, by direct contact with real-life situations, students are actively involved in observing, reasoning, analysing, and problem-solving. Learning becomes more relevant and significant because mathematical concepts studied at the classroom are used in the real-life situations during excursions. This participatory learning improves assimilation, retention and long-term comprehension of concepts thus leading to better academic performance. Field trips are therefore seen as a necessity in every level of education as well as different subjects. Field trips are usually external field trips to places of educational interest in the classroom and are led by a teacher or an instructor. They are mainly used to give the learners first-hand information about concepts, people, places, and processes to complement classroom learning and to make the learning permanently acquired. Contrary to the conventional lecture approach where the instructor is the only source of knowledge and the students are just mere consumers, field trips attract the sense of sight, touch, and hearing. Sensory experiences are very important in learning and

retention since learners have a tendency to remember better what they see and experience than what they hear. Field trips expose the learners to imagery and practical experiences that arouse curiosity and build knowledge. They can perceive phenomena at hand, systematize their experiences, and make logical inferences based on the real-life scenarios. Field trips are also part of language development of learners, since they learn new terminologies and enhance their communication skills by discussing and interacting. Moreover, social skills, including cooperation, sharing of responsibility, and teamwork, are developed in the course of the collaborative activities during the excursions. The learners also start to appreciate their environment and get more conscious of their expectations as custodians of their immediate environment.

Moreover, field trips enable a learner to investigate boldly and raise valuable questions of the surrounding world. They enhance the abilities of questioning and make students accustomed to various social and educational environments. The general purpose of field trips is to expand learning by offering the student a chance to communicate with the community resource persons, observe the working practice, and have insights that would otherwise be difficult to obtain in the classroom. Field trips are practical examples to demonstrate the relevance of field trips to the education of Mathematics. An example of such a visit is the visit to a textile factory where the students will be exposed to how Mathematics is used in planning, designing, and manufacturing. The educators may lead the students to the discussion of the need of correct calculations and the impact of mathematical errors on the quality of the products. In the same manner, a field trip to a farm will be applicable to impart knowledge using concepts of measurement, counting, estimation, and calculation of yield. The students will be able to compute farm production by measuring the plots, counting the produce and perform mathematical operations to find the overall production. These experiences enable learners to appreciate the usefulness of Mathematics in life.

Field trips also offer natural learning conditions which are able to cater to various learning styles and abilities. Not every learner can succeed in the traditional classroom environment and others need other setups to attain effective learning. According to Webb (2000), Natural Learning Environments (NLEs) were described as alternative learning environments that tap on the strengths and talents of the learners. These settings may be implemented at any stage of learning and are especially useful in situations when the learners have their needs that are not properly addressed in the traditional classroom settings. There are three types of field trips that can be applied in teaching and they include instructional, content-based and motivational field trips. Instructional field trips are meant to fulfil certain objectives of a course that cannot be effectively met by simply teaching in classrooms. The field trips are structured as content based which means that it is directly related to the content of the subject especially in higher institutions. Motivational field trips on the other hand are extracurricular activities, which are meant to arouse the interest of the learners and enhance the general school programme. There are a number of community places that can be used to improve mathematical thinking. Visiting banks will also enable the students to learn about interest, exchange rates, profit and loss. The shopping malls and markets are the places where one can teach estimation, arithmetic operations, transactions, discounts, and algebraic thinking. Measurement of solids and liquids can be taught by eating out and length, width, and breadth can be reinforced by visiting the textile industries or fabric stores. Real life contexts in teaching time, distance and speed are found at the train stations. Such familiar environments enable the learners to relate mathematical concepts to day-to-day activities hence motivate and comprehend.

To conclude, the continued low performance of students in Mathematics requires the implementation of new and learner-oriented teaching and learning methods. Field trips provide experiential learning that is rich and bridging the theory and practice. With the help of field trips, the teacher can encourage the deeper learning, better retention, and increase the skills of the students in

relation to applying mathematical concepts to the real world.

Statement of the Problem

Despite the popularity and wide range of acceptability and usage of Mathematics, students/learners' performance in Nigeria over the years has not been encouraging. Chief examiner's report on Mathematics examination (West African Senior School Certificate Examination) MAY/JUNE WASSCE 2008 - 2018, explained that there are evidences that questions from some areas of the syllabus were poorly handled. This may be attributed to inadequate preparation or poor interpretation of the demands of the questions. Most topics in Mathematics were known to have been taught using traditional/ conventional methods or integrative methods of teaching. Many suggestions have been made one of which has been the use of innovative teaching strategies. Various strategies have been introduced to improve teaching and learning of these mathematics topics. A strategy that is not commonly looked into is the use of field trip strategy. Little is known on the use of this strategy in the teaching and learning of Mathematics at secondary school level especially in Nigeria. Many students learn better by what they see. There has also been emphasis of activity-based learning for students in many other subjects and mathematics cannot be left out been one of the most important subjects at the senior secondary level. Many people would believe this to be impossible or rather a herculean task. Mathematics seen as central to the teaching and learning of other Science subject is seen as integral to Science Technology Engineering and mathematics (STEM) education. Teaching of STEM is seen as important in societal development. It then means that one of the best ways to teach STEM is by taking students to various locations in the society to see where and how concepts will be applied. Taking students to field to teach Mathematics could then be a viable option for effective learning of Mathematics and by extension STEM. Therefore, this study would determine the effect of Fieldtrip Strategy on Senior Secondary School Students academic achievement in Mathematics in Ile-Ife, Osun State, Nigeria.

Purpose of the Study

The main purpose of this study was to investigate the effect of Fieldtrip strategy on senior secondary school students' academic achievement in mathematics in Ile-Ife, Osun State, Nigeria. Specifically, the objectives of this study include;

i) examine the effect of Field Trips Strategy and Conventional Method on students' academic achievement in mathematics; and

ii) determine the joint effect of gender and instructional strategy on academic achievement of students in Mathematics

Research Hypotheses

The following null hypotheses were tested:

H_o1: There is no significant effect of Field Trip Strategy and Conventional Method on students' academic achievement in mathematics; and

H_o2: There is no significant joint effect of gender and instructional strategy on academic achievement of students in Mathematics.

Methodology

A quasi-experimental pretest- post-test non-equivalent control group design was adopted for the study. The sample was made of all SS I students in Ile-Ife, Osun State. The sample size was 50 senior secondary I students who were drawn from their intact classes in two randomly selected secondary schools. One intact class was assigned to the experimental group (n=25) and the other intact class to the control group (n=25). The Mathematics Achievement Test (MAT) was used to collect the data. The instrument was validated through face and content validation by experts in Mathematics Education and Measurement and Evaluation, who assessed the relevance, clarity and coverage of the test items in relation to instructional objectives. Kuder-Richardson Formula 20 (KR-20) was used to determine the reliability of the MAT, and the coefficient was 0.67, which was considered acceptable. Pretest was administered to both groups before treatment. The experimental group was taught “Measures of

Central Tendency" through a systematic field trip to the local markets while the control group was informed about the same topic in the traditional expository way. The duration for the treatment was four weeks, after which the posttest was administered to both groups. Data were analyzed using mean and standard deviation to answer the research questions, while Analysis of Covariance (ANCOVA) was used to test the hypotheses with the pre-test score as a covariate.

Instructional Package

The topic taught for the study is Measure of Central Tendency (Mean, Median, and Mode).

Mean, Median and Mode are called the measures of central tendency. They represent a whole set of data or information. The mean is often called the average. To find the mean, sum up the data after which you divide the sum by the number of pieces in the set.

The median is the middle number in an ordered set of data.

The mode is the number that occurred most in the given set of data.

Table 1: Guide for Field Trip

Field Trip Strategy	**Procedure**	**Steps**
Selection of Places of Excursion	• Identify objectives and plan of evaluation for the field visit. • Select the place to visit and arrange date and time. • Conduct pre-visit to familiarize yourself with the major features of the field and obtain address, directions, contact person and mobile numbers.	Teacher went around to identify Market that is near to school and provides maximum safety for learners

Field Trip Strategy	Procedure	Steps
Logistics Planning	• Apply for administrative approval and file requisition for transportation • Arrange special equipment like cameras and collect money for admission fees if the site demands. • Inform parents about the trips. • Create a list of student names and home phone number for emergency.	Teacher used market with lowest cost of transportation possible for the students. Teacher also gets permission from school authorities
Field Trip Preparation/ Pre-trip discussion	• Discuss the purpose of the field trip • Show photographs or posters of the site. • Set a standard conduct and discuss money usage, lunch plans, dress code and other necessary things. • Discuss how to ask good questions and make a list of open-ended observation questions to gather information. • Overview the field trip schedule.	Teacher explains what is expected of the students on the trip, introduces them to the topic and explains what they are expected to do on the Trip

Field Trip Strategy	Procedure	Steps
The Field Trip:	• Let students to sketch if it is necessary. • Ask prepared questions and note the answers. • Do things that you have planned.	Students were taken to two different markets that are close to the school environment. The names of the markets are; Oja-titun market and Stadium market in Oranmiyan, Ile-ife. Moremi Government High School is situated at Hezekiah Oluwasanmi Road 7, Ile-ife. It takes fifteen minutes to walk from the school to the Stadium. The students accompanied by the Researcher and her assistance took the first set of students to the stadium market where they were supervised to group and count the number of food stuff sellers, pepper sellers, and vegetable sellers. The following numbers were derived; (Moremi Government High School, Stadium Market) Pepper sellers = 10 Vegetable sellers = 6 Food item sellers = 8

Field Trip Strategy	Procedure	Steps
Post-field Trip:	• Let student to share their observations and reactions to field trip experiences. • Create classroom bulletin board displaying materials collected while on field trip. • Let class to compose thank-you letter to those who helped during the field trip. Include special information learned.	The number acquired were used to explain the concept of mean, median and mode. The highest number was 10 pepper sellers which is represented as the mode. Mode = 10 The average number of all the sellers is $\frac{10 + 6 + 8}{} = 24 / 3 = 8$ Mean = 8 Median is the number at the middle of any set of given numbers. In this case, the median is found thus: 10, 8, 6 or 6, 8, 10. (arranged in descending or ascending order) The median is 8 Oranmiyan high School, oja-titun Market) Students were taken to the market place to count and group shop owners in term of ethnic groups. Three major ethnic groups observed were: Yoruba, Igbo and Hausa

Field Trip Strategy	Procedure	Steps
		Yoruba = 25 Igbo = 15 Hausa = 10 Total = 50 Mean = 25+15+ 10/3 =16.67 Median =25,15,10 = 15 Mode = 25
Evaluating Field trip:	• What was the unique educational value in this trip? • Did students meet the objectives? • Was there adequate time? • Were there adequate staff and adult supervision? • What points to be emphasized next time? • What points to be emphasized next time? • What problems should be addressed in the future?	Teacher and students evaluated their experiences after the trip

Results

Research Hypothesis one: There is no significant difference in the performance of students taught using Teacher Expository Method and the students taught using field trip in Mathematics in Osun state.

This hypothesis was tested using Analysis of Covariance

(ANCOVA) where pre-test scores were used as covariates. Descriptive statistics revealed that students in Field Trip group scored higher in mean scores in the post-test as compared to those in the control group.

The ANCOVA value showed a significant main effect of instructional strategy on students' achievement in Mathematics ($F = 58.04$, $p < 0.05$). The null hypothesis was rejected thus. The mean score was presented in Table 1

Table 1: Descriptive Statistics of Students taught using teacher Expository and Field Trip method

Group	Mean	Std. Deviation	N
Conventional Method	9.1400	1.98987	50
Field Trip Strategy	11.8200	1.52114	50
Total	10.4800	2.21783	100

Table 1 showed that the mean performance of those taught using teacher expository method had a mean score of 9.14 while those taught using field trip had a mean score of 11.82. This showed that those taught using fieldtrip had a better academic performance in Mathematics than those taught using teacher expository methods in the study area.

Table 2: ANCOVA table of Students' Achievement Scores by Instructional Strategy (Using Pretest as Covariate)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	214.857[a]	2	107.428	38.296	.000	.441
Pre-test (Covariate)	35.297	1	35.297	12.583	.001	.115
Group	162.799	1	162.799	58.035	.000	.374
Error	272.103	97				
Total	11470.000	100				
Corrected Total	486.960	99				

Group	Sex	Mean	Std. Deviation	N
Conventional	Male	9.6923	1.97523	26
	Female	8.5417	1.86452	24
	Total	**9.1400**	**1.98987**	**50**
Field Trip	Male	12.2963	1.43620	27
	Female	11.2609	1.45282	23
	Total	**11.8200**	**1.52114**	**50**
Total	Male	11.0189	2.15273	53
	Female	9.8723	2.15303	47
	Total	**10.4800**	**2.21783**	**100**

Table 4 showed that the male taught using the conventional method had a mean score of 9.69 while the male taught using field trip had a mean score of 12.29, it also revealed that the female taught using the teacher expository method had a mean score of 8.54 while the female in the experimental group had a mean score of 11.26. This showed that in all respect, the male and female in the treatment group had a better performance than the male and female in the control group.

Table 5: Two-Way ANCOVA Summary on Effects of Gender and Instructional Strategy on Achievement

Source	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Pretest (Covariate)	29.748	1	29.748	10.287	.002	.097
Instructional strategy	176.393	1	176.393	61. 003	.000	.386
Gender	29.748	1	29.748	0.512	.475	.005
Strategy *Gender	0.083	1	0.083	0.029	.866	.000
Error	277.561	96	2.891			
Corrected Total	486.960	99				

Table 5 showed a significant main effect of instructional strategy on students' post-test achievement ($F = 61.003$, $p<0.05$), while the main effect of gender was not significant ($F = 0.512$, $p>0.05$). In addition, the interaction effect between the instructional strategy and gender was not significant ($F = 0.029$, $p>0.05$), showing that the effectiveness of the Field Trip instructional strategy did not depend on students' gender.

Discussion

This research project found out that students who were taught Mathematics through the Field Trip strategy was much better than those who were taught through the traditional expository approach. This is in line with previous research results that learner-centred and experiential instructional methods boost student academic performance. The outcome also confirms the effectiveness of Field Trip strategy in teaching concepts of mathematics such as statistics through the connection of classroom learning and real-life experiences. The research also established that gender had no significant effect on the academic performance of students, as well as, neither did it have an interaction with instructional strategy. This implies that Field Trip strategy is gender-neutral and helpful to both male and female learners. This observation is in line with the studies which showed no significant gender differences in Mathematics achievement in cases where the innovative teaching methods are used.

The findings indicated that the students taught using field trip performed better than students taught using expository method. This finding corroborated the findings of Yusuf (2006) and Amosa (2013). Yusuf (2006) noted that students taught using field trip performed better than the students taught using conventional method in teaching and learning Social Studies. This study showed that the use of field trip is not only applicable to social sciences and sciences but also in Mathematics. Also, Amosa (2013) affirmed that the gender of the learners is not a factor in teaching and learning of Mathematics; male students taught using community resources did not perform better

than female students who were also exposed to the community resources hence emphasizing that the strategy is applicable in Mathematics irrespective of the gender.

Suwapoleme, Estawul, Sababa, and Filgona (2016), in an attempt to investigate effect of fieldtrip on senior secondary school students' academic achievement in Geography in Adamawa State, Nigeria found that Fieldtrip Strategy appears to have a better record of success in increasing students' motivation to learn and enhancing higher academic achievement. Students taught Geography using Fieldtrip Strategy in the study performed significantly better than those taught using conventional method. However, the strategy has shown not to be gender friendly in that male students achieved better results in geography than their female counterpart hence. showing a disparity with the findings of this study.

The finding agrees with the finding of Agboola and Abe (2017) in a study to compare the effects of inquiry-based and fieldtrip instructional strategies on primary school pupils' performance and retention and attitude to basic science in Ekiti state, Nigeria. Agboola and Abe found that fieldtrip enhanced pupils' retention and attitude in Basic Science. Ogbuluijah (2014), carried out a study to investigate the effects of Students' Agricultural field trips on their performances in agricultural science in selected secondary schools in Rivers State. Ogbuluijah (2014) found out that field trip enhanced knowledge on agricultural processing methods, improves farm product utilization and contributes to species improvement and genetics and also students' performance. These findings agreed with the findings of the study.

Conclusion

The research finds that Field Trip instructional strategy is an effective approach in enhancing the academic performance of students in Mathematics. Field trips Learning Mathematics outside the classroom helps students gain knowledge on mathematical concepts, remember and apply them in real life. It was not identified that gender

is a determinant factor in the achievement of students, and this means that the Field Trip strategy is equally effective with both the male and female students. The plan is thus viable in enhancing the learning of Mathematics and facilitating STEM education.

Recommendation

According to the results of this study, the following recommendations are offered to the teachers, curriculum developers, and publishers of textbooks:

1. The developers of the curriculum must intentionally incorporate Field Trip-based learning activities in Mathematics curriculum at the secondary school level. Guides to curriculum should be explicit on the appropriate topics (statistics, mensuration, geometry and commercial arithmetic) in which field trips are effectively implemented, the proposed locations, learning outcomes and evaluation plans. To assist teachers in their effective classroom practice, the national Mathematics curriculum must offer clear instructions on how to plan, conduct and assess field trips, resource management and how the field trips relate to the learning outcomes.

2. Mathematics teachers should often incorporate and integrate Field Trip instructional strategies into classroom practice.

3. The mathematics textbooks should be integrated with field-based learning activities and examples that are real-life. Structured field trip activities, case studies of markets, farms, industries and financial institutions, guided questions that will encourage data collection, analysis and interpretation should be incorporated into the textbooks.

4. The textbooks in mathematics need to be updated to incorporate student centred and action-based exercises that are part of experiential learning, hence reducing the excessive dependence on the abstract and procedural problem-solving methods.

5. The curriculum planners and the textbook developers must make sure that the field trip activities must be gender inclusive because it was found that gender did not play a significant role in the academic performance of the students provided that proper instructions were used.

6. The curriculum developers, textbook publishers and teachers should be encouraged to collaborate in order to make sure that the instructional materials are contextually relevant, culturally correct and in line with the societal uses of Mathematics especially in support of STEM education.

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