IMPACT OF FIELD-BASED INQUIRY METHOD OF INSTRUCTION ON SCIENCE ACHIEVEMENT OF PRIMARY PUPILS OF PRIVATE SCHOOLS IN MAKURDI

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Abstract
Inspite of the recommendations of curriculum planners for teachers to use guided inquiry approach in teaching primary pupils, emphasis is still on conventional instructional strategy; though it is rich in content delivery, it does not engage students in active, authentic and scientific investigation. This study therefore determined the extent to which the field-based, inquiry method of instruction (FBIMI) will be effective in impacting primary school pupils' science achievement as compared to the conventional strategy. The study adopted a quasi-experimental design particularly a non-equivalent control pre-test and post-test group type. The sample for the study consisted of 329 pupils from six schools selected through both purposive and random sampling techniques. Basic Science and Technology Achievement Test (BSTAT) made up of 25 multiple choice items (of options A to E) was the instrument used in this study. The reliability estimate for BSTAT was found to be 0.87. It was found that teaching method, FBIMI is an important factor in science achievement of learners and the students exposed to FBIMI achieved significantly higher than those exposed to conventional strategy. The study revealed no gender disparity in science achievement with the use of FBIMI at primary school level. FBIMI is very suitable for pupils of primary school age therefore; Basic Science and Technology Curriculum by NERDC should include the use of outdoor, field-based experiences among its teaching and learning materials. Also, school supervisors should ensure that teachers use FBIMI as teaching strategy for basic science and technology.

Keywords: Inquiry method; Field-based inquiry strategy; pupils' science achievement; basic science

Introduction
Discoveries in psychology and brain neurophysiology led to new and renewed theories of learning which advocate knowledge construction rather than knowledge transmission. Inquiry-based curriculum and teaching techniques emerged as a combination of several such theories such as Lev Vygosky's constructivism theory, Bloom's taxonomy of learning, Piaget's theory of intellectual development, Howard Gardner's theory of multiple intelligences, Georgi Lazanov's theory of accelerated learning also called brain-based or whole brain learning. The origin of the modern day concept of science teaching as inquiry lies with the 1960s National Science Foundation (NSF) funded curriculum projects (DeBeor, 1991; Rudolph, 2002; Anderson, 2003). From the onset of the introduction of science into schools it was advocated that science instruction be based on sense perceptions and experience with the physical world, the gathering of data, rational argument and the drawing of conclusions based on available data.

The process of inquiry is aimed at enhancing learning by increasing learner involvement, multiple ways of knowing and sequential phases of cognition. Inquiry-based curriculum has been shown to develop independent and critical thinking skills, positive attitudes and curiosity

toward science and increased achievement (Johnstone & Al-Shuaili, 2001; Schneider, Krajcik, Marx & Soloway, 2002; Beerer, 2004; Wenning, 2005, Millar, 2009). Despite its advantages, few people practise inquiry-based education. As it is the case with any new pedagogy, there are a lot of forces opposing the practice of inquiry. For example, Abel and Roth (1992) and Beerer (2004) enumerated some of the factors influencing science teaching in primary school as insufficient instruction time in comparison to other subjects, teacher perception of the importance of science in an elementary curriculum, limited content knowledge held by elementary teachers, limited experience through formal course work in participating in and presenting hands-on science and lack of administrative support for the teaching of science. But Thiers (2000) argued that there are important economic, environmental and social realities that demand new skills and literacy from our students today. Igboko and Ibeneme (2006) identified globalization and rapid technological changes as some of the contributory factors to the shift from traditional educational practices such as programmed instruction, demonstration method and lecture or expository methods which have proved incapable of producing the effects required for coping with the challenges posed by globalization and rapid technological development. They further advocated that the realities of globalization earnestly calls for turning out skilled workers who are flexible, adaptable and imbued with higher-order thinking, problem-solving and collaborative work skills. Polman (2000) cited the Secretary's Commission on Achieving Necessary Skills (SCANS) as saying that the information-oriented and service-oriented sectors of the economy require more active problem-solvers, rather than passive direction followers, and that inquiry based curricula and pedagogy are out to address this need.

In Nigeria, Olanrewaju (1999) and Martins (1994) identified a mode of teaching in schools whereby teachers are initiators of learning and pupils are passive listeners. Albert (2000) observed that this method is rather a familiar feature of science classes in which teachers provide students with a large set of science facts along with the many special science words that are needed to describe them. According to Albert such teacher seems to be preparing students for a quiz competition rather than preparing them for life and so his teaching may not capture the interest of students who are making preparation to cope with life.

In America the National Research Council (NRC) and American Association for Advancement in Science (AAAS) have developed a programme of science teaching by inquiry across the K – 12 grades (NRC, 2000, 2001). As a matter of fact the inquiry pedagogy has been adopted by the entire American Science Community as well as the National Science Teachers Association (NSTA), the National Association for Research in Science Teaching (NARST) and the Association for Educators of Teachers of Science (AETS). Beerer (2004) opined that life-long literacy is not just knowing how to read and write but to acquire the ability to understand and use science. Literacy in science and ability to use science has actually placed some nations of the world as advanced and others as third world countries. According to the National Science Education Standards (NSES), to develop a scientific individual entails providing classroom learners with a science curriculum that teaches science as a body of knowledge and as a way of knowing about the natural world based on evidence from observation and experimentation (NRC, 1996)
Inquiry is central to science teaching and learning. When engaged in inquiry, students describe objects and events, ask questions, construct explanations, test those explanations against current or prevalent scientific knowledge and communicate their ideas to others (NRC, 1996; Beerer, 2004). Beerer concurs with the idea that inquiry approach is multifaceted and he outlined its benefits which include fostering curiosity as a habit of the mind and providing teaching strategies for motivating learning. Albert (2000) added that knowledge gained by

inquiry approach is more likely to be retained and incorporated permanently into the students' view of the world than knowledge gained otherwise.

The emphasis on inquiry based approach to teaching is not found in reports, standards and reform movements in America alone. In Africa and Nigeria in particular, frantic efforts have been made towards this direction of teaching and learning science. The African Primary Science Project (APSP) later called Science Education Programme for Africa (SEPA) and the Nigerian Integrated Science Project (NISP) are good examples of efforts towards inquiry based instruction. Topmost on the list of the aims of APSP is to develop children with first hand familiarity with a variety of biological, physical and man-made phenomena in the world around them. Secondly, to develop children in further exploration of the world around them based on their own initiative. Thirdly, to develop in children the ability to find out things for themselves, to see problems and be able to set about resolving them. On the basis of these aims the curriculum was focused on the study of concrete phenomena.

In Nigeria, Martins (1994) affirms that in the inquiry approach, memorization of isolated facts is discouraged. Instead, students are encouraged to 'learn how to learn'. She further highlighted the teaching methods recommended in Science Teachers Association of Nigeria (STAN) newsletter no. 1 (1970) as follows:

(i) use of discovery teaching tactics;
(ii) inclusion of problem solving activities;
(iii) involvement of students in open ended laboratory exercises.

As a matter of fact, all the methods recommended are inquiry based. Despite the overwhelming acceptance of inquiry focused learning based on concrete, biological, physical and man-made phenomena, research reports on how to teach using such a method are not common. Presently the philosophy of science education has slightly changed to emphasize technology education as early as primary school level so that learners acquire the skills they need for life and work. Achor (2003) observed that besides making the technology aspect of the curriculum so outstanding early in a child's education, basic science and technology requires that learning be made practical to depict its inquiry oriented nature and so make it easier to understand.

Direct field experiences with opportunities for active, authentic scientific investigation offers promise of helping pre-service teachers develop the needed skills for inquiry-based teaching (Nugent, Kunz, Levy, Harwood & Carlson, 2008). It is hoped that this approach will also be useful in helping primary school pupils' to improve their science achievement, retention of science knowledge and acquisition of science process skills. The problem of science teaching in Nigeria is not so much the issue of poor curriculum as it is of poor implementation. Moreover, in primary schools, implementing a standard based curriculum is a formidable challenge to primary school teachers most of whom are not specialists.

The science community worldwide has accepted the superiority of the inquiry approach to teaching and learning science over other methods. However, research on the impact or effectiveness of field-based inquiry method of instruction on primary school pupils' learning of science is scarce, especially at the lower basic level in Benue State and Nigeria. The State is noted to witness poor achievement of students in science at the secondary school level (Ogbeba, 2009; Shikkan, 2006) and therefore researchers have began to question what happens in terms of achievement at the primary school level. Etuk, Etuk, Etukudor-Eyo and

Samuel (2011) noted the poor performance of pupils in science at the primary school level in Nigeria. The authors also found that constructivist instructional strategy facilitated pupils' achievement in science more than expository instructional strategy.

This researcher is interested in finding out the impact of a field-based inquiry method of instruction on basic science and technology achievement. Thus, this research assessed the influence of field activities, as compared to classroom-contained activities on primary school pupils' science achievement. Rickinson, Dillon, Teamey, Morris, Choi, Sanders and Benefield (2004) concluded that well planned and delivered field work provides experiences that cannot be duplicated in the classroom; it positively impacts learning leading to reinforcement between affective and cognitive domains of learning and higher level learning.

Pupils in primary school are said to achieve in science when they are able to group similar materials and relate their basic properties to everyday uses. They should be able to describe the growth of plants and explain the life-cycles of familiar animals; give examples of forces, including the behaviour of magnets. From simple practical investigations, they should be able to observe main features and changes, and recording their findings as a picture or display; name and describe planets of the solar system, outline the water cycle, and sort animals into main groups. They need to know more about specific forces such as friction and gravity, and build, explain simple electrical circuits, explain a wider range of scientific ideas, such as how water could be purified, or how plants reproduced and benefited the environment by producing oxygen. They are expected to demonstrate understanding of the basic properties of electricity, light and sound, and how different forms of energy could be inter-converted (Martin, Mulis, Beaton, Gonzalez, Smith, & Kelly, 1997).

The question as to whether there are gender differences in mathematics and science achievement remains unanswered. While some findings indicate that there are differences, it is unclear whether such differences are actually gender or age – specific or they are due to differences in attitudes or opportunities for mathematics and science (Ogbeba, 2009; Etuk, Etuk, Etukudor-Eyo & Samuel, 2011). Specifically, there were no gender differences in problem solving in elementary or middle school, but differences favouring males emerged in high school and in college (Manning, 1998; Lee, 2002). This researcher is interested in finding out what obtains in primary school class five in (lower basic five) in Makurdi, Benue state.

Statement of the Problem

Over the last four decades, a lot of efforts have been made towards curriculum improvement, in the area of teaching methods and the achievement of Nigerian students in the sciences. Other efforts at promoting science learning and the choice of science courses in colleges and universities included the 60:40 admission policy in tertiary institutions in favour of science courses, scholarship allowances paid to science students and science allowances paid to science teachers and so on. These efforts have not really yielded the expected outcome, neither have science students filled the 60% quota given them. No nation of the world became technologically developed by simply exposing her citizens to the facts, principles and theories of science. Rather, it is the involvement of learners in active hands-on activities through inquiry pedagogy that could lead to technologically developed minds which are capable of causing technological development.

In Nigeria, studies by Mani (1981), Olanrewaju (1999), Tarjudeen (2001) and Shikaan (2006) showed that inspite of the recommendations of curriculum planners for teachers to use guided inquiry approach in teaching, this is not done. The traditional expository approach to teaching, though rich in content delivery, does not engage students in active, authentic, scientific investigation, nor does it adequately address the problem solving process and inquiry skills students need to acquire to cope with today's world.

This study therefore determined the extent to which the field-based, inquiry method of instruction will be effective in impacting primary school pupils' science achievement as compared to the conventional strategy.

Purpose of the Study

The purpose of this study was to determine the impact of field-based inquiry method of instruction on primary school pupils' science achievement. The study set out to achieve the following specific objectives:

(i) Determine the difference if any in the achievement of pupils taught science using field-based inquiry method of instruction and the achievement of those taught science by conventional strategy.

(ii) Compare the achievement of boys and girls taught using the field-based inquiry method of instruction.

Research Questions

The study aimed at finding answers to the following questions:

(i) What is the difference in science achievement between pupils taught science using field-based inquiry method and those taught using conventional strategy?

(ii) How do girls compare with boys in mean science achievement when exposed to the field-based inquiry method of instruction?

Research Hypotheses

The following null hypotheses (Ho) were tested at 0.05 alpha level of significance:

Ho_1 There is no significant difference between the mean achievement scores of pupils taught science using field-based, inquiry method of instruction and those taught with conventional strategy.

Ho_2 The mean achievement scores of boys and girls do not differ significantly when they are taught using the FBIMI.

Research Method

The study adopted a quasi-experimental design, investigating cause - effect relationship. The type of quasi-experimental design adopted was the non-equivalent control group design. This is because intact classes existing in the primary schools were used in order not to disrupt school operations. Specifically the result of the experimental group which was taught using the field-based inquiry method was compared with the control group, which was taught using the lecture method. Quasi-experimental design approximates the conditions of true experiments in a setting which does not allow control and manipulation of variables. Sambo (2008) is of the view that it is natural to use existing classrooms in schools for a study and a lot simpler than to start creating classroom groups through random selection and random assignment. He further comments that the non-equivalent control group design is worth using when the true experimental designs are not possible.

The study population consists of all primary five (5^{th} graders) pupils of the 118 government approved private primary schools in Makurdi, Benue state. Available data in the Ministry of Education statistic department, Makurdi area dated April, 2011 showed that there were 10,620 primary five pupils. Primary five pupils are particularly chosen because they are expected to have covered a significant amount of what should be taught in primary school in basic science and technology curriculum. The choice is also to check the interference of pupils' literacy level and the comprehension of concepts taught since at this level, most pupils can read and write.

The sample for the study consisted of three hundred and twenty-nine pupils (329) from six schools selected by random sampling. Ali (2006) said that smaller samples are preferred for experimental studies in order not to make the study unwieldy or intractable since experimental studies impose more rigorous demands on the researcher. The sample size was selected in consideration of the fact that the study was a quasi-experimental design and the time and attention primary school pupils needed to be given to do the activities. Purposive and random sampling was used to select six government-approved private schools within the different parts of Makurdi local government area. The purpose for choosing the private schools was to avoid interruption of the research work through any unforeseeable strike actions of teachers of the public schools.

Instrumentation

Basic Science and Technology Achievement Test (BSTAT) was the instrument used in this study. This instrument was initially a 30-item multiple choice objective test, drawn from topics in the national primary school curriculum for Basic Science and Technology (NERDC, 2007) module five and Basic Science and Technology for Primary Schools book five by the Science Teachers Association of Nigeria (STAN, 2010). The items were drawn based on two of the four themes. The topics covered under the two themes were domestic animals, domestic animals as pets, reproduction in plants, acids, bases and soaps. The test items were presented to two professors and a senior lecturer in the science education for validation.

The items were rephrased or reconstructed by experts, after which it was trial-tested in a pilot study on a similar sample like the study sample for reliability estimate. The item difficulty index for each item was also analyzed using the scores of trial testing. The 25 items that scaled through the exercise were used to construct a table of specification to show the spread of items based on Bloom's taxonomy of objectives. Table 1 refers.

Table 1: Table of specification for the development of basic science and technology achievement test (BSTAT) based on Bloom's Taxonomy of Objectives

S/No	Contents		Knowledge 44%	Comprehension 36%	Application 20%	Analysis	Synthesis	Evaluation	Total 100%
1.	Domestic animals	16%	2	1	1	-	-	-	4
2.	Domestic animals as pets	20%	2	2	1	-	-	-	5
3.	Reproduction in flowering plants	20%	2	2	1	-	-	-	5
4.	Acids	20%	2	1	2	-	-	-	5
5.	Bases	8%	1	1	-	-	-	-	2
6.	Soaps	16%	2	2	-	-	-	-	4
	Total 100%		11	9	5	0	0	0	25

Basic Science and Technology Achievement Test (BSTAT) and the two-types of lesson notes were given to two professors and a senior lecturer in science education, Benue State University for critical examination. They were requested to study the objectives of the research and ascertain if the items had face and content validity; that is, if they both covered the topics to be taught, were grammatically correct and tested the objectives of the topics treated and were relevant to the research objectives and questions. They were also requested to make their recommendations as to whether they were suitable for primary school children to appropriately interpret and respond to. Similarly, they examined the suitability of the lesson notes in teaching inquiry-focused lessons and lecture lessons. Some of the tests items were rephrased for clarity and easy understanding to the primary school pupils.

The lesson notes for field-based inquiry method were also corrected to highlight their specific use as well as align with the expected format of lesson note preparation. The corrected instrument and lesson plans were used for item analysis in order to determine the difficulty index of the test items for Basic Science and Technology Achievement Test. Only 25 items out of 30 initial items constructed were found to possess the acceptable difficulty index of 0.3 to 0.7. The twenty-five items were then used for reliability analyses of the instrument using Kuder Richardson 21. The reliability estimate for BSTAT was found to be 0.87.

Data Collection Procedure

Six research assistant teachers were trained. The first phase of the training involved introducing the assistants to the lesson plans written by the researcher for use. The method was explained to them and the objectives of the research were made known to them. The teachers were allowed to privately study the six lesson plans and another meeting was conveyed for them to ask questions and have their difficulties and doubts cleared. The second phase involved taking a walk round the school premises to find out the possibility of teaching the individual lessons in

their respective school environments. The research assistants were involved in teaching, conducting test and marking of scripts.

The researchers along with the research assistants went round to conduct the pre-test in the six schools selected. The teachers were allowed to teach for six weeks, with occasional visits from the researchers to clarify issues and observe lessons. The experimental group was taught using the field-based inquiry method while the control group was taught using the conventional strategy. After the six weeks teaching the researcher went round the schools to administer the post-test having reshuffled the items in the BSAT. All teachers who participated in the teaching were duly motivated. Where pupils needed exercise books they were supplied with some. All the tests were administered and marked by the researchers and research assistants.

Results

Mean and standard deviation were used to answer the research questions. All the hypotheses were tested using Analysis of Covariance (ANCOVA) in agreement with Ali (2006) who asserted that it is a more rigorous statistics than Analysis of Variance (ANOVA) and is used for multi-group comparison. He further stated that ANCOVA is specifically used in a pre-test/post-test quasi experimental research design and/or when subjects are selected. When intact classes are used for treatment and control respectively, the gain score, the difference between the pre and post test means are analyzed to determine the statistical significance between and within groups, as covariates between pre-test and post-test.

Research Question 1

What is the difference in science achievement between pupils taught using field-based inquiry method and those taught using conventional strategy?

The result of data analysis to answer this research question is as presented in Table 2.

Table 2: Mean and standard deviations of pretest and posttest for experimental and control groups in BSTAT

Method	Test	N	Mean	Standard Dev	Mean Gain
Field-based inquiry method	Pretest	182	9.9945	2.6458	6.2198
	Posttest	182	16.2143	3.9238	
Conventional strategy	Pretest	147	7.9796	2.6650	3.5510
	Posttest	147	11.5306	3.5852	
Mean Difference	-	-	-	-	2.6688

Table 2 shows that the mean gain, that is, the difference between pretest and posttest means of the experimental group was 6.22. This mean gain was higher than the control group mean gain which was 3.55. This gives a mean difference of 2.67 in favour of the experimental group.

The experimental group achieved higher than the control group. To ascertain if the difference in achievement was significant, hypothesis one was tested.

Hypothesis 1

There is no significant difference between the mean achievement scores of pupils taught science using field-based inquiry method of instruction and those taught with the lecture method.

The results of data analysis to test hypothesis 1 is as presented in Table 3.

Table 3: ANCOVA for experimental and control group students' achievement

Source	Sum of squares	Df	Mean square	F	Sig of F
Corrected model	4116.860a	4	1029.215	143.101	.0001
Intercept	599.087	1	599.087	83.297	.0001
Pretest	2322.712	1	2322.712	322.948	.0001
Method	488.911	1	488.911	67.978	.0001
Error	2330.277	324	7.192	.	
Total	72056.000	329			.
Corrected total	6447.137	328			

a. R Squared = .639 (Adjusted R Squared = .634)

Table 3 shows that there is a significant difference between pupils' mean achievement of the experimental group and control group. The calculated F value 67.98 is significant at 1 and 328 degrees of freedom because P value of 0.001 is less than 0.05 (P=0.00<0.05) alpha value. The null hypothesis is therefore rejected. There is a significant difference between the mean achievement scores of pupils taught science using FBIMI and those taught with the lecture method.

Research Question 2

How do girls compare with boys in mean science achievement when exposed to the field-based inquiry method of instruction?

The results of data analysis to answer this research question is as presented in Table 4.

Table 4: Mean and standard deviation for pretest and posttest experimental male & female students in BSTAT

Sex	Test	N	Mean	Standard Dev	Mean Gain
Male	Pretest	103	9.7282	2.8395	6.7568
	Posttest	103	16.0485	3.9142	
Female	Pretest	79	10.3418	2.3419	6.0886
	Posttest	79	16.4304	3.9506	
Mean Difference	-	-	-	-	.6682

Table 4 shows the mean achievement scores of girls and boys (pupils) on BSTAT exposed to FBIMI. The mean gain for boys was 6.76 and that of girls was 6.09 with mean difference of 0.67 in favour of boys. This implies that girls achieved slightly higher than boys when taught by FBIMI.

To ascertain if this difference was significant or not, hypothesis five had to be tested.

Hypothesis

The mean achievement scores of boys and girls do not differ significantly when they are taught using the FBIMI.

The results of data analysis to test hypothesis 5 is as presented in Table 5.

Table 5: ANCOVA for experimental students' achievement by gender

	Sum of squares	df	Mean square	F	Sig of F
Corrected model	1474.584a	2	737.292	100.586	.0001
Intercept	334.144	1	334.144	45.586	.0001
Pretest	1468.066	1	1468.066	19.121	.0001
Sex	3.536	1	3.536	200.284	.488
Error	1312.059	179	7.330	.482	
Total	50635.000	182			.
Corrected total	2786.643	181			

a. R. Squared = .529 (Adjusted R Squared = .524)

Table 5 shows that value of F Calculated which was 0.48 is not significant at 1 and 181 degrees of freedom because P value was 0.49 and higher than 0.05 alpha value ($F_{1, 181}$ =0.48, P = 0.49> 0.05). Therefore the null hypothesis was not rejected. This implies that there is no significant difference between the achievement of boys and girls who are taught by the FBIMI. It then means that gender is not a significant factor in the mean achievement of boys and girls who were taught primary science by FBIMI.

Discussion of Findings

The study centered on the impact of a field-based inquiry method of instruction on pupils' science achievement. It is found that students in experimental group achieved higher than students in control group. That there was a significant difference in mean achievement between pupils exposed to field-based inquiry strategy and those exposed to conventional strategy. The implication of this is that method is a significant factor in pupils' achievement in basic science and technology. Thus pupils taught using the FBIMI performed better on the BSTAT than their counterparts who were taught using the conventional strategy.

The reason for the better achievement in science by the experimental group may be linked to the fact that pupils of primary five class are within the concrete operational stage. Tolman (2002) said, the concrete operational stage spans the elementary grades and calls for abundance of concrete experiences in learning. He advocated for the inclusion of opportunities for interaction with the physical and social environments to observe, manipulate, ask questions and experience science concepts. When pupils had opportunity and were encouraged by the teachers to observe on the field, manipulate concrete materials, discover differences in flower parts, soaps, animals and test for acid and bases in natural substances it boosted their curiosity and spurred them on to learn. At the end of the teaching session pupils had opportunity for development of process skills and carried out exercise on the Acquisition of Science Process Skills Test (ASPST) with much excitement. As such the pupils found the FBIMI suitable for learning and therefore achieved higher than their counterparts. This result also confirms what Martins (1994), I-shin (2009), Gbodi and Dantani (2009), Eronkhon (2004) found in their researches that inquiry method and hands-on method led to higher achievement in science among primary school pupils and even secondary school pupils. It also confirms the view of other authors such as Johnstone and Al-shuaihi, (2001); Schneider, Krajcik, Mark and Soloway,

(2002); Beerer,(2004); Wenning (2005); Millar, 2009) who said that inquiry based teaching results to critical thinking skills, positive attitudes and curiosity toward science and increased achievement.

It is also found that boys had a mean achievement test higher than that of girls with a negligible mean difference but the difference was found to be insignificant. This implies that gender is not a significant factor in pupils' science achievement in primary school. This means that both male and female pupils under the same condition will achieve equally well in science. The researchers assert that like many authors Gyuse, (1989) Okeke (2008), that gender differences in performance are caused by stereotyping of parents, teachers and society. Especially when children begin to turn into adolescent in Africa there is so much restriction about what a girl should do and what is not proper, this has a way of silencing many other desirable qualities even her academic performance. The authors also have consistently discovered no disparity in both acquisition of process or psychomotor skills as others call it and even cognitive achievement in primary school pupils. The findings of I-Shin, (2009) discovered no significant difference among males and females in primary 5 school pupils in their performance on hands-on activities. Gbodi and Dantani, (2009) also found no disparity exhibited in learning primary science among boys and girls who were taught using realia. Gyuse (1989) pointed out that the assertion that boys perform better than girls is an age long sex-stereotype but has not been confirmed by research at least not among primary school pupils. The so-called gender difference in mathematics and science achievement was not seen in the findings of this research. Manning, (1998); Lee, (2002) even wondered whether the differences were actually gender or age-specific or they are differences in attitudes or opportunities for mathematics and science. However, Pennet and Paret (2008) said that differences were discovered as early as kindergarten level.

Conclusion

Teaching method FBIMI is an important factor in science achievement of learners. The study revealed no gender disparity in science achievement with the use of FBIMI at primary school level. If the right method is employed for teaching it is hoped that both boys and girls will continue to perform equally well in their science career.

Recommendations

The following recommendations are made based on the findings of this research:

(i) FBIMI has shown to be suitable for pupils of primary school age therefore, Basic Science and Technology Curriculum by NERDC should include the use of outdoor, field-based experiences among its teaching and learning materials in column six of the Basic Science and Technology Curriculum. School supervisors should also ensure that teachers use it as teaching method for basic science and technology.

(ii) Teacher training institutions such as colleges of Education, University Faculties of Education should train pre-service teachers in the use of FBIMI

(iii) Proprietors should make school environment conducive for the use of FBIMI. Teaching aids like school gardens and animal farms should be necessary features of schools.

(iv) Teachers should not restrict themselves to the four walls of the classroom they should explore the environment as they lead pupils to study phenomena and materials on the field.

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