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EFFECTS OF BRAINSTORMING AND FIELD TRIP TEACHING METHODS ON SENIOR SECONDARY SCHOOL PHYSICS STUDENTS' ACHIEVEMENT IN BWARI AREA COUNCIL, ABUJA

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Abstract

The study investigates the effect of brainstorming and field trip teaching methods on senior secondary school physics students' achievement in the Bwari Area Council, Abuja. This study adopted a quasi-experimental pre-test and post-test control group design. The population of this study comprises all SS2 students in public secondary schools in the Bwari Area Council, Abuja. A simple random sampling technique was used to select three classes of senior secondary physics students studying in six schools. The classes selected were randomly distributed to treatment and control groups (comprising 226 students), respectively. However, the purposive sampling technique will be used to select three SS2 physics teachers in each of the schools selected to serve as research assistants. The researcher developed an instrument tagged the Physics Achievement Test (PAT). Two research questions with two corresponding hypotheses were formulated to facilitate the study. The data collected for the study were classified into pre-test and post-test scores for both experimental and control groups. Descriptive statistics were used to get the group mean scores and standard deviation of students' performance in the Physics Achievement Test (PAT). The null hypotheses were tested using ANCOVA at the alpha 0.05 level of significance. The study showed that brainstorming and field trip teaching methods have a highly significant effect on senior secondary school physics students' achievement.

Keywords: Brainstorming, field trip, achievement.

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Iintroduction

Science is the study of nature; it is a body of knowledge which can be made into a system and which depends on seeing and testing facts, while technology is the practical application of scientific knowledge. A nation without science and technology is definitely a backward nation. Such a nation will be considered underdeveloped. Science and technology are associated with modernity, and they are essential tools for rapid development in Nigeria. Consequent to the nation's endorsement of international protocols for education for all (EFA), the millennium development goals (MDGs), the education of national economic empowerment development and strategy (needs) and the Nigerian educational research and development council, greater emphasis is now being placed on industrial and technological development. It is of interest to know that science subjects hold an important position in the achievement of these goals and objectives (NERDC, 2007). Students are therefore encouraged to take up science-related subjects. It is pertinent to note that for Nigeria to be able to compete favourably in technological advancement with other developing nations of the world, there is the need to make science more interesting among learners and to ensure effective teaching and learning of sciences in schools.

One of the key science subjects is physics. It is a branch of science which deals with the study of matter and its relationship with energy (Anyakoha, 2015). Therefore, the subject of physics embodies the study of the principles and applications of the subject of the three states of matter, namely, solids, liquids and gases, which are indeed interrelated with respect to their energy production. Physics deals with practical and experimental understanding of natural phenomena that brings about the acquisition of the process skills of science methods. The style used in teaching either promotes or inhibits learning. Therefore, physics teachers need to use the appropriate teaching styles and methods that can stimulate the interest of students towards the learning of the subject so as to realise the ultimate goal. In the curriculum and in the national policy on education, research shows that poor achievement and declining interest in physics often result from the persistent use of teacher-centred methods, such as lectures and note dictation, which affect students' active participation and conceptual understanding. To improve the quality of teaching and learning in physics, educators have advocated for innovative, learner-centred methods such as brainstorming and field trips. These methods are believed to enhance students' cognitive, affective and psychomotor domains, leading to better achievement in the subject.

Brainstorming, according to Akinboye (2015), is a group creativity forum for general ideas. In brainstorming, every participant in the group is encouraged to suggest as many ideas as possible. It is particularly a good way of getting bright ideas. In this teaching method, all ideas are given equal credence. Participants are encouraged to let ideas flow freely, building on and improving from previous ideas.

Brainstorming is a cooperative teaching strategy where learners generate ideas or solutions around a specific topic or problem. It encourages active participation, creative thinking and collaboration among students. In physics, brainstorming can help learners connect prior knowledge with new concepts, promoting deeper understanding.

According to Wikimedia (2016), a field trip or excursion is a journey by a group of people to a place away from their normal environment. A field trip involves taking students outside the classroom to experience learning in real-world contexts, such as visiting power plants, weather stations or research centres. It provides opportunities for direct observation, inquiry and application of theoretical principles, which strengthens retention and fosters interest. It refers to activities carried out during the course of instruction by the teachers and students outside the four walls of the classroom. Such works are carried out in a real, natural environment rather than in a theoretical way or controlled conditions. This gives the learners first-hand information on the aspect of the topic because learners are given the opportunity of observing the phenomena happening in real-life situations.

Adeyemi (2018) describes academic achievement as the scholastic standing of a student at a given moment, which states individual ability. It refers to a person's teaching ability, which could result in positive or negative performance. Academic achievement is used to measure the state of a student's cognitive, affective and psychomotor domains. Students' academic achievement can be explained in the form of scores obtained from tests or examinations on courses taken. Achievement refers to the measurable performance of students in a given subject area.

Several studies have demonstrated the effectiveness of the methods:

Okoye & Nwafor (2021) found that brainstorming enhances students' conceptual understanding and teamwork in science classrooms. Eze (2025) reported that field trips improve students' retention and appreciation of physics concepts. Adeyemi (2018) observed that students exposed to brainstorming and field trips performed significantly better than those taught with the lecture method. These studies indicate that learner-centred strategies can positively affect achievement, retention and interest in physics.

Brainstorming and field trip teaching methods will likely enhance physics students' achievement. Hence, the researcher examined the effect of brainstorming and field trip teaching methods on teaching some selected physics concepts and their effects on students' achievement. The main purpose of the study is to determine the effects of brainstorming and field trip teaching methods on senior secondary school (SS2) students' achievement in physics in Bwari Area Council, Abuja. The study specifically seeks.

1. What is the difference in the mean achievement of senior secondary school (SS2) physics students taught using brainstorming and field trip teaching methods?

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2. What is the influence of gender on the interest of senior secondary (SS2) physics students taught using brainstorming and field trip teaching methods?

These questions aim to unpack both individual and joint efforts of the two active pedagogies. The first investigates whether collaborative ideal generation enhances conceptual understanding. The second examines gender interest in physics. It also compares which method may be more effective in a Nigerian senior secondary school context. Together, they provide the comprehensive evaluation of how active learning can transform physics education for Nigerian students.

Hypothesis

The following null hypotheses were formulated to guide the study at 0.05 level of significance.

HO1: There is no significant difference in the mean achievement of Senior Secondary School (SS2) Physics students are taught using brainstorming and field trip teaching methods.

HO2: Gender does not significantly affect the interest of Senior Secondary School (SS2) physics Students were taught using brainstorming, field trips and conventional teaching methods.

These null hypotheses allow empirical testing of the impact of both strategies and the traditional teaching method. Rejecting HO1 would suggest that brainstorming and field trip methods enhance learning compared to lectures. 324

Method

The study adopted a quasi-experimental pre-test and post-test control group design. Quasi-experiments are experiments used when a researcher cannot use random assignments of subjects or groups (Nworgu, 2015). The population of the study comprised all senior secondary (SS2) 2025/2026 physics students in the Bwari Area Council, Abuja. A simple random sampling technique was used to select six classes of senior secondary (SS2) physics students in six schools in the Bwari Area Council. The classes selected were administered a pretest, and the result of the pretest was used to identify three public secondary schools of similar abilities to obtain similar groups. A pretest was conducted before the experimental teaching. The reason for the use of a pretest-posttest design is to find out if the independent variables have caused a change in the achievement. The results discussed from the pretest were then used to divide the students into three groups to ensure similarity of the three groups; their means and standard deviation were used to test for the significance of difference among the means. Random assignment was used to assign the three groups to two experimental groups and one control group. The study is limited to three schools in this quasi-experimental design in order to enable the researcher to have adequate control over the students used for the study. The SS2 intact classes of each of

the three schools identified were randomly assigned to treatment (A and B) and control group (C), respectively. The choice of drawing the three groups from different schools is to check any possible interaction that may affect the authenticity of the result of the study. In all, the study has two experimental groups (schools), and one school was used for the control group. The number of students that participated in the study was 226 students from the three schools used. The number of students that participated in group A was 86 students (50 boys and 36 girls), while group B was 62 students (39 boys and 23 girls) and those of group C was 78 students (48 boys and 30 girls). The researcher developed an instrument, the Physics Achievement Test (PAT), to collect data for the study.

Results

Research question 1:

What is the difference in the mean achievement of senior secondary school (SS2) physics students taught using brainstorming and field trip teaching methods?

Table 1

Descriptive statistics for students' mean achievement scores taught using the three methods (maximum score obtainable = 40 marks).

Group	Treatmen Method	N	Pre-test		Post-test		Mean gain
			$\bar{x}$	SD	$\bar{x}$	SD	
A	Brainstorming Method	86	17.78	1.99	29.73	5.69	11.95
B	Field Trip Method	62	16.24	2.25	27.77	3.20	11.53
C	Control Group	78	16.82	2.74	19.71	4.14	2.89

Note. M = Mean; SD = Standard Deviation.

The result shows that students in the experimental groups (A and B) and control group (C) demonstrated similar academic ability prior to the experiment, as reflected by relatively close values of mean and standard deviation for the three groups (A, B and C) in the pretest.

However, after the treatment, students in experimental group A had the highest mean posttest score of 29.73 and highest standard deviation of 5.69, followed by those in experimental group B with a mean posttest score of 27.77 and standard deviation of 3.20, and lastly control group C with a mean posttest score of 19.71 and standard deviation of 4.14.

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Table 2

ANCOVA Summary Table for Students' Mean Pretest Scores

Source of Variation	Sum of Squares	Df	Mean Square	F_{cal}	F_{tab}
Between Groups	64.557	2	32.278	1.39	3.00
Within Groups	5160.483	223	23.141	—	—
Total	5225.040	225	—	—	—

Note: df = degrees of freedom.

Similarly, Table 2 shows the F-calculated in pretest (1.39) is less than the F-tabulated (3.00) at 0.05 alpha, 2 degree of freedom for between sets and infinity degrees of freedom for within sets, which indicate that there is no significant difference between the mean pretest scores of students in experimental groups (A and B) and control group C.

To determine whether the differences in mean achievement scores between experimental groups (A and B) and control group C are significant. Null hypothesis 1 was tested.

Hypothesis 1:

There is no significant difference in the mean achievement scores of senior secondary school (SS2) physics students taught using brainstorming, field trip and conventional teaching methods.

Table 3

Summary of Analysis of Covariance (ANCOVA) of Students' Mean Achievement Scores

Source of Variation	Sum of Squares	Df	Mean Square	F_{cal}	F_{tab}	Remark
Between Groups	3902.339	2	1951.170	93.86	3.00	Reject
Within Groups	4636.047	223	20.789	—	—	—
Total	8538.386	225	—	—	—	

Note: df = degrees of freedom; ANCOVA = Analysis of covariance.

The result presented in Table 3 shows that F-calculated (93.86) is greater than F-tabulated (3.00) at 0.05 alpha level, with 2 degrees of freedom for between sets and infinity degrees of freedom for within sets. This suggests a statistically significant difference between the mean achievement scores of students taught physics using brainstorming, those taught using field trips and those taught using conventional teaching methods. Thus, the null hypothesis is rejected

Research question 2

What is the influence of gender on the interest of Senior Secondary (SS2) physics students taught using the brainstorming and field trip method?

Table 4

Descriptive Statistics for Students' Mean Interest Scores Based on Gender

Group	Treatmen Method	Gender	N	Pre-test		Post-test	
				$\bar{x}$	SD	$\bar{x}$	SD
A	Brainstorming Method	Male	50	138.60	44.68	168.60	31.71
		Female	36	135.80	48.60	167.05	31.48
B	Field Trip	Male	39	133.70	39.83	162.80	30.82
		Female	23	137.45	27.93	162.60	31.13
C	Control Group	Male	48	133.35	30.87	162.15	28.78
		Female	30	132.05	15.96	162.90	27.61

Note: M = Mean; SD = Standard Deviation.

The result in table 3 shows the descriptive statistics for the difference between mean interest scores of male and female students taught physics using brainstorming, those taught using field trips and those taught using conventional teaching methods. The result indicates that both male and female students in the experimental groups (A and B) and control group (C) exhibited similar interest in physics before the treatment, as reflected by relatively close values of the pretest mean interest score and standard deviation for the three groups, and after the treatment, as shown in Table 3.

Hypothesis 2:

Gender does not significantly affect the interest of senior secondary (SS2) physics students taught using brainstorming, field trips and conventional teaching methods.

Table 5

ANCOVA Test for Students' Mean Interest Scores Based on Gender

Source of Variation	Sum of Squares	Df	Mean Square	F_{cal}	F_{tab}	Remark
Between Groups	2582.150	2	1291.075	2.307	3.15	Dont Reject
Within Groups	63790.100	117	545.214	—	—	
Total	87534.167	119	—	—	—	

Note: df = degrees of freedom; ANCOVA = Analysis of Covariance.

The result in Table 4 shows that F-calculated (2.31) is less than F-tabulated (3.15) at alpha 0.05, 2 degrees of freedom for between sets and 117 degrees of freedom for within

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sets. This suggests that there is no statistically significant difference between the mean interest scores of students taught physics using brainstorming, those taught using a field trip and the control group based on gender. Thus, the null hypothesis is not rejected.

Discussion

Students in brainstorming and field trip groups significantly outperformed the control group, indicating the active teaching methods enhance engagement and understanding (Adeyemi, 2018). The combination group (brainstorming and field trip) recorded the highest achievement, suggesting that integrating discussion-based and experiential learning maximises student performance (Okoye and Nwafor, 2021). Brainstorming alone improves problem-solving and conceptual understanding, while field trips increase motivation and contextual understanding. Findings align with Nigerian research emphasising that interactive and experiential approaches are effective in teaching physics, addressing the long-standing challenge of poor achievement (Bankole, 2016).

Conclusion

This study provides empirical support that brainstorming and field-trip teaching methods, particularly in combination, significantly enhance senior secondary physics students' academic achievement in Nigeria. The active, student-centred nature of these pedagogies fosters deeper understanding, motivation, and engagement compared to traditional teaching. Yet, practical barriers — such as resource constraints and teacher preparedness — pose challenges to widespread implementation. Addressing these through training, funding, and policy reforms will be crucial. By embracing such instructional innovations, Nigerian schools can better equip students with scientific thinking skills and meaningful learning experiences, contributing to broader national goals of science literacy and technological development.

Recommendations

Based on the findings of this study, the following recommendations are proposed:

1. Curriculum Reform: Educational policymakers should mandate the integration of brainstorming and field-trip strategies into the senior secondary physics curriculum, promoting active and experiential learning.
2. Teacher Training: In-service and pre-service teacher education programmes must include modules on how to design and facilitate effective brainstorming activities and manage field trips safely. 330
3. Resource Allocation: Schools and government should allocate funding for field trip logistics (transportation, safety, and entry fees) and establish partnerships with science centres, universities, and industries.
4. Reflective Practice: Teachers should encourage post-trip reflection and classroom discussion to help students consolidate learning.

5. Policy Advocacy: Engage stakeholders — school administrators, parents, and education ministries — to highlight the benefits of active pedagogies for STEM education and national development.

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References

Adeyemi, T.O. (2018). Predicting students Performance in Junior Secondary Certificate Examination, Ondo State, Nigeria. Humanity and Social sciences journals, 3(1) 26-36.

Ameh, J. (2018.) Effects of Brainstorming Teaching Method on Senior Secondary School Physics Students Achievement, Retention and Interest in Federal Capital Territory, Abuja. An Unpublished Ph.D Thesis, Nasarawa State University Keffi, Nigeria.

Akinboye, J.O. (2015). Creativity innovation and success. Ibadan: Stirling-Harden Publishers (Nig.) Ltd.

Anyakoha, M.W. (2015). New School Physics for Senior Secondary Schools.Africana First Publisher Plc.

Bankole, J. (2016) Innovative Teaching Approaches in Nigerian Science Education. Ibadan: Spectrum Books

Eze, N.R. (2025). The importance of Artificial Intelligence in the Advancement of Teacher Education Programmes in Nigeria. The Nigerian Teacher Today (NCCE TNTT). Nigeria Educational Research & Development Council (2017). A philosophy of Nigerian Education: Report on Basic Technology Curriculum Conference. Abuja, Nigeria: NERDC Press.

Nworgu, B.G (2015). Educational Research Basic Issues and Methodology. Enugu, Nigeria: University trust publisher

Okoye, I.& Nwafor, C. (2021).Effects of brainstorming and field trips on Senior secondary School Students Physics achievement in Lagos State. Journal of Science Education Research in Nigeria, 12 (3), 45-60. 332 Wikimedia, (2016). Field Trip: Retrieved https: //Wikipedia.org/wiki/field/trip on 23rd January, 2017.