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Effect of Brainstorming Instructional Strategy on Physics Students' Academic Achievement and Retention in Secondary Schools in Delta State

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Abstract: *This study examined how brainstorming affects Delta State secondary physics students' academic performance and retention. Study questions and hypotheses were six. This study used a quasi-experimental design with pre-test, post-test, and control group. 18,879 Delta State SSII physics students were the study's population. This study included 223 SSII physics students. The researcher devised the Physics Achievement Test (PAT), which was validated by three specialists and has a reliability coefficient of 0.79, to collect data for the study. PAT data were t-tested. In terms of mean achievement and retention scores in physics, students taught using the brainstorming strategy outperformed those taught with lecture method. Brainstorming improves physics student achievement and retention more than lecture. Physics teachers should brainstorm with secondary school students.*

Keywords: Brainstorming instructional strategy, academic achievement, retention

Introduction

It goes without saying that all countries, including Nigeria, work to advance science and technology. Any nation's progress is evaluated based on how far science and technology have come. A country is said to be developed if it has advanced scientifically and technologically, according to Jegede and Adedayo (2013). The authors also claimed that education in physics has a significant role in advancing scientific and technological advancement. According to Farinde, Ehimetalor, and Dada (2017), the science of physics focuses on how matter interacts with energy. Physics is the science of measurement, to put it simply. Thus, fundamental physics ideas and principles are crucial for the advancement of technology at the national level. Teaching physics in secondary schools creates future scientists who can invent technologies that improve daily life (Ajayi, 2008). Thus, technology relies on physics. This vital subject's teaching and learning results must be improved to support Nigeria's technological progress (Jegede & Adedayo, 2013). Ajaja (2016) states that secondary school physics should develop core abilities and attitudes to equip students for technological applications of physics and excite and promote creativity. This may be why Pratoomtong (2011) advised focusing the teaching and learning process to help students realise their maximum potential to meet these physics curriculum objectives. To meet the physics curriculum's goals, the subject emphasises field studies, guided discovery, laboratory procedures and abilities, and conceptual attitude (FRN, 2013)..

According to Caine (2012), effective teachers should plan lessons that emphasise the learners' active role in creating their own knowledge and understanding through interaction with their surroundings. However, in order for students to fully engage in the activities and use their entire brain, they must be fascinating to them and appropriate for their developmental stage. This will boost their academic performance. However, physics teachers frequently use the teacher-centered style to teaching, which is frequently better suited for addressing broad subject matter, which is typical of most physics courses, instructing a sizable class, and completing the scheme of work. This inevitably causes students to perform poorly on such concepts. As a result, scientific education research in Nigeria has kept looking for effective approaches to teach physics ideas and other science courses. The fact that, despite physics' significance, students' achievement has remained consistently atrocious necessitates the quest for more creative approaches to make the teaching and study of physics more meaningful.

From 2007 to 2012, less than 40% of students passed physics with credit, according to the WASSCE Chief Examiner's Report. From 2013 to 2018, more students earned credit passes. In 2013, 1,648,363 students were enrolled, 51.73% of whom got credit passes or above. In 2014, 57.42% of 1,365,384 students received credit passes or above, up from 56.42% in 2013. In 2014, 766,936 students received credit passes or higher, down from 852,699 in 2013. 2015, 2016, 2017, and 2018 showed the similar trend. The Chief Examiner's report shows that credit pass rates rise and fall annually. Many people are quite concerned about the shifting physics student achievement levels. According to Asogwa, Muhammed, Asogwa and Ofegbu (2016), a closer examination of the way physics is taught is necessary given the students' persistently low academic achievement in the subject.

Academic achievement refers to how much learning students have gotten out of a given course of study. Omachi (2010) defines achievement as a student's current academic performance. Academic achievement is usually defined as showing what you learned in school. Academic achievement is defined as forward academic movement accomplished by work and ability. This is frequently cognitive in nature and is evaluated by testing or ongoing evaluation. The development of a country is aided by effective education and strong academic performance. Because schools shape society's future, parents, teachers, and students are aware of the

long-term effects of high and low academic achievement. Academic achievement and retention are typically related because students' achievement can be increased if they can remember what they have learned in class.

The capacity for memory and recall of facts, ideas, and experiences acquired over time is known as retention. Knowledge must be preserved as images for advancement. Restored images are triggered by stimuli (Morris, 2014). This is why it is important to communicate physics topics to students in a fashion or manner that appeals to their subconscious in order to facilitate quick memory of the material. Teachers can assist students remember concepts and information by creating memorable settings with visual or aural images through projects, plays, simulations, and other active learning.

Okoye (2012) defines retention as retaining new meanings. The percentage of the original meaning retained at any time is vary. Between the time a meaning is developed and its reproduction, it is forgotten, reducing its availability. Retention is excellent, forgetting is bad. Frequent assessments, comprehensive feedback, and active student participation in learning projects increase retention. Active participation during instruction improves learning and memory.

Evidence suggests that there is a significant failure rate in physics exams, which may be related to the teaching approach. According to the WAEC Chief Examiner's Report from 2018, effective and meaningful instruction could raise students' performance in physics. The research recommends that teachers increase their students' participation in the classroom in order to foster an interest in physics among their students. In order to determine how interventions, affect learning outcomes, it is important to look for interventions that can be changed. This might help with the issues with physics education in schools. The use of brainstorming as an educational method in physics classes is activity-focused and may encourage student engagement. Based on this, the researcher tried to compare the effects of teaching physics students two units of SS2 physics curriculum using the brainstorming instructional strategy with teaching using the traditional lecture method.

To quickly generate many ideas about a specific topic, the brainstorming instructional approach is typically employed in an individual or group context (Bringula, Basa, Cruz & Rodrigo, 2015). It can aid in fostering learners' imaginative thinking, energising them, and encouraging involvement and building on others' ideas. The cognitive abilities required for idea generation are developed in large part through the engagement of the students. It was discovered that brainstorming worked well for attaining this. A rigorous physics curriculum engages students with important concepts, encourages them to make connections between what they are learning and what they already know and with current issues, think critically and creatively about what they are learning, and apply what they have learned to real-world situations.

The brainstorming strategy could give physics students many opportunities to be creative, generate many ideas through explanation, clarification, and persuasion, and participate in discussions to train and encourage critical thinking. Hypothesis-testing questions help students infer and form conclusions. Physics students can develop a wider range of ideas and use the best ones while brainstorming, giving them a broader sense of reasoning and the ability to generate a variety of such ideas when presented with similar or different real-life challenges. Brainstorming could improve physics learning compared to lectures.

The lecture method is a teacher-centered, student-peripheral technique in which the teacher presents a pre-prepared lesson, with or without teaching aids (Asogwa, Muhammed, Asogwa & Ofoegbu, 2016). According to the authors, teachers "talk about the subject" as students read about it. The teacher lectures to the class. Students take notes without asking questions. It's an early type of education. The lecture method lacks critical and creative thinking and engages students just moderately. Since students remain inactive during lectures, rote learning occurs. The study on the effect of brainstorming strategy on students' achievement and retention in Delta State was developed against this backdrop.

Statement of the Problem

Evidence of subpar performance indicated in the Chief Examiner's Reports indicates that the teaching strategies used by physics teachers play a significant role in students' learning and memory retention. Such approaches could result in students not comprehending the principles, capabilities, and applications of physics. Other reasons include family background, lack of enthusiasm in the subject, unintelligible texts, lack of a lab, and outdated equipment and instructional materials. The WAEC Chief Examiners have seen over the years that students' work demonstrates a lack of knowledge of physics principles. The reports also reveal a generally low level of achievement in the subject, which suggests that physics teachers must reinvent their delivery strategies to support physics students in raising achievement and remembering learnt concepts. Many academics have attempted to address the teacher element in physics instruction in the Nigerian setting by looking at physics instructors' instructional tactics, laboratory practises, skill, and competency in the subject. Despite the breadth of the research, there has not been a noticeable improvement in students' physics achievement. Students' performance and memory in physics could both be improved through brainstorming strategy. The desire to research how brainstorming strategy affect students' achievement and retention in physics was prompted by this.

Purpose of the Study

The study examined the effect of the brainstorming strategy on the academic achievement and retention of physics students at Delta State. The study specifically aimed to:

- determine the difference in mean achievement scores in physics between students taught using the brainstorming strategy and lecture method;

- determine the difference between students taught physics using the brainstorming strategy and lecture method in terms of mean retention scores.

Hypotheses

This study's hypotheses were as follows:

1. The mean achievement scores in physics between students taught using the brainstorming strategy and lecture method do not differ significantly.
2. There is no significant difference between students taught physics using the brainstorming strategy and lecture method in terms of their mean retention scores.

Methods

The study employed pre-test, post-test, and control group quasi-experimental design. 18,879 Delta State SSII physics students were the study's population. This study included 223 SSII physics students. The researcher used the three-expert-approved Physics Achievement Test (PAT) to collect data. A table of specifications and three experts verified the instrument's content and face validities respectively. The Kuder-Richardson formula 21 assessed PAT reliability. 50 Physics students at Otibio Grammar School, which did not participate in this study, took the PAT. The Kuder-Richardson 21 formula was applied to data. PAT reliability was 0.79. To teach electricity and magnetism, the experimental group brainstormed while the control group were lectured. Pre- and post-treatment tests were administered. Four weeks after the posttest was a retention test. The scores were t-tested.

Results

- The mean achievement scores in physics between students taught using the brainstorming strategy and lecture method do not differ significantly.

Table 1

t-test Comparison of Pretest and Posttest Scores of Students

	Group	N	$\bar{x}$	SD	df	t-cal.	Sig. (2-tailed)	Decision
Pretest	Brainstorming	120	28.63	5.95	221	1.791	0.075	Not Significant
	Lecture	103	27.24	5.58				
Posttest	Brainstorming	120	66.88	9.26	221	9.530	0.000	Significant
	Lecture	103	55.65	8.18				

Table 1 shows no significant difference in pretest mean achievement scores between brainstorming and lecture physics students, with a t value of 1.791 and a P(0.075) > 0.05. Thus, the t-test tested null hypothesis 1. Table 1 shows a significant difference in posttest mean achievement scores between students taught physics using brainstorming and lecture methods, with t = 9.530, P(0.000) < 0.05. Thus, the mean achievement scores in physics for students taught utilising the brainstorming and lecture method differ significantly, preferring the former.

- There is no significant difference between students taught physics using the brainstorming strategy and lecture method in terms of their mean retention scores.

Table 2

t-test Analysis of Retention Test Scores of Students

Group	N	$\bar{x}$	SD	df	t-cal.	Sig. (2-tailed)	Decision
Brainstorming	120	49.97	8.82	221	4.999	0.000	Significant
Lecture	103	43.77	9.69				

Table 2 shows that students taught physics using brainstorming and lecture methods had significantly different mean retention scores (t = 4.999, P(0.000) < 0.05). Thus, students taught utilising the brainstorming had higher physics memory ratings than those taught using the lecture method.

Discussion

The study indicated that brainstorming-taught physics students outperformed lecture-taught students. The discrepancy in accomplishment scores may be due to differences in teaching tactics, which may have altered students' physics performance. This may be due to students' active participation in the brainstorming teaching method. The educational plan brainstorming session may have helped students understand physics concepts. The brainstorming instructional group uses solid reasoning to provide solutions to a teacher-posed challenge. However, the lecture group's teacher taught them. Teachers explained and kids listened. The lecture technique group's passive engagement may have lowered performance.

The brainstorming instructional strategy group outperformed the lecture method group in Social Studies, supporting Adeyemi and Ajibade (2011)'s findings. Bilal (2012) found that brainstorming as a teaching method helped Princess Alia University College women acquire innovative problem-solving skills. Bilal (2012) found a statistically significant difference between the

experimental group (brainstorming instructional strategy) and the control group (lecture method) in the total score and sub-scores of creative thinking, favouring the experimental group and proving the efficacy of the strategy in developing creative thinking skills.

The study also found that brainstorming-taught physics students outperformed lecture-taught students. Due to their active, independent inquiry, they were able to repeat the learning materials. Repetition, which aids learning, helped students create teaching tactics. Teaching others helped students retain the information. Since students wanted to understand and share course information, learning was more meaningful. Avoiding rote learning and learning in brainstorming groups boosted their memory. This confirms Filgona, Filgona, Sababa, and Ndatuwong (2016), who found that brainstorming improves social studies recollection more than lecturing.

Conclusion

This study concludes that brainstorming improves students' physics achievement and retention more than lecture.

Recommendations

This study suggests:

1. Secondary school physics teachers should use brainstorming in physics' instruction.
2. Physics teachers should provide students the brainstorming topic before class. This will provide them a broad understanding of the issue or problem.
3. Government and other education stakeholders should provide in-service training for teachers on simulated brainstorming and other cooperative learning strategies.

References

Adeyemi B. A., & Ajibade, Y.A. (2011). The comparative effects of simulation games and brainstorming instructional strategies. *African online,* 5(3), 64-80.

Ajaja, O. P. (2016). *Teaching methods across disciplines (2nd ed.).* Ibadan: Bomn Prints.

Ajayi, P. O. (2008). Evaluation of instructional materials for the implementation of senior secondary school physics curriculum in Nigeria. *Nigerian Journal of Counseling and Applied Psychology,* 4(1), 100-110.

Asogwa, U. D., Muhammed, A., Asogwa, E. N., & Ofoegbu, T. O. (2016). Effect of interactive computer simulation package on senior secondary school students' achievement and retention in genetics concepts. *Asian Journal of Information Technology,* 15(14), 2313- 2321.

Bilal, A. A. (2012). The effect of using brainstorming strategy in developing creative problem-solving skills among female students in Princess Alia University College. *American International Journal of Contemporary Research, 2,* 109-115.

Bringula, R., Basa, R. S., Cruz, C.D., & Rodrigo, M. M. T. (2015). Effects of prior knowledge in mathematics on learner – interface interactions in a learning by teaching intelligent tutoring system. *Journal of Educational Computing Research,* 6(2), 321-333.

Caine, G. (2012). Guiding the innate constructivist. *Educational Leadership,* 60(1), 70-73.

Farinde, O. E., Ehimetalor, H. E., & Dada, S. K. (2017). *Essential physics for senior secondary schools (5th ed.).* Ibafo, Ogun State: Tonad Publishers Limited.

Federal Republic of Nigeria. (2013). *Nigeria's national policy on education* (Revised ed.). Yaba, Lagos: NERDC.

Filgona, J., Filgona, J., Sababa, L. K., & Ndatuwong, G. L. (2016). Effects of concept mapping and brainstorming instructional strategies on junior secondary school students' achievement in social studies in Mubi Educational Zone, Nigeria. *British Journal of Education, Society & Behavioural Science,* 18(2), 1-18.

Jegede, S. A., & Adedayo, J. O. (2013). Enriching physics education in Nigeria towards enhancing a sustainable technological development. *greener Journal of Educational Research,* 3(2), 080-084.

Morris, R. (2014). Brain project leaders need an open mind. *Nature*, 511, 292 -237.

Okoye, A. C. (2012). Effects of computer assisted instruction on students' acquisition of science process skills, retention and interest in biology (Unpublished doctoral thesis). Nsukka, University of Nigeria.

Omachi, G. T. (2010). Nigerian secondary school laboratories and goals of science education. *Proceedings of the 41th Science Teachers Association of Nigeria Annual Conference,* 2(1), 26-30.

Pratoomtong, W. (2011). A development of science learning activities based on 4mat system and learning styles to promote multiple intelligences of sixth grade students (Unpublished doctoral thesis). Srinakharinwirot University.

WAEC (2012-2018). *Chief examiner report, Physics,* Lagos, Nigeria: WAEC Press.