

THE EFFECT OF BRAINSTORMING ON STUDENTS ACADEMIC ACHIEVEMENT IN PHYSICS IN SENIOR SECONDARY SCHOOLS OF MAKURDI LOCAL GOVERNMENT AREA OF BENUE STATE, NIGERIA

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ABSTRACT

This study was designed to investigate the effect of brainstorming on student academic achievement in physics in senior secondary schools of Makurdi Local Government Area. Quasi experimental design was adopted for the study. One hundred and fifty six students in physics in senior secondary schools in Makurdi Local Government area formed the sample for the study. Intact classes were assigned to experimental and control group. The experimental group was taught using the brainstorming strategy. Four research questions and four hypotheses were generated and formulated to guide the study. A Physics Achievement Test (PAT) was developed and used for obtaining data. The data was analyzed using simple percentage and t-test to answer the research question and to test the hypotheses at 0.05% level of significance. Findings of the study showed that there is more improvement in the academic performance of students based on brainstorming strategy than those taught based on the conventional teaching method. From the research findings, the research has the following recommendations for learning of physics for students, parent and guardians, teachers of physics, school authorities and government. Students should pay more attention while been taught physics using brainstorming method and allied study material. This is because they will learn faster, perform well in their examination, and evidently further studies.

However, students cannot do this alone, parents are therefore encouraged by the findings of this work to motivate their ward and children for the use of such materials where required so that their wards can access it for good.

Teachers on the other hand are recommended by this research to accept school policies of using brainstorming in the teaching of physics. It becomes essential for school authorities to make it a policy for physics teachers to use these methods and materials throughout the process and learning of physics. At the state and national levels that harmonize education, the policy on teaching and learning of physics should be incorporated in templates for supervision of schools. The government through its agencies should ensure that teaching aids are provided by schools and properly used in teaching in other to give a better understanding of what is been taught. This will go a long way to improve the standard of learning that the government has been yearning for.

Keywords :- Brainstorming strategy, Academic Achievement, Physics, Experimental group and Control group.

1. INTRODUCTION

In this era of technological explosion and advancement driven by science and technology, we cannot deny the assuming conspicuous and multi-dimensional impacts of science and technology on every facet of lives as well as our nation. Every, from the so-called little or poor man on the street to the very rich or highly placed individuals in the society is in one way or the other at ease with the importance of science. Following the relevance and globalization of science, no country wants to lag behind in scientific and technological development. And so, countries try to pay attention to science education with the utmost aim of training up her citizens so as to acquire the needed manpower (scientists, nurses, technologists, doctors, engineers, science educators, among others) who in their different fields can contribute meaningfully to the scientific and technological development of their nations (Costu,B., Ayas, A.A, and Calick, M., Unal,S.&Karatas, F.O.2005)[1] to achieve this requires effective teaching and learning of science in our schools.

Educational technology: is a wide field with many destinations, educational technology can be considered either as a design science or as a collection of different research interest addressing fundamental issues of learning, teaching and social organization. Therefore, educational technology is based on theoretical knowledge drawn from different disciplines (communication, education, psychology, sociology, philosophy, artificial intelligence, computer science e.t.c) plus experimental knowledge draw from educational practice (Descryver 2011)[2].

Among the three pure science subjects (physics, biology and chemistry) at the secondary schools level, Physics is a pure science that deals with the behavior of matter and energy and how it relates with other physical properties. The world today is full of technology and technology itself is built by the laws of physics.

A good study of the subject shows that Physics is an everyday science. It affects us in whatever we do. Everything around uses energy in one way or another, our automobiles, planes, and trains burn fuel, our computers require electrical sources and wi-fi connections, and our telecommunication devices operate on cellular signals. Essentially with our expanded capabilities has come about an increasing need for new forms of energy, and this form may be nuclear power or alternative energy sources such as Fossil fuels or hybrid power.. When learning about and discussing physics, we focus heavily on energy, the core element of the science. To better understanding this connection, it helps to refer to a solid working definition of physics. Physics is the science in which matter and energy are studied both separable in combination with one another and a more detailed working definition of physics maybe; the science of nature, or that which pertains to natural objects, which deals with the laws and properties of matter and forces which act upon them. Quite often, physics concentrates upon the forces having an impact upon matter that is gravitation, heat, light, magnetism, electricity, and others.

Brainstorming strategy is one of the most important strategies in provoking creativity and solving problems in the educational, commercial, industrial and political fields, brainstorming strategy was introduced by Alex Osborn, an American advertisement company manager in 1938 as a result of his inconvenience of traditional business meetings. Brainstorming means the use of brain to the active problem solving and the brainstorming session aims to develop creative solutions to problems (Jarwan, 2005)[3]. On the other hand, creative thinking is known as a compound mental activity aiming to direct a strong desire to look for solutions or reaching for original solutions that were not know before (Jarwan, 2008)[4]. With regard to creative problem solving it is based on the cognitive structure. It is the mental process of creating a solution to a problem, it is a special form of problem solving in which the solution is independently create rather than learned with assistance. Creative problem solving always involves creativity (Qattami, 2010)[5].

Brainstorming can be view as a technique in which an individual or group engages in critical thinking to generate wide-ranging ideas toward solving a problem. This strategy is now widely applied in different fields of human endeavour including education. With regard to brainstorming and academic performance, studies Ashammari,M.K 2015[6], Fanona,Z.N 2012[7], Keshwan,B.A 2014[8], and Mohammed, K.H. 2016[9] have revealed the relevance of brainstorming in promoting the learning of school subjects, creative thinking and critical thinking as well as academic achievement.

Al-maghrawy, 2012[10] defines brainstorming as a group creativity forum for general ideals.

1.1 Statement of Problem

Despite the continuous efforts exerted by the Ministry of Education in Nigeria, represented by all its educational institutions aimed at improving the quality of the learning process, there is still a gap between the negative results in terms of the level of achievement in physics did not reach the required level.

Within the framework of the search for finding a way to overcome this phenomenon, the study seeks to reach the strategy of teaching related to the life of the students, the use of the method of brainstorming in the teaching of physics in senior secondary schools in Makurdi local government area, and testing it and studying its impact on academic achievement, the researcher hopes that the results of this study and its recommendations will contribute to improving the methods of using modern teaching methods in physics in general, teaching physics skills and stimulating and encouraging students to study these rules and assimilation and then employing them.

1.2 The importance of the study

This study is important because it addresses a vital topic that concerns many, and the parties involved in the process of learning and teaching, in order to raised the achievement level of students in the rule of physics, while we see a clear weakness in students to acquire skills and apply the rules correctly in their solving of problems, and this study came to highlight the method of brainstorming and how to use it to bridge the gap resulting from traditional practices in the teaching of physics, and benefit from the results to improve the level of achievement of the students in this subject.

1.3 purpose of the Study

The study aims to achieve the following main objectives:

1. Determine the effect of brainstorming on students' academic achievement in physics in senior secondary schools in Makurdi.
2. To ascertain whether there is difference in academic achievement between urban and rural students taught using brainstorming strategy and those taught using conventional methods.
3. To compare academic achievement of urban and rural male physics students taught by the use of brainstorming.
4. To compare academic achievements of male and female physics students taught using brainstorming strategy and those taught by the use of conventional method.

1.4 Question of the study

To achieve the objective of the study, the researcher tries to answer the following questions:

1. Is there any difference in academic achievement of students taught Physics in Senior Secondary Schools Makurdi Local Government Area using brainstorming strategy and those taught using conventional method?
2. Do urban and rural physics students in senior secondary schools Makurdi Local Government area taught using brainstorming strategy differ in achievement from those taught using conventional methods?
3. Is there any difference in academic achievement between urban and rural male Physics students in Senior Secondary Schools Makurdi Local Government Area taught using brainstorming strategy?
4. Do urban female physics students in Senior Secondary Schools Makurdi Local Government Area taught using brainstorming strategy differ in academic achievement from rural female counterparts taught using the same strategy?

1.5 Hypotheses

The following hypotheses were tested in the study at 0.05 level of significance:

1. There is no significant difference in the mean achievement scores of student exposed to brainstorming strategy and those who are taught by the use of conventional method.

2. There is no significant difference in the mean achievement scores of rural and urban physics students who are taught using brainstorming strategy and their counterpart taught using conventional method.
3. There is no significant difference in the mean achievement scores between urban and rural male students taught using brainstorming strategy.
4. There is no significant difference in academic achievement between urban female senior physics students taught using brainstorming strategy and their rural counterpart taught using the same strategy

2 METHODOLOGY

This section describes procedures employed in finding out the effect of brainstorming on student's academic achievement in physics senior secondary schools. The research design employed for this study is the quasi-experimental design. The area of study is Makurdi Local government area of Benue state. The population of the study consist of all senior secondary school physics students in all senior secondary schools in Makurdi Local Government Area. The sample size of this study is 150 students from four intact classes in co-educational schools in Makurdi Local government area of Benue State. Multi staged simple random sampling technique was used to select four schools in Makurdi. All SS1 Classes in each of the selected schools offered physics. The schools were divided into two groups through balloting; the first two classes from two schools represented the classes for teaching using the conventional teaching method while the next two classes from the remaining two schools represented the classes for teaching with the use of brainstorming strategies.

Physics Achievement Test (PAT) was used to collect data. Both the pre-PAT and post-PAT were developed based on selected topic. The pre and post-PAT consisted of fifteen (15) multiple choice questions. Some of which were adapted from the Senior Secondary Certificate Examination (SSCE) conducted by the West African Examinations Council (WAEC). The researcher developed the questions based on the content of topic used in the investigation. The objectives of the topics, stated in Physics Curriculum (NERDC-Nigerian Educational Research and Development Council) served as a guide for developing the questions.

The students were provided with options lettered (a) to (d) to choose only one of the options following each question. Physics Achieved Test (PAT) were used to measure the performance of students in both pre-test and post-test. Ensuring the validity of the instrument used for data collected, the Physics Achieved Test questions which were constructed by the researcher was presented to the supervisor for validation.

The supervisor scrutinized the instrument in terms clarify, proper wording, appropriateness and adequacy of items for the study. The structure of the items and adequate thing was also vetted by the authorities. Comments and corrections received from these renowned experts were used to modify the items of the instrument. The researcher went to four sampled schools and administered the PAT pre-test to the students before the commencement of the experiment. Using the same length of time, the researcher taught each of the group for forty (40) minutes. The first intact group was taught with the conventional teaching method and the second intact group with brainstorming method. The data collected comprising the pre-test and post-test scores of the physics achievement test (PAT) were analyzed using statistical techniques according to research questions and test of hypotheses. Descriptive and inferential statistics were used to analyze the data. Frequency counts, percentage, mean and standard deviation to answer the research question. On the other hand, t-test statistics was used to test the various hypotheses at 0.05a-level.

3. RESULTS.

TABLE-1: Sampled Schools.

NAME OF SCHOOLS	NUMBER OF STUDENTS
Tilley Gyado, College, North-bank, Makurdi.	40
Special Science Secondary School, Makurdi	38
Community Secondary School, Apir.	40
Sam-Alex Secondary School, Apir.	38

3.1 Research Question 1

Research question one states that, is there any significant difference in the mean achievement scores of students taught physics using brainstorming strategy when compared with the mean achievement scores of students taught physics using conventional method?

To answer this research question, frequency count, mean and standard deviation were used and the results set out on table 2

Table- 2: Mean and Standard Deviation for Experimental and Control Group

Teaching Approach Deviation	No of students	Mean scores	Standard
Experimental Group	40	74.25	11.08
Control Group	38	28.97	15.68
Mean Difference		45.28	
Total	78		

The results in table 2 show that a difference of 45.28 exists between the means of the two groups to the favor of the experiment group.

3.2 Research Question 2

Research Question 2 states that do urban and rural senior secondary physics students taught using brainstorming strategy differ in achievement from those taught using conventional method.

To answer this research question, frequency count, mean and standard deviation were used and the results set out on table 3 and 4.

Table-3: Mean and Standard Deviation for Achievement Scores of urban schools.

Teaching Approach Deviation	No of students	Mean scores	Standard
Experimental Group	40	74.25	11.08
Control Group	40	35.5	17.25
Mean Difference		38.75	
Total	80		

Table-4: Mean and Standard Deviation for Achievement Scores of rural schools.

Teaching Approach Deviation	No of students	Mean scores	Standard
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Experimental Group	38	33.3	13.33
Control Group	38	28.97	15.68
Mean Difference		4.33	
Total	80		

Table 3 shows that a difference of 38.75 exist between the means of the two groups. In table 4 there is a mean difference 4.33 between the two groups.

3.3 Research Question 3

Research question 3 states that is there any difference in mean achievement between urban and rural male senior physics students taught using brainstorming strategy.

To answer this research question, frequency count, mean and standard deviation were used and the results set out on table 5.

Table-5: Mean and Standard Deviation for Achievement Scores of rural and urban males

Group	No of students	Mean scores	Standard Deviation
Rural	26	66.4	14.12
Urban	28	15	21.59
Mean Difference		51.4	
Total	54		

Table 5 shows a mean difference of 51.4. Therefore there is a significant difference in the mean academic achievement between rural and urban male students taught using brainstorming strategy.

3.4 Research Question 4

Research question 4 states that, do urban female senior physics students taught using brainstorming strategy differ in academic achievement from their rural counterparts taught using the same strategy?

To answer this research question, frequency count, mean and standard deviation were used and the results set out on table 6.

Table-6: Mean and Standard Deviation for Achievement Scores of urban and rural females.

Group	No of students	Mean scores	Standard Deviation
Experimental Rural	12	62	14.12
Experimental Urban	12	61.15	21.59
Mean Difference		0.85	
Total	24		

The table shows that there is a difference of 0.8 and -1.15 between the means and standard deviations of the urban and rural girls all taught using brainstorming strategy. This differences are in favor of the urban girls. It should be noted that the differences are statistically insignificant as revealed by the t-test statistic in the same table.

3.5 Hypotheses

The four-hypothesis formulated for this study were tested using the t-test statistics to test the various hypotheses at 0.05 α -level

3.6 Hypothesis One

There is no significant difference in the mean achievement scores of students exposed to brainstorming strategy and those who are taught by the use of conventional method.

Table-7: Two-tail t-test Result in Respect of Mean Scores of Experimental and control groups.

Group	N	Mean	S.D	df	t-Calculated	t-Critical
Experimental Group	40	74.25	11.08			
Control Group	38	28.97	15.68	76	14.61	1.67

The result in Table 7 showed that the t-calculated value of 14.61 is greater than the t-critical value of 1.67, therefore, the hypothesis one is rejected giving room for the conclusion that there is significant difference between the mean scores of the students taught using the conventional method of instruction. In other words the students taught using brainstorm strategy achieve better and higher than the students taught using conventional method.

3.7 Hypothesis Two

There is no significant difference in the mean achievement scores of rural and urban physics students who are taught using brainstorming strategy and their counterpart taught using conventional method.

Table- 8: Two-tail t-test Result in Respect of Mean achievement Scores of urban schools.

Group	N	Mean	S.D	df	t-Calculated	T-Critical
Experimental group	40	74.25	11.08			
				78	14.57	1.6646
Control group	40	35.5	17.25			

Decision: From Table 8 above, the calculated value of t is 14.57 which is greater than the critical value of 1.67, therefore the hypothesis is rejected giving room for the conclusion that there is a significant difference between the mean scores of students taught with brainstorming strategy in urban schools and those taught using conventional methods in urban schools.

Table- 9: Two-tail t-test Result in Respect of Mean achievement Scores of rural schools.

Group	N	Mean	S.D	df	T-Calculated	T-Critical
Experimental Group	38	33.3	13.33			
				74	1.296	1.6657
Control Group	38	28.97	15.68			

Decision: From the Table 9 above, the calculated value of 1.3 which is less than the critical value of t which is 1.67, therefore the hypothesis is not rejected in rural schools rather it is upheld that there is no significant difference in the mean achievement are taught using brainstorming strategy and their counterpart taught by the conventional method.

3.8 Hypothesis Three

There is no significant difference in the mean achievement scores between urban and rural male students taught using brainstorming strategy.

Table -10:Two-tail t-test Result in Respect of Mean achievement Scores of rural and urban males.

Group	N	Mean	S.D	df	T-Calculated	T-Critical
Rural	26	66.4	14.12			
				52	3.12	1.67
Urban	28	15	21.59			

From the table 9 the calculated t value of 3.12 is greater than the critical value of 1.67. Therefore the hypothesis is rejected. This means that there is significant difference in the mean achievement scores of urban and rural male students taught using brainstorming strategy.

3.9 Hypothesis Four:

There is no significant difference in academic achievement between urban female senior physics students taught using brainstorming strategy and their rural counterpart taught using the same strategy.

Table- 11: Two-tail t-test Result in Respect of Mean achievement Scores of urban and rural females males.

Group	N	Mean	S.D	df	T-calculated	T-critical
Experimental	12	62	13.20			
Urban				22	0.149	1.71
Experimental	12	61.15	14.35			
Rural						

From Table 11, the calculated value of 0.149 is less than the critical value which is 1.71. therefore there is no significant difference of female senior physics students taught using brainstorming strategy in urban school do not differ in counterparts taught using the same strategy.

4. CONCLUTIONS

Considering the result obtained from this research, it is obvious to accept the fact that there is significant difference in the performance of students taught physics based on brainstorming and those based on conventional teaching method. And this result shows that the use of brainstorming in teaching physics is more effective than the conventional teaching method irrespective of gender.

5. REFERENCES

- [1]. Costu,B., Ayas, A.A, and Calick, M., Unal,S.&Karatas, F.O.2005''The competence of material science teachers and laboratory determination of solution preparation'' .hacethepeuniv.Fac.educ),.2.8: 65-72, 2005.
- [2]. An, y.j., &Reigeluth, c. (2011). Creating Technology-Enhanced, learner-centered classroom; k-12 Teachers's Beliefs, Perceptions, Barriers, and support needs. Journal of Digital learning in teacher Education, 28(2), 54-62.
- [3]. Ashammari, M.K. ''Effective brainstorming in teaching social studies for elementary schools in Saudi Arabia''.Journal of Education & social policy, 2(3), 70-75, September, 2015.
- [4]. Fanona, Z.N. '' The effect of using the model of generative learning and brainstorming in the development of concepts and the attitude towards biology for the eleventh grade male students''2012.
- [5]. Keshwan,B.A. ''To study the effects of brainstorming instructional strategies and stimulation game on secondary schools students' achievement in social studies''. Golden Research thoughts,3(11) 1-5, May, 2014.

- [6] Mohammed, K.H. ‘‘ Effect of brainstorming on Balga Applied University’s students’ achievement in the course ‘‘E 101’’ and its relation to some variable’’. *Journal of Literature, languages and Linguistics*,20:81-86,2019.
- [7]. Jarwan,F. (2005).Teaching thinking: definition and applications. Amman: Dar Al-fkir,jordan.
- [8]. Jarwan, F. (2008).Giftedness and talents. Amman: Dar Al-fkir.jordan.
- [9]. Qattami, N. (2010). Methods of teaching gifted and talented. Amman: Dar Al-maseera.
- [10]. Al-Maghray, A(2012) . effectiveness of using the brainstorming Technique to learn some Basic Skills and collection of Knowledge for Beginners in volleyball *World Journal of Sport Sciences* 6(4):361-366
- Osborn, A.F. ‘‘ Applied imaginations: principles and procedures of creative problem solving (3rd Rev. Edition)’’. New York: Charles scribner’s sons, 1963.

