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Effect of the System Approach on Academic Achievement in Basic Science Among Junior Secondary School Students in the Federal Capital Territory, Nigeria

***Amos, E., & Paul-Fiase, R.U.**
Department of Science and Environmental Education, University of Abuja

***Corresponding author email:** estykwaryama78@gmail.com; +2348036072961

Abstract
This study investigated the effects of system approach on academic achievement of Basic Science students in junior secondary schools in the Federal Capital Territory, Abuja, Nigeria. The research design adopted was quasi experimental pretest posttest non-equivalent control group; the study was carried out in two randomly selected co-educational secondary schools in the Federal Capital Territory, Abuja. A sample size of 384 Basic Science students was used. The instruments for data collection were Basic Science Achievement Test (BSAT). Descriptive statistics were used to answer the research questions while ANCOVA was used to test the null hypotheses. The results of the analysis showed that there was a significant difference between the mean achievement scores of experimental and control groups and there was no significant difference between the mean achievement scores of male and female students in the experimental group. Based on the findings of the study, it was concluded that system approach if employed by Basic Science teachers and properly handled, will make Basic Science teachers' lesson interesting, motivate learners to learn and lead to higher academic achievement of Basic Science students and it is also gender friendly. It was therefore recommended among others that there is need for Basic Science teachers in the Federal Capital Territory to always employ system approach in the process of teaching and learning since the approach was found to impact positively on the academic achievement of Basic Science students.

Keywords: System Approach; Teaching Approach, Academic Achievement; FCT, Abuja.

Introduction

Education is the bed-rock of development of any nation upon which the bulk of present day technology breakthrough is built. All nations in the world including Nigeria are striving hard to improve or develop technologically and scientifically. This could be achieved through laying a solid foundation in science and technology studies. One of the goals of education in Nigeria as enshrined in the National Policy on Education (FRN, 2015) posited that education should develop individual into a morally sound, patriotic and effective citizen. This is achievable through educational activities that are learners centered for maximum development and self-fulfillment. Science as school subjects comprises of Physics, Chemistry, Mathematics, Agriculture and Basic science. Basic Science refers to foundational study of the natural world, aimed at helping learners understand the fundamental principles of science. It introduces students to key areas such as biology, chemistry, physics, health science, and environmental science, providing the ground work needed for more advanced scientific learning. According to Nigerian Junior Secondary School curriculum, Basic science is designed to develop students' curiosity, critical thinking and problem solving skills by helping them observe their environment, ask questions and seek logical explanation for phenomena (NERDC, 2025).

System approach (SA) is a holistic methodology that views teaching and learning as an interconnected system. It considers the various components that influence the learning process and seeks to optimize the entire system to achieve better learning outcomes. It also involves the use of logical problem- solving Strategies to identify and resolve instructional problems which involves planning, organizing and evaluating educational programs to determine their success or otherwise. Michelle, (2019) described the concept of SA as elbows: - system approach is a systematic attempt to coordinate all aspects of a problem towards specific objectives. In the context of science

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teaching and learning, system is a unit as a whole incorporating all its aspects and parts, namely, students, teachers, curriculum content, media, methodology, infrastructure and evaluation of instructional objectives? The science teaching-learning process is viewed as communication and control taking place between the components of a system. In this case, the system is composed of a teacher, a student and a programme of instruction, all in a particular pattern of interaction (Michelle, 2019).). Teaching and learning through this approach (SA) will surely improve science students' academic achievements and knowledge retention. Academic achievement is an important educational variable that expresses the success or failure of a teaching and learning process. It is a measure of what a student has accomplished after exposure to educational program. Martinez et al (2019) sees academic achievement as the assessment strategy by which the evidence about students learning is gathered through students' work on a performed task. Academic achievement is the scholastic standing of a student at a given moment which states individual intellectual abilities.

Academic achievement is an important educational variable that expresses the success or failure of a teaching and learning process. It is a measure of what a student has accomplished after exposure to educational program. Martinez et al (2019) sees academic achievement as the assessment strategy by which the evidence about students learning is gathered through students' work on a performed task. Also, academic achievement is the scholastic standing of a student at a given moment which states individual intellectual abilities. There are conflicting reports in the literature concerning the effect of teaching strategies on students' achievements. Dajal et al. (2023) opined to this fact that another trigger of poor achievement in Biology is ineffective teaching method because most teachers resolve to the use of talk-chalk method or lecture method because it saves time, gives wider coverage of syllabus, less tedious.

Gender has remained an issue in the front burner of academic discourse. Scholars have become enthusiastic on addressing issues that have continued to create differences among people on the basis of gender which has continued to have adverse consequences on sustainable economic development of the nation. Kyado, (2020), Achor and Gbadamosi (2020), Dajal et al. (2022), stated that, there was no significant difference in the achievement of male and female students in sciences while the studies of Okereke and Onwukwe, (2011) cited in Oweoye and Agbaje (2016) showed that the male students achieved better than the female students in basic science. These showed that the issue of gender in Basic science achievement has not been resolved. Therefore, the need to find new approach in the classroom which can be combined with gender to bring about understanding of difficult or abstract of basic science concepts and ultimately lead to improved achievement of learners. It is against these backgrounds that the researcher investigated the effect of system approach on the basic science students' academic achievement in junior secondary schools, Federal Capital Territory (FCT), Nigeria.

Statement of the Problem

Persistent poor achievement of students in science oriented subjects and basic science in particular at the Basic Education Certificate Examination is a threat to the attainment of the educational goals and science education in particular as well as a grave concern to parents, teachers, school administrators, government and psychologists. Over the years, several research have revealed the poor achievement of students in science subjects (Basic Science) was attributed to the teachers' use of ineffective approaches in science teaching which among other factors have contributed to the students' poor academic achievement in basic science and technology at the junior secondary school.

However, the need to re-address this academic problem is to find instructional strategy that could assist in enhancing students' achievement of basic science. Apochi and Paul-Fiase (2023) stated that most science teachers used the lecture method so as to cover a wide range of topic within short time and yet this does not give room for proper understanding of the subject. The factors responsible for poor academic achievement of students in basic science subject can be attributed to poor reading habit, negative student's perception towards basic science, gender inequalities, inadequate laboratory facilities, inadequate staff motivation and inadequate instructional materials among others. Also, Okebukola (2019) also attributed poor achievement in basic science to the use of ineffective teaching and learning strategies and lack of appropriate learning environment under which Basic Science teaching takes place. The curricular developmental aspect of Basic Science has focused more on rote learning over years which make instruction teacher-centered.

Furthermore, to buttressed this fact, it is observed by FCT Education Resource Centre (ERC) available data that, the problem affecting poor achievement in Basic Education Certificate Examination (BECE) is attributed to poor teaching delivery or teacher's method of presenting the content of the curriculum to learners amongst others, the results in 2020 showed that, fifty nine thousand, nine hundred and thirty-eight (59,938) candidates sat for the examinations, 79.80% have credits in five subjects including English Language and Mathematics while 23.20%

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failed. But it further disclosed that in 2021 and 2024 candidates that sat one hundred and thirty-one thousand, eight hundred and twenty-two, number that passed were 78.61% and 79.13% respectively. Hence, the need to use appropriate method like system approach that can boost student's achievement.

Purpose of the Study

This study therefore, set out to investigate the effect of system approach on the basic science students' academic achievement in Junior Secondary Schools, FCT, Nigeria. The specific objectives are as follows:

i. To compare the mean academic achievement scores of students taught basic science with system approach and those taught using conventional method.
ii. To determine the mean achievement scores of male and female students taught basic science using system approach

Research Questions

In an attempt to address the problem, the following research questions were answered:

i. What is the mean academic achievement scores of students taught basic science with system approach and those taught using conventional method?
ii. What is the mean achievement scores of male and female students taught basic science using system approach?

Hypotheses

Based on the above questions, the following hypotheses were tested:

HO_1: There is no significant difference between the mean academic achievement scores of students taught basic science with system approach and those taught using conventional method.

HO_2 There is no significant difference between the mean achievement scores of male and female students taught basic science using system approach.

Methods and Materials

The research design adopted for this study was quasi-experimental that specifically, applied non- randomized pre-test, post-test, post-post-test control group. According to Akinwaare and Oyeninhun (2023), a quasi-experimental design is a design that, there is manipulation of an independent variable. The design is chosen in order to ensure thorough manipulation of the variables in the study. The instructional strategy is the independent variable while academic achievement of Basic science is the dependent variable. Being an experimental study, the samples for the studies will be grouped into experimental and control groups. The experimental group will be taught basic science concepts using system approach while the control group will be taught the same concept using conventional talk-chalk method. Intact classes were used in order to avoid distortion on the normal class settings and the school timetables. The design is presented symbolically in Table 1.

Table 1: **Representation of Research Design**

Group	Pre-test	Treatment	Post-test
Experimental	0_1	X_2	0_2
Control	0_1	-	0_2

Where:

0_1 = Pretest
X_2 = Treatment of experimental group
0_2 = Post-test

The population of the study will consist of all the one hundred and seventy-nine thousand, two hundred and one (179,201) JSS II Basic science students in all the six Area councils in FCT, Abuja (Computer statistics Unit, UBEB, (2025). The reason for the choice of this class is that JSS II students are not new to Basic science and have acquired the basic prerequisite knowledge in the subject. Also, at this level they are not likely to face any imminent external examination. But the targeted population was four thousand, four hundred and eighty (4,480) JSSII Basic science students in the five (5) public senior secondary schools in Bwari Area Council categorized into 2,200 male and 2,280 female. The sample size of 384 formed in this study was determined using the Krejcie and Morgan (1970) sample size determination table, which provides statistically adequate sample sizes for finite populations at a 95% confidence level and a 5% margin of error. Multistage sampling technique was adopted for this study in order to ensure systematic selection, adequate representation, and reduction of selection bias across the study area. The procedures were carried out in four distinct stages as follows: At first stage, simple random

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sampling is used to select one Area Council from the six (6) Area Councils in Federal Capital Territory. The reason for the choice of simple random sampling technique was to give each Area Council equal chance of being selected in the study. At the second stage, two co-educational secondary schools will be selected using simple random sampling technique. The choice of co-education schools was because gender is one of the variables in the study. At the third stage of sampling, one intact class of Basic science students in JSSII from the two sampled schools were selected randomly (tossing a coin method) and the two classes were assigned experimental group and control group. Experimental group was taught using system approach strategy while the control group was taught using conventional method.

The instruments used for data collection were Basic Science Achievement Test (BSAT) and Lesson Plan. Basic Science Achievement Test was used for pretest and posttest in the study. It comprised of twenty-five (25) items multiple choice objective test questions with four (4) options lettered A, B, C and D. The test items are based on the following Basic Science concepts: Ecology & Ecosystem (pollution, cycles, associations, population); Conservation of Natural Resources (soil conservation, agencies); Insects & Arthropods (life cycle, mouthparts, importance) and Health & Diseases (pathogens, vectors, parasites). It will be used for pre-test and post-test (Appendix III and V respectively). The researcher prepared two sets of lesson plans for teaching both experimental and control groups and each unit contained six lessons that lasted for six weeks. One set of lesson plan was prepared using system approach while the other set was prepared based on conventional method.

Basic Science Achievement Test (BSAT) instrument validity was established through face and content validation (table of specification/test blue print) by two experts in Science Education and two in the sampled schools to examine the relevance, clarity and adequacy in measuring the constructs. The comments and recommendations of the experts helped in selection and modification of the test items for the study. After the validation, the BSAT items was subjected to pilot test to find out the reliability of the instruments using one intact class consisting of fifty (50) JSS 2 Basic science students outside the scope of the study. The reliability of BSAT was determined using test re-test method and Pearson Product Moment Correlation Coefficient (r) was adopted to determine the reliability coefficient of the two instruments which gave 0.81. This indicated that the items were reliable within the acceptable limits. The BSAT was administered as pre-test for both experimental and control group, after which the researcher and the research assistants went round the selected schools and taught students personally for 6 weeks during their lesson periods using the prepared lesson plan. However, in the last one week, the researcher administered the BSAT post- test. The script were marked and recorded with the use of the developed marking scheme. The Marks obtained from the pre- test and post- test from the instruments (BSAT) was used as data for this study which was also used to determine the effectiveness of system approach on students' achievement in Basic science.

The data collected were analyzed using descriptive and inferential statistics. The Research questions was answered using frequency counts, means and standard deviations while, ANCOVA statistics to test the hypotheses formulated at 0.05 alpha level of significance. The analysis was computed with the use of the Statistical Package for Social Science (SPSS), version 27.

Results

The following research questions were formulated and answered as follows:

Research Question one: What is the mean academic achievement scores of students taught basic science with system approach and those taught using conventional method?

Table 2: Mean and Standard Deviation of pretest and posttest on Academic Achievement for Experimental and Control Group

	N	Mean		Std. Deviation		Mean
Groups		**Pretest**	**Post-test**	**Pretest**	**Post test**	**Diff.**
Experimental	192	30.35	38.5	.62	.78	8.15
Control	192	29.9	37.6	.27	.52	7.7
Total	**384**					

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Table 4 shows the mean and standard deviation of scores of students taught Basic science using system approach in Experimental Group and those taught using conventional method in the Control Group at pretest and posttest. It was observed that the mean scores of the two groups at post-test differ, where students taught through system approach had higher mean scores of 38.5 with standard deviation of .78 while those taught through talk-chalk method had mean scores of 37.6 with standard deviation of .52

Research Question Two:
What is the mean achievement scores of male and female students taught basic science using system approach?

Table 3: Mean and Standard Deviation of pretest and posttest on mean academic achievement of Male and Female in Experimental Group

	N	Mean		Std. Deviation		Mean
Gender		**Pretest**	**Post-test**	**Pretest**	**Post test**	**Diff.**
Male	95	20.15	26.5	.45	.59	6.35
Female	97	13.90	17.5	.37	.47	3.60
Total	**192**					

Table 5 shows the mean and standard deviation of scores of male and female students taught Basic science using system approach in Experimental Group at pretest and posttest. It was observed that the mean scores of the two groups at post-test differ, where male students had higher mean scores of 26.5 with standard deviation of .59 while their female counterparts had mean scores of 17.5 with standard deviation of .37

Hypotheses
HO_1: There is no significant difference between the mean academic achievement scores of students taught basic science with system approach and those taught using conventional method.

Table 4: Summary of Analysis of covariance (ANCOVA) on Achievement scores of Experimental and Control Group

Source	**Type III Sum of squares**	**df**	**Mean Square**	**F-Cal.**	**Sig.**	**Decision**
Correctional Model	1055.527	3	154.309	18.236	0.000	
Intercept	807.418	1	807.418	91.538	0.000	
Pretest	5854.762	1	5854.762	52.522	0.000	
Group	**5842.330**	**1**	**5842.330**	**64.319**	**0.000**	**S**
Gender	0.0614	1	0.065	0.0614	0.685	NS
Group	**17.613**	**1**	**17.613**	**2.811**	**0.085**	**NS**
Error	838.677	242	8.041			
Total	35801.000	237				
Corrected Total	1786.325	235				

*: Significant at $p< 0.05$

Table 4 revealed F-value, = 64.319, p-value = 0.000. The hypothesis one (HO1) was not accepted because p-value is less than 0.05. This implies that there is significant difference between mean achievement scores of

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junior secondary school students taught Basic science using system approach and those taught using conventional method in favored of experimental group.

HO_2 There is no significant difference between the mean achievement scores of male and female students taught basic science using system approach.

Table 4 revealed F-value, = 0.0614, p-value = 0.000. The hypothesis two (HO2) was accepted because p-value is greater than 0.05. This implies that there is no significant difference between mean achievement scores of junior secondary school male and female students taught Basic science using system approach.

Discussion

The purpose of the study was to determine effect of system approach on the Basic science students' academic achievement in Junior Secondary Schools, FCT, Nigeria. Findings of the research work on Basic science students' achievement taught using system approach method improved learners achievement significantly higher than the those taught using the conventional method of teaching. As a result, the null hypothesis which states that there is no significant difference between the mean academic achievement scores of students taught basic science with system approach and those taught using conventional method was not accepted. The result is in agreement with the findings of Samuel et al. (2025) who observed that the use of system approach method in teaching Basic science improved students' achievement in science than the conventional method. The analysis of the achievement of male and female students taught Basic science with system approach method revealed that there was no significant difference in the mean achievement scores of students taught using system approach method. As a result, the null hypothesis which states that there is no significant difference between the mean achievement scores of male and female students taught basic science using system approach was accepted. This contradict the result of the study of Quinn et al. (2020), who revealed that there was significant difference in the achievement of both male and female students taught Basic science using system approach methods.

Conclusion

Based on the findings of the study, it was concluded that system approach had improve students' academic achievement and enhance gender friendliness of Basic Science students in the area and the country at large.

Recommendations

Based on the research findings, the following recommendations were made:

1. Government should encourage the use of system approach teaching method in the teaching and learning of Basic science and other subjects in junior secondary schools by organizing workshops and seminars in training and retraining of teachers on the use of the aforementioned teaching methods.
2. Basic Science teachers should endeavor to use the system approach learning method in teaching since this method enhances achievement and has the potential of developing critical thinking and creative abilities in the students without being gender biased.
3. Basic science teachers should vary their instructional approach by using system approach learning method against the consistent use of conventional teaching method because system approach learning method has been found to enhance the academic achievement of Basic science students.
4. Extra lessons should be organized by schools to bridge the gap existing between high, moderate, and low-level scoring students in Basic science.

References

Achor, E.E., & Gbadamosi, O.B. (2020). Raising the achievement and retention levels of secondary school students in physics through brain-based learning strategy in Taraba State, Nigeria. *BSU Journal of Science, Mathematics and Computer Science, 1(2), 1-13*

Akinwaare, M.O., & Oyeninhun, A.O. (2023). Effect of goal-oriented prenatal education on birth preparedness complication readiness and institutional delivery among semi-urban pregnant women in Nigeria.

Apochi, M.A & Paul-Fiase R.U. (2023). Effects of Sequential Teaching Methods on Retention in Biology among Senior Secondary School Students in Niger State, Nigeria. *Zamfara International Journal of Education (ZIJE), 3(6),*

Dajal R.G., Apochi M.A & Paul-Fiase R.U, (2022). Effects of Sequential Teaching Methods on Senior Secondary School Biology Students' Achievement in Niger State, Nigeria. *Ilorin Journal of Education, University of Ilorin, 42(2), 75-82.*

Federal Republic of Nigeria, (2015). National Policy on Education, Abuja: NERDC Press

Cite this article as:
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Krejcie, R.V., & Morgan, D.W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30(3), 607-610*

Kyado, J.J., Achor, E.E., & Fahewa, M.A. (2020). Upgrading students' achievement and retention in Basic science using analogy and demonstration strategies. *CCU Journal of Science, 1(1), 81-96*

Martinez, I., Morgan, Y., Chambel, M. & Marques- Pinto, A. (2019). Antecedents of academic performance od university students; Academic engagement and psychological capital resources. *Educational Psychology, 39 (8), 1047- 1067.*

Michelle, S. (2019). Importance of' system approach principles in teaching and learning. Pima Publishing Limited.

Nigerian Educational Research and Development Council, (2025). *Revised secondary school science curriculum for implementation.* NERDC Press.

Okebukola, P.A. (2019). The place and state of education in Nigeria's development imperative and urgency of reform: Can the dry bones of quality education rise again?

Okereke and Onwukwe, (2011). Influence of gender, school location and the use of play-simulation on school achievement in Chemistry. *Journal of Research in National Development (JORIND) (9)1. Retrieved from www.transcampus.org/journals.*

Owoere, P.O. & Agbaje, R.O. (2016). Students' Attitude and Gender as correlates of Students' Academic Performance in Biology in Senior Secondary Schools. *International Journal of Research and Analytical Reviews, 3(3).*

Samuel, J., Dajal R.G., & Apochi M.A. (2025). Effects of system approach on achievement and retention of Basic science students in junior secondary schools in the Federal Capital Territory, Abuja, Nigeria. *International Journal of Innovative Social Sciences & Education Research (IJSSER).*

Universal Basic Education Board, Federal Capital Territory, Abuja (2025). Computer Statistics report.

Quinn K.N., Kelley, M.M., McGill, K.L., Smith E.M., Whipps Z., & Holmes N.G. (2020). Group roles in unstructured Labs show inequitable gender divide. *Physical Review Physics Education Research, 16(1), 010129.*

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