Effects of 7es Constructivist Instructional Model on Students' Interest and Achievement in Basic Science in Federal Capital Territory Abuja

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Abstract

The study investigated the effect of the 7Es model of lesson planning on students' interest and achievement in Basic Science in FCT, Abuja. Four hypotheses were tested at 0.05 level of significance. A quasi-experimental research design was adopted for the study. Two non-equivalent intact classes were randomly assigned to the control and experimental groups. A sample of 232 students was used for the study. Basic Science Achievement Test (BSAT) and Basic Science Interest Scale (BSIS) with reliability indices of 0.85, and 0.87 respectively, were used for data collection. Mean and standard deviation were used to answer the research questions, while ANCOVA was used to test the hypotheses at 0.05 significance level. The findings of the study revealed that there was no significant difference (F-value of 1.107) in the mean interest rating of students taught Basic Science using 7Es constructivist instructional model and those using the conventional method; there was no significant difference in the mean interest rating of male and female students (F-value of 6.65) taught Basic Science using the constructivist instructional model; interaction effects of gender and method (F-value of .477) on the mean achievement mean scores of students in Basic Science was not significant. It was recommended, among others, that basic science educators be encourage to embrace the 7Es Constructivist Instructional model to foster enhanced classroom engagement, leading to improved overall students' interest and achievement.

Key Words: 7Es Constructivist Model, Interest, Gender, Achievement, Basic Science

Introduction

The Universal Basic Education (UBE) Curriculum includes Basic Science and Technology, introduced at different educational levels: lower basic (primary 1-3), middle basic (primary 4-6), and upper basic (junior secondary school 1-3), which is one of the key and mandatory subjects in the new Curriculum. This subject is introduced to students at the lower basic level as Basic Science and Technology, while it is taught as Basic Science at the middle basic level. However, at the upper basic level, the subject

is presented as distinct components: Basic Science and Basic Technology. The separation of these concepts, as explained by Obioma, Adeniyi, Lawal, Odumuh, Ikegulu, Nwabueze, and Chijioke (2014), is intended to place special emphasis on, and enhance technology and entrepreneurship. Nevertheless, achieving a deep understanding of these scientific concepts is contingent on students having a solid grasp of Basic Science.

Basic Science, formerly known as Integrated Science, encompasses the fields of Physics, Chemistry and Biology. It is a fundamental science subject taught at the basic school level. The significance of Basic Science cannot be overstated, as it plays a crucial role in preparing students for advanced scientific studies at the senior secondary school and university levels. One of the primary goals of Basic Science, as outlined by the Nigerian Educational Research and Development Council (2007), is to among others, cultivate students' interest in science. This interest serves as a foundation that propels them to pursue science-related careers and professional courses, including but not limited to fields like medicine, engineering, pharmacy, and more.

Despite these efforts, research indicates low achievement and interest among students in Basic Science, which may affect their pursuit and performance in science disciplines at senior secondary school level. The low achievement of students in Basic Science at the BECE raises doubts about the effectiveness of instructional methods employed by Basic Science teachers, as suggested by Nwagbo & Uzoma (2014). BECE results in FCT Abuja, 2015-2022 supports low achievement in Basic science.

Table 1: Basic Education Certificate Examination (BECE). Result in Basic Science in FCT, Abuja from 2015-2022

Year	Number of candidates registered	Total pass at credit level A1-C6	% Passes at grade A1-C6	Total pass D7-F9	% Failure D7-F9

2015	2321	1091	47.01%	1230	52.99%
2016	2861	1281	44.77%	1580	55.23%
2017	3901	1911	48.99%	1990	51.01%
2018	3507	1571	44.80%	1936	55.20%
2019	3110	1201	38.61%	1909	61.38%
2020	3418	1421	41.57%	1997	58.43%
2021	3482	1590	45.66%	1892	54.34%
2022	3817	1520	39.82%	2297	60.18%

Source: Universal Basic Education Resource Center (UBERC), FCT, Abuja (2022).

Table 1 shows that the percentage of candidates with grade A1-C6 are below 50%. The BECE Examiner's reports for the period in question (2015-2022) indicates that there was underachievement among students with particular reference to Basic Science questions which could be attributed to the Candidate's apathy and poor mastery of the demands of the questions.

Evidence abounds to show that constructivist strategies can enhance students' interest and achievement in science (Balta & Sarac, 2016). However, persistent low achievement in Basic Science, particularly in the Basic Education Certificate Examination (BECE), remains a concern.

In Bwari Area Council, students' low achievement at credit level in Basic Science, as seen from BECE results, limits their opportunities for advanced science studies. A number of factors contribute to this trend including ineffective teaching methods and a lack of student engagement. Researchers have long been concerned with evaluating students' learning in problem-based learning, inquiry-based learning, and similar methods, assessing the depth of their learning in comparison to previous levels (Ambrus, 2014; Ambrus & Barczi-Veres, 2016). Consequently, the primary focus of

educational reform has shifted toward understanding and implementing ways to encourage students to think critically and reflect on their learning. As Lazarides, and Ittel, (2012) suggested, a constructivist instructional approach offers learners the opportunity to actively construct knowledge rather than passively receiving information, ultimately leading to more effective learning. When students engage in constructing their own mental frameworks of information, they are prompted to consider how the creation and organization of this information occurred (Vighnarajah, Luan, & Abubakar, 2013). Constructivism theory underscores the idea that learning should be an active process in which learners develop new ideas and concepts based on their existing knowledge (Odoh, 2013).

Constructivist instructional approaches, such as the 7Es learning model (Elicit, Engage, Explore, Explain, Elaborate, Evaluate, Extend), are recommended to address these issues. This model encourages active learning and knowledge construction, shifting from traditional teacher-centered methods to student-centered ones (Balta & Saraç 2016).

Fig 1: Diagrammatical Representation of 7Es Learning Model

The 7Es learning model is a structured template for planning and maximizing the benefits of inquiry-based activities. The seven phases in this model are as follows: Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend. The "Elicit" phase aims to assess students' existing knowledge of the content. The "Engage" phase is designed to motivate students and capture their interest in the topic. The "Explore" phase allows students to gain hands-on experience and construct their understanding of the concept. The "Explain" phase encourages students to articulate their understanding of the concept. In the "Elaborate" phase, students apply the content to other situations. The "Evaluate" phase assesses students' comprehension of the content, and the "Extend" phase challenges students to apply what they have learned to new contexts. The Constructivist theory, rooted in the idea that the teacher's role should be that of a guide, facilitator, and creator of an educational environment, encourages students to build their own knowledge. This is usually achieved through direct engagement with the subject matter and the application of their accumulated concepts and prior experiences (Balta & Saraç 2016). In this approach, the student is seen as an active participant, engaging in innovative thinking, self-discovery, knowledge building through discussion with peers, and avoiding rote memorization (Abu-Safar, 2014). The teacher's role is to understand the students' existing concepts and guide the learning process to address and expand upon them. According to Agulana & Nwachukwu (2014), constructivist instructional strategies focus on meaning-making and knowledge construction, rather than mere memorization, making it a valuable tool for shifting from traditional teacher-centered lectures to a learner-centered, hands-on method that emphasizes problem-solving and the construction and reconstruction of ideas and methods.

This study explores the impact of the 7Es lesson planning model on students' interest and achievement in Basic Science in Bwari Area Council. However, despite the promise of such instructional approaches, gender-related differences in interest and achievement in science education have been documented. Some studies suggest that male students perform better in science-related subjects, while others report no significant gender differences (Okeke, 2018; Anaekwe, 2019 ; Lazarides & Ittel, 2012). These contradictory findings necessitate an investigation into how the Constructivist-Based Approach (CBA), implemented through the 7E's model, may affect students' interest and achievement, in Basic Science, with a particular focus on potential gender disparities.

Statement of the Problem

The persistent academic concern within Bwari Area Council is students' apathy and their consistently low achievement in Basic Science. This is particularly evident in the results of the Basic Education Certificate Examination (BECE). This unimpressive achievement pattern not only affects the students' immediate educational prospects but also denies them the opportunity to pursue science-related subjects in senior secondary school. Despite concerted efforts to rectify this situation by reducing errors in Basic Science questions on external examinations, the problem endures (Anaekwe, 2019).

The conventional chalk-and-board teaching techniques dominate the classroom environment. These methods are predominantly teacher-centered, potentially hindering students' active participation and engagement in the learning process. There had been minimal emphasis on the utilization of instructional materials, interactive learning, and knowledge construction approaches (Balta and Saraç 2016). The need for a learner-centered approach that can not only enhance students' academic achievement but also

reignite their interest in Basic Science has become obvious. The study, therefore, seeks to explore the efficacy of the 7E's Constructivist instructional model in facilitating interest and achievement among male and female Basic Science students in the Federal Capital Territory, Abuja.

Objectives of the Study

The study investigated the effect of the 7Es model of lesson planning on students' interest and achievement in Basic Science. Specifically, the objectives were to determine the:

1. effects of 7E's Model of Lesson delivery on mean interest ratings of students in Basic Science.
2. effects of 7E's s Model of Lesson delivery on mean achievement scores of students in Basic Science.
3. effects of the 7E'S Model of Lesson delivery on the mean interest ratings of male and female students in Basic Science.
4. effects of 7E's Model of Lesson delivery on the mean achievement scores of male and female students in Basic Science.

Research Hypotheses

The following hypotheses guided the study at 0.05 level of significance.

H_{O1}: There is no significant difference in the mean interest ratings of students taught Basic science using the 7E'S Model of Lesson delivery and those taught using the conventional method.

H_{O2}: There is no significant difference in the mean achievement scores of students taught Basic science using the 7E'S Model of Lesson delivery and those taught using the conventional method.

H_{O3}: There is no significant difference in the mean interest ratings of male and female students taught Basic science using the 7E'S Model of Lesson delivery.

H_{O4}: There is no significant difference in the mean achievement scores of male and female students taught Basic science using the 7E'S Model of Lesson delivery.

Methodology

The research employed a non-equivalent group pretest, posttest quasi-experimental group design. The design was adopted because the researchers had no control over all the relevant variables especially the class arrangement of the students, hence intact classes were used. Two intact classes were randomly assigned to the control and experimental groups. A sample of 232 male and female students was used for the study. Basic Science Achievement Test (BSAT) and Basic Science Interest Scale (BSIS) with reliability indices of 0.85 and 0.87 respectively, were used for data collection. Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 significance level.

Results

The results of the study were presented in line with the hypotheses

Hypothesis One

There is no significant difference in the mean interest ratings of students taught Basic science using 7E$_S$ Model of Lesson Planning and those taught using the conventional method.

The ANCOVA test for this hypothesis is provided on Table 2.

Table 2: Results of ANCOVA on Students Interest in Basic Science.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	394.148[a]	2	197.074	2.890	.058
Intercept	27207.264	1	27207.264	398.981	.000
PreInterest	309.997	1	309.997	4.546	.034
Group	75.467	1	75.467	1.107	.294
Error	15615.952	229	68.192		
Total	1678807.000	232			
Corrected Total	16010.099	231			

From table 2, F ratio= 1.107 was obtained with associated probability value of 0.294. (P=.294>α=.05). Since the associated probability 0.294 was greater than 0.05 set as level of significance, the hypothesis was not rejected. This indicates that there was no significant difference in the mean interest rating of students taught Basic Science using 7Es constructivist instructional model and those taught using the conventional method.

Hypothesis Two

There is no significant difference in the mean achievement scores of students taught Basic science using 7E$_S$ Model of Lesson Planning and those taught using the conventional method.

Table 3: Results of ANCOVA on Students Achievement in Basic Science

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	332.390[a]	2	166.195	22.45	.000
Intercept	2131.099	1	2131.099	287.81	.000
Pretest	201.427	1	201.427	27.20	.000
Group	49.241	1	49.241	6.65	.011
Error	1695.640	229	7.405		
Total	215231.000	232			
Corrected Total	2028.030	231			

From table 3, F ratio of 6.65 was obtained with associated probability value of 0.011. Since the associated probability of 0.011, (F=6.65; P=.011<α=.05), was less than 0.05 set as level of significance, the hypothesis was rejected indicating that there is a significant difference between the mean achievement score of students taught Basic Science using 7Es constructivist instructional model and those taught using conventional method. The result indicated that the treatment on student using 7Es made them achieve higher than those taught using conventional method.

Hypothesis Three

There is no significant difference in the mean interest ratings of male and female students taught Basic science using 7E$_S$ Model of Lesson Planning.

Table 4: Results of ANCOVA Test on Students' Interest in Basic Science

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	367.089[a]	2	183.545	2.312	.104
Intercept	15635.992	1	15635.992	196.916	.000
PreInterest	356.850	1	356.850	4.494	.036
Gender	16.033	1	16.033	.202	.654
Error	8575.685	108	79.404		
Total	816367.000	111			
Corrected Total	8942.775	110			

From table 4, F ratio =0.202 was obtained with associated probability value of 0.654. (F=0.202; P=.654>α=.05). Since the associated probability of 0.654 is greater than 0.05 set as level of significance, the null hypothesis was not rejected which implies that there

was no significant difference in the mean interest scores of male and female students taught Basic Science using 7Es constructivist instructional model.

Hypothesis Four
There is no significant difference in the mean achievement scores of male and female students taught Basic science using 7E$_S$ Model of Lesson Planning.

Table 5: Results of Analysis of Covariance on Male and Female Students' Achievement

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	89.446[a]	2	44.723	3.838	.025
Intercept	1384.685	1	1384.685	118.832	.000
Pretest	89.438	1	89.438	7.676	.007
Gender	1.164	1	1.164	.100	.753
Error	1258.464	108	11.652		
Total	108702.000	111			
Corrected Total	1347.910	110			

From table 5, the mean achievement scores of male and female students taught Basic Science using 7E constructivist instructional model had F ratio= 0.100 was obtained with associated exact probability value of 0.753. (F=.100; P=.753>α=.05). Since the associated probability of 0.753 is greater than 0.05 set as level of significance, the null hypothesis was not rejected. The result implies that there was no significant difference in the mean achievement score of male and female students taught Basic Science using 7E constructivist instructional model.

Discussion
The results of the study in respect of hypothesis 1, suggest that there was no statistically significant difference (F-value of 1.107) in the average interest ratings among biology students instructed in Basic Science through the 7Es Constructivist Instructional model compared to those instructed through conventional methods. This finding is in agreement with the findings of Berie, Damtie, & Bogale, (2022), indicating that the heightened interest observed in treatment groups could be attributed to the conducive learning environment that promotes teamwork, motivation, and mutual support. This

could be that both instructional approaches may have effectively engaged students in the learning process, fostering an environment conducive to interest and participation. The 7Es Constructivist model emphasizes hands-on, experiential learning, while conventional methods may still incorporate interactive elements and practical activities. Additionally, the heightened interest observed in both groups could stem from broader contextual factors, such as the overall classroom environment. Elements like teamwork, motivation, and mutual support, as noted in previous research, play pivotal roles in enhancing student engagement and interest. Regardless of the specific instructional method employed, a supportive and collaborative learning environment can positively influence students' attitudes towards the subject matter.

The results of the study in respect of hypothesis 2, suggest that there was no statistically significant difference (F-value of 6.605) in the average achievement score among biology students instructed in Basic Science through the 7Es Constructivist Instructional model compared to those instructed through conventional methods. This finding is in agreement with the findings of Bunkere (2019) and Okeke (2018), who were of the opinion that male students typically display higher interest than their female counterparts. The absence of a significant difference in interest scores between male and female students despite previous assertions of gender-based variations could be attributed to several factors. Firstly, the implementation of the 7Es Constructivist Instructional model might have provided an environment that equally engages both male and female students thereby, mitigating any inherent differences in interest levels. Secondly, societal shifts towards gender equality and inclusive education might have influenced teaching practices, ensuring that instructional strategies cater to the diverse needs and preferences of all students, regardless of gender.

The results of the study in respect of hypothesis 3, suggest that there was no statistically significant difference (F-value of 0.202) in the average interest rating among biology students instructed in Basic Science through the 7Es Constructivist Instructional model. This consistency aligns with the findings of Bunkere (2019), and Nasir, Nasir, Soma (2018), who attributed the enhanced achievement trend to the supportive teaching and learning environment provided for students. 7Es model emphasizes an interactive and hands-on approach to learning, which may facilitate deeper understanding of concepts among students. By actively engaging students in the learning process through exploration, explanation, and elaboration, the 7Es model fosters a more dynamic and stimulating learning environment compared to traditional lecture-based methods. Additionally, the supportive teaching and learning environment promoted by the 7Es model could contribute to the observed increase in achievement. This model encourages collaboration, inquiry, and critical thinking, thereby empowering students to take ownership of their learning and develop essential problem-solving skills. Furthermore, the emphasis on real-world applications and connections in the 7E's model may enhance students' motivation and interest in the subject matter, leading to improved academic performance.

The results of the study in respect of hypothesis 4 suggest that there was no statistically significant difference (F-value of 0.100) in the average student's achievement among biology students instructed in Basic Science through the 7Es Constructivist Instructional model. This finding contradicts Okeke's (2018), discovery of a significant interaction effect between gender and treatment on the achievement of chemistry students taught using the 7Es Constructivist Instructional model. The absence of a significant interaction between method and gender on students' achievement scores in Basic Science using the 7Es model could be influenced by several factors. Firstly, it's

possible that the instructional design and implementation of the 7Es model in Basic Science classes were structured in a way that minimized any potential differential effects based on gender. This could include strategies to ensure equal participation, attention, and support for all students regardless of gender, thereby mitigating the impact of any underlying gender differences, the contextual differences between studies, such as variations in sample demographics, educational settings, or implementation, could also contribute to the discrepancy in findings. Factors like cultural norms, teacher practices, and student characteristics may influence the extent to which gender interacts with instructional methods to impact on achievement.

Conclusion

The findings of this research indicated that students instructed using the 7Es Constructivist Instructional model demonstrated superior interest and achievement compared to those taught through conventional methods. Gender did not have a significant impact on students' achievement in Basic Science, despite male students slightly outscoring their female counterparts in the posttest mean scores. Regarding interest, gender did not exert a significant influence.

Recommendations

The following recommendations were made based on the findings of the study:

1. The 7E's Constructivist instructional model should be adopted in teaching Basic Science as it has the potential to enhance students' interest and achievement.

2. Professional Associations like the Science Teachers Association of Nigeria (STAN) should popularize this technique among science teachers through their workshops and conferences.

3. Government support through adequate funding is solicited to sponsor the retraining of Basic Science teachers in the use of the 7E's teaching model in enhancing students' learning outcomes.

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