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# Effects Of 7Es And 3Es Instructional Strategies On Secondary School Students' Of Biology Performance In Taraba State, Nigeria

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**ABSTRACT**
This study investigated the Effects of 7Es and 3Es Instructional Strategies on Secondary School Students' of Biology Performance in Taraba State, Nigeria. Quasi - experimental design was used for the study. Two purposes of the study, two research questions and two hypotheses guided the study. The population consisted of 2,516 Secondary School II Biology students out of which 224 were sampled out for the study. The instrument used for the study was Genetic Performance Test (GPT) with the reliability index of 0.84, using Kuder-Richardson formula 20 ($K\text{-}R_{20}$). The research questions were answered using mean and standard deviations while the null hypotheses were tested at 0.05 level of significance using analysis of covariance. The result revealed among others that there is significant difference between the mean Performance scores of students taught Genetics using 7Es instructional Strategy and those taught same concept using 3Es instructional Strategy in favor of 7Es instructional Strategy. Based on the findings of the study, it is evident to conclude that the use of 7Es instructional Strategy enhanced student's performance in Genetics than the 3Es instructional Strategy. It is therefore recommended among others that Biology teacher's trainee should be trained on the use of 7Es instructional Strategy.
**Keywords:** 7Es and 3Es instructional strategy and Performance

## INTRODUCTION

Science is one of the components of the school curriculum and Biology is one of the subjects in the science curriculum. Biology is a life science subject concerned with the study of living organisms with regards to their structure, function, growth, evolution, distribution, identification, and taxonomy (Joda, 2019). The subject also pave's way for students to learn the relationship between living and living things and the environment. Hillis et al. (2020) defined biology as the scientific study of life, which involves systematic study of living things and interaction with each other and their environment. The knowledge of biology helps in checking environmental degradation such as desertification, erosion, ecosystems, genetic engineering, and pollution, among others.

The study of biology equips the learner with knowledge, skills, and attitudes vital in enabling the learner to protect and conserve the environment, population control, combat diseases, and improve food production, as forwarded by (Cherono et al., 2021). In addition, biology enables students to enter into career sectors such as education, health, agriculture, and the environment. Because of the importance of biology in life, it has become necessary for the Nigerian child to study biology at the secondary school level of education, which has numerous goals.

The major goals of teaching and learning biology include the following:

1 To provide the youth with sound knowledge of the basic principles and techniques of biology;

2 To produce knowledgeable, highly motivated, professional, and effective teachers of biology who will be able to develop in students an appreciation and understanding of biological processes and principles;
3 To develop confidence in biology teachers and enhance their ability to adapt to the changing situation in science and a technologically oriented society;
4 To view biology as a process of inquiry into the living world;
5 To analyze the activities of living things in their environment;
6 To demonstrate practical skills in handling scientific apparatus;
7 To demonstrate excellence and professional competence in teaching secondary school biology; 8 To inculcate positive scientific attitudes and values in society and promote a positive disposition towards biology, science, and scientific enterprise and to apply concepts and methods acquired in new areas of study and in everyday situations.

As important as the subject is, biology results in most certified examination , such as the) Senior School Certificate Examination (SSCE) and the West Africa Senior School Certificate Examination (WASSCE), have not been satisfactory in Nigeria as a result of students' poor performance, as forwarded by Ali and Gasim in (Nneji *et al.,* 2024). The poor students' performance observed at the secondary school exit examination in biology revealed the inability of students of biology to achieve the stated objectives for teaching the subject, which could be due to students' poor performance during lesson delivery in the classroom

The underperformance of biology students in the West African Senior School Certificate Examination in Nigeria has become a worrisome situation that calls for urgent attention. Arakoyu and Chukwu (2017) stated that the Chief Examiners' report on the West African Senior School Certificate Examination 2017 showed that the performance of Biology students in 2017 was slightly lower with a raw mean score of 31 and a standard deviation of 11.92 when compared with the raw mean score of 31 and the standard deviation of 10.91 of WASSCE 2016. The West African Examination Council's (WAEC) Chief Examiner's Report 2013, 2014, 2015, 2016, 2017, and 2018 noted that students' performance in biology was very poor. And also the underperformance of the students' biology in WAEC in the years 2019 to 2022 as forwarded by the Test Development Division, (West African Senior Secondary Examination Council (WASSEC) Taraba State 2022)

Performance is the act of completing a task successfully and effectively with the use of one's abilities and effort in order to meet academic objectives. Most importantly, the learning of biology requires the use of sequence process skills. Falode (2016) opined that performance refers to measurable changes in students' behavior in academics as a result of exposure to a given concept. Narad and Abdullah (2016) define academic performance as the knowledge acquired and evaluated by a teacher using grades or scores and/or educational goals that students and teachers have set to be accomplished within a given time frame

Academic performance is considered to be the benchmark of academic progress. Folade (2016) argued that the educational system is a productive system that has outputs. The outputs are generally defined in terms of students' test scores, which denote academic performance. Students' academic performance is produced by several inputs in the educational process, of which the teacher as an input is the principal factor in education provision and thus affects the quality of education in a significant way. Proper instructional strategy should be put in place in order to ensure that students learn meaningfully, which might improve students' poor performance in biology

Concerns about Nigerian secondary school students' biology performance have been voiced by parents, educators, and the general public. Inadequate methods of instruction and improper use of instructional resources were identified as shortcomings in science teachers by Kingaru (2014), Wamkota and Masibo (2017). Additionally, Oduol (2018) linked the low biology performance to the use of ineffective teaching and learning strategies as well as the absence of a good conducive learning environment. Research has indicated that a number of factors, including anxiety, a lack of motivation, poor teaching methods, family background, the school/classroom environment, peer groups, the overburdened biology syllabus, the difficulty of some topics and concepts, and teachers' lack of dedication and creativity, are among the reasons why secondary school students' academic performance falls short of expectations (Haruna, 2021). When the appropriate instructional strategies

are used to teach secondary school biological concepts, may be students' performance could improve, and they would be able to retain learned concepts more effectively.

Danjuma and Bajon (2022) explained that the teacher variable, that is, the teachers' teaching strategy, has been responsible for the students' poor academic performance in science; poor instructional methods. The resultant effect is the low performance level in students' outcomes, both in internal and external examinations. This implies that mastery of biology concepts might not be fully achieved without the use of an effective instructional delivery strategy. Innovative instructional strategies such as the 7Es and 3Es instructional strategies could be effective in the teaching and learning of biology.

The 7Es instructional strategy is a comprehensive instructional strategy that accommodates various methods, such as cooperative learning, group work, lectures, laboratory investigations, and direct instruction, as noted by Balci et al., in Abdullahi *et al.*, (2021). The 7Es instructional strategy is a student-centered, inquiry-based learning strategy that lays the foundation for proper conceptualization by students through various activities, spread across seven phases, as Eisenkroft, in Abdullahi *et al.*, (2021) noted. These phases are Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend. This method encompasses various methods that aid students in constructing new knowledge, such as cooperative learning, group work, laboratory investigations, and direct instruction, by clearing their thought processes. Bulbul and Balci et al., as explained in (Abdullahi *et al.*, 2021).

Importance of The 7Es instructional strategy: The 7Es instructional strategy many advantages for both the teacher and the students which are as follows: (a) Aid in a deeper understanding of the concepts, (b) It Promotes Transfer of Learning. (c) Also, it stimulates intrinsic motivation to learn. (d) Generates confidence and self-esteem. (e) Develops thinking skills, communication and social skills

The 3Es Instructional Strategy is a strategy that is based on the principles of engagement, exploration, and explanation which involves engaging students in a meaningful learning experience, allowing them to explore concepts and ideas in depth, and providing explanations to help them understand and apply their learning. It also affords the teacher the ability to display his teaching dexterity by responding to students' conceptions or lack thereof and seizing those moments during teaching to capitalize on promoting conceptual understanding (Danielson, 2016). Importance of Instructional Strategy *(*a) It increases student's engagement. (b) It also promotes critical thinking. (c) Encourages hands-on learning. (d) Supports different learning styles (e) Fosters deeper understanding. . It is, however, on this base that the researcher deemed it fit to investigate the effects of 7Es and 3Es instructional strategy on secondary school students' performance in biology

Gender refers to the differences between men and women in social terms: as men, to what a man can do; as "woman," to what a woman can or cannot do. Therefore, gender is a social construct that categorizes and divides organisms based on sexual requirements and traditionally prescribed duties (Egara and Mosimege, 2023). The term gender is also used to analyze the responsibilities of men and women in society. To carry out the assigned responsibilities effectively, the members of society need to depend on their retentive knowledge as well as their level of performance, which in most cases is determined by the instructional strategy used in training the populace. Therefore, it is worthy to note that performance is an important academic factor that could be influenced by gender

**Problem of the study**

Students' persistently poor performance in biology is a major problem that requires urgent and serious attention. Students' achievements in 2017, and 2018 showed that students' performance in biology was very poor as noted by (Chukwu and Dike, 2019)

Most of the research in education biology has dealt with curriculum issues, teaching effectiveness, and the use of student-friendly instructional materials. One therefore wonders why all the solutions proffered and implemented have not been able to reverse this trend of poor performance. Thus, this study was an attempt to see if the 7Es and 3Es instructional strategies could be used to remedy the problem of poor performance of students in secondary school biology in Taraba State, Nigeria.

**Purpose of the Study**

The main purpose of this study was to investigate the effects of the 7Es instructional strategy instructional strategy and 3Es instructional strategy on secondary school students' of biology performance and retention in genetics in Taraba State, Nigeria. Specifically, the` study found out:

1. The performance of students taught genetics using the 7Es instructional strategy and those taught the same concept using the 3Es instructional strategy.

2. The performance of male and female students taught genetics using the 7Es instructional strategy and those taught using the 3Es instructional strategy.

**Research Questions**

The following research questions guided the study:

1. What is the mean performance score of students taught genetics using the 7Es instructional strategy compared to their counterparts taught the same concepts using the 3Es instructional strategy?

**Hypotheses**

The following null hypotheses were formulated and tested at the 0.5 level of significance to guide the study.

$H0_1$: There is no significant difference in the mean performance scores of Students taught genetics using the 7Es instructional strategy, and their counterparts taught the same concepts using the 3Es instructional strategy.

## METHODOLOGY

The research design used for this work was the pretest, posttest, non-equivalent control group quasi-experimental research design. The choice of quasi-experimental design is considered appropriate for this study because it involves the use of intact classes that were purposely selected to avoid disruption of normal class lessons. And also, a quasi-experimental design is well suited for studies conducted in a natural real-world setting such as a classroom in secondary schools since the researcher cannot randomly assign students to control and experimental groups as the students are already assigned to existing class rooms. *Stage two:* two public secondary schools were purposefully selected from the selected local government

The population of the study consisted of 2,516 Secondary School II Biology students. The researcher adopted a multi-stage sampling procedure consisting of a number of distinct stages: Taraba state – 10 education zone – 1Education zone – 1 Local Govt. Area – Two schools – Two intact class. *Stage one:* Jalingo Local Government Area was purposefully selected out of Ardo-Kola and Lau from the three local government areas in the Jalingo education zone. The reason purposive sampling was used is because the conventional schools that have similar characteristics (like having qualified biology teachers, good classrooms, and science teaching facilities) are mostly found around the state headquarters. *Stage two:* two public secondary schools were purposefully selected from the selected and Simple random sampling was used to select two intact classes by lucky dip from each of the sampled schools comprising of 224 students, 121 male and 103 female.

The instrument used for the collection of data for this study was the Biology Performance Test (GPT). The GPT is a multiple-choice test that consists of 40 items. Each multiple-choice item has five options, ranging from (a) to (e) which was validated by three experts all from the Taraba State University jalingo and a reliability coefficient of 0.84 was obtained using Kuder-Richardson formula 20 ($K\text{-}R_{20}$)

The collected data were analyzed using the mean and standard deviation in order to answer the research questions. While the null hypotheses were tested using two-way analysis of covariance (ANCOVA) at 0.05 level of significance.

## RESULTS

**Table 1:** Mean performance score of students taught genetics using the 7Es instructional strategy compared to their counterparts taught the same concepts using the 3Es instructional strategy.

| Group | N | Pretest | | Posttest | | Mean |
|---|---|---|---|---|---|---|
| | | Mean | Std. Dev | Mean | Std. Dev | Gain |
| 7Es Instruction | 105 | 17.57 | 1.692 | 25.53 | 2.275 | 7.96 |
| 3Es Instruction | 119 | 17.42 | 1.476 | 20.45 | 1.899 | 3.03 |
| Mean Differences | | 0.15 | | 5.08 | | 4.93 |

Table 1 shows the mean scores and standard deviations in the performance scores of students taught genetics using the 7Es instructional strategy and those taught using 3Es instructional strategy. It is observed that the mean scores of students in the 7Es Instruction group is 17.57 in pretest and 25.53 in posttest, while their standard deviations are 1.692 and 2.275 for performance test. Students in the 3Es Instruction group have the mean scores of 17.42 and 20.45 in pretest and posttest respectively and standard deviations of 1.476 and 1.899. The results show that students in the 7Es group had a higher mean gain (7.96) compared to the 3Es group (3.03), indicating a significant difference in favor of the 7Es instructional strategy.

**Table 2:** Mean performance score of male and female students taught genetics using the 7Es instructional strategy compared to their counterparts taught genetics using the 3Es instructional strategy.

| Group | Gender | N | Type of test | Mean | Mean Gain | Standard Deviation |
|---|---|---|---|---|---|---|
| **7Es Instruction Group** | Male | 51 | Pretest | 17.53 | | 1.725 |
| | | | Posttest | 26.61 | 9.08 | 2.228 |
| | Female | 54 | Pretest | 17.61 | | 1.676 |
| | | | Posttest | 24.52 | 6.91 | 1.820 |
| **3Es Instruction Group** | Male | 70 | Pretest | 17.54 | | 1.603 |
| | | | Posttest | 21.57 | 4.03 | 1.480 |
| | Female | 49 | Pretest | 17.24 | | 1.267 |
| | | | Posttest | 18.86 | 1.62 | 1.137 |

Table 2 shows the mean scores and standard deviations in the performance scores of male and female students taught genetics using the 7Es instructional strategy and those taught using 3Es instructional strategy. It is observed that the mean scores of male and female students in the 7Es Instruction group is 17.53 in pretest, 26.61 in posttest and 17.61 in pretest, 24.52 in posttest respectively, while their standard deviations are 1.725, 2.228, 1.676 and 1.820 for performance test. Male and female students in the 3Es Instruction group have the mean scores of 17.54 in pretest, 21.57 in posttest and 17.24 in pretest, 18.86 in posttest respectively, while their standard deviations are 1.603, 1.480, 1.267 and 1.137 for performance test. It was further observed that the mean gain scores for male and female students taught using 7Es Instruction are 9.08 and 6.91 respectively. The results show that Male students in the 7Es group had a higher mean gain (9.08) compared to male students in the 3Es group (4.03) and Female students in the 7Es group had a higher mean gain (6.91) compared to female students in the 3Es group (1.62). The use of both instructional packages favored male students' more than female students.

**Hypotheses One:**

**Table 3**: One-way Analysis of Covariance of the Mean Performance Scores of 7Es Instructional Strategy and 3Es Instructional Strategy.

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared |
|---|---|---|---|---|---|---|
| Corrected Model | 1471.298[a] | 2 | 735.649 | 174.517 | .000 | .612 |
| Intercept | 634.574 | 1 | 634.574 | 150.539 | .000 | .405 |
| Pretest | 32.038 | 1 | 32.038 | 7.600 | .006 | .033 |
| **Group** | **1415.476** | **1** | **1415.476** | **335.791** | **.000** | **.603** |
| Error | 931.591 | 221 | 4.215 | | | |
| Total | 119203.000 | 224 | | | | |
| Corrected Total | 2402.888 | 223 | | | | |

Table 3 shows the results of a one-way ANCOVA (Analysis of Covariance) comparing the mean performance scores of students taught genetics using the 7Es instructional strategy and those taught using the 3Es instructional strategy. The results indicate that There is a significant difference in the mean performance scores between the two groups ($F(1, 221) = 335.791$, $p < 0.05$). The null hypothesis is rejected, indicating that the two groups differ significantly. The effect size (eta square =

0.603) is high, indicating that 60.3% of the difference in the mean score is attributed to the instructional strategy used and The pretest scores were used as a covariate to control for initial differences between the groups. The results suggest that the 7Es instructional strategy had a significantly positive impact on students' performance in genetics compared to the 3Es instructional strategy. The high effect size indicates that the instructional strategy had a substantial influence on the outcome.

## DISCUSSION

The results in Table 1 showed that students in the 7Es group demonstrated a higher mean gain (7.96) compared to the 3Es group (3.03), indicating a significant improvement in their understanding of genetics concepts. The mean scores of students in the 7Es group increased from 17.57 in the pretest to 25.53 in the posttest, indicating a significant improvement in their performance. In contrast, the mean scores of students in the 3Es group increased from 17.42 in the pretest to 20.45 in the posttest, indicating a smaller improvement in their performance. The higher mean gain of the 7Es group suggests that the instructional strategy was more effective in promoting students' understanding of genetics concepts. This also shows the effectiveness of 7Es instructional strategy in enhancing students ' performance in Genetics in Biology.

The findings of this study agrees with that of Rogayan (2022) study in Philippine as well as Cherono et al. (2021), who all affirmed that students instructed with 7Es instructional strategy performed significantly better than those instructed with 3Es instructional strategy and emphasized that 7Es teaching strategy should be encouraged to enhance students ' performance . However, this finding contradicted Ajayi and Atsuwe (2024) submission which revealed that low ability students that were taught Chemistry using 3Es instructional strategy improved in academic performance. The use of 7Es instructional strategy was more effective in teaching Genetics than 3Es teaching strategy due to the fact that the 7Es instructional Strategy is designed to engage students in a more interactive and inquiry-based learning experience, which can lead to deeper understanding and better hence, enhances their Performance

Furthermore, the finding shown in Table 2 indicates a significant difference in the performance scores of male and female students taught genetics using the 7Es instructional strategy compared to those taught using the 3Es instructional strategy. Male students in the 7Es group demonstrated a higher mean gain (9.08) compared to the female students in the group with mean gain (6.91) and the male students in the 3Es group with mean gain (4.03), compared to the female students in the group with mean gain (1.62) However, the results also show that the use of both instructional packages favored male students' more than female students.

This finding disagrees with Cherono et al. (2021) and Awan and Azeem (2017) who all affirmed that the 7Es instructional package favored female students' more. Other authorities in the likes of Adu and Folson (2023) revealed a significant difference in performance between male and female students in the same group with the instructional package. This could be due to a variety of factors, such as differences in learning styles or prior knowledge.

## CONCLUSION

On the basis of the outcome of the study, it can be significantly concluded that

1 The use of 7Es instructional strategy is very effective for the teaching and learning of Biology in secondary schools because it improves students' performance

2 7Es instructional strategy have been proven to be gender friendly as such teachers of Biology can adopt the use of 7Es as an instructional strategy in other to enhance students' understanding of biological concepts

## RECOMMENDATIONS

On the basis of this study, the researcher forwarded the following recommendations:

1. School supervisors and principals should ensure that the use of 7Es instructional strategy is encouraged and recommended in schools for the effective implementation of the Biology curriculum by regular supervision and monitoring on their own part.

2. Ministry of Education and school proprietors should ensure that teachers of Biology are trained to use modern effective teaching methods especially 7Es instructional strategy through sponsorship to workshops, seminars and even further trainings as this will prove productive in this 21st century.

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