

Effects of 7Es Constructivist Instructional Model on Biology Students Interest and Achievement on Respiratory System in Abuja, Nigeria

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ABSTRACT

This study investigated the effects of the 7Es constructivist instructional model on students' interest and achievement in the respiratory system, comparing it with the conventional teaching method. A quasi-experimental design was used, involving a pre-test, post-test, and control group. The population of the study comprised 8,792 SS II students from co-educational school in Abuja, Nigeria. A sample of 120 secondary school students was selected from biology intact classes in Abuja, Nigeria. The students were divided into two groups: one taught using the 7Es constructivist model, and the other using the conventional method. Data were collected using a Respiratory System Interest Inventory (RSII) and a Respiratory System Achievement Test (RSAT), the reliability of the instruments RSAT was determined using Richard-Kuderson, a reliability coefficient of 0.74, while Cronbach alpha was used to determine the reliability index of RSIS, RSIS yielded a reliability index of 0.84. The results showed that the instruments were suitable for the study. The results were analyzed using means and standard deviation to answer the research questions and Analysis of Covariance (ANCOVA) to test the hypotheses at 0.05 level of significance. The findings revealed that while both methods increased students' interest, there was no significant difference in interest between the two groups ($p = 0.294$). However, a significant difference in achievement was observed, with the 7Es group scoring significantly higher than the conventional group ($p = 0.011$). The study concluded that the 7Es constructivist model is highly effective in enhancing students' academic achievement in biology, particularly in the respiratory system. Despite its limited impact on student interest, the model's inquiry-based, active learning approach fostered deeper understanding and higher retention of knowledge. It is recommended that educators adopt the 7Es constructivist model to improve student outcomes in biology, while also exploring additional strategies to boost student interest. Further research is suggested to investigate methods for enhancing student engagement alongside constructivist instruction.

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INTRODUCTION

In recent years, educational researchers and practitioners have sought to explore teaching

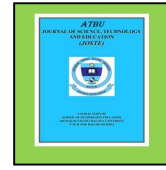
strategies that improve student engagement and achievement, particularly in science subjects. Conventional lecture-based teaching methods,

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which are teacher-centered, often limit students' active participation, resulting in low levels of interest and poor retention of content. In contrast, constructivist approaches, which emphasize student-centered learning, have been shown to be more effective in promoting deeper understanding and fostering a positive attitude towards learning (Apkan & Beard, 2016). Biology, being a fundamental science subject, plays a critical role in the education of students, especially in preparing them for careers in health sciences, environmental studies, and biotechnology. However, there has been a growing concern over students' performance and interest in biology, particularly in topics that require a deeper understanding of complex systems, such as the respiratory system. The respiratory system, though fundamental to understanding human physiology, is perceived as abstract by many students, contributing to challenges in both comprehension and sustained interest. Thus, the need for innovative and effective instructional strategies is becoming increasingly crucial in biology education.

One approach that has garnered attention is the 7Es Constructivist Instructional Model. Rooted in constructivist learning theory, this model emphasizes active learning, allowing students to construct their knowledge based on experiences, exploration, and reflection. The 7Es model includes seven phases: Elicit, Engage, Explore, Explain, Elaborate, Evaluate, and Extend, each designed to guide learners from initial inquiry to deeper understanding and application of knowledge (Eren, 2017; Schraw & Lehman, 2017; Morrison & Lederman, 2018). This research seeks to explore the impact of the 7Es model on students' interest and achievement in the respiratory system, a key topic in biology. The 7Es model is an instructional framework derived from constructivist theory. Constructivist theory, championed by scholars such as Jean Piaget and Lev Vygotsky, posits that learners actively construct their own understanding based on their experiences, rather than passively receiving information (Morrison & Lederman, 2018; Prince & Felder, 2016). The 7Es model specifically extends this approach by creating structured phases that

promote inquiry, collaboration, and reflection, ensuring that learning is not only meaningful but also sustained over time.

The phases of the 7Es model are as follows:

1. **Elicit:** The teacher identifies students' prior knowledge and misconceptions related to the topic, providing a foundation for new learning.
2. **Engage:** The teacher captures students' interest and curiosity, motivating them to explore the concept further.
3. **Explore:** Students engage in hands-on activities, experiments, or investigations, allowing them to discover new concepts on their own.
4. **Explain:** The teacher guides students in reflecting on their experiences and helps them articulate their understanding.
5. **Elaborate:** Students apply their newly acquired knowledge to novel situations, deepening their understanding and encouraging critical thinking.
6. **Evaluate:** Both students and the teacher assess understanding, providing feedback and determining areas for further development.
7. **Extend:** Students are encouraged to apply their knowledge in real-world contexts, connecting classroom learning to everyday life.

Several studies have highlighted the effectiveness of the 7Es model in improving learning outcomes (Eren, 2017; Schraw & Lehman, 2017; Morrison & Lederman, 2018; Tekkaya, 2012). For instance, it has been found to increase student motivation, foster critical thinking, and enhance retention of complex scientific concepts. However, there is limited research on its application in specific biology topics such as the respiratory system, which presents a unique challenge due to its abstract nature and the need for understanding both macroscopic and microscopic processes.

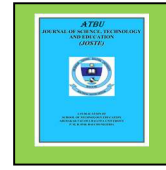
Given the importance of the respiratory system in understanding human physiology and its relevance to health and wellness, it is essential to explore strategies that make this topic more

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accessible and engaging to students. This study aims to fill this gap by investigating how the 7Es Constructivist Instructional Model affects students' interest and achievement in learning the respiratory system in biology.

Statement of the Problem

Despite the critical role of biology in science education and its relevance to fields such as medicine, healthcare, and environmental studies, students' performance and interest in biology have been consistently declining. This issue is particularly evident in the study of complex topics such as the respiratory system, which students often find abstract and challenging. Poor performance and lack of interest in biology at secondary school levels are major concerns for educators and stakeholders, as they have long-term implications for students' academic success and career choices in science-related fields. The respiratory system, a key component of human physiology, requires students to understand both macroscopic anatomical structures and microscopic physiological processes. However, traditional instructional methods, which are often teacher-centered and lecture-based, have proven insufficient in engaging students and enhancing their comprehension of such complex topics. Studies have shown that students tend to memorize biological facts for exams without gaining a deep understanding of the concepts (Ogunleye & Babajide, 2011), and this surface-level learning contributes to their lack of interest and poor retention of knowledge.

In light of these challenges, there has been growing interest in adopting innovative, student-centered instructional strategies that promote active learning, deeper understanding, and sustained interest. The 7Es Constructivist Instructional Model, a learning approach grounded in constructivist theory, offers a structured way to engage students in meaningful learning experiences. By moving away from passive learning, the 7Es model encourages students to explore, reflect, and apply knowledge, which could be instrumental in addressing the issues of low achievement and disinterest in biology (Eisenkraft, 2003). However, despite its theoretical promise,

there is limited empirical research on the specific impact of the 7Es model on students' interest and achievement in the respiratory system.

Given the critical importance of understanding the respiratory system in biology education, this research seeks to fill the gap by investigating how the 7Es Constructivist Instructional Model affects students' interest and achievement in this topic. Specifically, it will examine whether students taught using the 7Es model perform better academically and show greater interest in the respiratory system compared to those taught using traditional methods. Without a clear understanding of the effectiveness of innovative instructional strategies like the 7Es model in enhancing student outcomes, biology educators may continue to rely on less effective teaching methods, perpetuating the cycle of low achievement and disinterest in key biological concepts. This study, therefore, addresses the need for empirical evidence on the impact of the 7Es model in improving the teaching and learning of biology, particularly in the area of the respiratory system.

The central problem that this study seeks to address is the low level of student interest and achievement in the respiratory system, a crucial component of biology education. Traditional instructional approaches have not been effective in engaging students or promoting a deep understanding of this complex topic. The question remains: can the 7Es Constructivist Instructional Model, which emphasizes student-centered, active learning, significantly enhance students' interest and achievement in the respiratory system compared to conventional teaching methods?

Purpose of the Study

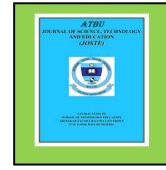
The purpose of this study was to examine the effects of the 7Es Constructivist Instructional Model on biology students' interest and achievement in the respiratory system. Specifically, the study aims to determine whether the implementation of the 7Es model leads to improved academic performance and greater interest in the respiratory system compared to traditional, lecture-based instructional methods.

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Research Questions

1. What is the effect of the 7Es Constructivist Instructional Model on biology students' interest in the respiratory system?
2. What is the effect of the 7Es Constructivist Instructional Model on biology students' achievement in the respiratory system?

Hypotheses

H₀₁: Students taught using the 7Es constructivist instructional model will demonstrate a significantly higher level of interest in the respiratory system compared to students taught using traditional instructional methods.

H₀₂: There will be a significant difference in students' academic achievement in biology regarding the respiratory system between those taught with the 7Es constructivist instructional model and those taught with traditional methods, with the former group achieving higher scores.

EMPIRICAL STUDIES

Fawole and Bello (2022) investigated the effect of 7es constructivist instructional strategy on senior secondary school students' academic performance in Biology. This recent study focused on the effects of the 7Es instructional model on senior secondary school students' academic performance in various biology topics, including cell biology and reproduction. The findings indicated that students in the experimental group outperformed their peers in the control group. However, the study did not specifically address the respiratory system or students' interest in biology topics. The study concentrated on different biology topics and did not assess the impact on students' interest, which is a major focus of the current research on the respiratory system.

Nwachukwu and Okoli (2021) explored the effect of 7Es instructional model and its impact on students' performance in biology topics in Abuja Secondary Schools" This study explored the effect of the 7Es instructional model on students' performance in

topics such as genetics, ecology, and plant biology. The researchers used a sample of 100 students and found a significant improvement in students' performance in these topics when taught using the 7Es model compared to traditional teaching methods. However, the study did not include the respiratory system as part of the topics investigated, nor did it measure students' interest. While the study highlights the effectiveness of the 7Es model, it did not focus on the respiratory system or examine the model's effect on students' interest, which is a key aspect of the current study.

Adeyemi and Eniola (2020) examined effect of 7Es constructivist instructional model on biology students' achievement in human anatomy. This research focused on the use of the 7Es model to teach human anatomy in biology. A total of 120 students were involved in the study, and the findings indicated that the 7Es model significantly improved both students' achievement and retention of anatomical concepts. However, the study did not specifically focus on the respiratory system. Although the study aligns with the current research in its focus on biology and the use of the 7Es model, it explored human anatomy as a whole and did not address student interest or achievement specifically in the respiratory system.

Olawale (2019) investigated the impact of 7Es instructional model on students' achievement in biology in selected secondary schools in Abuja. This study investigated the impact of the 7Es instructional model on students' achievement in biology, specifically focusing on the topic of photosynthesis. Using a quasi-experimental design, the study sampled 150 senior secondary school students and divided them into control and experimental groups. The results showed that students taught using the 7Es model performed significantly better than those taught using traditional lecture-based methods. However, the study did not assess students' interest levels or focus on the respiratory system. While the study focused on biology achievement, it did not examine the respiratory system, nor did it evaluate the impact on students' interest, which is a core aspect of the current research.

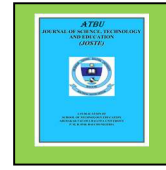
Onyeka (2018) examined effectiveness of constructivist-based teaching strategies on

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students' academic achievement and interest in Biology. The study examined the effects of various constructivist-based instructional strategies, including the 7Es model, on students' academic achievement and interest in biology. The study involved 200 secondary school students in Abuja and found that constructivist strategies significantly improved both achievement and interest. However, the study covered multiple topics in biology and did not focus exclusively on the respiratory system. This study covered a broader range of biology topics rather than focusing on the respiratory system, as the current study does. Additionally, it examined multiple constructivist strategies, not exclusively the 7Es model.

METHODOLOGY

The study employed a quasi-experimental design using a pre-test and post-test control group approach. This design allowed for the comparison of two groups: one that was taught using the 7Es constructivist instructional model and a control group that received traditional instructional methods. This design helps to establish causal relationships between the teaching method and student outcomes. The target population consisted of N secondary school biology students in Abuja, Nigeria. Stratified and simple random sampling was used to ensure representation from different classes within the selected schools. A sample of 120 students from two intact classes from two different schools were selected, with 60 students assigned to the experimental group and 60 to the control group. The selection ensure that students are from similar backgrounds and academic levels to control for confounding variables. Respiratory System Interest Inventory (RSII) – a 20-item Likert scale questionnaire was developed to assess students' interest in biology, specifically focusing on the respiratory system. The questionnaire measured various dimensions of interest, including relevance, enjoyment, and motivation. Respiratory System Achievement Test (RSAT) 30-item multiple-choice and short-answer test was developed to assess students' academic achievement in the respiratory system. The test

covered key concepts, processes, and applications related to the respiratory system. The reliability of the instruments RSAT was determined using Richard-Kuderson, a reliability coefficient of 0.74, while Cronbach alpha was used to determine the reliability index of RSIS, RSIS yielded a reliability index of 0.84. The results showed that the instruments were suitable for the study.

Pre-Test Administration: Prior to the intervention, all students completed the interest inventory and achievement test to establish a baseline measurement of interest and knowledge regarding the respiratory system.

Experimental Group: Students in this group were taught using the 7Es constructivist instructional model, which includes the following stages:

- i. Elicit: Activating prior knowledge related to the respiratory system.
- ii. Engage: Using hands-on activities to engage students in the learning process.
- iii. Explore: Facilitating inquiry-based exploration of concepts related to the respiratory system.
- iv. Explain: Providing direct instruction and clarifying concepts.
- v. Elaborate: Encouraging students to apply their understanding to real-world scenarios.
- vi. Evaluate: Assessing student understanding through formative assessments and peer evaluations.
- vii. Extend: Students were encouraged to apply their knowledge in real-world contexts, connecting classroom learning to everyday life.

Control Group: Students in this group received traditional instruction, which includes lectures, textbook readings, and guided discussions focused on the respiratory system without the interactive components of the 7Es model.

Post-Test Administration: After the instructional period (approximately 4-6 weeks), all students completed the interest inventory and achievement

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test again to measure any changes in interest and achievement.

Data Analysis

Data analysis was performed using statistical software (SPSS). The following analyses were conducted using:

- i. Descriptive Statistics: Means and standard deviations were calculated for the interest inventory and achievement test scores.
- ii. Inferential Statistics: Analysis of Covariance was used to test the hypotheses at 0.05 level of significance.

This methodology was employed to comprehensively assess the effects of the 7Es

constructivist instructional model on biology students' interest and achievement in the respiratory system. By employing a quasi-experimental design and utilizing both qualitative and quantitative measures, the study aims to provide valuable insights into effective teaching practices in biology education.

DATA ANALYSIS AND RESULTS

Results of data obtained and analyzed from the study are presented as follows:

Research Question One: What is the effect of the 7Es Constructivist Instructional Model on biology students' interest in the respiratory system?

Table 1: Mean Interest Scores of Students Taught Respiratory System Using 7Es Constructivist Instructional Model and those Taught Conventional Method

Group	N	Pre-Interest		Post-Interest	
		Mean	SD	Mean	SD
Experimental	60	60.63	9.876	85.29	9.017
Conventional	60	60.16	7.378	84.08	7.628

Table 1 presents the Mean Interest Scores and Standard Deviations of students taught the respiratory system using the 7Es constructivist instructional model compared to those taught using the conventional method. For the 7Es constructivist model, the pre-interest score was 60.63 with a standard deviation of 9.876, and the post-interest score was 85.29 with a standard deviation of 9.017. In contrast, students taught using the conventional method had a pre-interest score of 60.16 with a standard deviation of 7.378, and a post-interest score of 84.08 with a standard deviation of 7.628.

Hypothesis One

H₀₁: Students taught using the 7Es constructivist instructional model will demonstrate a significantly higher level of interest in the respiratory system compared to students taught using traditional instructional methods.

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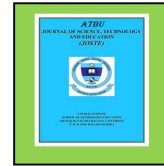


Table 2: Results of ANCOVA on Students Interest in Respiratory System.

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	115	68.192		
Total	1678807.000	120			
Corrected Total	16010.099	119			

Table 2 presents the results of the Analysis of Covariance, indicating no significant difference in the interest levels of students taught the respiratory system using the 7Es constructivist instructional model compared to those taught with the conventional method. The analysis yielded an $F_{(1, 115)}$ value of 1.107, with an associated p-value of 0.294. Since the p-value (0.294) is greater than the 0.05 level of significance, the hypothesis was not rejected. This suggests that there is no statistically significant difference in the mean interest scores between students taught with the 7Es model and those taught with traditional methods.

Research Question Two

What is the effect of the 7Es Constructivist Instructional Model on biology students' achievement in the respiratory system?

Table 3: Means and Standard Deviations of Achievement Scores of Students in the Experimental and Control Groups

Group	N	Pretest		Posttest	
		Mean	SD	Mean	SD
Experimental	60	17.81	2.59	31.10	3.50
Conventional	60	17.50	1.92	29.60	2.14

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Table 3 displays the mean achievement scores of students taught the respiratory system using the 7Es constructivist instructional model compared to those taught using the conventional method. For the 7Es model, the pretest mean score was 17.81 with a standard deviation of 2.59, while the post-test mean score increased to 31.10 with a standard deviation of 3.50. In contrast, the conventional method showed a pretest mean score of 17.50 with a standard deviation of 1.92, and a post-test mean score of 29.60 with a standard deviation of 2.14. These results highlight differences in student achievement between the two teaching methods.

regarding the respiratory system between those taught with the 7Es constructivist instructional model and those taught with traditional methods, with the former group achieving higher scores.

Hypothesis Two

H₀₂: There will be a significant difference in students' academic achievement in biology

Table 4: Results of ANCOVA on Students Achievement in Respiratory System.

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	115	7.405		
Total	215231.000	120			
Corrected Total	2028.030	119			

Table 4 presents the results of the Analysis of Covariance, revealing a significant difference in the mean achievement scores between students taught the respiratory system using the 7Es constructivist instructional model and those taught with the conventional method. An $F_{(1, 115)}$ value of 6.65 was obtained, with a corresponding p-value of 0.011. Since the p-value (0.011) is less than the 0.05 significance level, the hypothesis was rejected. This indicates a significant difference in the mean achievement scores, with the 7Es constructivist method having a notable impact on the post-test achievement scores. The results suggest that students taught using the 7Es model achieved significantly higher than those taught using the conventional method.

DISCUSS OF FINDINGS

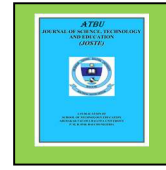
Table 1 reveals the pre- and post-interest scores for students taught using the 7Es constructivist model and those taught through conventional methods. The results show that students in both groups experienced an increase in interest from pre-test to post-test. However, the increase in post-interest scores is slightly higher for students taught using the 7Es constructivist instructional model (pre-interest: 60.63, post-interest: 85.29) than for those taught using the conventional method (pre-interest: 60.16, post-interest: 84.08). This suggests that the 7Es model had a slightly greater impact on fostering students' interest in the subject. Constructivist approaches, such as the 7Es model, have been shown to actively engage students by encouraging exploration, reflection, and collaborative learning,

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which could account for the higher post-interest scores (Akpan & Beard, 2016). In contrast, conventional methods often rely on passive learning, which may not stimulate the same level of interest.

In Table 2, the Analysis of Covariance (ANCOVA) examines whether there is a statistically significant difference in the interest scores between the two groups. The F-value of 1.107 with a p-value of 0.294 indicates no significant difference between the interest levels of students taught using the 7Es model and those taught with the conventional method, as the p-value is greater than the 0.05 significance threshold. While both the 7Es constructivist model and the conventional method led to an increase in student interest, the lack of a statistically significant difference ($p = 0.294$) suggests that the instructional model alone may not be the sole driver of student engagement. Despite the apparent increase in post-interest scores for both groups, this result suggests that while the 7Es model may slightly enhance interest, the difference between it and the conventional method is not statistically significant. Previous research has indicated that while constructivist methods can engage students more actively, factors such as student motivation, prior knowledge, and classroom environment also play significant roles in determining interest levels (Eren, 2017, Onyeka, 2018).

Research suggests that student interest is influenced by a complex interplay of factors, including personal motivation, prior knowledge, and the learning environment (Schraw & Lehman, 2017). Even though the 7Es model encourages active learning and student participation, these factors may not be sufficient to significantly enhance interest compared to more traditional methods, especially if students already have a baseline interest in biology. The respiratory system, being a core topic in biology, might naturally elicit a certain level of curiosity from students, regardless of the instructional method. As a result, the content itself could have played a larger role in maintaining interest across both groups. Constructivist models like the 7Es rely heavily on interaction, discussion, and

collaboration. In classroom settings where these dynamics are well-facilitated, interest may be higher. However, if logistical or environmental factors (e.g., classroom size, time constraints) limit the effectiveness of group work, the impact on interest might be less pronounced (Eren, 2017).

Table 3 highlights the pre- and post-achievement scores of students in both groups. For the 7Es constructivist group, the pretest mean score was 17.81, which increased to 31.10 in the post-test, indicating significant improvement. Similarly, the conventional group's pretest score of 17.50 improved to 29.60 in the post-test. However, the post-test achievement scores for the 7Es model are higher than those of the conventional group. This finding aligns with the literature suggesting that constructivist teaching approaches, such as the 7Es model, can significantly enhance students' academic performance by promoting critical thinking, problem-solving, and deeper understanding of content (Morrison & Lederman, 2018; Onyeka, 2018). The collaborative and student-centered nature of the 7Es model allows students to build knowledge actively, which likely contributes to higher achievement.

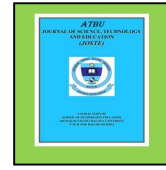
Table 4 presents the results of ANCOVA for the achievement scores, showing a significant difference between the two teaching methods. The F-value of 6.65 with a p-value of 0.011 indicates that the difference between the post-test achievement scores of students taught using the 7Es model and those taught through conventional methods is statistically significant. Since the p-value is less than the 0.05 significance level, the hypothesis of no difference is rejected, confirming that the 7Es constructivist instructional model has a more significant positive effect on students' achievement than the conventional method. This result supports earlier findings in educational research, which highlight that constructivist strategies lead to deeper learning and higher retention of knowledge, as they allow students to connect new information with their existing cognitive frameworks (Olawale, 2019; Adeyemi & Eniola, 2020; Nwachukwu & Okoli, 2021; Fawole & Bello, 2022).

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The significant difference in achievement between students taught with the 7Es constructivist model and those taught with the conventional method ($p = 0.011$) highlights the effectiveness of the constructivist approach for improving academic performance. The 7Es model is grounded in constructivist theory, which emphasizes active learning through exploration, engagement, and reflection. By encouraging students to construct their own understanding of the respiratory system through inquiry and problem-solving, the model fosters deeper cognitive processing, which leads to improved retention and application of knowledge (Akpan & Beard, 2016). This is in contrast to conventional methods, which often rely on rote memorization and passive learning, limiting the depth of understanding. The 7Es instructional model follows a structured sequence of learning stages—Engage, Explore, Explain, Elaborate, Evaluate, Extend, and Examine. Each stage is designed to scaffold student learning, progressively deepening their comprehension of the material. This approach aligns with cognitive theories of learning, such as Vygotsky's Zone of Proximal Development, which posits that students learn best when supported through progressively challenging tasks (Morrison & Lederman, 2018). Constructivist models are known for promoting higher-order thinking skills, such as critical thinking, analysis, and synthesis. By actively engaging students in these processes, the 7Es model enables them to apply their knowledge more effectively in the post-test, resulting in higher achievement scores compared to students taught using traditional methods (Prince & Felder, 2016). The 7Es model often incorporates real-world contexts and applications into learning activities. By linking biological concepts, such as the respiratory system, to practical, everyday experiences, students are able to see the relevance of what they are learning, which enhances both their understanding and motivation to succeed.

These factors likely contributed to the significantly higher post-test achievement scores for students taught using the 7Es model.

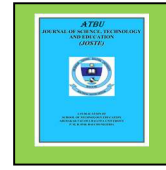
CONCLUSION

In this study, the effects of the 7Es constructivist instructional model on students' interest and achievement in the respiratory system were compared with those of the conventional teaching method. The results showed that while both methods increased student interest, there was no significant difference between them. However, the 7Es model led to a significant improvement in student achievement, demonstrating its effectiveness in fostering deeper understanding and better academic performance. These findings suggest that the 7Es model is a valuable teaching strategy, particularly for complex biological topics, as it enhances students' learning outcomes. While it may not greatly impact student interest, its influence on achievement highlights its importance in education. Therefore, educators should consider incorporating the 7Es model into their teaching practices to promote better student learning and performance in science education.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are made to enhance teaching and learning outcomes in biology, particularly in topics like the respiratory system:

1. Adopt the 7Es Constructivist Instructional Model in Biology Classrooms: Given its significant impact on student achievement, schools and educators should implement the 7Es constructivist instructional model as a primary teaching approach. This model encourages active participation, critical thinking, and deeper understanding, which are essential for mastering complex biological concepts.
2. Combine Constructivist Methods with Strategies to Boost Student Interest: Although the 7Es model significantly improved achievement, it did not have a notable effect on student interest. Educators should explore additional motivational strategies, such as integrating real-world applications, incorporating hands-on activities, and



- using technology to create more engaging lessons that can enhance both interest and achievement.
3. Provide Professional Development for Teachers: To effectively implement the 7Es model, teachers need to be well-trained in constructivist pedagogy. Schools and educational institutions should offer professional development programs to equip teachers with the skills necessary to facilitate active learning, manage diverse classroom dynamics, and apply constructivist principles effectively.
 4. Promote Collaborative Learning Environments: The 7Es model thrives in collaborative settings where students can engage in group activities, discussions, and peer learning. Schools should foster environments that support teamwork and group-based inquiry, providing the necessary resources and time for such activities.
 5. Further Research on Enhancing Student Interest: Since student interest did not show significant differences between the 7Es model and conventional methods, further research is recommended to explore ways to effectively combine constructivist instructional strategies with approaches that increase student engagement and interest in learning.

REFERENCES

- Adeyemi, T. A., & Eniola, F. O. (2020). Effect of 7Es constructivist instructional model on biology students' achievement in human anatomy. *Journal of Science Education*, 34(2), 123-134.
- Akpan, J. P., & Beard, L. A. (2016). *Constructivist-Based Learning in Science Education: Constructivist Approaches to Teaching and Learning Science*. *Journal of Science Education and Technology*, 25(5), 716–732.
- Eren, A. (2017). Uncovering the Role of Pre-Service Teachers' Interest in Teaching. *Teaching and Teacher Education*, 61, 62–72.
- Fawole, T. B., & Bello, K. O. (2022). Effect of 7Es constructivist instructional strategy on senior secondary school students' academic performance in biology. *International Journal of Educational Research*, 45(1), 78-90.
- Morrison, J., & Lederman, N. G. (2018). Science teachers' use of constructivist practices: Developing inquiry-based instruction. *International Journal of Science Education*, 40(3), 331–347.
- Nwachukwu, J. C., & Okoli, P. O. (2021). 7Es instructional model and its impact on students' performance in biology topics in Abuja secondary schools. *Journal of Educational Methodology*, 29(3), 210-222.
- Olawale, S. A. (2019). Impact of 7Es instructional model on students' achievement in biology in selected secondary schools in Abuja. *Journal of Biology Teaching and Learning*, 11(4), 456-472.
- Onyeka, A. D. (2018). Effectiveness of constructivist-based teaching strategies on students' academic achievement and interest in biology. *Journal of Educational Psychology*, 27(2), 145-159.
- Prince, M., & Felder, R. (2016). Inductive teaching and learning methods: Definitions, comparisons, and research bases. *Journal of Engineering Education*, 95(2), 123–138.
- Schraw, G., & Lehman, S. (2017). Situational interest and learning. *Educational Psychologist*, 36(3), 169-181.
- Tekkaya, C. (2012). Misconceptions as a barrier to understanding biology. *Journal of Science Education and Technology*, 11(1), 94-100.

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