BSU Journal of Education (BSUJE)

Vol. 25 No. 1 Dec. 2025
ISSN: 1117-6350

IMPROVING STUDENTS' PERFORMANCE AND RETENTION IN READING OF SCIENCE-BASED TEXTS USING 5E AND SCAFFOLDING STRATEGIES IN BENUE STATE, NIGERIA

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Abstract

This study examined how 5E and scaffolding strategies could improve students' performance and retention in reading of science-based texts in Benue State, Nigeria. The study utilized a quasi-experimental, pretest, posttest non-randomised equivalent group design selecting purposively a sample of 44 low achieving senior secondary one students in two different schools from a population of 10,980 students in the 307 secondary schools in Benue State. Two research questions and two hypotheses guided the study. The instruments for data collection were Science Reading Performance Test (SRPT) and Science Reading Retention Test (SRRT). The SRPT was subjected to trial testing and its reliability coefficient was analysed using Kuder-Richardson Formula 20 (K-R 20). This yielded a coefficient of 0.96. The research questions were answered using mean and standard deviation and the hypotheses were tested at 0.05 significance level using Analysis of Covariance (ANCOVA). It was found that there was no significant difference in the performance of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy (1,44,=4.456; 0.41; p=0.296 >0.05) and there was no significant difference in the retention ability of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E and scaffolding strategies (1,44,=1.122; 1.122; p=0.296 >0.05). Based on these findings, it was recommended that Head teachers should organise seminars aimed at educating teachers on how to use 5E and scaffolding strategies in the teaching of reading comprehension in order to improve students' academic performance and their retention ability.

Keywords: *scaffolding, 5E strategy, reading comprehension, science-based texts, academic performance and retention.*

Introduction

Science determines the pace at which every nation of the world develops. This is evident in the fact that nations are rated developed, developing or underdeveloped based on scientific and technological indices. This is because the importance of science is noticeable in advancements in healthcare, education and many other aspects of human life. It is a fact that nations attach much importance to science as most of man's discoveries are pioneered by scientists (Udu, 2019). There is therefore the need to ensure that students develop skills that may improve the reading comprehension of science-based texts, a content area that has been observed to present some areas of difficulties for learners.

Classroom experience shows that most students encounter difficulties when they read science-based texts. These difficulties are as a result of text-based factors, limited background knowledge and difficulties in identifying main ideas. On text-based factors, Strategic Education Research Partnership (SERP, 2023) found that the challenges science-based texts pose to readers are: the use of familiar words with unfamiliar meanings, the use of unfamiliar words or words with lexical density (less functional words); the presence of many abstract nouns and the problem of polysemy (words with different meanings outside the field of science). Limited background knowledge on the other hand refers to the difficulty faced by students in relating science texts to their local environment; difficulties that may arise from the identification of main ideas in the text could be linked to complexities in the vocabulary loads of the texts with few helpful supporting details. These problems, according to SERP (2023), have been observed to impede reading comprehension.

Due to the complex nature of science texts, comprehension may be more daunting for low-achieving students who are already struggling to attain minimum pass grades. A Low-achieving student refers to a student that fails to attain the minimum credit pass grade in course, test or examination (English Language Teaching and Testing Guide, 2024). Operationalising the term in the domain of science entails that students who consistently fail to grasp minimum comprehension in Chemistry, Biology, Physics and could be categorised as low-achievers in science.

The grading system by the West Africa Examinations Council (WAEC) details grades that may be translated as low-achieving as: 45 -49 (D7), 40-44 (E8) and 0- 39 (E9) (Scholaro Database, 2024). This implies that a student is considered as a low-achiever in science when he or she scores below 50 (0-49) in aggregate. Relatedly, the Eurydice Report on the State of Mathematics and Science Learning (2022) presented among its recommendations that effective classroom learning strategy and a dedicated reading culture are core ways of bridging the gap between low-achievers and high-achievers in the science class. By implication, the roles reading comprehension plays in the learning from science-based text is discernible.

Reading comprehension is a combination of both the information in the text and psychological processes like previous knowledge and metacognition. Comprehension is an active process that encompasses making predictions, summarising core ideas, questioning predictions and clarifying concepts that seem unclear (Liou, 2021). Reading therefore entails extracting information appropriate to the context of what is being read (Udu, 2021). Based on this view, reading is a meaning-making process that combines background knowledge with information from print. For an individual to learn in the formal school setting and at all levels of education, reading comprehension is fundamental. However, in recent times, the level of reading comprehension has been a source of worry. Recent reports from the United Nations Children Emergency Fund (UNICEF, 2023) shows that about 75 percent of Nigerian children aged 7 to 14 cannot read a simple sentence. The report also reveals that Nigerian students perform poorly in science because of inadequate comprehension skills. These submissions by UNICEF stress the urgency of improving reading comprehension in Nigeria, especially in science-based texts. The need for this urgency on improving reading comprehension in science-based text is not unconnected with the recent reports from examination boards in the country.

The performance of students in external examinations has not been impressive over the years. The West African Examinations Council (WAEC, 2018, 2019, 2022) reported that out of

the 1,572,396 who sat for the Senior Secondary Certificate Examination (SSCE) in 2018, a total of 786.380 students failed to obtain the minimum credits pass in in English Language (WAEC Chief Examiner's Report. 2018). The trend continued in 2019 to 2022. In 2019, 569,653 students failed to attain minimum credit pass in English language while about 118,379 and 378,542 could not obtain the minimum credit pass in the subject in 2019 and 2022 respectively (WAEC chief Examiners Report, 2019 & 2022). These reports show that many students fail English language yearly in external examinations. As a subject that incorporates the four skills of listening, speaking, reading and writing, Aina Ogundele, and Olanipekun (2013) found that correlation exists between proficiency in English language and academic performance of students in science.

. Science-based texts refer to books, journals and notes that explain science related contents. This is also referred to as content area texts in the domain of science. Adequate insight in reading comprehension offers important point for authors to consider when designing texts that could assist students in reading to learn science (Gallagher, Fazio & Ciampa, 2017). This is crucial because the organisation of concepts in science texts may present some difficulties for the average reader at the secondary level of education. Science texts are even more demanding to comprehend for English as second language (ESL) readers as the texts are linguistically complex, syntactically complex and conceptually domain-specific with dense information (Abdul-Hamid & Samuel, 2013). It could be deduced that as a result of these features, the understanding of science concepts present complexities that the reader must surmount in order to achieve comprehension. These complexities which may have some effects on students 'interest in science, must, according to Muodumogu (2019), be resolved by the ESL teacher so as to deepen the content knowledge of students.

Science texts within the context of this study encompasses Chemistry, Physics and Biology. The academic achievement of students in these subjects have been a source of concern for major stake-holders in education. Reports from Chief Examiners of WAEC for 2021, 2022 and 2023 indicated that in 2021, out of the 801,522 students who sat for Chemistry, a raw mean of 27.0 and a standard deviation of 6.93 indicated that students performed poorly in the subject. This trend of poor performance continued in 2022 which recorded a raw mean score of 28.0 over 50 and a standard deviation of 9.38.

Like Chemistry, students' performance in external examinations in Physic and Biology have also not been impressive. .A 2023 report by WAEC Chief Examiners showed that students perform poorly in Physics as the raw mean was 29.0 out of 50 . Similarly, in Biology, the Chief Examiner reports that out of the 1,068,567 that sat for the examination, the raw mean of 30.0 and a standard deviation of 10.91 indicated that students performance was not impressive. Similarly, Chukwu and Arokoyu add that in two years, the percentage failure of student who wrote Physics Senior School Certificate Examination (SSCE) organised by WAEC was 70% in 2017 and 67% in 2018. Similarly, the WAEC Chief Examination Report (2023) indicated that not less than 30% out of the 1,409, 529 students 'failed. The Chief Examiners explained that students' poor comprehension of Biology concepts which translates to their inability to explain these concepts was one of the weaknesses of students . These downtrends in the level of students' performance in Chemistry Physics and Biology could also be linked to students' ability to comprehend and retain contents.

Retention is a psychological construct that can only be inferred from the academic performance of students. As Muodumogu and Iorpev ((2019) aptly put it, comprehension and retention are the core goals of reading. Knowledge retention is the ability of the learner to store information in the long term memory and recall same when needed (Colman, 2022). The goal of every reading, especially in science-based area, is for students not to only pass examinations but also use the knowledge outside the school environment. For instance, knowledge that is properly retained from science subjects like Biology, Physics and Chemistry help doctors in hospitals to treat patients and inventors to arrive at ingenious inventions.

While it is almost impossible to recall all the concepts that the learner has learned after a month, it is however detrimental for the learner to forget most of such information within the shortest time. Xu (2023) explains that Hermann

Ebbinghaus, one of the first psychologists to study how forgetting occurs, submitted that memory retention declines over time and could be improved by presenting information in a meaningful manner. This suggests that retention could be improved by the way the teacher presents the learning material and how students comprehend same as they read. By implication, for one to recall, there is need to train the mind to do so (Imoko & Anyagh, 2012); as it is often obvious that poor retention of science texts translates to poor academic achievement (Achor, 2020). It is therefore vital to adopt teaching strategies that could improve the retention ability of students by improving their comprehension of science-based texts. in this light, Kidir and Samuel (2023) and Joda (2019) in separate studies found that although scaffolding and 5E strategies improve students' retention ability, there was no significant difference in their effects.

In recent years, there is a continuous paradigm shift in learning. Modern educators (Achor, 2022, Ochogwu & Ukume, 2020; Ochogwu, 2019; Alam, 2016; Imoko & Anyagh, 2012) have emphasised the need for teachers to discourage the use of the traditional or conventional teaching methods and adopt progressive strategies. This is because, the traditional method of teaching is characterised by the teacher dominating the teaching and learning activities with little or no consideration for how the learner learns. As a result, the class may be populated with low-achieving students who struggle to comprehend even the most basic explanation. Oyetunde (2013) specifically points out that the poor reading ability of students could be attributed to poor instructional methodologies of teachers. This opinion aligns with the submission by Muodumogu (2012) that many students in public schools are unable to use reading as a tool for learning, hence, they are not strategic in reading. It is therefore vital for the teacher to adopt strategies that could improve students' reading comprehension and retention, especially in science based-texts. A deviation from the conventional method which focuses on the teacher's capability to cover the syllabus without recourse to how students comprehend and retain information, to strategies that consider the comprehension and retention abilities of students could be the needed solution to students' inadequate comprehension of science-based texts.

Reading researchers (Ochogwu & Mohammed, 2023; Muodumogu, 2019; Udu, 2021; Oyetunde, 2013; Ari, 2017) have over the years encouraged the use of effective strategies to improve students' comprehension. Prominent amongst these strategies are: the Know-Want to know-Learn strategies (KWL), The Think-Pair-Share, Directed Reading and Thinking Activity (DRTA), Project Based learning (PBL), reciprocal teaching, 5E model, scaffolding and many others. These modern teaching strategies emphasize students-centered learning as against the conventional approach which leads to teacher-centered learning. The present study investigated the effect of 5E and scaffolding strategies in helping students comprehend and retain science-based texts.

The 5E model is one of the instructional strategies designed to improve the academic performance of students at all levels of education. Though the strategy was first developed by Atkin and Karplus (1962), in recent years, the studies of Bybee and Landes (1990) on the model has received more attention. The strategy was aptly named 5E because of the presence of the letter "E" in each word that makes up the acronym. 5E stands for Engagement, Exploration, Explanation, Elaboration and Evaluation. The strategy was designed based on cognitive psychology and constructivist learning. The strategy enables learners to interpret their learning and internalise the interpretation. The strategy also enables students to connect learning to their experiences and apply same to new and cogent contexts (Gerges, 2022).

The stages learners and the teacher go through using the 5E model constituted the acronym. The phases of the model place the student at the centre of learning (Zusy, 2023). According to Bybee and Landes (1990), the first phase of the model is engagement. The teacher is expected to prepare learners for the task of learning at this phase. The teacher does this by creating a connection between the background knowledge of the students and the new content. The engagement phase logically prepares the stage for the exploration phase.

The exploration stage is the second stage of the 5E strategy. The exploration stage is the first

contact the learner makes with the content or activity. Students at this stage carry out activities or investigations that are aimed at demystifying the concept or skill (Australia Academy of Science, 2023). They are expected to describe the problem or phenomena in their own words. Exploration may also entail diligently reading the recommended portion of a content in order to get the needed information. The exploration phase leads to explanation, the third and crucial stage of the 5E model.

The explanation stage is the teacher-led stage. The success of the explanation stage depends on the ability of the teacher to get feedback from the students (Lesley University, 2023). The teacher, at this stage, gives additional explanation to aid the understanding of what has been learned by students at the exploration stage. The teacher encourages students to present their understanding of the concept while he or she corrects their misconceptions (Bybee, 2009). The teacher, at this stage, encourages students to ask questions. The explanation stage methodically leads to evaluation, the final stage of the 5E strategy. .

The evaluation stage is also a crucial point in the 5E model. The stage accounts for the success or otherwise of the reading exercise. The teacher is therefore expected to ensure that this phase receives adequate attention. The evaluation stage provides the teacher with the opportunity to assess students' progress in line with the objectives of the instruction. The stage provides feedback to the teacher on different aspects of the learning (Zusy, 2023). It is essential to note that the questions the teacher asks at this stage are not only literal but inferential and critical. This helps to determine if what is learned is properly retained and can be accessed in the future. The feedback the teacher gets at the end of the evaluation stage is used to start the model all over again. This implies that the 5E strategy is presented in a cyclic form.

One of the gains of the 5E strategy apart from the obvious advantage of promoting the engagement of students in learning, is that the model is cyclical. This entails that the progress discovered at the evaluation phase is subsequently absorbed into the engagement stage of the next lesson as previous knowledge. This continues as students progress in education. Like the 5E model, scaffolding strategy has also been designed to improve the academic performance of students.

Scaffolding is a teaching strategy that has been used over the years to simplify instruction. Scaffolding is an instructional strategy the teacher uses to deliver instruction in distinct segments by providing graduated support for students to master new concepts or skills (University of Sandiego, 2023). The essence of the scaffolding is to constantly provide a support based instruction for students as they learn (Boonmoh & Jumpakate, 2019).

What is today known as scaffolding strategy is a product of the works of Vygotsky (1978) in his cognitive development theory. According to Vygotsky, the potential for cognitive development is limited to a Zone of Proximal Development (ZPD).This zone is the area of exploration or learning that is influenced by cognitive preparedness and the help students get from social interaction in order to fully develop. Simply put, the help students get when they interact with pairs and the teacher determine how they develop cognitively.

Scaffolding was also popularised in the domain of education by the works of Bruner (1986.). According to Bruner, the teacher provides scaffolds to ensure that the child's ineptitude is rescued or rectified by appropriate intervention, and then remove the scaffolds part by part as the reciprocal structure can stand on its own. This implies that learning activities and content are structured from simple to complex. As a result, as students read, they gradually are able to comprehend complex contents. The teacher achieves this by making the purpose for the reading clearly known to the students through asking purpose setting questions and encouraging students to constantly do same as they read.

Scaffolding could be used in the reading class to help students comprehend complex texts. Scaffolding provides students with scaffolds which are in the form of meaningful contexts about the content. This is what Gonser (2021) refers to as "don't jump in –slow down and set it up". This implies that the first component of scaffolding in reading is ensuring that students stand on a platform that connects their background knowledge to the text.

The teacher adds further scaffolds by teaching unfamiliar words in the text. This is

necessary because science-based texts contain words that appear to be strange to students. This step is vital because in a research that was aptly named "knowledge threshold study" by O'Rilly, Wang and Sabatini (2019), the finding indicated that if students are unfamiliar with 50% of the terms in the text, comprehension may be compromised. The conscious explanation of the meaning of science concepts help students to build their vocabulary and become independent in their reading.

Studies have shown that students' could benefit maximally from scaffolding and 5E if the teacher uses either of the strategies effectively . Baliwan (2023) found that although the strategies effectively improve the academic performance of students, there existed no significant difference in their effects. This finding agrees with Vonna, Mukminatien and Laksm (2015) who found that scaffolding strategy significantly improves writing ability of students. Similarly, Acheampong and Eminah (2024) found that there is no significant difference in the performance of students exposed to 5E and scaffolding strategies.

The multidirectional effects of scaffolding and 5E strategies are further captured in positive findings by researchers (Sotáková & Ganajová, 2023; Varoglu, Yilmaz & Sen, 2023; Seven, Tiryyaki & Ceylan, 2017; Adu & Folson, 2023; Onah , 2022; Ayiera, Owaa and Mwebi (2024)) over the years. It is these findings on the effects of 5E and scaffolding that prompted the researcher to investigate if the strategies could improve students' performance and retention of science-based texts in Benue State.

Statement of the Problem

Language on the one hand is seen as a facilitator and on the other hand as a barrier to the the learning of science. Udu (2018) asserts that language and the learning of science are multidimensional, requiring both the science textbook writer and the science teacher to use language that can increase students' understanding of difficult science concepts. Science is one among the many content areas that students are expected to learn in school. It is a field of study that students often find difficult to comprehend due to complexities which often emanate from abstract and non-linear presentation of facts by authors of science texts. The facts presented in these textbooks are characterised by lexical density and the use of unfamiliar words. All these problems may make the comprehension of core science texts like Physics, Chemistry and Biology difficult for senior secondary one students.

The poor performance of students in science has been continuously manifested in the reports by WAEC Chief Examiners. A careful study of these reports from 2014 to 2024 will reveal that the number of students who fail to attain minimum credit passes especially in Chemistry and Physics have never been less than eight thousand. The reports also often stressed that key weaknesses of students is the ability to understand science concepts and comprehend the questions. These difficulties often emanate from students' inability to be intentional in their reading. This has been observed to impede comprehension.

Furthermore, the difficulties presented by science-based text have been observed to affect the comprehension and retention ability of students. The complex nature of science texts may make it difficult for students to identify the main ideas in the texts, as well as to retain and recall textual information that buttress the main ideas. Since the central purpose of reading an informational text is to locate the main idea, students' inability to do so may lead to poor academic performance and retention in science contents (as reflected in reports from the West African Examination Council).

There is need to take conscious steps towards addressing the problems of interest, academic performance and retention of science-based texts. This is owing to the fact that science is seen as a requisite content that should be promoted at all levels of education (Samilsha, 2023). The study therefore investigates if 5E and scaffolding strategies could effectively improve the performance and retention of students in science concepts

Purpose of the study

The purpose of this study was to investigate how 5E and scaffolding strategies can improve students' performance and retention of science-based texts in Benue State. Specifically, the study sought to:

1. Ascertain the difference in the performance of low-achieving senior secondary one

students taught reading comprehension of science-based texts using 5E model and scaffolding strategy

2. determine the difference in the retention ability of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy

Research Questions

The study was guided by the following research questions:

1. What is the difference in the performance of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy?
2. What is the difference in the retention ability of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy?

Hypotheses

The study was guided by the following hypotheses which were tested at 0.05 level of significance :

1. There is no significant difference in the performance of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy
2. There is no significant difference in the retention ability of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy

Methods

The study adopted the quasi-experimental design. Specifically, the study adopted the pre-test-post-test non-equivalent groups design. Quasi-experimental design is a research design that establishes a cause and effect relationship between the dependent and independent variables (Isnawan, 2022; Thomas, 2020). The design was selected because the researchers could not randomization the subjects, as this could have disrupted the organisation of the classes . Pretest was administered to all the groups (in the two schools selected for the study) in the first week. The scripts were retrieved and marked. Treatment began in the second week and ended in the seventh week. The treatment took place once a week and lasted for 80 minutes. The post-test was administered in the eighth week while the post-posttest was administered two weeks after the post-test to ascertain the retention level of the students. Experimental group one was exposed to 5E strategy while group group B was exposed to scaffolding strategy.

The area of the study is Benue state, specifically Otukpo Local Government. The population comprised all the 10,980 secondary school students in Benue State (Teaching Service Board, 2024). The sample comprised two intact classes of 53 students (31 boys and 22 girls) drawn from two public secondary schools in Otukpo Local Government Area of Benue State. The purposive sampling technique was used to sample Otukpo Local Government Area as the area of the study because Otukpo is often referred to as the commercial and educational headquarters of Zone C, Benue State. Class dossiers and score sheets of students were assessed to ensure that classes with the highest number of low-achieving students were selected for the study. Students who scored less than 40 in Chemistry, Biology and Physics were selected.

The instrument for the study were Science Reading Performance Test (SRPT) and the Science Reading Retention Test (SRRT). Science Reading Performance Test (SRPT) was a 33-items test adapted from educpadi (2024). The test had two sections. Section A elicited students' Bio-data while section B contains SRPT question. The items on section B covered Senior Secondary One (SS1) topics in Physics, Chemistry and Biology. The test specifically covered the topics: chemical bonding, diamond (Chemistry) force, Newton's laws of motion (Physics) and cell (Biology).

The Science Reading Retention Test (SRRT) had the same items as the SRPT. However, the items were reshuffled and administered two weeks after administering the SRPT. The reason for administering SRRT two weeks after the SRPT was to verify if students can recall the content after a passage of time.

The Science Reading Performance Test (SRPT) was subjected to trial testing involving 20 students in a school outside the ones sampled

for the study. Kuder Richardson Formula 20 (K-R $_{20}$) was used to ascertain the reliability coefficient . This yielded a coefficient of 0.96.

Two English teachers in the sampled schools served as research assistants. The research assistants were trained on how to use 5E and scaffolding strategies in teaching students how to read and comprehend science-based texts. The data collected were analysed using mean and standard deviation to answer the research questions and Analysis of Covariance (ANCOVA) to test the null hypotheses at 0.05 level of significance.

Results

Research Question 1:

What is the difference in the performance of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy?

Table 1: Mean Performance Scores of Students taught reading comprehension of Science- Based Texts using 5E and Scaffolding strategies

Strategies		Pre-SRPT	Post-SRPT	Mean gain
5E Strategy	Mean	10.11	27.00	22..51
	N	22	22	
	Std. Deviation	2.91	4.49	
Scaffolding Strategy	Mean	13.04	30.10	17.06
	N	22	22	
	Std. Deviation	3.41	7.68	
Mean difference				5.45

Table 1 shows the mean performance scores of low achieving students taught reading comprehension using 5E and scaffolding strategies. The table shows that 22 low achieving students were taught using 5E strategy and 22 students were taught using scaffolding. The table shows that the mean performance scores of students taught using 5E strategy is 10.11 with a standard deviation of 2.91 at pre-test and 27.00 with a standard deviation of 4.49 at posttest. On the other hand, the mean performance scores of students taught using scaffolding is 13.04 with a standard deviation of 3.41 at pre-test and 30.10 with a standard deviation of 7.68 at post-test.

Table 1 further shows that the mean gain in performance of low achieving students taught reading comprehension using 5E strategy is 22.51 while those of students using scaffolding is 17.06. The difference in the mean performance scores of students taught using 5E strategy and those taught using scaffolding strategy is 5.45 in favour of 5E strategy. This result means that students taught using 5E strategy performed better than their counterparts taught using scaffolding strategy.

Research Question 2

What is the difference in the retention ability of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E strategy and scaffolding strategy?

Table 2: Mean Retention Scores of Low Achieving Students taught reading comprehension of Science-Based Texts using 5E and scaffolding strategies

Strategies		Pre-SRRT	Post-SRRT	Mean gain
5E Strategy	Mean	10.11	24.76	14..74
	N	22	22	
	Std. Deviation	2.21	4.41	
Scaffolding Strategy	Mean	13.04	27.40	14.36
	N	22	22	
	Std. Deviation	2.92	5.81	
Mean difference				0.33

Table 2 presents the mean retention scores of low achieving students taught reading comprehension using 5E and scaffolding strategies. The table shows that the mean retention scores of students taught using 5E strategy is 10.11 with a standard deviation of 2.91 at pre-test and 24.76 with a standard deviation of 4.41 at post-test. On the other hand, the mean retention scores of students taught using scaffolding is 13.04 with a standard deviation of 3.41 at pre-test and 27.40 with a standard deviation of 5.81 at post-test.

Table 2 further shows that the mean gain in retention of low achieving students taught reading comprehension using 5 E strategy is 14.74 while those of students using scaffolding is 14.36. The difference in the mean retention of students taught using 5E strategy and those taught using scaffolding strategy is 0.33 in favour of 5E strategy. This means that students taught using 5E strategy retained better than the ones taught with scaffolding strategy.

Hypotheses

The following hypotheses were tested at 0.05 level of significance**:**

Hypothesis 1: There is no significant difference in the performance of low-achieving senior secondary one students taught reading comprehension of science science-based texts using 5E and scaffolding strategies

Table 3: ANCOVA of Performances Scores of Low achieving Students' Taught Reading Comprehension of Science –based Texts 5 E and Scaffolding Strategies.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	179.813[a]	2	89.907	2.391	.105	.109
Intercept	1176.001	1	1176.001	31.271	.000	.445
Pretest	79.137	1	79.137	2.104	.155	.051
GROUP	42.204	1	42.204	1.122	.296	.028
Error	1466.663	38	37.607			
Total	35704.000	44				
Corrected Total	1646.476	42				

Table 3 shows that F(1,44) = 1.122; p = 0.296 > 0.05. Thus, the null hypothesis which states that there is no significant difference in the mean performance scores of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy is not rejected. This implies there is no significant difference in the mean performance scores of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy. The partial eta square of .028 (3%) shows that the strategies have small effect size.

Hypothesis 2

There is no significant difference in the mean retention scores of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E and scaffolding strategies.

Table 4: ANCOVA of Retention Scores of Low achieving Students Taught Reading Comprehension of Science –based Texts 5 E and Scaffolding Strategies.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	124.436[a]	2	62.218	2.544	.092	.118
Intercept	2136.613	1	2136.613	87.353	.000	.697
Pretest	53.143	1	53.143	2.173	.149	.054
GROUP	108.991	1	108.991	4.456	.411	.105
Error	929.466	38	24.460			
Total	28874.000	44				
Corrected Total	1053.902	42				

Table 4 shows that F(1,44) = 4.456; p = 0.41 > 0.05. Based on this result, the null hypothesis which states there is no significant difference in the mean retention scores of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy is not rejected. This implies there is no significant difference in the mean retention scores of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy. The partial eta square of .105 (10%) obtained shows that the 5E strategy has medium effect size after controlling for other effects.

Discussion of Findings

The following findings of this study are discussed in line with the results from research questions and hypotheses.

One of the findings of the study is that there was no significant difference in the mean performance scores of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy. The result shows that low achieving students performed better when taught with 5E and scaffolding strategies. Due to the separate positive effects of these strategies on students' performance, there was no significant difference in their means. It finding could be due to the tendency of the strategies to actively involve students in the teaching and learning process. This finding aggress with Baliwan (2023) who conducted a study on the effect of 5E's learning process and scaffold learning on the performance of Grade 10 (senior secondary one) students in Physics in the Philippines and found that there was also no significant difference in the performance of students taught 5E model and scaffolding. The finding supports the findings of Sotáková and Ganajová, (2023); Varoglu, Yilmaz and Sen (2023); Seven, Tiryyaki and Ceylan (2017). The finding also agrees with Tumasi, Nti, Acheampong and Eminah (2021) who after a

study on effect of the 5E instructional model on students' academic achievement in Physics found that that though the strategies significantly improved the academic performance of students, the differences in the effects were not significant when compared with each other.

The study also revealed that there was no significant difference in the mean retention scores of low-achieving senior secondary one students taught reading comprehension of science-based texts using 5E model and scaffolding strategy. The finding establishes the effects of 5E and scaffolding strategies on the retention ability of students. Although the difference between the strategies is not significant, it must be noted that both strategies significantly improved the retention ability of students based on their improved mean scores at postposttest. This finding could be due to the ability of the strategies to capture and sustain students' attention, an act that may lead to improved retention ability . The finding is in congruence with Kadiri and Samuel (2023) who investigated effect of scaffolding instructional strategy and 5E on students' achievement and retention in Mechanics in Niger State, Niger and found that while 5E and scaffolding strategies improve students' retention in Mathematics, there exist no significant difference in their effects.

The findings agrees with the findings of Ayiera, Owaa and Mwebi (2024) and Adu and Folson (2023). The finding specifically agrees with Joda (2019) who conducted a study on the effect of instructional scaffolding strategy and 5E model on senior secondary school Biology Students' academic achievement and retention of concepts and found that there was no significant difference in the retention ability of those taught through instructional scaffolding and 5E strategy. Additionally, the study conforms to Kadiri and Samuel's (2023) finding that there was no significant difference in the mean retention of students taught Mechanics using scaffolding instruction strategy and the 5E strategy.

Conclusion

The study concludes that students' interest, academic performance and retention ability in science-based texts could be improved with the use of scaffolding and 5E strategies. Based on the findings, the strategies could particularly improve the performance and retention ability of low achieving students in science-based texts.

Recommendations

The following recommendations were made based on the findings:

1. Head teachers should organise seminars aimed at educating teachers on how to use 5E or scaffolding strategies in teaching of reading comprehension in order to improve students' academic performance.
2. Teachers should improve the retention ability of students by teaching them with either 5E or scaffolding strategy as results has shown that these strategies are effective.

References

Abdul-Hamid, S & Samuel, M. (2013). Reading scientific texts: some challenges faced by EFL readers. *International journal of Social Sciences and Humanities,* 2(6), 509-513.

Achor, E. E (2020). Upgrading students' achievement and retention in Basic Science using analogy and demonstration strategies *Coal City University. Journal of Science,* 1(1), 81-86.

Adu, A., & Folson, D. (2023). Effectiveness of 5E instructional model on students' performance in Mathematics non-routine problem. Retrieved on 30th March, 2024 https://journalajarr.com/index.php/AJARR/article/view/482

Aina, J. K., Ogundele, S. Olanipekun, R. (2017). *The physics authentic learning experience through the peer instruction.* Saarbrucken: LAP Lambert Academic Publisher

Alam, M. (2016). (Constructivism: a paradigm shift from teacher centred to student centred approach. *International journal of Indian psychology*, 1 (79), 2349-3429.

Alshehri, M.A. (2016). The impact of using (5e's) instructional model on achievement of Mathematics and retention of learning among fifth grade students. *Josr journal of Research & Method in Education.* 6 (2), 43-49

Atkin, J. M., & Karplus, R. (1962). Discovery or invention? *The Science Teacher,* 29 (5), 45-51.

Ayeira, E. K, Owaa, J., & Mwebi, B. (2024). Effects of scaffolding on interest to learn english among secondary school learners in kenyenya sub-county, Kenya. *International Journal of Novel Research in Education and Learning, 11,(3), 89-98*

Boonmoh, A, & Jumpakate, T. (2019). Using scaffolded instructions to improve students' skills. Retrieved 13th August, 2023 from https://www.researchgate.net/publication/.

Bybee, R., & Landes, N. M. (1990). Science for life and living: an elementary school science program from Biological Sciences improvement Study .*The American Biology Teacher,* 52(2), 92-98

Colman, H. (2022). Learning retention-how to make information stick. Retrieved 13th August, 2023 from https://www.ispringsolutions.com/blog/learning-retention.

English Language Teaching and Testing Guide (2024). Low-Achievers. Retrieved 24th September, 2024 from ttps://www.nysed.gov/sites/default/files/programs/state-assessment/38

Eurydice Report on the State of Mathematics and Science learning (2022). Mathematics and science learning in schools, 2022. Retrieved September, 24th 2024 from https://eurydice.eacea.ec.europa.eu/node/23258

Fazelian, P., Ebrahim, A.N., Soraghi, S. (2010). The effect of 5E instructional design modelon learning and retention of sciences for middle class students. *Procedia Social and Behavioral Sciences* 5, 140–14

Gallagher, T., Fazio, X.E., & Ciampa, K. (2017). A comparison of readability in science-based texts: Implications for elementary teachers. *Canadian Journal of Education,* 40 (1), 2-29

Gerges, E. (2022). How to use the 5E model in your science classroom. Retrieved 18th December, 2023 from https://www.edutopia.org/article/how-use-5e- modelyourscience.classroom/

Gonser, S. (2021). 4 Strategies to scaffold complex but essential. Retrieved 17th December, 2023 from Readinghttps://www.edutopia.org/article/4-strategies-scaffold-complex-essential-reading

Imoko, B. I., & Anyagh, I. P. (2012). Effect of formula strategy on students' retention in algebra. *Africa Journal of Sustainable Professional Development,* 1 (2), 19-24

Isnawan, M.G. (2022). Quasi-experimental design. West Lombok, Indonesia: Nashir Al-Kutub Indonesia

Kidiri, J.O., & Samuel, I. W., (2023). Effects of scaffolding instructional strategy on students' achievement and retention in mechanics in Niger State Nigeria. International Journal of Education, Research and Library Science, 13(8), 97-106

Lesley University (2023). Empowering Students: The 5E Model Explained. Retrieved 13th August, 2023 from https://lesley.edu/article/empowering-students-the-5e-model-explained

Liou, K (2021). Reading comprehension. Retrieved 23rd August, 2023 from https://www.sjsu.edu/writingcenter/docs/handouts/Reading%20Comprehension.pdf

Muodumogu, C.A. (2012). What methodologies do universal basic education teachers use in teaching reading in Benue state, Nigeria? *Botswana Journal of African Studies* 26, (2), 157- 170

Muodumogu, C.A. (2019). Effects of concept mapping strategy and students' achievement in reading comprehension in Vandeikya Local Government Area of Benue State, Nigeria

Muodumogu, C.A. (2019). Effects of concept mapping strategy and students' achievement in reading comprehension in Vandeikya Local Government Area of Benue State, Nigeria. 18(2), 183-191

O'Rilly, T., Wang, Z., & Sabtini (2019). How much knowledge is too little? When a lack of knowledge becomes aa barrier to comprehension. *Psychological Science*, 30(9), 1344-1351.

Ochogwu C.E. (2019). Classroom practices: issues and trends in reading comprehension instruction in Nigeria Retrieved 12th August, 2023 from https://www.researchgate.net/publication/344457849

Ochogwu, C.E., Ukume, G.D. (2020). Methodological problem of teaching English language in Nigerian school. *Nigeria Journal of Trends in Language, Arts and Social Sciences Education,* 1(1), 45-53

Ochogwu, C.E., & Mohammed, U.I (2023). Effect of interactive strategy and whole-class approach on students' performance and retention in content area reading. *Benue State. Benue State University Journal of Education, 23(2), 200-206* .

Onah, K.T. (2022). Effect of scaffolding teaching approach on students' academic achievement in quantum Physics in Enugu Education Zone. *Greener Journal of Educational Research,* 12 (1), 13-21

Oyetunde, T.O. (2013). The intentional English teachers' theories, methods and activities: Tips for teaching English functionally. Jos: LECAPS Publishers.

Samiksha, S. (2023). Importance of Science and Technology in National Development – Essay. Retrieved 20th August, 2023 from https://www.yourarticlelibrary.com/technology/importance-of-science-and-technology-in-national-development-essay/8563

Scholaro Database (2024) Grading system in Nigeria. Retrived 23rd September, 2024 from https://www.scholaro.com/db/Countries/Nigeria/Grading-System

Seven, S., & Ceylan, H. (2017). The effect of the 5E learning cycle model and cooperative learning method in the constructivist approach on academic success and students' attitude towards subject of "Sound" . Retrieved on 30th March, 2024 from https://journaljesbs.com/index.php/JESBS/article/view/114

Sotáková, I., & Ganajová, M. (2023). The effect of the 5E instructional model on students' cognitive processes and their attitudes towards chemistry as a subject. *EURASIA Journal of Mathematics, Science and Technology Education,* 19 (9), 2-22

Strategic Education Research Partnership (2023). The challenges of science texts. Retrieved 29th August, 2024 from https://www.serpinstitute.org/reading-science/challenges-of-science-text

Thomas, L. Quasi-experimental l design. (2020). Retrieved 10th January , 2025 from https://www.scribbr.com/methodology/quasi-experimental-design/

Udu, T.T. (2018). Language prerequisite for effective teaching of science at the secondary school level in Nigeria. In E.E Achor, N.A. Ada, A.U. Okoronka, & E.I Ettang (Eds). *Rethinking Teacher Education in Nigeria*. (199-214). Lagos: SamArtrade

Udu, T.T. (2018). Teachers' and students' attitudes towards reading and writing: Do they correlate to students' achievement in English? *Studies in English Language and Education, 8 (1), 143-156*

Udu, T.T. (2019). Effect of communicative language teaching approach on SS2 students' use of English passives in Katsina-Ala Local Government Area of Benue State, Nigeria. *International Journal of English Literature and Social Studies (IJELSS),* 4 (2), 297-303.

UNICEF (2023). Reading, Maths: UNICEF's verdict on Nigerian children. Retrieved 23rd August, 2023 from https://tribuneonlineng.com/reading-maths-unicefs-verdict-on-nigerian-children/

University of Sandiego (2023). 7 scaffolding learning strategies for the classroom. Retrieved 18th august, 2023 from https://pce.sandiego.edu/scaffolding-in-education-examples/

Varoglu, L. Yilmaz, A & Sen, S. (2023); Effect of 5E learning cycle assisted with concept maps on conceptual understanding. *Pedagogical Research,* 8(3), 1-12

Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press

WAEC Chief Examiners Report (2018) Retrieved 2nd August, 2023 from https://leadership.ng/waec- records-76-36-pass-in-2022-wassce-2/

WAEC Chief Examiners Report (2021) Retrieved 2nd August, 2023 from https://leadership.ng/waec- records-76-36-pass-in-2022-wassce-2/

Xu, A. (2023). The powerful role of forgetting in learning. Retrieved 13th August, 2023 from https://www.psychologyinaction.org/2022-11-6-the-powerful-role-of-forgetting-in-learning/

Zusy, S. (2023). The 5E model: 5 steps to motivate student learning. Retrieved 18th December, 2023 from https://blog.gale.com/the-5e-model-5-steps-to-motivate- student-learning/