

Effects of Educational Games, Drills and Practice Strategies on Academic Achievement in Biology concepts among Secondary School Students in Abak LGA, Akwa Ibom State, Nigeria

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Abstract

The study examined the effects of educational games, drills and practice strategies on senior secondary students' academic achievement in Biology in Abak Local Government Area, Akwa Ibom State, Nigeria. Two research questions and two hypotheses were formulated to guide the study. The design of the study was a quasi-experimental design of pre-test post-test non-randomized design. The population of the study consisted of all the two thousand, five hundred and twenty-four (2,524) SS two students studying Biology in the eleven (11) public secondary schools. Simple random sampling technique was used to select three co-educational secondary schools out of the population. The sample of the study comprised of one hundred and forty-three (143) students in three intact classes. The instrument for data collection was tagged: Biology Achievement Test on Respiratory System (BATRS) was adapted from past questions by the researcher. The reliability index of the instrument was found to be 0.81 using Kuder-Richardson 20 formula (K-R 20). Descriptive statistics of mean and standard deviation was used to answer the research questions. While the hypotheses were tested using Analysis of Covariance (ANCOVA) at $p \leq 0.05$ level of significance. Results showed that students taught respiratory system using educational games gained better than those taught using drill and practice, followed by those taught using expository strategy. There was a significant difference in academic achievement mean scores of male and female students taught the concept of respiratory system. Based on the findings it was recommended among others that teachers should incorporate active teaching strategies such as educational games, drills, and practice exercises to improve students' understanding and engagement in Biology. Students should participate in educational games and drills to enhance learning, problem-solving skills, and critical thinking in Biology.

Keywords: Educational Games, Drills, Practice, Biology Concepts, academic achievement

Introduction

Science is a means of finding practical ways of using scientific discoveries or turning scientific knowledge into use. Science is also addressed as a systematic process of acquiring the fundamental knowledge about the universe (Itighise & Akpan, 2021). The aim of learning science in secondary schools is to promote the understanding of concepts taught, with a view to applying knowledge of such understanding in the real-life situation. The National Policy on Education (FME, 2013) emphasizes that sciences should be taught in schools in such a way that it will have meaning and relevance to the needs of the students' and society; provide the students' the opportunity to explore; interact with and intercept certain scientific processes going on in their environment. Science is a necessity for any nation that wants to maintain its independence, sovereignty, self-reliance, ensure growth, and have its head held high among civilized nations (UNESCO, 2015). This is because science and technology provide the basic tools for industrialization and economic development in the areas of communication, transportation, energy, information, pollution and waste control. In Nigeria, the study of science is of great importance that a lot of emphasis had been laid on the learning of science, as contained in the National Policy of Education (FME, 2013). This can be achieved by the inculcation in the learners the necessary scientific skills and attitudes. The inculcation of scientific skills and attitudes in students can only be achieved through the proper of various science subjects. These include Mathematics, Health science, Agriculture, Chemistry, Physics and Biology.

Biology is a branch of science that deals with the study of living organisms which is divided into many specialized fields that cover their morphology, physiology, anatomy, behaviour, origin and distribution. It is a science subject that has its origin in the need of human beings to know more about themselves and the world around them. Biology contexts are often complex and studied at various levels from the individual molecule to global ecosystem (Edikpo, Akpan & Atabang, 2024). In all spheres of human activity, Biology plays a prominent role. Its application in genetic engineering has resulted in the production of high yielding plant and animal species. This has contributed in the meeting of food demands for the ever-

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growing human population (Shishua & Keraro, 2017). Biology is indispensable in the field of medicine such as organ transplant and controls a wide range of diseases. It also has application in industries such as the use of microorganisms in food processing. Areas where the knowledge of Biology is applied among others include Agriculture, Brewery, Geology, Mining, Population Control and Environmental Conservation (UNESCO, 2015). The knowledge of Biology is intrinsically related to nation building and a sustainable relationship exists between the nature and human society. Biology is a key discipline in understanding and responding to some of the most pressing issues of the day, from the many challenges arising from population growth, human impacts on ecosystem and services to climate change and sustainability. Its knowledge also helps to eliminate poverty and reduce the number of hungry people through expansion in diversity and magnitude of bioscience enterprise. The bioscience enterprises include raw bio- commodities like rubber; palm oil produced using seed materials, using hybrids, tissue culture and bio-fermentation, bio-pesticides, bio-fertilizers, bio- remediation and biotech seeds. Each of the enterprise is based on sound biological knowledge. The listed enterprises provide job opportunities for the student with knowledge of Biology in public and private sectors of the economy. In Nigeria, the Biology curriculum as a learning syllabus has National objectives at secondary school level. These include preparing students to acquire: adequate laboratory and fields skills in Biology; meaningful and relevant knowledge in Biology; ability to apply scientific knowledge to everyday life in matters of personal and community health and agriculture; and reasonable and functional scientific attitude (Montes et al., 2018). To ensure full realization of these objectives, the content and context of the syllabus placed great emphases on field studies, guide- discovery, laboratory techniques and skill coupled with conceptual thinking (FME, 2013). Biology education is an indispensable instrument for the development of any nation; It is offered in all senior secondary schools in Nigeria which attracts the greatest patronage of both science- oriented and art- based student (Atabang, Edikpo & Akpan, 2024; Nwosu, 2016). Biology provides a platform for students to develop the ability to apply science concept and principles in solving everyday life problems and building a progressive society. There are records in the field of Biochemistry, Physiology and Molecular Biology among others that made subject a central focus in most human activities including problem like radiation, family life, food scarcity management and conservation of natural resources as well as ethics are anchored on Biology. There are various concepts in Biology and there are ways of learning them effectively. Some Biology concepts described things which are not easily accessible or abstract concepts that cannot be fully comprehended at the first time. Students struggle to form their cognitive structures in many alternative conceptions. These include nervous co-ordination, respiratory system, genetic and evolution (Kurt et al., 2016).

Respiratory system refers to one of the vital system in living being which necessitates the intake of oxygen and release of carbon dioxide in a biochemical process of the body (Kurt et al., 2016). It is a structure or system that enhances respiration which is a common characteristic that are indicator of life for all living beings. Respiratory system is basically of two parts; upper respiratory parts which include nose, mouth, pharynx and the lower respiratory parts including the larynx, trachea, bronchi, bronchioles lungs and alveoli (Kurt et al., 2016). The concept of respiratory system is highly complex and has many dimensions as it pertains to all living beings from human to single cell organism and the dimension of respiratory system differs by species (Kurt et al., 2016). Gultepe et al. (2016) found alternative conception among others regarding human respiratory system such as air taken from outside goes to the stomach; breathing can only be executed through the mouth and nose; the respiratory system differs from single cell organism to higher animals. Also, the facts that the processes of respiration contained numerous concepts and each of these concepts is linked with one another thus render the respiratory structure more complex. These are several reasons why students fail to adequately construct the cognitive structure about the concept of respiratory system. Respiratory system plays a vital function in living beings and its learning requires the use of appropriate instructional strategies for the reduction of the complexities in the concept so as to improve students' performance in Biology. Umoetuk, Atabang and Babayemi (2025) noted that students' achievement in science is a function of instruction and instructional strategies used. Babayemi et al (2023) stated that teachers' mode of presentation of various science concepts affect students' performance in the subject. One of the most important factors in the learning process is students' failure to correlate the concept taught, in their minds as well as their cognitive structures. The cognitive structure is a structure that represents the relations of concepts in the students' long-term memory and that is based on assumption (Kurt et al., 2016). WAEC Chief Examiners' Report, (2018) has shown that students' performance in Biology examination is not encouraging. An examination of the performance of Biology students mirrored a decline in the percentage of Biology candidates obtaining credit grades. The senior secondary school Biology candidates have a number of problems associated



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with both the cognitive and motor skills which have culminated in the poor achievements in the certificate examination, (Chief Examiner's report, 2016-2020). Such problems identified in the Chief Examiners report, (2018- 2022) include: Lack of specific knowledge and inability to exploit; lack of deeper understanding and inability to explain, interprets and apply Biology principles; Lack of deeper understanding of cognitive skills; Inability to use proper biological terms where appropriate and lack of deeper understanding of biological concept. Ajayi and Ogbeba (2017) also attributed the poor performance partly to the teachers' choice of instructional strategies that do not keep the students actively involved through hands-on and minds-on activities during lesson deliveries. Another challenge contributing to poor performance of students in this technological age include the barriers to effective integration and utilization of digital technologies such as inadequate or outright lack of digital devices, lack of access to digital equipment due to high cost, slow internet connection, lack of digital based instructional materials and resources for teachers which in turn hinders the development of effective and professional teaching skills (Akpan & Uko, 2014; Itighise, 2016; Dele-Ajayi et al., 2019; Akpan et al., 2022 and Akpan & Udo, 2022, Itighise, & Akpan 2022). Other factors contributing to the failure may be connected to the way in which the teachers introduce their lesson at the beginning of each topic or unit, hence the need by the teachers to change their pattern of introduction, lack of or insufficient laboratory facilities and equipment, psychological factors such as anxiety and low self-esteem (Olatunji, 2015; Ajayi & Ogbeba, 2017).

Biology requires serious input by the teacher in terms of planning to teach to achieve instructional objectives (Nwosu, 2016; Edikpo et al., 2024). Thus, students' performance as generally observed has been attributed to teachers' failure to use effective teaching strategies such as educational games, Drill and practice strategies during the learning process in Biology. Biology requires serious input by the teacher in terms of planning to teach to achieve instructional objectives (Nwosu, 2016). This trend of poor performance of students in Biology and the high percentage of failure if not arrested, will spell doom for the scientific and technological development of the nation. Research have showed that the facilitating learning strategy for the learner and learning process in education is the learner- centered methods (Babajide, 2017; Agomuoh & Nzewi, 2018). In the words of Madu (2015) the teacher plays a dual role as a learner as well as a tutor by getting exposed to new knowledge /ideas, as such, he learns new things every day during the learning processes. With this, he becomes a resource rather than an authority. There are many learner- centered methods which include demonstration method, discussion method, cooperative method, and discovery or inquiry-based strategies, puzzle based instructional strategies, games, drill and practice and collaborative teaching strategies but for purpose of this research, the researcher focused on educational games, Drill and practice strategies. Educational game teaching strategy involves designing and incorporating educational content within a game format, where students actively participate and interact with the game mechanics to acquire knowledge or develop skills. It refers to using games as an educational tool or strategy to facilitate teaching and engagement (Li et al., 2021). According to Wordu and Atabang (2024); Priyaadharshini et al. (2020); Itighise and Udosen (2015) educational games teaching strategy is considered one of the most innovative teaching approaches for increasing students' interest in education by playing games. Different playful experiences can enable children to construct knowledge by playing and exploring a real-world problem often driven by students' interest in inquiry (Ukah, Atabang, & Eden 2025; Hirsh-Pasek, 2020). Educational games also referred to as gamification is a process that uses game elements, such as points, rewards, badges and competition during the teaching process, establishing interactive and engaging learning environments (Ukah, Atabang, & Eden 2025; Turan et al., 2016). It aims at enhancing motivation, engagement, and participation using the inherent appeal of games. Designing interactive and entertaining games, primarily for education, is a step forward in implementing educational games learning strategy. Serious games enable players to cultivate their knowledge and practice their skills by overcoming numerous interruptions during gaming (Yu, 2019). Itighise and Udosen (2015) comments that appropriate design of educational carton facilitates learning by stimulating creativity, igniting interest, promoting discourse, and cultivating a competitive drive for exploration in diverse fields. During an educational game class learning, students have fun and enjoy themselves with increased imagination and natural curiosity, which can lead to high levels of participation and the student's involvement in the learning process. In this way, students can be more successfully engaged in meaningful learning than traditional teaching methods (Karram, 2021). Educational games can be used at the beginning and end of a lesson. For this reason, they can foster students' interest and motivation towards lessons, or review, reinforce and assess the learned topics. Therefore, educational games promote students' active participation in lessons and thus assist with their learning (Atabang, Eden & Daniel, 2024; Adeyemi, 2017). Such games include among



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others, crossword picture puzzle. Crossword-picture puzzle (CPP) game strategy is an active learning and instructional strategy combining both verbal (crossword) and visual (picture-puzzle) elements. In practice, students are given specially designed puzzle-based tasks that integrate key science vocabulary/terminology (via crosswords) and pictorial or diagrammatic clues (via spot-the-change, cut-up, or rearrangement picture puzzles) to engage with scientific concepts (Babayemi & Akinsola, 2014). The strategy is intended to move beyond passive lecture (“chalk-and-talk”) by involving students in active retrieval, recall, concept association, and problem-solving in a collaborative or individual manner (Babayemi, 2014). Drill and practice learning strategy on the other hand involves a sequence of tasks, exercises, or words repeated over and over until they can be performed faultlessly. In a drill and practice design, words are presented to the students with questions to respond to or problems to solve, the student responds, the student informed whether the answer is correct and if the student is right, he/she is given another problem to solve, but if the student responds with a wrong answer, he or she is corrected. Drill and practice are interactive and help students remember the concepts they have been taught previously (Zubairu & Musa, 2020). Therefore, the use of Drill and practice strategy in teaching respiratory system in Biology might help students to retain better. Expository teaching strategy is another strategy considered in this study. It is a strategy the teacher uses to impart or expose knowledge to the students in a step-to-step way through lecture, explanation and the provision of guided practice through oral drills. It is often used by teachers to cover a lot of material in a short amount of time; present information in a clear and organized manner; it also allows for the teacher to control the pace of the lesson. According Sunday et al. (2025) it makes student to be inactive during lesson delivery. This is because it makes the lesson boring for students who are not interested in the subject matter; it does not allow for much interaction between the teacher and the students; does not allow for much interaction between the students themselves; and does not allow for much opportunity for students to ask questions or share their own ideas.

Gender is one of the factors that influence students’ academic performance and this calls for examining performance in relation. Gender is based primarily on the socio-cultural differences between girls and boys. Gender is a psychological term describing behaviour and attributes expected of individuals on the basis of being male or female (Atabang, & Umanah, 2024; Umanah & Sunday, 2022; Umanah & Akpan, 2024). Some vocations and professions have been regarded as men’s (engineering, arts and crafts, medicine and agriculture) while others as women’s (catering, typing and nursing) depending on the belief that girls are weaker sex, therefore, complex and difficult tasks are allocated to boys while the girls handle the relatively easy and less demanding tasks. According to Nworgu (2015), there is an acknowledged problem of female under performance when compared with their male counterparts apparently under equivalent conditions and this problem of female under performance appear to be more pronounced in Science and Mathematics. Atabang and Umanah (2024), noted that gender issue is an important factor in educational setting and could be a hindrance to high achievement of learners in science. Some research work has shown contradicting evidences in science due to gender. For instance, students’ academic achievement in science due to gender. Umanah and Sunday (2025), Sunday and Edet (2024); Edet et al. (2025a) found out that there is no significant difference in the academic achievement of male and female in Biology, Chemistry and Basic science respectively. It is therefore worthwhile to see how educational games, Drill and practice strategies would bridge the gap in science achievement between male and female students in Biology. This study intends to find out the effects of educational games, Drill and practice strategies on students’ academic achievement in Biology in Abak Local Government Area.

Statement of the Problem

In spite of the significant role of Biology in life, the performance of students in Senior School Certificate Examinations has been experiencing a decline. The poor performance in Biology examination is a problem to teachers and a cause of concern to the public. The undesirable achievement of Biology students has been attributed to poor teaching and learning strategies adopted by teachers during classroom instruction. This situation has created the need to explore the efficacy of alternative teaching strategies. The use of alternative teaching strategies such as educational games, Drill and practice strategies may allow new materials especially difficult concept on Biology to be easily assimilated with the students’ prior knowledge, thus enabling them to develop an understanding of the concept. It is on this basis that the researcher poses the question; What is the effect of educational games, Drill and practice teaching strategies on students’ academic achievement in the concept of respiratory system in Biology?



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Purpose of the Study

The main purpose of this study is to examine the effects of educational games, Drill and practice strategies on senior secondary students' academic achievement and retention in Biology in Abak Local Government Area, Akwa Ibom State. Specifically, the objectives of the study are to:

1. Compare the difference in the academic achievement mean scores of students taught the concept of respiratory system using educational games, drill and practice and expository teaching strategies.
2. Examine the difference in the academic achievement mean scores of male and female students taught the concept of respiratory system using educational games, drill and practice and expository teaching strategies.

Research Questions

1. What is the difference in the academic achievement mean scores of students taught the concept of respiratory system using educational games, drill and practice and expository teaching strategies?
2. What is the difference in the academic achievement mean scores of male and female students taught the concept of respiratory system using educational games, drill and practice and expository teaching strategies?

Research Hypotheses

1. There is no significant difference in the academic achievement mean scores of students' taught the concept of respiratory system using educational games, drill and practice and expository teaching strategies.
2. There is no significant difference in the academic achievement mean scores of male and female students taught the concept of respiratory system using educational games, drill and practice and expository teaching strategies?

Research Methodology

The researcher adopted the quasi-experimental design of pre-test, post-test and non-equivalent control group design. This is for obvious reasons as it is not always practicable to have complete randomization of the subjects due to the possibility of disrupting school organization in the process. The study was conducted in Abak Local Government Area of Akwa Ibom State, Nigeria. The population of the study consisted of all the two thousand, five hundred and twenty-four (2,524) SS two students studying Biology in the eleven (11) public secondary school in Abak Local Government Area, Akwa Ibom State (Source: Local Education Committee, Abak Educational Zone, 2023). Simple random sampling technique was used to select three co-educational secondary schools out of the 11 public co-educational secondary schools in the study area. The sample of the study consisted of SS 2 Biology students from 3 intact class representing experiment group 1, experimental group 2 and control groups respectively. The total number of participants from the three selected intact classes formed the sample for the study. The sample of the study comprised one hundred and forty-three (143) SS II Biology students in three intact classes. Simple random sampling techniques were employed in selecting schools for the study. The instrument for data collection was tagged: Biology Achievement Test on Respiratory System (BATRS) was adapted by the researcher. The instrument was made up of two sections, section A and section B respectively. Section A was on personal data of the subjects while section B will be made up of (50) fifty multiple choice test questions. Having four options A, B, C and D with one correct option and three distractors. The instruments were subjected to face validation by three experts, one experienced biology teacher, a lecturer from the Department of Science Education and one in Test and Measurement Department of Science Education, Akwa Ibom State University. The validators scrutinized the instrument in terms of proper wording of items, appropriateness and adequacy of the items for the study. The test items were administered on thirty (30) students in one of the coeducational secondary schools that was not part of the sample size. The results were subjected to the Kuder-Richardson 20 formula (K-R 20) and a reliability coefficient of 0.81 was obtained. Data collected were analyzed using descriptive statistics of mean and standard deviation to answer the research questions. While the hypotheses were tested using Analysis of Covariance (ANCOVA) at $p \leq 0.05$ level of significance.

Presentation of Results

Research Question 1: What is the difference in the academic achievement mean scores of students taught the concept of the respiratory system using educational games, drill and practice and expository teaching strategies?

Table 1: Mean and standard deviation of students' pre-test and post-test mean achievement scores by teaching strategies

Groups	N	Pretest		Posttest		Mean Difference
		Mean	SD	Mean	SD	



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Educational games	48	6.19	2.40	34.71	7.22	0.49
Drill and practice	45	6.33	3.88	34.22	6.86	
Educational games	48	6.19	2.40	34.71	7.22	15.81
Expository	50	6.34	1.77	18.90	8.57	
Drill and practice	45	6.33	3.88	34.22	6.86	15.32
Expository	50	6.34	1.77	18.90	8.57	

Results in Table 1 shows the mean difference (post-test and pre-test) in the academic achievement mean scores of students taught the concept of respiratory system using educational games and drill was 0.49 while that of students taught using educational games and expository was 15.81 and that of drill and practice and expository teaching strategies was 15.32, respectively. This result indicates that students taught respiratory system using educational games gained better than those taught using drill and practice, followed by those taught using expository strategy.

Research Question 2: What is the difference in the academic achievement mean scores of male and female students taught the concept of respiratory system using educational games, drill and practice and expository teaching strategies?

Table 2: Mean and standard deviation of pre-test and post-test mean achievement scores by gender

Groups	N	Pretest		Posttest		Mean Difference
		Mean	SD	Mean	SD	
Male	66	5.65	2.36	30.76	7.66	3.21
Female	77	6.83	2.99	27.55	12.48	

Source: Field work 2025

Result in Table 2 shows the mean difference (post-test and pre-test scores) for male and female Biology students in all the groups taught the concept of respiratory system. The result reveals that the pre-test mean achievement scores of male students in all the groups taught the concept of respiratory system was 5.65 while the pre-test of the female counterparts was 6.83. The post-test result revealed that the mean achievement scores (30.76) of male students in all the groups taught the concept of respiration was higher than the post-test mean achievement scores (27.55). This was observed with a remarkable mean difference of 3.21 indicating that male students in all group achieved academically better than their female counterparts in respiratory system.

Hypothesis one: There is no significant difference in the academic achievement mean scores of students taught the concept of respiratory system using educational games, drill and practice and expository teaching strategies, respectively.

Table 3: Analysis of Covariance (ANCOVA) of students' post-test achievement classified by teaching strategies with pre-test as covariate

Source	Sum of squares	Df	Mean	F	Sig	
Corrected model	10852.27 ^a	6	1808.71	47.71	.00*	Significant*
Pre-test (Covariate)	32.12	1	32.12		.85	.36
Main effect:						
Teaching Strategy	8152.14	2	4076.07	107.52	.00*	
Error	5155.62	139	37.91			
Corrected total	16007.88	142				

*significant at $p < .05$

The result on Table 3 shows the ANCOVA on the effect of teaching strategy (educational games, drill and practice and expository) on students' achievement in the concept of respiratory system. The result shows that an F-ratio of ($F(2, 142) = 107.52, p < 0.05, \eta^2_p = 0.00$) was obtained. Since the associated probability value of 0.000 is less than 0.05 set as level of significance, the null hypothesis was rejected. Thus, inference drawn is that there was a significant difference in the academic achievement mean scores of students taught the concept of respiratory system using educational games, drill and practice and expository teaching strategies, respectively. In order to determine the direction of significance, a Scheffe's Posthoc test was done as shown in Table 4

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Table 4: Summary of Scheffe's Posthoc pair wise comparison of students' post Test achievement classified by teaching strategies

Treatment groups (I)	(J)	Mean Diff (I-J)	Std. Error	Level of sig.
Educational games	Drill and practice	0.520*	1.581	1.000
Expository		15.84*	1.540	0.000
Drill and practice	Educational games	-0.520	1.581	1.000
Expository		15.32*	1.581	0.000
Expository	Educational Games	-15.84*	1.540	0.000
Drill and practice		-15.32*	1.565	0.000

R Squared = .678 (Adjusted R Squared = .664) *p<0.05

Table 4 shows the post-hoc result of the significant difference in the mean achievement scores of students in respiratory system who were exposed to educational games, drill and practice and expository. From the result, the mean difference of 0.520 at p=1.000 between educational games and drill and practice. This implies that there is no significant difference in the mean achievement scores of students taught the concept of respiratory system using educational games and drill and practice teaching strategies. The result also shows a mean difference of 15.84 at p=.000 between educational games and expositor. This implies that there is a significant difference in the mean achievement scores of students taught the concept of respiratory system using educational games and expositor teaching strategies. Lastly, the result shows a mean difference of 15.32 at p=.000 between drill and practice and expository. This result indicates that there is a significant difference in the mean achievement scores of students taught the respiratory system using drill and practice, and expository teaching strategies.

Hypothesis two: There is no significant difference in the academic achievement mean scores of male and female Students taught the concept of respiratory system

Table 5: Analysis of Covariance (ANCOVA) of students' post-test achievement classified by teaching strategies with pre-test as covariate

Source	Sum of squares	Df	Mean	F	Sig
Corrected model	10852.27 ^a	6	1808.71	47.71	.00*
Pre-test	32.12	1	32.12	.85	.36
(Covariate)					
Main effect:					
Teaching Strategy	8152.14	2	4076.07	107.52	.00*
Gender	710.80	1	710.80	18.7	.00*
Error	5155.62	139	37.91		
Corrected total	16007.88	142			

R Squared = .885 (Adjusted R Squared = .879)

p<.05

Table 5 shows the ANCOVA of the effect of teaching strategy (educational games, drill and practice and expository students' achievement scores in the concept of respiratory system. The result shows that an F-ratio of ($F(1, 142) = 18.75$, $p < 0.05$, $\eta^2_p = .00$) was obtained. The obtained associated exact probability value of 0.00 is less than 0.05 set as level of significance, the null hypothesis was rejected. Hence, it is concluded that there was a significant difference in academic achievement mean scores of male and female students taught the concept of respiratory system.

Discussion of Findings

Findings showed that there was a significant difference in the academic achievement mean scores of students taught the concept of respiratory system using educational games, Drill and practice and expository teaching strategies. This can be attributed to increased students' motivation and participation of concepts due to educational games compared to passive expository teaching. Active teaching through the use of educational games also enhances understanding and performance. Again, educational games often incorporate problem-solving and decision-making, fostering critical thinking skills that enhance understanding compared to traditional methods. This is in line with Etiubon *et al.*, (2021) who found that students taught computer tutorial achieved higher than those taught with computer drill-practice and lecture methods. This finding is in contrast with Zuabiru and Musa (2020) who found that there was no significant difference in the post-test performance

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scores of students taught Biology with the use of computer game and drill and practice. This finding is also in contrast with Majebi and Akin (2022) who found that the exploratory strategy was more effective than the game based on science process skills and knowledge. Findings showed that there was a significant difference in academic achievement mean scores of male and female students taught the concept of respiratory system. This may be due to differing confidence levels between males and females when engaging in science-related topics. Competition or active participation might have influenced one gender's engagement more than the other. Also, previous exposure to biology concepts or interest in human anatomy could vary between genders, leading to differences in motivation, curiosity, and academic performance in the topic. This finding is in line with Atabang and Umanah (2024) whose findings showed that males achieve better than females in Basic Science. This finding is in contrast with Maduabuchi and Iheanacho (2016) which shows that there is no significant difference in the performance of male and female students taught with drills. This finding is in contrast with Zuabiru and Musa (2020) who found that there was no significant difference in the performance of male and female students taught Biology with the use of computer Game. This finding is also in contrast with Sunday et al. (2025) Edet et al. (2025b); Wordu and Atabang (2024) and Etiubon *et al.*, (2021) which showed that gender is a non-significant factor in academic achievement of students.

Conclusion

The study showed that there was a significant difference in the academic achievement means scores of students taught the concept of respiratory system using educational games, Drill and practice and expository teaching strategies on senior secondary students' academic achievement in Biology in Abak Local Government Area. Additionally, gender differences in academic achievement were observed. It was there concluded that active teaching strategies, such as educational games, significantly improved students' academic achievement compared to traditional expository teaching.

Recommendations

Based on the findings, it is recommended that;

1. Teachers should incorporate active teaching strategies such as educational games, drills, and practice exercises to improve students' understanding and engagement in Biology.
2. Students should participate in educational games and drills to enhance teaching, problem-solving skills, and critical thinking in Biology.
3. Curriculum Planners should integrate active teaching strategies such as educational games and practice drills into the senior secondary school Biology curriculum and ensure that gender considerations are incorporated into curriculum design to cater to diverse teaching needs and abilities.

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