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EFFECTS OF ADAPTIVE LEARNING STRATEGY ON SENIOR SECONDARY STUDENTS' INTEREST IN BIOLOGY IN AKKO, GOMBE STATE, NIGERIA

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ABSTRACT

The study examined how senior secondary two students in Akko, Gombe State, Nigeria, responded to an adaptive learning strategy in terms of their interest in ecology. The study was prompted by the students' low performance in the senior secondary school biology external examination, particularly in the area of Akko Local Government. To direct the investigation, two purpose of the study and two research questions were developed, and the hypotheses were tested at the 0.05 level of significance. The non-randomized pre-test, post-test control group design was specifically used in the study's quasi-experimental research design. 2407 secondary school students studying biology in the eleven public senior secondary schools in the Gombe State local government area made up the population. 120 senior secondary two biology students from two public secondary schools were chosen as the sample as intact classes. These two secondary schools were chosen through basic random sampling methods. The Students Ecology Interest Questionnaire (SEIQ) which have reliability scores of 0.861 instruments was used to collect the data. The study's conclusions demonstrated a statistically significant difference between the experimental and control groups' posttest achievement mean scores for SSII students studying ecology. The mean score of SSII students' posttest interest in Ecology varied significantly between the experimental and control groups. The study's conclusions suggest that adaptive learning can be utilized to increase students' interest in and performance in ecology, and consequently, biology as a whole. The study concluded with some recommendations, one of which is that in order to raise secondary school students' academic performance, teachers must become proficient in the skills and methods of adaptive learning.

INTRODUCTION

It is impossible to overestimate the importance of science and technology to the advancement of any nation. This is so because science is the cornerstone that supports the majority of technological advancements. According to Rau (2018), science is a body of organized knowledge that is primarily used through methodical experimentation and observation to study physical and natural phenomena. Agbo (2015) defined science as a systematic body of knowledge that aims to investigate nature through its processes, products, skills, and interests in a previous study. Therefore, science is the process of acquiring knowledge. It is a dynamic human activity concerned with understanding of the working of things in our environment. This can only be achieved through science education. Science education is a process of imparting and acquiring scientific knowledge. One of the purposes of science education is to help the individuals to maximise their potentials for optimal self and national development.

There are other three-fold purposes of science education. These three purposes include the preparation of the more willing and able students with special ability for higher studies, acquisition of multidimensional (different aspect) scientific and technological literacy and lastly, to apply the acquired skills to everyday living. Through the knowledge of science and technology, a nation develops its manpower in such critical areas as medicine, engineering, architecture, agriculture, Science Teachers and other science-based profession and technologies. The importance of science and technology in Nigeria can be felt clearly in the areas of transportation, communication, agriculture, health care, space exploration, food production and so on.

Science is made up of three basic subjects that are classified as core science such as Biology, Chemistry and Physics. Biology is a branch of science which studies life. The subject covers the studies of living organisms (animate) and how they interact with each other and their environment. It examines the structure, function, growth, origin, evolution and genetics of living and interactions with the environment. Biology classifies and describes organisms, their functions and how species come into existence; it is a basic human science that has always involved the understanding, composition, function and survival of living things and their interactions in nature. It is an area of science that is concerned with the study of living organisms, their behaviour, their functions, their origin, development and their relationships with their environment. Biology is also a study that ranges from microscopic, cellular and

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molecular to the biosphere encompassing the earth's surface and its environment. The content of the subject provides an opportunity to present science in areas of Medicine, Agriculture, Biotechnology, Genetics, engineering, food production industries and environmental studies. This could be the reason why the subject is recognised in Nigeria.

Biology is an integral part of science. It is a subject that deals with the living system. The interrelatedness between Biology, Chemistry and Physics has made the development of several techniques that led to advancement in medicine, pharmacy, petrochemical, agriculture and engineering possible. Through the understanding of phenomena such as genetics and photosynthesis, one could infer that biology has gone a long way to improve the social and economic prospect of mankind. Biology encompasses living organism, how it functions and what these functions are, how it develops, how living things come into existence and how they react to one another and with their environment. Biology takes into account, interactions between living and non-living things. It also encompasses theoretical and experimental activities by which human beings try to find solutions to their everyday problems. Various authors have defined Biology in different ways.

Azmi (2015) defined biology as that branch of science which involves the study about life of plants, animals, humans and any other type of living organisms. The above definition implies that biology is a subject that deals with the study of plants and animals. Babagana, Yaki and Idris (2016) seems to agree with this when they defined biology as the branch of science concerned with the study of life that embraces the structure, growth, functioning and evolution of living things. Eldon, Enger and Rose (2017) stated that the nature of science and the fundamental biological concepts is so important for any person, regardless of his or her occupation. Biology can also be viewed as a subject that studies lives. This is because it studies the interrelationship between living organisms. Biology encompasses various topics that are life's processes, for example, movement, respiration, nutrition, irritability, growth, excretion and reproduction. These life's processes are characteristics of all living things and living things are the things that have life and can carry out life's activities. Biology is a natural science concerned with the study of life and living organisms, including their structure, function, growth, evolution, distribution and taxonomy. Biology is one of the science subjects that senior secondary students offer in senior secondary certificate examinations in Nigeria (FRN, 2014). It is a popular subject among students and its popular nature among other science subjects has made it a distinct choice for all students (Lawal, 2011).

Biology has been identified as the bedrock of understanding life, treating ailment and maintenance of the ecosystem. It is an interesting study that ranges from microscopic cellular molecules to the biosphere, encompassing the earth surface and its living organisms. Biology can therefore be defined as the science of life (Ogunleye, 2012), it is a natural science that involves the study of life and living organisms including their physical and chemical structure, function, development and evolution. Biology involves several sub disciplines.

Anderson (2018) carried out a study on teaching to address diverse learning needs (adaptive learning): development and validation of a differentiated instruction scale. The objective of the study included among others to develop and implement adaptive learning as a strategy in the selected few units of ecology standard and its effect on the achievement, concept attainment and process skills of students belonging to different intelligent groups. The study was quasi-experimental in nature when non-randomized pre and posttest design was used. The design for the study was also a comparative research in which an experimental group was compared to a second group that was taught in a lecture, teacher-centered manner called the control group. The sample was 100 ninth grade biology students from two classes in a high school in Detroit, US.A. The data were collected via a pre and post-administration of the Biology Achievement Ecology Test (BAET). One of the classes was randomly chosen as experimental group (58), which was taught using adaptive learning and the other was control group (42) which did not receive any presentation adaptive learning but lecture method. The study conducted in six weeks. The material covered was about ecology. The data was analyzed using mean, standard deviation, and a two-way ANOVA. The result from the study showed that adaptive learning instruction was more effective that lecture instruction in improving ecology achievement of the participating students. The study did not consider other variables like gender. This study under consideration will consider gender as an intervening variable. The study even though was in adaptive learning, was carried out in America, this study will be carried out in Akko Local Government Area, Gombe state, Nigeria.

Poor teaching methods have been pointed out as one of the reasons for underachievement in biology by the students. Teaching methods are being blamed because the teacher's instructional method plays an important role in skill acquisition and meaningful learning. This implies that the success of the educational system depends largely on the teacher and the implementation of various teaching strategies in the classroom. These strategies should be more of student centred. One of such strategies is the adaptive learning.

Adaptive learning as defined by Moskal, Carter and Johnson (2017), is one technique for providing personalized learning, which aims to provide efficient, effective, and customized learning paths to engage each student. Adaptive learning systems use a data-driven approach to adjust the path and pace of learning, enabling the delivery of personalized learning at scale. Adaptive systems can support changes in the role of faculty, enable innovative teaching practices, and incorporate a variety of content formats to support students according to their learning needs. Adaptive learning tools collect specific information about individual students'

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behaviors by tracking how they answer questions. The tool then responds to each student by changing the learning experience to better suit that person's needs, based on their unique and specific behaviors and answers.

Strimel, (2014) carried out a study on the effects of adaptive learning on students' performance in technology based course. This study was conducted among students of the second year SMPP 2 Hudilo, in the academic year of 2013/2014. There were 86 students selected as sample and divided into the experimental and control group. The study used a pre-test and post-test only control group design. The analysis was made by using ANOVA facilitated by SPSS version 16.0 for windows. The result indicated that (1) there was a significance effect of adaptive learning on students' self-confidence (F=834.104 and sig=0.000; P<0.05). (2). There was a significance effect of adaptive learning on students' machine handling competency (F=70.325 and sig= 0.00; P=0.05) (3) simultaneously, self-confidence and students' machine handling competency (F-observed< 0.05).This study revealed the effects of adaptive learning strategy to students' self-confidence and students machine handling competency of the second grade SMPP 2 Hudilo in the academic year2013/2014. The study is similar to the present study in the strategy used but the present study will be carried out in biology among secondary school students.

Prast, Weijer-Bergsma, Kroesbergenand Van Luit, (2015) researched on the effects of adaptive learning on students' achievement in primary school mathematics. The sample of the study consists of (80) pupils. The sample is distributed as follows: (44) students in the first experimental group which is taught according to adaptive learning strategy and (36) students in the control group which is taught according to traditional way of teaching. The two groups are matched in terms of the following variables: the students age (in months), their intelligence, their achievement in sciences (in the fourth primary stage) the researcher has constructed an achievement test which include (20) items. These items are multiple choice items. The validity of this test has been ascertain and also reliability is obtained by using Pearson Correlation formula which yield (0.83) coefficient, after analyzing the results statistically it has revealed a statistically significant differences in favor to the experimental groups the first and the second lines in achievement and retention. This means that adaptive learning helps in enhancing pupils achievement in the primary schools. The study did not indicate the method of data analysis and the location. The present study will state its methods of data analysis and will be carried out in Akko Local Government Area of Gombe state.

Interest is a powerful dictator and motivator in the learning process. Interest is the feeling that prompts one to spontaneous activity. Interest according to Sulde and Sulde (2016) can be defined as an emotion that triggers the feeling that prompts one to spontaneous activity. Students are likely to pay adequate e attention to learn, remember, imagine and read more readily when their interest and emotions are positively provoked towards the subject. Interest is therefore a tendency to seek out and participate in any type of activity, as a personal preference for one activity over another. Interest as a human sentiment, goes along with values, attitudes and other forms of human preferences. This means that interest motivates and compels attention, operating at the realm of affective domain. Factors that affect interest include personal and socioeconomic/environmental factors. Personal factors include students' physical, health and physical development, mental health and development, age, sex, pattern of instinctive behaviour, emotions and sentiments. The socio-economic status includes rearing practices in the family, cultural status, education, among other aspects. Interest therefore makes the students to feel alert, awake and excited at the delivery of learning instructions in the biology class. The overall outcome of interest is that interest may lead to achievement on the part of the student. Interest as a human sentiment, goes along with values, attitudes and other forms of human preferences. This means that interest motivates and compels attention (Ogundele, 2010), operating at the realm of affective domain. Factors that affect interest include personal and socioeconomic/environmental factors.

According to Aggrawal (2010), interest is a powerful dictator and motivator in the learning process. The implication is that, students are likely to pay attention to learn, remember, imagine and read more readily when their interest and emotions are positively provoked. Interest is therefore a tendency to seek out and participate in any type of activity, which Okoli (2005) sees as a person's preference for one activity over another. Interest therefore makes the students to feel alert, awake and excited at the delivery of learning instructions. The teacher would energize the students by introducing varieties into his/her teaching. The interest students develop has a powerful influence on their behaviour, which lasts unto older years, even after school, meaning that interest can affect students' academic performance.

Researchers have examined how teachers can increase students' interest and engagement in the classroom. According to Mazer, (2012), students' interest can be triggered in the moment by certain environmental factors such as teacher behaviours. He discovered that increase in emotional arousal heightens a students' attention, which makes it easier to encode more information. The teachers' behaviours stimulate emotional arousal in students, which leads to greater emotional interest and learning engagement. The implication is that, these actions of interest demonstrated by the teacher during teaching makes students to experience cognitive interest and eventual greater academic achievement. For instance, Uhumuabi and Umoru (2005) investigated the relationship between interest and achievement in mathematics and sciences. They found that achievement of students in mathematics and sciences depend largely on students' interest they generate while studying these subjects. They further found that intrinsic and extrinsic interests are important determinants of achievements in mathematics and sciences.

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There has been various research works on gender and biology with conflicting views. The conflicting research finding can be hinged on enrolment and achievement in biology by both male and female. Gender has remained an issue in the front burner of academic discourse. Scholars have become enthusiastic on addressing issues that continued to create differences among people on the basis of gender which has continued to have adverse consequences on sustainable economic and technological development of the nation. Olorundare (2019) defined gender as stereotyping to a collection of commonly held beliefs or opinions about what are "appropriate" behaviors and activities for males and females. Miller and King (2014) view gender as a social, historical and cultural construct and conditioning, indicating acceptable and preferable forms of behavior and attitudes for both men and women in the society. This researcher is of the view that there is no conclusive research on gender and achievement.

Imam and Dada (2012) defined gender as the social roles, responsibilities, and behavior created in our families, societies and culture. It also includes the expectations held about the characteristics, aptitudes and likely behaviors of both men and women. These roles are passed on from generation to generation. (United States Aid for Individual Development (USAID), 2015). Gender can also be viewed as a socially ascribed attribute which differentiates feminine from masculine. For Ekeh (2010), gender is a socio-cultural construct that assigns roles, attitudes and values considered appropriate for each sex. Oraifor (2010) opined that sex is based on biological and physical differences between male and female while gender refers to cultural understanding about what constitutes masculinity and feminity in a society. Gender differences in science are a global phenomenon that is confined to countries with high numbers of out of school girls. Benson (2012) noted that one factor that militates against science literacy is gender discriminatory barriers in African societies that operate against equitable participation of boys and girls in science education. He observed that one out of four girls of school age is actually in school. Curricular pedagogic practices and class-room organization, according him, further hinder the access and retention of girls in science education.

Gender refers to male and female and is a specially constructed phenomenon that is taught about society ascribed different roles, duties, behavior and mannerisms to the two sexes (Makittene, 2016). The researcher added that, gender is a social connotation that has sound physiological background, and is used to refer to specific cultural patterns of behavior that are attributed to human sexes. Akpochafor (2019) supported that gender relates to cultural attributes of both male and female. The author further explained that, gender has to do with personality and control components of self-concept. Unlike sex, this is concerned with only the distinction between male and female based on biological characterizers. Sigh (2010) saw gender as socio- cultural construct that connotes the differential roles and responsibilities of men and women in a particular society. Sigh further explained that, gender determines the role which one plays in non to general politics, cultural, science and economic system of the society.

Statement of the Problem

This study was inspired in response to the poor achievement of senior secondary school students in biology and especially ecology in Akko Local Government Area, Gombe State. The issue of poor achievement of students in biology has been of much concern among science teachers. According to WAEC Chief Examiners' reports of 2016, 2017 and 2018, there has been a decline in students' achievement in biology examinations.

Likewise, the chief examiners (WAEC and NECO) reports of 2015, 2016, 2017, 2018,2019 and 2020 indicated that students perform poorly in biology and in questions regarding ecology in the examinations. Specifically, the chief examiners report of 2015 and 2016 have reported the failure of students in biology to be 302,102 (44.02%) and 315,919 (41.97%) respectively. In 2017, the failure is 9,169,508 (62.776). In some instances, the students avoided answering questions on the topic ecology.

It was also reported by the chief examiner (WAEC) reports (2018) that students found various ecological concepts difficult to understand. The concepts that are difficult include ecosystem, biomes, food chain, food web, and biosphere. The poor achievement and lack of interest in ecology among students can be attributed to poor teaching methods as reported by various researchers such as Egolum and Nwafor (2014) who pointed out that the traditional teaching methods have not yielded expected results. The poor achievement of students in biology have been attested to by other researchers such as Agbowuro (2014) who stated that candidates achieve poorly in biology (especially in questions related to ecology and genetics).

The consequences of not addressing the problem of lack of interest in biology and in ecology in particular is not providing a formidable workforce in important careers and profession in science. It is in the light of this and in an attempt to find an effective instructional approach which would improve Senior Secondary students' interest in biology and especially in ecology, that this study proposes to investigate the effects of adaptive learning strategy on the interest of senior secondary students in ecology in Akko, Gombe State, Nigeria.

Purpose of the Study

The main purpose of the study is to find out the effects of adaptive learning strategy on senior secondary two students' interest in ecology in Akko, Gombe state, Nigeria. Specifically, the objectives of the study are to:

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1. determine the pre-test and post-test interest mean scores of senior secondary two students in Ecology in the experimental and control group in Akko, Gombe State, Nigeria.
2. find out the differences between the post-test interests mean scores of male and female senior secondary two students in Ecology after exposure to adaptive learning strategy.

Research Questions

The following research questions were formulated to guide the study.

1. What are the differences between the pre-test and post-test interest mean scores of senior secondary two students in Ecology in the experimental and control group in Akko, Gombe State, Nigeria?
2. What are the differences between the post-test interests mean scores of male and female senior secondary two students in Ecology after exposure to adaptive learning strategy?

Hypotheses

The following research hypotheses were tested at 0.05 level of significance in the study:

1. There is no significant difference between the post-test interest mean scores of senior secondary two students in Ecology in the experimental and control group in Akko, Gombe State, Nigeria.
2. There is no significant difference between the post-test interest mean scores of male and female students when exposed to the adaptive learning strategy?

METHODOLOGY

Research Design

The study adopted quasi-experimental research design. Specifically, the non-equivalent control group pretest-posttest design. The design was made of two groups namely the control and experimental which were not composed on the basis of randomization. This design was chosen due to the fact that it was impossible to carry out a random assignment of subjects to groups. In this study, the researcher used one arm in a school as the experimental group and another arm in another school as the control group.

Population of the Study

The population for this study comprised of 8 senior secondary schools in Akko Local Government Area, Gombe State who are having same characteristics of being public schools, having more harmonized programs which are uniformly coordinated, having two arms of SSII students offering biology, have been writing WASSCE for the past 10 years, having a biology laboratory with adequate equipment, having teachers with at least degree in (B.Sc. Ed) Biology. The 8 senior secondary schools have a total of 1418 senior secondary students offering Biology, having 811males and 607 females.

Sample and Sampling Technique

The sample for the study was made up of 120(71males and 49 females) students offering Biology from two public secondary schools in Akko Local Government Area, Gombe state. One intact class each was used in the selected schools for control and experimental group. In determining the groups, the researcher flipped a coin to determine which of the intact class served as experimental and the one that served as the control. The use of separate schools was to prevent interferences from the students which may occur if the same school was used for the experimental and control groups.

Instrument for Data Collection

The research instruments that was used for this study is the Students Ecology Interest Questionnaire (SEIQ). The SEIQ sought to elicit information from the students on their interest in ecology before and after subjecting them to adaptive learning.

Method of Data Collection

Two research assistants (one from each school) were trained for 3 days by the researcher to assist in the administration of the instruments. The researcher ensured that each research assistant has a minimum teaching qualification of B.Sc.Ed in biology with some years of teaching qualification and experience. This was necessary to ensure that they possess the required knowledge of the subject matter. In the training process, the researcher went through the instruments and the lesson plans with them. The research assistant for the experimental group was trained on the adaptive learning strategy while the control group was trained on conventional lecture method.

Method of Data Analysis

All the research questions were answered using mean and standard deviation. The Analysis of Covariance (ANCOVA) was used to test the hypotheses.

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ANALYSIS OF RESEARCH QUESTIONS

Research Question 1

What are the differences between the pre-test and post-test achievement mean scores of senior secondary two students in Ecology in the experimental and control group? This can be seen below.

Table 1

Pre-test and Post-test Mean Achievement Scores of SSII Students' in Ecology in the Experimental and Control Groups

Group		Pre-test		Post-test		Mean		
	N	Mean $\bar{x}$	SD	Mean $\bar{x}$	SD	Gain	$\bar{x}$-	Difference
Experimental	53	37.45	8.85	66.77	10.41	29.32		
								24.5
Control	67	37.85	9.49	42.67	9.62	4.82		

Table 3 presents the mean and standard deviation results of pre-test and posttest mean achievement scores of SSII students' in Ecology in the experimental and control groups. The result for experimental group shows that the post-test mean score (x = 66.77, SD = 10.41) is higher than the pre-test mean score of 37.45 and a standard deviation of 8.85 with a mean gain of 29.32, indicating that there was improvement in the achievement of students after exposure to adaptive learning strategy. Also, for the control group the mean score was 37.85 and a standard deviation of 9.49 for the pretest. In the post-test, the mean score was 42.67 and a standard deviation of 9.62 with a mean gain of 4.82. It then means that students in the experimental group had a higher achievement mean score after treatment using adaptive learning strategy as against those in the control group who were not given treatment, with a mean difference of 24.5. This implies that adaptive learning strategy does increase students' achievement in Ecology.

Research Question Two

What are the differences between the pre-test and post-test interest mean scores of senior secondary two students in Ecology in the experimental and control group in Akko, Gombe State, Nigeria?

Table 2

Pre-test and Post-test Interest Mean Scores of SSII Students' in Ecology in the Experimental and Control Groups

Group		Pre-test		Post-test		Mean		
	N	Mean	SD	Mean	SD	Gain	$\bar{x}$-	Difference
Experimental	53	38.60	6.78	63.19	11.61	24.59		
								19.68
Control	67	39.76	6.98	44.67	8.89	4.91		

Table 4 presents the results of pre-test and posttest interest mean scores of SSII students' in Ecology in the experimental and control groups. The result for experimental group shows that the post-test interest mean score (x = 63.19 SD = 11.61) is higher than the pre-test mean score of 38.60 and a standard deviation of 6.78 with a mean gain of 24.59 indicating that there was increase in the interest of students to Ecology after exposure to adaptive learning strategy. Also, for the control group the mean score was 39.76 and a standard deviation of 6.98 for the pretest. In the post-test, the mean score was 44.67 and a standard deviation of 8.89 with a mean gain of 4.91. It then means that students in the experimental group had a higher interest mean score after treatment using adaptive learning strategy as against those in the control group who were not given treatment, with a mean difference of 19.68. This implies that adaptive learning strategy does increase students interest in Ecology.

RESULT OF TEST OF HYPOTHESES

Hypothesis 1

There is no statistically significant difference between the post-test achievement mean scores of senior secondary two students in the control and experimental groups in Akko, Gombe State, Nigeria.

Table 3

ANCOVA Result on Posttest Achievement Mean Scores of Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	17192.406[a]	2	8596.203	85.629	.000	.594
Intercept	19525.747	1	19525.747	194.500	.000	.624
Pre-test	2.498	1	2.498	.025	.875	.000
Group	17190.830	1	17190.830	171.241	.000	.594
Error	11745.561	117	100.389			
Total	370058.000	120				
Corrected Total	28937.967	119				

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R Squared = .594 (Adjusted R Squared = .587)

Analysis of Covariance (ANCOVA) was conducted to determine if a significant difference exists in the posttest achievement mean score of SSII students in Ecology in the experimental and control groups. Table 7 shows that $F(1,117) = 171.24$, $p < 0.05$, since the p-value of 0.000 is less than 0.05 level of significance ,the null hypothesis was rejected, indicating that there was a significant effect of adaptive learning strategy on students achievement in Ecology. The result further reveals an adjusted R squared value of .587 which means that 58.7 percent of the variation in the dependent variable which is achievement is explained by variation in the treatment of adaptive learning strategy, while the remaining is due to other factors not included in this study. Hence, we can say that adaptive learning strategy can help improve students' achievement in Ecology.

Hypothesis Two

There is no statistically significant difference between the post-test interest mean scores of senior secondary two students in Ecology in the experimental and control group in Akko, Gombe State, Nigeria.

Table 8

ANCOVA Result on Posttest Interest Mean Scores of Experimental and Control Groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	10174.582[a]	2	5087.291	48.817	.000	.455
Intercept	11385.049	1	11385.049	109.250	.000	.483
Pre-test	28.171	1	28.171	.270	.604	.002
Group	9986.015	1	9986.015	95.825	.000	.450
Error	12192.718	117	104.211			
Total	357542.000	120				
Corrected Total	22367.300	119				

a. R Squared = .455 (Adjusted R Squared = .446)

Analysis of Covariance (ANCOVA) was conducted to determine if a significant difference exists in the posttest interest mean score of SSII students in Ecology in the experimental and control groups. Table 8 shows that $F(1,117) = 95.83$, $p < 0.05$, since the p-value of 0.000 is less than 0.05 level of significance ,the null hypothesis was rejected, indicating that there was a significant effect of adaptive learning strategy on students interest to Ecology . The result further reveals an adjusted R squared value of .446 which means that 44.6 percent of the variation in the dependent variable which is interest is explained by variation in the treatment of adaptive learning strategy, while the remaining is due to other factors not included in this study. Hence, we can say that adaptive learning strategy can help increase students' interest to Ecology.

DISCUSSION OF THE FINDINGS

The study examined the effects of adaptive learning strategy on senior secondary two students' achievement in ecology in Akko, Gombe state, Nigeria. The results showed that exposure to adaptive learning strategy was found to be effective in improving the achievement of secondary school students in Ecology in Akko LGA as indicated in the result that there is a significant difference between the posttest achievements of students in the experimental and control groups in Ecology. This finding is in line with that of Park and Datnow (2017) who carried out a study on ability grouping and differentiated instruction (adaptive learning) in an era of data driven decision making. The study was carried out in the United State of America. One hundred and twenty high school slow learners in biology were identified and randomly assigned to the lecture group (n = 60) and adaptive learning group (n = 60) respectively. Analysis of the post-test scores indicated that the group taught by the adaptive learning instructional strategy performed significantly ($P > 0.05$) better than their lecture group counterparts. The result of the data analyzed for the study, provided support for the efficacy of the adaptive learning technique in bringing about meaningful learning in ecology concepts in slow learners in the experimental group.

The finding is also in line with Strimel, (2014) who carried out a study on the effects of adaptive learning on students' performance in technology based course. This study was conducted among students of the second year SMPP 2 Hudilo, in the academic year of 2013/2014. The result indicated that there is a significant difference between the posttest achievements of students in the experimental and control groups in machine handling. This a clear evidence that adaptive learning strategy can improve students' achievement. This finding is also in line with Prast, Weijer-Bergsma, Kroesbergen and Van Luit, (2015) who researched on the effects of adaptive learning on students' achievement in primary school mathematics. The sample of the study consists of (80) pupils. After analyzing the results statistically, it revealed a statistically significant differences in favor to the experimental groups

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the first and the second lines in achievement. This means that adaptive learning helps in enhancing pupils' achievement in the primary schools.

It also showed that there was no statistically significant interaction effect of gender and treatment on interest to Ecology. This finding is consistent with that of Petö, Elekes, Oláh, and Király (2020) who carried out a research on the impact of adaptive modelling Instruction on Students' Learning interest; small steps toward an empathic multicultural world through a new perspective of social categorization as a tool in adaptive learning. The strategies adopted were adaptive learning and lecture method. They were taught ecology for 6 weeks and post-tested. An interest test was administered two weeks later. Results indicated significant differences among students in the two instructional groups on students' cognitive achievement. The adaptive learning produced a more positive effect on students' achievement in biology, but there was no statistically significant interaction effect of gender and treatment on interest of the students in Ecology.

REFERENCES

1. *Agbo, F.O. (2015) Effects of individualized, collaborative fieldwork and expository learning on Biology students' ability to solve problems. International Journal of Research in Science, Technology and Mathematics Education, 1(2), 82-89.*
2. *Agbowuro, C. (2014). Effects of metacognition of meaningful learning of some biological concepts in senior secondary schools in Plateau State. An unpublished Ph.D. thesis, Department of science and technology education, Faculty of Education, University of Jos.*
3. *Aggarwal, J.C. (2010). Essential of educational psychology. (2nd edition). New Delha: Vikas publishing House.*
4. *Akpochafo, W.P. (2019). Social studies and femimst issue for teacher's education. Benin city: Justice JecoPress and Publishing Ltd.*
5. *Anderson, N. P. (2018) Teaching to address diverse learning needs: development and validation of a differentiated instruction scale. International Journal of Inclusive Education, 17(11), 11-31.*
6. *Azmi, M.S. (2015). Biology laboratory apparatus. http://www.laboratoryapparatus.org/2010/07/biology*
7. *Babagana, M., Yaki, A.A., & Idris, B. (2016) Effects of computer simulation and jigsaw techniques in teaching reproductive system in human in senior secondary schools, Minna Metropolis, Niger State. Journal of Information Engineering and Applications. 6(6), 8-14.*
8. *Benson, M. (2012). Science technology and Mathematics Education for sustainable development in Africa: Scientific and technological literacy, culture, self-identity. Proceedings of the 43th annual conference of science teachers' association of Nigeria.*
9. *Ekeh, A. (2010). Effects of problem-solving strategy and Gender on Academic Achievement of Pre-Service Teachers in Genetics for functional skills Acquisition: International Journal of Research in Science, Technology and Mathematics Education. 3(2), 47-60.*
10. *Eldon, E. Enger, D. and Rose, B. (2017). Concepts in biology. http://www.books.google.nl/books. McGraw Hills Education.*
11. *F.R.N (2014). National policy on education. N.E.R.D.C. Press Yaba Lagos Nigeria*
12. *Imam, H. & Dada, M.S. (2012). An investigation in to basic education and gender equality in Gwagwalada Area Council, Federal Capital Territory (FCT). Abuja. International Journal of Education and Management Sciences. 1(1), 108-111.*
13. *Lawal, H.A. (2011) Teachers' Understanding of Biology Curriculum content and requirement Practices. Journal of the Science Teachers' Association of Nigeria, 33(2), 78 – 83.*
14. *Makittene, O.M. (2016) Gender and achievement in the sciences. Journal of Research in Education, 17 (2) 157-174.*
15. *Mazer, J. (2016). Researchers examine how teachers can increase students in phys.org/./2012 l0 .teachers-students. Retrieved on 14th April, 2014.*
16. *Moskal, P.,Carter, D. & Johnson, D. (2017), 7 Things You Should Know About Adaptive Learning. Adaptive CoursewareFaculty DevelopmentInstructional TechnologiesDigital Learning):EDUCAUSE Learning Initiative (ELI)https://www.pearsonlearned.com › new-insights-about-adaptive-learning-wh*
17. *Ogundele, A.O. (2010). Effect of models on interest and academic achievement of auto mechanic students in Technical Colleges in Lagos state. Thesis submitted to the department of Vocational Teachers' proceedings of August 2018 55th Annual Conference (Mathematics Education).*
18. *Ogunleye, T.E. (2012), Effects of two teaching methods on achievement and Attitude to Biology of Students of different levels of scientific literacy. International Journal of Educational Research, 2(1), 216 – 229. www.elsevier.com/locate/ijdures.*
19. *Olorundare, A.S. (2019). Comparative effects of concept-mapping, analogy and expository strategies on secondary school students' performance in chemistry in Ilesa Nigeria. Journal of Curriculum and Instruction, 7(1&2,), 2009. Published by Department of Science Education, University of Ilorin, Ilorin Nigeria.*
20. *Okoli, C. E. (2012). Instruction to educational psychological measurement. Lagos: Victor Printer Nig. Ltd.*
21. *Oraifor, S.O. (2010). Gender and teacher education: evidence, explanation and implications in S. O. Oraifor and O.C. Ikponwosa (eds.) Benin City: Institute of education. University of Benin.*
22. *Petö, R. Elekes, F. Oláh, K & Király, I. (2020). Small steps towards an emphatic multicultural world through a new perspective of social categorization as a tool for adaptive learning. ncbi.nlm.nih.gov retrieved 25/1/2020.*
23. *Prast, E. J., Van de Weijer-Bergsma, E., Kroesbergen, E. H., &Van Luit, J. E. H. (2015). Readiness-based differentiation in primary school mathematics: Expert recommendations and teacher self-assessment. Frontline Learning Research, 3(2), 90–116. doi:10.14786/flr.v3i2.163.*
24. *Strimel, G. (2014). Authentic education by providing a situation for student-selected problem-based learning. Technology and Engineering Teacher, 73(7), 8–18.*

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25. *Sulde, O. & Sulde, G. (2016). Psychology of learning. 3rdedition. Madles publishers. New Oleans. USA.*
26. *Uhumuabi, P.O, Umoru, G.E (2005). Relationship between interest in mathematics and achievement in mathematics and science among polytechnic students. A case study on Buchi Polytechnic.*