

## **EFFECT OF BIOLOGY PRACTICAL ON THE ACHIEVEMENT OF SENIOR SECONDARY SCHOOL STUDENTS IN BIOLOGY IN QUA'AN PAN LOCAL GOVERNMENT AREA OF PLATEAU STATE**

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### **ABSTRACT**

*This study investigated the effect of Biology practical on the academic achievement of Senior Secondary School biology students in Qua'an Pan Local Government Area of Plateau State. The study adopted pre-test and post-test non randomized quasi experimental design. Three research questions and three hypotheses guided the study. One hundred (100) Senior Secondary School students were sampled from the population of 490 SS 2 students. Two schools were sampled out of twelve (12) Government Secondary Schools in Qua'an Pan L.G.A, whereby school A is the control group and school B is the experimental group. Instrument for data collection was Biology Achievement Test (BAT) consisting of eight (8) multiple -choice test and two essay items was constructed. The instrument was validated by three Experts, one in measurement and evaluation and two in biology education. The reliability test was done using Cronbach Alpha method to determine the reliability. The reliability obtained was 0.71. The research questions were answered using mean and standard deviation while hypothesis were tested using t-test. The findings of the study showed that students taught biology using practical activities performed better than their counterparts using conventional method. The result also showed that gender has significant difference on student's performance when taught with practical. The researcher therefore, recommends that teachers should employ practical activities in teaching biology to enhance student`s performance.*

**Key words: Biology practical, achievement**

### **INTRODUCTION**

The word 'science' is often misunderstood by many people. Ali (2014) views it as a kind of legal magic while others understood it as a white man's propaganda about things. A lot of people, who attempt to define science, make reasonable but fragmentary definition of it. Little of the people realize that most of man's daily activities involve practical science (Singet, 2005). For example, when someone wakes up in the morning and takes a glass of water and not kerosene or groundnut oil that is science in action. When a mother strikes a stick of match, lights a candle and watches it melts, she is doing science. When a Baker adds yeast and not sand or soil to flour to make it rise, he too is doing science. Even a Barber in the village, when he applies soap solution to his client's hair to soften it, he is applying the knowledge of science in practice. Therefore, with the above few instance of what science is it then means that science is not magical as people in their thought think. Science is everywhere and all around us, though many people are yet to see it in this light, but that does not dismiss the existence of practical science.

Ali (2007) viewed science as a dynamic human activity that is anime at understanding of the working of our globe. In other words, science consists of a variety of information, abilities, and operations concerning the natural environment. He believes that science is more concerned with different investigative processes and activities with regards to developing inquiring and controlling knowledge, skills, capabilities and attitudes about the natural factors of the environment. From all these processes reliable and verifiable facts are accumulated for use in science and other related

discipline or fields. Science as a body of knowledge arrived at through systematic and procedural processes based on tentative observations and experiment. From his postulation science is a way of thinking in an effort to understand nature and order of investigating a body of established knowledge. Ambuno and Osakwe (2008) opined that "without science, the world today would not have been what it is. Technological advancement which is the practical application of scientific knowledge to solve human enormous problem, has completely changed and transformed the world. This is very visible in all spheres of human life ranging from communication, health, agriculture, banking, education, building, fabrics among others.

Science being very broad in nature has various disciplines of human endeavours related to Physics, Chemistry and Biology. Laboratory work is the hall mark of learning these disciplines. Biology for instance, requires skills in carrying out practical investigation regarding concepts like types of food, nutrients, cells, tissues, diseases, organic systems, pathogens among many others. Biology remains a branch of science that studies life and its various forms in relation to its environment. It concerns itself with structures, behaviours, distribution, the origin of plants and animals and their relationship interaction with their environments. Abuga (2007) defined Biology as a natural science in which we study living organisms, plants and animals. Biology as a science studies living things, man's curiosity, intrinsic and inquisitiveness about the dynamic world around him, leading to his strives and explorations to investigate the origin, nature, characteristic and usefulness of life. To get this done, man engages in practical experimentation and observation which are fundamental and indispensable in science. Like other science subjects, Biology in Senior Secondary Schools is composed of practical activities. It is geared towards simplifying the theoretical contents in order to facilitate effective and efficient learning of the subject.

Rob & Jonathan (2000) state that practical activities in Biology estimate learner interest in the science subjects they are studying, when they are made to personally engage in useful practical activities. Ude (2018) in his study revealed that students in the experimental group that are taught biological concepts using practical activities always perform better than the control group (those taught without practical activity method). To further support this, Rughnill (2011); Alison (2013); and Alexander, (2016) established that students exposed to Biology practical activities (experimentation) tend to learn more of what is taught, retain it longer, appear more satisfied with their practical work and perform better in examinations than when taught with other instructional formats. However, the knowledge gained through practical work and experiences promote and prolong memory retention that theory alone may not achieve. From this junction, it is obvious that students or learners acquire more in any science lesson or subjects if giving the opportunity and time to do such activities emerging from manipulating apparatus, classifying, designing, experimenting, hypothesizing to make inferences and verifying results.

The gender gap between the female students' achievement in Biology theory and practical examination and their male counterpart has prompted a great deal of discussion. The factors that underlie performance deficits remains poorly understood. Research shows that female students under performed in Biology theory and practical examination compared to their male counterparts due to the higher levels of test anxiety in the female students (Brimoh & Okayi 2011). Test anxiety has been observed to have negative impact on female students' performance. Ihejiamazu, Obi, and Neji (2020) also affirmed that there is a significant influence of gender on the academic performance of Biology students. According to Aguisiobo (2008) and Akprochafo (2009), gender stereotyping in the educational sector and cultural beliefs hinders girls' participation in science. In addition, poor performance of most female students and some male students in Biology examination in some Senior Secondary Schools has been attributed to lack of students' exposure to practical activities by teachers, unqualified teachers that can organize and monitor the practical lessons, shortage of practical facilities and the limited time allocated for practical classes. (Brimoh & Okayi, 2011). Other factors including unorganized curriculum, teacher's qualification, work load experience, general lack of teaching skills and ineffective style of delivery of subject matter as well

as reliance on theoretical teaching are also identified as some of the causes of failure in Biology theory and practical examination by most female and male students (Osborne 2014).

In Nigeria, Adiodoh (2001) opined that effective teaching and learning require accurate and exact observations, carefulness and thoroughness of technique and logical interpretation of data. He further stressed that practical work is part of Biology and should be carried along with theory. The National policy on Education (NPE 1981) stipulates that Biology should be taught at all secondary school levels and in an effort to implement the goals and aims of NPE, the West African Examination Council (WAEC) syllabus (1998-2003) postulates the aims and objectives in the teaching of Biology in secondary schools as: to enable students understand the structure and functions of living organisms as well as to appreciate nature; to enable students acquire adequate laboratory and field skills in order to carry out and evaluate experiments and projects in Biology; to enable students acquire necessary scientific skills ranging from observation classification and interpretation of data; to enable students acquire necessary scientific attitudes for problem solving; and to enable students apply biological principles in everyday issues that affect personal, social, environmental, community and economic order. Therefore, failure in effective training of teachers and students in practical skills may lead to poor performance and achievement (KNEC report, 2003).

In Quan'an-Pan Local Government Area of Plateau State it has been observed by the researcher during his teaching practice exercise that biology teachers usually teach Biology theoretically ignoring the significance of practical activities. To support this, Sifunna and Kaina (2007) opined that teachers are still constrained when it comes to laboratory exercises and conducting practical as a way of teaching science. This to a large extent affected the achievement of students in the subject. This is supported also by Obidiwe (2015), who asserted that practical aspect of Biology is neglected so much or not taught at all, that students are almost not prepared for their Seniors Secondary Certificate Examination (SSCE). As a result, students fail Biology in their S.S.C.E. This implies that there is failure on the path of the teachers as many complained that practical activities are time consuming financial demanding etc. and so abandoned these essential activities until when students are about writing their senior secondary certificate examination such as NECO and WASSCE. In this case, students are rushed into practical haphazardly without obtainable skills and knowledge of what and how such practical have been conducted.

Practical activities in teaching Biology are necessary and are learned gradually in the course of repeated experience. Students understand better when they are involved in practical experiment during practical lessons and obtain their results. Such students will not only remember the procedure involved but also feel proud for obtaining the correct results, thus stressing the need to match theory with practical lessons (Kilder & Okoro, 2017). It is against this background that this study is intended to determine the effect of Biology practical on the achievement of senior secondary school students in Biology in Qua'an Pan Local Government Area of Plateau State.

### **Statement of the Problem**

Biology which serves as a prerequisite at O-level for studying some disciplines such as Medicine, Pharmacy, Agriculture, Food Technology equips individuals with diverse information about the basic principles of life and natural laws influencing living things. The teaching of Biology in secondary schools need to be more practical oriented in order to enhance students' achievement in the subject but the irony is that the practical lessons have suffered neglects in the subject in Qua'an Pan Local Government Area of Plateau State as it was observed by the researcher during his teaching practice period due to inadequate materials and facilities, inadequacy of qualified teachers and the class size to carry out practical, thus, affecting the overall achievement of students in Biology.

Several researchers established that teaching Biology involves more practical activities than talking all the time. Resources such as diagrams, field works and real objects when effectively

used to explain the subject matter very well is better than mere lecture. The proper place for effective practical activities is the laboratory. Biology being one of the science subjects cannot be taught or learnt effectively in the absence of practical activities. Practical activities help students to understand and assimilate what is being taught which by extension improve their achievement in the subject. To this end, this study seeks to determine the effect of Biology practical on the achievement of senior secondary school students in Biology in Qua'an Pan Local Government Area of Plateau State.

#### Research Questions

The following questions guided the study:

1. What is the pre-test mean scores of students that are taught Biology using theoretical (conventional) and those taught using practical teaching methods in senior secondary schools in Qua'an Pan Local Government Area of Plateau State?
2. What is the post-test mean scores of students that are taught Biology using theoretical (conventional) and those taught using practical teaching methods in Qua'an Pan Local Government Area of Plateau State?
3. What is the post-test mean scores of students based on gender in Qua'an Pan Local Government Area of Plateau State?

#### Hypotheses

The study postulated the following hypotheses:

**H<sub>01</sub>:** There is no significant difference between the post-test mean achievement scores of students taught Biology using practical method and those taught using theoretical method in senior secondary schools in Qua'an Pan Local Government Area of Plateau State.

**H<sub>02</sub>:** There is no significant difference between the post-test mean achievement scores of students based on gender in senior secondary schools in Qua'an Pan Local Government Area of Plateau State.

#### Methodology

The research design used in the study was a pre-test, post-test control group quasi experimental type. The pre-test was used to establish equality or no difference between the treatment groups at the beginning of the experiment only. The population of the study comprised 2, 400 students across the eight public senior secondary schools in Qua'an Pan Local Government Area of Plateau State (Survey, 2021). The sample of the study consisted of two public Senior Secondary schools and 96 Senior Secondary 2 (SSII) students who the researcher believes were not preparing for any external examinations unlike SSIII classes and had completed SSI work in Biology. The two schools were chosen using a simple random technique and were named schools A and B. School A consists of 50 students (21 females and 29 males) was considered as the control group (taught Biology using theoretical approach), Likewise, school B consists of 46 students (20 females and 26 males) and was considered as the experimental group (taught Biology using practical approach).

The study sought to provide answers to three research questions. The study attempts to establish empirically whether the usage of theoretical or practical teaching methods is important for academic achievement of students in Biology. This was determined quantitatively by a written test. A Biology Achievement Test (BAT) was used in the study as instrument for data collection. The BAT consists of 30 multiple choice questions with short essay questions set by the researcher. The content areas taught in both the control and experimental groups are: cells, enzymes, pollutants, plants and animals.

The instrument, BAT, was validated by three experts, two from the Department of Science and Technology Education and one from the Department of Measurement and Evaluation, Faculty of Education, University of Jos. The Validates ensured the content validity of the questions in the BAT. The final draft of the BAT was produced based on the Validates' corrections and inputs. To the determine the internal consistency of the instrument, BAT, the researcher trial tested the instrument on 27 students (14 from school A and 13 from school B) in Jos North LGA of Plateau

State which were not part of the study area. A Cronbach Alpha method was used to determine the reliability. The reliability obtained was 0.71.

Before the administration of the instrument, permission was sought from the principals of the selected schools to allow their schools to be used for the study. Before the treatments, two pre-tests were administered to the SS II Biology students, one for school A (control group) and the other for school B (experimental group). At the end of the pre-tests, the teacher collects students' \*scripts for marking and recording of scores obtained by each student in both schools. At this point, the students in both schools were taught Biology using theoretical and practical approaches. The teacher in the control group (school A) was the students' regular class teacher who taught them Biology using theoretical approach. The teacher in the experimental group (school B) was the researcher who also taught students Biology using practical approach. The teaching in both schools lasted for three weeks after which the students were given a test (post-test) using BAT. After the administration of each test, the teachers collected students' scripts for marking and then recorded the results which were scored at 100%. The pre-test and the post-test achievement of the students were used as data for this study.

The achievement scores of the students in both schools at pre-test and post-test were analyzed using descriptive statistical and inferential statistical tools. The research questions were answered using means and standard deviations. The null hypotheses postulated were analyzed using an independent sample t-test to determine whether there is significant difference in achievement of students taught Biology using theoretical and practical approaches. The decision rules were: reject the null hypotheses if the p-value is less than 0.05 otherwise accept the null hypotheses if the p-value is greater than 0.05. All analyses were carried out using Statistical Package for Social Sciences (SPSS), version 25.0.

## RESULTS

### Research Question One

What is the pre-test mean scores of students that are taught Biology using theoretical (conventional) and those taught using practical teaching methods in senior secondary schools in Qua'an Pan Local Government Area of Plateau State?

Table 1: Mean Achievement and Standard Deviation of Students Taught Biology Using Theoretical and Practical Methods in Pre-Test

Group		N	$\bar{X}$	S.D	Mean Gain difference
Theoretical (Control)	Method	50	38.40	5.928	
Practical (Experimental)	Method	46	37.93	7.116	0.465

N = Number of Students;  $\bar{X}$  = Mean Scores; SD = Standard Deviation

Table 1 revealed the achievement scores of students in control and experimental groups before they were taught Biology with theoretical (conventional) and practical teaching methods. The students in the control group had a mean score of 38.40 with a standard deviation of 5.928 while the students in the experimental group had a mean score of 37.93 with a standard deviation of 7.116 in the BAT. A mean gain of 0.465 was obtained between the groups. It can be deduced from the analysis that the mean achievement scores of students taught Biology using theoretical and practical methods were low and approximately equal at pre-test. Similarly, looking at the values of the standard deviations between the two groups, there is almost a perfect closeness between the groups.

Similarly, as shown in the table, the result of an independent sample t-test between the mean achievement scores of students taught Biology using theoretical (conventional) and practical methods of teaching at post-test. Testing at an alpha level of 0.05,  $t_{cal} = 12.534$  with a p-value of

0.000 which is less than the alpha level of 0.05 ( $p=0.000<0.05$ ) showing a significant difference in the scores between the two groups as they were taught using different teaching methods. Therefore, the null hypothesis which states that there is no significant difference between the post-test mean achievement scores of students taught Biology using theoretical (conventional) and practical teaching methods in senior secondary schools in Qua'an Pan Local Government Area of Plateau State.

Research Question Two:

What is the post-test mean scores of students that are taught Biology using theoretical (conventional) method and those taught using practical method in senior secondary schools in Qua'an Pan Local Government Area of Plateau State?

Table 2: Mean Achievement and Standard Deviation of Students Taught Using Theoretical and Practical Methods of Teaching at Post-Test

Group	N	$\bar{X}$	S.D	Mean Gain	$t_{cal}$	P-value	Decision
Theoretical Method (Control)	50	53.60	5.349				
Practical Method (Experimental)	46	72.39	8.611	18.791	12.954	0.000	Reject

$t_{cal}=12.530$ ,  $p=0.000 < 0.05$  the null hypothesis is rejected

Data in Table 2 showed the mean achievement scores of students taught Biology with theoretical (conventional) and practical teaching methods at post-test. Students taught Biology using a theoretical (conventional) method had a mean score of 53.60 while students taught using a practical method had 72.39. The standard deviations of students in control and experimental groups are 5.349 and 8.611 respectively. However, the mean gain between the two groups is 18.791. Comparing the mean achievement scores between the students taught Biology with theoretical (conventional) and practical teaching methods at post-test which was evident in the mean gain, it shows that students taught Biology using a practical method outperformed the students taught using theoretical (conventional) in the BAT.

Similarly, as shown in the table, the result of an independent sample t-test between the mean achievement scores of students taught Biology using theoretical (conventional) and practical methods of teaching at post-test. Testing at an alpha level of 0.05,  $t_{cal} = 12.534$  with a p-value of 0.000 which is less than the alpha level of 0.05 ( $p=0.000<0.05$ ) showing a significant difference in the scores between the two groups as they were taught using different teaching methods. Therefore, the null hypothesis which states that there is no significant difference between the post-test mean achievement scores of students taught Biology using theoretical (conventional) and practical teaching methods in senior secondary schools in Qua'an Pan Local Government Area of Plateau State is rejected.

Research Question Three

What is the post-test mean scores of students based on gender in Qua'an Pan Local Government Area of Plateau State?

Table 3: Mean Achievement and Standard Deviation of Students Based on Gender Taught Biology Using Theoretical and Practical Teaching Methods at Post-Test

Group	N	$\bar{X}$	S.D	Mean Gain	$t_{cal}$	P-value	Decision
Male	55	64.09	12.364				
Female	41	60.61	10.793	3.481	1.439	0.153	Accept

$t_{\text{cal}} = 1.439$ ,  $p = 0.153 > 0.05$  the null hypothesis is accepted

Table 3 revealed the mean achievement scores of male and female students taught Biology with theoretical (conventional) and practical teaching methods at post-test. The mean achievement scores of male and female students are 64.09 and 60.61 respectively. The mean gain between the two gender is 3.481. Also, the table showed that the standard deviations of male and female students are 12.364 and 10.793 respectively. From the results, it showed that male students had mean score a little greater than the mean score obtained by female students implying that male students outperformed their female counterparts in the BAT. Looking at the values of the standard deviations between the two gender one could see a little gap between their achievement scores.

Also, the result of an independent sample t-test between the mean achievement scores of male and female students in BAT at post-test. Testing at an alpha level of 0.05,  $t_{\text{cal}} = 1.439$  with a p-value of 0.153 which is greater than the alpha level of 0.05 ( $p = 0.153 > 0.05$ ), implying that the achievement scores between the male and female students do not differ. Therefore, the null hypothesis which states that there is no significant difference between the post-test mean achievement scores of students taught Biology using theoretical (conventional) and practical teaching methods based on gender in senior secondary schools in Qua'an Pan Local Government Area of Plateau State is accepted.

## **DISCUSSION**

Findings based on research question one in relation with the pre-test mean scores of students that are taught Biology using practical method and those taught using theoretical method in senior secondary schools in Qua'an Pan Local Government Area of Plateau State revealed that the mean achievement scores of students taught Biology using theoretical (conventional) and practical teaching methods were low and approximately equal at pre-test. Similarly, the values of the standard deviations between the control and experimental groups showed an almost perfect closeness between the groups. This study is in disagreement with the finding of Abubakar (2020) whose study revealed that even at pre-test, the performance of students in experimental often exceeds those in control group.

Finding based on research question two with respect to the post-test mean scores of students that are taught Biology using theoretical (conventional) method and those taught using practical method in senior secondary schools in Qua'an Pan Local Government Area of Plateau State revealed that when comparing the mean achievement scores between the students taught Biology using theoretical (conventional) and practical teaching methods which is evident in the mean gain, it implies that students taught Biology using a practical method outperformed the students taught using theoretical (conventional) in the BAT. This finding is in relation with the finding of Ude (2018) whose study revealed that students in the experimental group that are taught biological concepts using practical activities always perform better than the control group (those taught without practical activity method). To further support this, Rughnill (2011); Alison (2013); and Alexander, (2016) established that students exposed to Biology practical activities (experimentation) tend to learn more of what is taught, retain it longer, appear more satisfied with their practical work and perform better in examinations than when taught with other instructional formats.

Finding based on research question three as regards academic mean achievement scores of male and female students taught Biology with theoretical (conventional) and practical teaching methods at post-test in senior secondary schools in Jos North LGA, Plateau State revealed that male students had mean score greater than the mean score obtained by female students implying that male students outperformed their female counterparts in the BAT. The values of the standard deviations between the two gender also revealed a little gap between their achievement scores. As this study revealed that male students performed a little better than female students, it disagrees with the finding of Ude (2018) who found out that in gender disparity, girls performed better than boys when taught Biology using practical activities. As both male and female students

obtained approximately equal achievement mean, it implies that performance of any of the gender can in no way affect the performance of the other.

In the same vein, finding based on hypothesis one ( $H_{01}$ ) showed that students taught Biology with practical method performed better than those taught with theoretical (conventional method). Therefore, it can be contended that there is a significant difference between the post-test mean achievement scores of students taught Biology using theoretical (conventional) and practical teaching methods in senior secondary schools in Qua'an Pan Local Government Area of Plateau State. This finding is in agreement with the finding of Ude (2018) whose result revealed that there is great difference between the experimental and control group in development of scientific skills for problem solving.

Also, finding based on hypothesis two ( $H_{02}$ ) revealed that male students performed a little above the female students in the BAT. Since the gap between the mean scores of male and female students is narrow, the t-test analysis showed that there is no significant difference between the post-test mean achievement scores of students taught Biology using theoretical (conventional) and practical teaching methods based on gender in senior secondary schools in Qua'an Pan Local Government Area of Plateau State. This finding relates with the finding of Ihejiamazu, Obi, and Neji (2020) whose analysis showed that there is a significant influence of gender on the academic performance of Biology students. This confirmed the assertion of Aguisiobo (2008) and Akprochafo (2009), that gender stereotyping in the educational sector and cultural beliefs hinder girls' participation in science.

## **CONCLUSION**

Based on the findings of this study on the effect of Biology practical on the achievement of senior secondary school students in Biology in Qua'an Pan Local Government Area of Plateau State, it was concluded that students' academic achievement in Biology is dependent upon practical activities. Biological practical activities are interrelated and interconnected with achievement of students. These activities develop students understanding of Biology content areas, their procedure, execution, observation and interpretations resulting to students' improved academic achievement and performance. As competence in practical enables students to become creative and developed ability to solve problems, it then becomes necessary for Biology teachers to guide students to construct knowledge in practical activities which in turns enable them to effectively and competently tackle questions in any biology examination to emerge successful and reliable in the field of biological sciences.

## **RECOMMENDATIONS**

Based on the findings of the study, the following recommendations are made:

1. Teachers should adopt student –centered practical activity method of teaching biology as student learn better when they are involved in activity – based learning.
2. Biology teachers should be made by State Government to upgrade their education, knowledge on practical activities involved in Biology through in-service programme, availing themselves in workshops, seminars so they could overcome the challenge of the 21<sup>st</sup> century which is known as Jet or E-age.
3. Plateau State government should give more attention to the educational system within the state by providing better infrastructures in schools, equipping laboratories, enumeration of staff promptly to enable adequate coverage of syllables.

This study examined the effect of Biology practical on the achievement of senior secondary school students in Biology in Qua'an Pan Local Government Area of Plateau State. The research design used was a pre-test, post-test control group quasi experimental type. The pre-test was used to establish equality or no difference between the treatment groups at the beginning of the experiment only. The population of the study comprised 2, 400 students across the eight public

senior secondary schools in the study area. The sample of the study comprised two public senior secondary schools and 96 senior secondary two (SSII) students who the researcher believes were not preparing for any external examinations and had completed SSI work in Biology. The two schools were chosen using a simple random technique and were named schools A and B. School A consists of 50 students (21 females and 29 males) was considered as the control group (taught Biology using theoretical approach). School B consists of 46 students (20 females and 26 males) and was considered as the experimental group (taught Biology using practical approach). The study posed three research questions and postulated two hypotheses to establish empirically whether the usage of theoretical or practical teaching methods is important for academic achievement of students in Biology. The research questions were answered using mean and standard deviation while the hypotheses were tested using an independent sample t-test as 0.05 level of significance. A Biology Achievement Test (BAT) was used in the study as instrument for data collection. The BAT consists of 30 multiple choice questions with short essay questions set by the researcher. To determine the internal consistency of the instrument, BAT, the researcher trial tested the instrument on 27 students (14 from school A and 13 from school B) in Jos North LGA of Plateau State. A reliability of 0.71 was obtained using a Cronbach Alpha method. The study revealed that the mean achievement scores of students taught Biology using theoretical and practical methods were low and approximately equal at pre-test but greatly differ at post-test as students taught using a practical method excellently than those taught using theoretical (conventional) in the BAT. Also, there is no significant difference between the post-test mean achievement scores of students based on gender. The study recommends that teachers should adopt student –centered practical activity method of teaching biology as student learn better when they are involved in activity – based learning

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