GENDER AND SENIOR SECONDARY SCHOOL STUDENTS’ ACADEMIC ACHIEVEMENT IN PRACTICAL BIOLOGY IN ADAMAWA STATE, NIGERIA

Amina A. Ghumdia
Federal College of Freshwater Fisheries Technology,
Baga, Borno State, Nigeria

Martins Fabunmi
Department of Science Education,
Modibbo Adama University of Technology,
Yola, Adamawa, Nigeria

Abstract
Biology prepares students to have a solid foundation in science and helps position them as future scientists. Lack of proper exposure to practical activities at the secondary school level had been identified to be responsible for students’ (especially girls) inability in developing appropriate practical skills needed for scientific and technological development. This study therefore examined the effect of gender on senior secondary school students’ academic achievements in Adamawa state. The study adopted ex-post facto research design. Four co-educational secondary schools were selected using simple random sampling technique. Senior secondary two (SS2) students from four intact classes with sample of 364 were randomly selected for the study. The instruments used for data collection were “Biology Practical Achievement Test” (BPAT) and “Biology Students Attitude Test” (BSAT) which were developed by the researcher and validated by three lecturers in the department of science Education, Modibbo Adama University of Technology, Yola. They were requested to assess the instrument in terms of clarity of expression, suitability of items, accuracy of answers and content coverage. The instruments were trial tested and the results were analyzed using K-R’20 formula which yielded reliability coefficients of 0.81 and 0.75 respectively. Data collected were analyzed using mean, standard deviation and, z-test and Pearson product moment correlation analysis. Results showed that there was no significant effect of gender on students’ practical Biology and that there is significant relationship between male and female students’ attitude and their performance in practical Biology. It was observed that the
Gender and Senior Secondary School Students’ performance of male and female differed significantly from each other’s. Also students’ attitude has positive relationship with their performance in practical Biology. Therefore the study concluded that gender has no significant effect on students’ achievements in practical biology. The study recommends amongst others that practical skills should be constantly developed in male as well as in female students so as to improve science practical skills of senior secondary school students.

Keywords: Gender, Achievements, Practical Biology

Introduction
Science is a great enterprise which nations depend on, in order to advance technologically. Science therefore, is receiving much emphasis in education because of its significance and relevance to life and society. Biology as a branch of science and a prerequisite for many fields of learning, contributes immensely to the technological growth of any nation. The study of Biology in senior secondary school can equip students with useful concepts, principles and theories that will enable them face the challenges before and after graduation.

Practical activities in Biology provide opportunities for students to actually do science as opposed to learning about science. Biology practical activities are science process skills (Nwagbo and Chukelu, 2011). Nzewi (2008) asserted that practical activities can be regarded as a strategy that could be adopted to make the task of a teacher more real to the students as opposed to abstract or theoretical presentation of facts, principles and concepts of subject matters. Practical Biology is the scientific study of the life and structure of plants and animals and their relative environments in real or experimental set-up rather than dwelling in the theory and ideas (Onyeizugbo, 2003). West African Examination Council (WAEC) (2008 – 2013) syllabus, buttressed the need for Biology practical in teaching and learning of Biology in secondary schools. The syllabus was designed to assess candidates in:

i. Understanding of the structure and function of living organisms as well as appreciation of nature;

ii. Acquisition of adequate laboratory and filed skills in order to carry out and evaluate experiments and projects in biology and
iii. Acquisition of necessary scientific skills. Examples: observing, classifying and interpreting biological data etc

Nzewi (2011) maintained that practical activities should engage the students in hands-on, mind-on activities, using varieties of instructional materials/equipment to help students enhance their acquisition of science process skills. Nwagbo (2008) stated that the use of practical activities (approach) to the teaching of biological concepts should therefore be a rule rather than an option to Biology teachers, if we hope to produce students that would be able to acquire the necessary knowledge, skills and competence needed to meet the scientific and technological demands of the nation.

Realizing the importance of practical activities in acquisition of science process skills as solution to scientific problems, the Federal Government, among other things, stated as one of the national goals of education in Nigeria that: “education should aim at helping the child in the acquisition of appropriate skills, abilities and competencies, both mental and physical as equipment for the individual to live in and contribute to the development of the society” (Federal Republic of Nigeria (FRN), 2004:29). In order to realise this goal, associations, such as Science Teachers Association of Nigeria (STAN) and Nigerian Integrated Science Project (NISP) were set up by the government to look into the various curricula used at various levels of the Nigerian educational system.

Scientific knowledge content involves theories, principles and laws. Knowledge acquisition methods, on the other hand, are ways of obtaining scientific information. These methods may be examined in two groups: science attitudes and process skills. Science attitude, inclination and orientation are the basic requirements for those who engage in scientific activities. Among these basic requirements, most significant characteristics are curiosity, humility, determination, open mindedness, modesty and honesty (Oğuzkan, 2014). The subject of this study encompasses Biology practical activities which facilitate the learning of science, provide active involvement of students, develop sense of personal responsibility in self learning, increase permanence of learning, as well as gaining of investigative attitudes and methods (Çepni, 2007). Lind (2008) opined that practical skills are skills used
while considering problems and in formulation of conclusions. These skills are used by scientists during their work. Students can be assisted in gaining these important skills, thus enabling them to understand and learn the world in which they live. These skills are the basis for scientific thinking and research. Abruscato (2000) averred that discoveries of scientists arise from a group of very different and important abilities referred to as science process skills. Carin and Bass (2001) stated that scientists use various methods to discover and explain the wonderful mysteries of our cosmos. These methods are known as SPS in science teaching of Biology practical. These form the foundational constituents of scientific thinking and are also used for problem solving in other fields as well. Practical activities are mental and physical skills utilised in data collection, data organisation through various methods, explanation of extraordinary circumstances and problem resolution. Practical processes are mental (and sometimes bodily) activities used in thinking, data collecting, data interpreting, or acquiring knowledge and understanding through manipulation of data [Organisation for Economic Co-operation and Development (OECD), 2009].

Biology practical skills are the mental and motor skills a scientist uses to carry out scientific investigation (Njoku, 2002; Ugwuadu. 2012). The science process skills include the following eleven practical skills, namely: observing, inferring, measuring, classifying, experimenting, interpreting data, using numbers, controlling variables, formulating hypotheses, predicting and formulating models (Akinbobola and Afolabi, 2010; Nzewi, 2011 and Al-Rabaani, 2014). Colvill and Pattie (2003) stated that, practical skills are inextricably linked to acquisition of new scientific knowledge. This could be the reason why the Federal Republic of Nigeria (FRN, 2004) in the National Policy on Education recommended the acquisition of appropriate skills, abilities and competencies both mental and physical for individuals to live and contribute to the development of the society. These skills and abilities can be acquired through practical skills.

Nowadays, another variable which should be attended to during the education-teaching process is the issue of individual differences. Individual differences are those variables which arise from mental, physical, environmental, cultural, economic and emotional reasons (Küçükahmet, 2007). Among most of the widely researched individual differences are gender, attitudes, thinking skills, cognitive styles,
intellect areas and motivation types (Ateş and Karaçam, 2010; Çelik, 2010).

Gender of students may be a factor in determining students’ achievements in practical skills. Children’s training experiences, gender differences in attitudes, parental and teacher expectation and behaviours, differential course taking between sexes may also be instrumental in giving rise to gender differences in achievement (Feingold, 2008). Studies (Eriba and Ande, 2006; Opara, 2011) have reported a significant difference in the performance of males and females in favour of males in Biology using inquiry based teaching method. However, Opara (2011) found that female students performed better than male students in practical skills. These gender differences in practical skills achievement have implications for this study and students’ future careers as well as science educators for science teaching and learning. Koleoso, Oyekan and Olabode (2008), examined the effect of sex in the achievement of students in practical Biology and the sample for the study consists of senior secondary two (SS2) Biology students in Nigeria. The result confirms the superiority of males over females. Onyeizugbo (2003) stated that Biology as one of the science subjects in all field of studies develops human thinking faculty to accurate observation, he also stated that practical are very necessary in teaching of Biology but some teachers deliberately refuse the use of practical in teaching. Their reason is that the use of laboratory materials waste a lot of time. Biology education programme should be built on the skills, knowledge and experiences, developed by the students, through participation in practical; Biology practical work assist students in utilizing their knowledge and skills acquired in real field outside the classroom. Opul, Ezeh and Ezemagu (2008) reported that much stress has been placed upon practical work for there is no substitute for it, for practical experiment must be the basis of knowledge in Biology. Hence, it becomes imperative at this point to find out the level of academic achievement in Biology practical activities of Biology in schools has been blamed on such factors as the inability of school authorities to provide materials and equipment for practical work, teachers’ failure to recognize the importance of practical work in science teaching. Aniodoh (2001) in his study noted that a sound theoretical and practical knowledge of Biology is needed for the management of our natural resources, provision of good health facilities, adequate food supply and
favourable life environment. Thus, the teaching and learning of Biology has to be encouraged in schools.

In the light of the above, it should be of a general concern to every Nigerian, including researchers to view this backwardness with some seriousness. There is great need to look into the issue of teaching and learning of this core science subject – biology.

The National Policy on Education (2014) stipulated that Biology should be taught at the secondary school level. And in pursuance of the goals of the policy, the West African Examination Council (WAEC) in their syllabus (2013) came up with the following aims and objectives in the teaching of Biology in secondary schools:

1. To understand the structure and functions of living organisms as well as to appreciate nature;
2. To acquire adequate laboratory and field skills in order to carry out and evaluate experiments and projects in Biology;
3. To acquire necessary scientific skills, for example, observations, classification and interpretation of Biology data;
4. To impart relevant knowledge in biology needed for future advanced studies in Biology;
5. To acquire scientific attitude for problem solving and
6. To be able to apply biological principles in every day in matters that affect personal, social, environmental, community health and economic problems (Nwagbo & Chukelu, 2011).

From the foregoing, we can understand that Biology practical lesson is most essential for effective teaching and learning of Biology in secondary schools. Hence it is necessary to carry out this study on gender and senior secondary school academic achievement in practical Biology in Adamawa state.

**Statement of Problem**

It has been observed that much attention has not been given to the performance of students in senior secondary school subjects most especially in Biology and the practical aspect of the subject in schools. This has been blamed on such factors as the inability of school authorities to provide materials and equipment for practical work and teacher’s failure to recognize the importance of practical work in science teaching.
According to Maduabam (2013), a sound theoretical and practical knowledge of Biology is needed for the management of our natural resources, provision of good health facilities, adequate food supply and favourable living environment. Thus, the teaching and learning of Biology has to be encouraged in schools. Moreover, this neglect, no doubt has relegated these subjects to the background in our Senior Secondary Certificate Examination (SSCE). A close look at the 2012 – 2014 SSCE results confirms that students’ performance has been very poor generally and particularly in Biology practical, failure is a great problem as it will affect the students’ performances in science that is why the researchers have decided to examine the cause and effects of poor performance in Biology practical. Similarly, according to Nnamonu (2013), students perform poorly in Biology practical leading to their failure in Biology examinations. Despite the importance of experimentation or practical work in science teaching and learning as observed in the descriptions and definitions of science, little or no emphasis is given on the teaching of practical during science lessons. This must be probably why students record poor performance or mass failure in pure science subjects at Senior School Certificate level in Nigeria. This research is, therefore, to assess the influence of gender on senior secondary school students’ academic achievements in practical Biology in Adamawa state. The statement of problem is therefore stated thus:

1. What is the effect of gender on Senior Secondary School Students’ academic achievements in practical Biology in Adamawa state?

Purpose of the Study
The purpose of the study is to find out the extent to which students’ gender influence their academic performance in practical Biology. Specifically, the study sought to determine:

(i) Whether there is any significant difference between the mean scores of male and female students in practical biology
(ii) If there is any relationship between students’ attitude and their performance in practical Biology
Research Hypotheses

H₀₁: There is no significant difference between the mean scores of male and female students in practical Biology

H₀₂: There is no significant relationship between male and female students’ attitude and their performance in practical Biology

Methodology

This study adopted causal – comparative research of an expost-facto type. In such a research design, the researcher does not have a direct control over the independent variables because their manifestations have already occurred or because they inherently cannot be manipulated (Uzoagulu, 1998). What the researchers did in the present study was to examine the influence of independent variables (Gender) on dependent variables (Practical Biology achievement) as it occurred rather than creating these manifestations. In other words the difference (gender) in the group exists naturally.

Area of the Study

Adamawa State is one of the six states which make up the North East geopolitical zone of Nigeria. It shares an international boundary with the Republic of Cameroon to the east and interstate borders with Borno State to the Northwest, Gombe State to the West and Taraba State to the Southwest. Its capital is Yola. Adamawa state lies on latitude ⁹⁰ ²⁰’ N and longitude ¹²⁰ ³⁰’ E.

Adamawa state has five educational zones. These zones are: Ganye, Gombi, Mubi, Numan and Yola. These educational zones are under the umbrella of Post-Primary Schools Management Board which is also controlled or supervised by Adamawa State Ministry of Education. The total secondary schools in the state that offer Biology as a subject are 118 senior secondary schools out of which 20 (twenty) are coeducational schools (Adamawa State Ministry of Education, Yola, 2016).

Population of the Study

The population consists of all the senior secondary three (SS3) students offering Biology in Government Secondary Schools numbering 4,023 in 20 coeducational senior secondary schools in Yola Education Zone of Adamawa State. This population consists of 2614(65 %) male students
and 1409 (35%) female students (Adamawa State Ministry of Education, Yola, 2016)

Sample and Sampling Technique
A sample of 364 Senior Secondary Three (SS3) Biology students was used for the study through random sampling technique. This sample size was obtained by the use of Yamane (1973) formula (See appendix XI on page 115). Yamane formula was used in determining the sample size that will gave correct representation of the population. Yola education zone was randomly selected for the study. The sample consists of SS3 students randomly sampled from four co-educational Senior Secondary Schools which are government owned schools in Yola educational zone of Adamawa State. These are: Government Day Secondary School, Doubeli, Capital School, Yola, Government Secondary School, Yelwa and Government Secondary School, Gwadabbawa. One stream out of four streams each of SS2 in each school were selected from the four schools by ballot system for the study. Table 2 shows the distribution of biology students across the sampled schools.

Table 1: Distribution of SS III Biology Students across the Sampled Schools.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Name of School</th>
<th>Class</th>
<th>Number of Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Government Day Secondary School, Doubeli</td>
<td>SSIII</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>Capital School, Yola</td>
<td>SSIII</td>
<td>92</td>
</tr>
<tr>
<td>3</td>
<td>Government Secondary School, Yelwa</td>
<td>SSIII</td>
<td>89</td>
</tr>
<tr>
<td>4</td>
<td>Government Secondary School, Godabbawa</td>
<td>SSIII</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>364</td>
</tr>
</tbody>
</table>

Table 1 shows the distribution of SS3 Biology Students across the sampled schools.

Instrument for Data Collection
Two instruments were used for the study. Namely: Biology Practical Achievement Test (BPAT) and Biology Students Attitude Test (BSAT).
BPAT is a forty eight multiple–choice objective test developed by the researchers. It was used to assess students’ achievement in practical Biology for acquisition of science process skills using Biology practical activities. Each item has 4 – option lettered A – D. The test was based on the units of study in SS3 Biology Curriculum used for the study (See Table 2). Items on the BPAT were drawn from the Biology concepts of food and digestive enzymes, cell and its environment and respiration in animals. These concepts were used because they are among topics in which students often exhibit weak performance (Awofala, Awoyemi, Fatade & Nneji, 2012). These topics were used to assess the students’ achievements in practical Biology using the BPAT. While BSAT was a four point Likert scale with 12 items. Subjects were required to tick (√) the option they felt was most appealing to them. The option ranged from strongly agreed (4) to strongly disagree (1).

<table>
<thead>
<tr>
<th>Content</th>
<th>Observation</th>
<th>Inferring</th>
<th>Experimenting</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food and Digestive Enzymes</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>Cell and its Environment</td>
<td>4</td>
<td>3</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Respiration</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>12</td>
<td>14</td>
<td>40</td>
</tr>
</tbody>
</table>

**Validation of the Instrument**

BPAT contains 48 items constructed by the researcher and validated for content and face validity. The validation was done by three lecturers in the Department of Science Education, Modibbo Adama University of Technology, Yola. They were requested to assess the instrument in terms of clarity of expression, suitability of items, accuracy of answers and content coverage. The validators were also asked to make suggestions and amendments – where necessary. At the end of the validation, 43 items remained while five items were removed. The 43 items were trial-tested on 30 SS2 students (comprising male and female students) in Government Senior Science Secondary School, Biu, Borno State. The school is not among the schools to be used for the study but
is of equal status with the schools in the study. The result of the trial testing was used for the item analysis. After the item analysis, three items were removed because they did not meet the cut-off points while 40 objective test items were upheld. Same lecturers validated the BSAT for face and content validity.

Reliability of the Instruments
The method of finding reliability of the instrument for this study is K-R 20 method. The 40 BPAT items and the 12 BSAT items were trial tested on SSII students in Government senior Science secondary school Biu. The results of the trial test were analyzed using K-R’20 formula and reliability coefficients of 0.81 and 0.75 were obtained for the BPAT and BSAT respectively.

Method of Data Analysis
Z-test and Pearson Product Moment Correlation Analysis were used to test the hypotheses. Z-test was used to test hypothesis 1 at 0.05 levels of significance. The decision rule for hypotheses analysis was that when the z – calculated is greater than the z – critical table value, the null hypothesis was rejected but where otherwise the null hypothesis was upheld, while Pearson Product Moment Correlation Analysis was used to test hypothesis 2.

3.0 Results and Discussion

3.1 Results
H_o1: there is no significant difference between the mean scores of male and female students in practical biology

Table 1: Z-test of Difference of Mean Achievement Scores of Male and Female Biology Students in Biology Practical Achievement Test (BPAT)

<table>
<thead>
<tr>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>df</th>
<th>Z-Cal</th>
<th>Z-Crit</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>208</td>
<td>54.56</td>
<td>181</td>
<td>1.03</td>
<td>1.96</td>
<td>Accepted</td>
</tr>
<tr>
<td>Female</td>
<td>156</td>
<td>54.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1 showed that the Z-cal is less than the Z-crit. Therefore, the null hypothesis is accepted. This means that there is no significant
difference between mean achievement scores of male and female students in practical Biology. In others words gender has no significant effect on students’ achievements in Biology practical.

**H02**: There is no significant relationship between male and female students’ attitude and their performance in practical Biology

### Table 2: Pearson Product Moment Correlation Analysis of Influence of Male and Female Biology Students’ Attitude on their Academic Performance in Practical Biology (N= 364)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>r</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male students attitude toward practical Biology</td>
<td>32.80</td>
<td>4.48</td>
<td>0.269</td>
<td>Rejected</td>
</tr>
<tr>
<td>Male students performance in practical Biology</td>
<td>54.56</td>
<td>16.24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female students attitude toward practical Biology</td>
<td>31.61</td>
<td>4.46</td>
<td>0.263</td>
<td>Rejected</td>
</tr>
<tr>
<td>Female students performance in practical Biology</td>
<td>54.03</td>
<td>16.22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The result of the analysis in table 2 shows that there is a significant positive relationships (r=0.269; 0.263); p<.05 between male and female Biology students’ attitude toward Biology and their performance in Biology practical. The null hypothesis was rejected because the calculated r-values of 0.269 and 0.263 respectively were found to be greater than the critical r-value of 0.14 at .05 alphas. The positive r-value in the results implies that the higher the students attitude, the higher their performance in Biology practical. On the other hand, the lower the students’ attitude to Biology, the lower their performance in Biology practical would be.

### 3.2 Discussion of Findings

The findings from hypothesis one shows that gender has no significant effect on students’ academic achievements in Biology practical. This findings conjures with the findings of Awoderu (2000) carried out a research on the effectiveness of laboratory-based and lecture methods on students’ achievement in Biology and they found that students’ achievement in Biology was not sensitive to the sex of students. The
results revealed no significant gender-related differences, but females achieved slightly higher grades than males. However, the finding of this study is in contrast to the findings of Croxford (2002); Kolawole, (2007) in their studies found that male students performed better than female students in the cognitive, affective and psychomotor skill achievements. There is a strong association between gender and response to science education. Similarly, Kolawole (2007) found that boys performed better than girls in both cooperative and competitive learning strategies when he conducted a research on the effects of competitive and cooperative learning strategies on Nigerian students’ academic performance in Mathematics.

The findings with regards to hypothesis two indicated that there is significant relationship between male and female students’ attitude and their performance in Biology practical. This finding is in line with the findings of other scholars (Al-Hajji, 2003; Igbojinwaekwu, 2004; Barnett, 2004; Iroegbu, 2014 and Barnett 2004) who in their individual studies observed that students show more positive attitude towards science laboratory work than theoretical instruction. Urevbu (2000) stated that science practical work is indispensable because it is where one learns why science insists on precise measurement, accurate observations, conciseness and clarity in observation. In addition, he asserted that science practical is helpful in bridging the gap between abstract ideas and realities. Oriaifo (1996) stated that lack of well-equipped science laboratories in secondary schools tend to deny students the chances of offering and passing science in the Senior School Certificate Examination (SSCE).

Conclusion
It was observed that the performance of male and female students differ significantly from each other’s. Also students’ attitude has positive relationship with their performance in Biology practical. Therefore the study concluded that gender has no significant effect on students’ achievements in practical Biology.

Recommendations
It is, therefore, recommended that:
1. Adequate practical work should be done in Biology to arouse the interest of students in the subjects
2. Practical work in Biology should be taken at least once in a week,
3. The laboratories should be adequately equipped in order to help the students bridge the gap between abstract ideas and realities and
4. Seminars/workshops should be organized for all categories of science teachers to enable them get used to practical work and thereafter, become competent science teachers.

References


