Student Variables as Correlates of Secondary School Students' Academic Performance in Biology

Adodo Sunday O.[1] , Oyeniyi Joke D.[2]

[1]Science and Technical Education ,Adekunle Ajasin University, Akungba- Akoko, Ondo State, Nigeria

[2]College of Education, Ikere- Ekiti. Ekiti State, Nigeria

Corresponding author : Oyeniyi J. D., College of Education, Ikere-Ekiti, Ekiti State, Nigeria

Abstract: *This study examined the student variables as correlates of Secondary School Students' academic performance in Biology in Ikere Local Government Area of Ekiti State, Nigeria. The design was a descriptive survey research type. The target population for the study were Biology students of senior secondary III (SS III) classes in Ikere Local Government Area of Ekiti State, Nigeria.. The sample for the study was four hundred and five (400) biology students (male and female) selected using stratified and simple random sampling techniques. Two hypotheses were raised to guide the study. The instruments used to elicit the relevant data were: the questionnaire designed by the researchers to elicit information on gender, attitude, and study habit of biology student and Biology Achievement Test. The data collected were analyzed using Pearson's Product Moment Correlation and multiple regression analysis. The hypotheses were tested at 0.05 level of significance. The results revealed that: there is significant relationship between students' variables (attitude towards Biology and Student study habit) and their academic performance in Biology in secondary schools. But, there is no significant difference between male and female students in their academic performance in Biology in secondary schools. Based on the findings of the study, it was recommended that: students of Biology must cultivate right attitude towards the learning of the subjects and that students of Biology must cultivate good study habit and good interest in the subject.*

Keywords: Student variables, secondary school students, academic performance and correlate

1. Introduction

The world is fast becoming scientific in thinking and behaviors that without good knowledge of science, it might be difficult for people to adequately function in it. The purpose of exposing children to science instruction right from primary school level is not necessarily to turn them into scientist per se but to provide favorable scientific attitudes of 'finding out' and 'hands-on' and to enable them raise questions about things that intrigue them.

Biology being a science of life occupies such an important position in the secondary school curriculum. It is designed, ultimately to educate individual who may or may not pursue biology related career, but at least acquire the knowledge of how and the basic essentials for the proper functioning of the body system. Biology as a course of study is perceived to be very interesting, vast and experimental. Almost all aspect of life science, both living and non-living has something to do with biology, ranging from engineering to mathematics, physics, chemistry. Biology is one of the pre-requisite subjects for the study of medicine, pharmacy, technological and other applied science. The importance of biology in the growth and development of any nation cannot be overemphasized. It is a discipline that seems to be synergic with other disciplines such as physics, chemistry, medicine, pharmacy, geography, geology. As a result of the importance attached to this subject – (biology), an element of it has been introduced to the pre-primary school through secondary school to the university level.

The broad aims and expectations of any teaching and learning programme are productivity and positive-evaluated end-product (achievement). But in recent times, Observations on students academic performance in science generally, and Biology, in particular over the years in the results of Senior Secondary Certificate Examination (SSCE) conducted by West African Examination (WAEC) and National Examination Council (NECO) revealed that a very few number of students perform better in Biology examination compared with other subjects. Parents and government are in total agreement that their huge investment on education is not yielding the desired dividend and that despite their hug investment on education, students' performances still remain poor. Teachers, also complain of students' low performance at both internal and external examinations [16] cited Asikhia, In particular, reports on WAEC results of Senior Secondary School Certificate Examination in Ekiti State over the years often revealed low performance of students in Biology. A summary of students' performance in Biology at WAEC from 2005-2012 are as given below:

Table 1: Summary of WAEC results in Biology in Ekiti State

Year	No Registered	A1- C6	D7- E8	F9
2005	10,057	3028 (30.1%)	4,278 (42.5%)	2751 (27.4%)
2006	11,846	6323 (53.4%)	3039 (25.6%)	2484 (21.0%)
2007	12,056	1167 (9.7%)	5523 (45.8%)	5366 (44.5%)
2008	12,844	2771 (21.6%)	4021 (31.3%)	6052 (47.1%)
2009	12345	3851 (31.2%)	4144 (33.6%)	4350 (35.2%)
2010	14588	7692 (52.7%)	3762 (25.8%)	3134 (21.5%)
2011	17132	7453 (43.5%)	6126 (35.8%)	3553 (20.7%)
2012	11527	2461 (21.4%)	4175 (36.2%)	4891 (42.4%)

Source: [23]

A cursory look at table 1 shows that not very many of the candidates had credit pass in the subject over the period of observation. This shows that the level of performance is not good enough. According to [36], students show disinterest in science generally. There are also mystifying beliefs among students about the exceptional difficulties associated with

the learning of biology in general. Students fear biology so much that anyone who enrolls in it is looked upon with awe, because the course is believed to be difficult and not easy to pass in examination. 18]; [27]; [26]; [9]; and [10] in their different studies discovered that poor academic performance and low enrolment in science generally, and Biology , in particular in Nigeria are caused by : poor reading habit, negative students attitude/interest towards biology, gender inequalities, inadequate laboratory facilities, inadequate staff motivation, inadequate instructional materials and so on. Against this backdrop, this study is out to investigate student variables (Student gender, Student attitude towards Biology and Student Study Habit) as correlates of secondary school students' academic performance in biology in Ikere Local Government Area, Ekiti State of Nigeria.

The importance of attitudinal outcomes in science teaching and learning process has long been acknowledged. Attitude is a very strong variable in learning [18]. It determines the success or failure of a child in learning. Attitude correlates with students' achievements in any subject as shown by [17], [27] and [3] in physics, chemistry, biology, history, yoruba, geography, integrated science and mathematics respectively. Similarly, [36] reported that attitude is a critical factor in learning. Attitude is the basis for motivation in learning. It is further stated that, it would be a serious omission in the process of socializing children, if the formation of preferred attitude and the evaluation of attitude are not deliberately planned for and included in school curriculum. [5] revealed that learners bring the attitude they acquired into the classroom and this has the capacity to facilitate or hinder learning rate. He then recommended that significant efforts should be made to develop and evaluate attitude – shaping techniques for the benefits of the students in the school. In consonance with this, [15] reported that students' positive attitude in science correlate highly with their science achievement.

[9] state that academic-self-concept primarily indicates one's self -perceived ability within a given academic area, while academic self-efficacy primarily indicates one's self-perceived confidence to successfully perform a particular academic task. This argument is based upon the comparison of typical items measuring both constructs. Academic self-efficacy items [31] usually start with 'how confident are you...' (e.g. 'that you can successfully solve equations containing square roots'). In contrast, self-concept items such as 'I have always been good at mathematics' clearly more aimed at measuring students' self-perceived academic ability.

Self-efficacy researchers stress the cognitive nature of academic self-efficacy beliefs. Self-efficacy items such as 'How sure are you that you can solve the following mathematical problems' are designed to tap exclusively into the cognitive aspect of students' self-perceptions. In contrast, some self-concept researchers [21] have suggested that students' academic self-concept does not only comprise a self-evaluative/cognitive dimension but also an affective/motivational dimensions. This dimension is reflected in operational definitions by items such as "I am proud of my mathematics ability" or "I hate mathematics". However, other researchers have argued that although self-evaluating one's ability gives rise to affective and emotional

reactions, these reactions should not be considered as part of someone's academic self-concept. Available research links both academic self-efficacy and academic self-concept to a number of desired student outcomes such as persistence [19], intrinsic motivation [7], the adoption of task and achievement goals [8], [35] low anxiety levels [34]; [37] and academic achievement [32]; [21]. Hence, [9] conclude that academic self-concept and academic self-efficacy seem to have comparable effects on students' motivation, emotion and achievement.

Likewise, a number of studies indicate that academic self-efficacy and academic self-concept also play a similar mediating role for the effects of background variables such as gender, prior knowledge and general cognitive skills on outcome variable such as (math) anxiety, interest and academic performance. For instance, [29] argue that math self-efficacy at least partially mediates the effect of general cognitive ability and high school math level in mathematics anxiety and mathematics performance. In contrast, [6] found that students' math self-concept and not their math (e.g., statistics) self-efficacy beliefs mediate the effect of prior math experience on math anxiety. The above described research results illustrate that, in order to gain more insight in the actual mediating and explanatory qualities of both judgments of self-perceived competence, more research that simultaneously investigates academic self-efficacy and academic self-concept is needed. However, such studies are rare (e.g., [19] and [30]).

Gender difference in attitude and achievement relating to science has been extensively investigated by researchers. [4] in his studies that conclusive empirical evidence as to the superiority of male over female in science is still lacking. However, studies have found that girls hold lower confidence in their ability than did boys. It was noted that teachers seem to pay more attention to students who are sure of themselves than those who are less sure. It was therefore recommended that teachers should pay equal attention to students having low confidence, as they would do with students having high confident levels. [4] suggested that teachers should perceive girls as having same source of intellect like boys. Efforts should be made to stimulate girls into learning science, most importantly Biology.

[14] also found no significant main effects of gender on students' achievement in energy concepts in physics, but reported interaction effects of treatment and gender as well as gender and numerical ability on student's achievement in energy concepts in physics. The result of the studies of [13] and [14] revealed one interesting fact that gender seem not to be as important in students' achievement as their innate ability. [Market's (1996) in an article on Gender related to success in Science and Technology examined the status of women in science, technology, engineering and mathematics, argued that women do not choose careers in these fields, simply because of gender xenophobia. She concluded that strategies such as early exposure and role model information should be employed to enhance technological literacy, as way to decrease gender xenophobia.

[26] attributed the low performance of girls in Biology and in science courses generally to lack of role models to women

in Science, Technology, Mathematics and sex stereotypes. [26] also cited the low employment of female science teachers. The teaching profession for science subjects is still dominated by males therefore the attitudes of female students towards the subjects. [1], identified sex-bias in the schooling process, including the instructional materials for the subjects. She noted a definite bias in the illustration and written textbooks on all criteria. According to [1], references to females were few and even when the sex of the person was immaterial, references to females in scientific activities were virtually non-existent and there were a few references to role models for girls. In Information sheet, [12]; [10]; and [24] revealed that more women than men pursue a post secondary degree in the U.S., however fewer females pursue an undergraduate degree in science and therefore do not enter into science, technology, engineering, and mathematics (STEM) related careers at the same rate as males. Females have demonstrated that they are equally capable as their male counterparts of learning and mastering science concepts and knowledge [10]. Views that females hold in relation to science and its application to solve real-world problems; courses that females are advised to enroll in during high school; and support from parents, teachers and other role models related to pursuing a career in STEM disciplines are factors that provide additional insight into gender differences in science achievement.

2. Research Hypotheses

Ho_1: There is no significant relationship between student variables and student academic performance in biology.
Ho_2: There is no significant relationship between the contributions of student variables to the academic performance of secondary school student in biology.

3. Methodology

The design was a descriptive survey research type. The target population for the study were SS III Biology students of senior secondary schools classes in Ikere Local Government Area of Ekiti State, Nigeria. Four hundred and five (400) Biology students (male and female), which were randomly selected from ten (10) secondary schools from Ikere Local Government Area of Ekiti state, formed the sample. The researchers used the following instrument to elicit the relevant data:

(i) the questionnare designed by theresearchers to elicit information on gender, atitude, and study habit of biology student.
(ii) (ii) Biology Achievement Test (BAT). A 25- item objective questions drawn from past WAEC questions.

4. Results and Discussion

The section presents the results obtained in the study in line with the two research hypotheses raised.

4.1 Hypothesis 1

There is no significant relationship between student variables and student academic performance in biology.

Table 2: Correlation matrix of student variables and student academic performance in biology.

	Gender	Attitudinal Scale	Study Habit	Student Academic Performance
Gender	1.000			
Attitudinal Scale	.029	1.000		
Study Habit	.017	.055	1.000	
Student Academic Performance	.060	.392*	.443*	1.000

* correlation is significant at the 0.05 level (2 – tailed)

The result from table 2 shows that r-cal between the students study habit and their academic performance in biology is significant (i.e. r-cal = .443 > r-table =0.195). Also, student attitude towards biology and their academic performance in biology is also significant (i.e. r-cal = .392 > r-table = 0.193). There is no significant relationship between student' gender and academic performance in Biology. In summary, student study habit shows the highest relationship with student academic performance in biology with r-cal = 0.443 and followed by student attitude with r-cal = .392 while student gender has the least value of r-cal = .060.

4.2 Hypothesis 2

There is no significant relationship between the contributions of student variables to the academic performance of secondary school student in biology.

In order to test the hypothesis, scores on all the identified predictors (students' variables) of academic performance constitute the independent variables while students' academic performance represents the dependent variable. These set of scores were subjected to statistical analysis using multiple regression analysis at 0.05 level of significance.

The regression model is specified as follows:

$$Y = f(x) = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + U_i$$

Where X_1 = student study habit ; X_2 = student attitude ; X_3 = gender ; b_i = slope and U_i = stochastic error term.
Regression result is presented in table 3 below

Table 3: Multiple regressions of the student variables and academic performance of secondary school students' in biology

Model	B	Std Error	Beta	T	Sig T	Rmk	R	R^2	F
Constant	208.947	21.222	-	9.846	.000	Sig			
Gender	7.992	2.047	.133	3.904	.000	Sig	.880	.808	86.887
Student Attitude	.120	.174	.022	.690	.490	Sig			
Study Habit	.103	.054	.069	1.918	.056	Sig			

Dependent Variable: student academic performance.

The result from table 3 shows that the students' gender is the single best predictor of student academic performance in biology with beta weight 0.133 (13.3%). Student study habit is the second best predictor of student academic performance in biology with beta weight 0.069 (7%) and followed by

students' attitude towards biology with beta weight 0.022 (2.2%) .

The composite relationship between predictors (students' variables) and academic performance is fairly high, positive and statistically significant at 0.05 level (R=0.880, P<0.05). The coefficient of determinant (R^2) is 0.808. This implies that about 81% variation in the students' academic performance is jointly explained by variation in the predictor variables. The remaining 19% unexplained variation is largely due to variation in other variable which are not in line with the regression model but otherwise constitute the stochastic error term.

Testing the effect of individual predictor variable on students' academic performance, the result shows that students' gender (t=3.904, P<0.05), students study habit (t=1.918, P<0.05) and students' attitude (t=0.690, P<0.05) were statistically significant at 95% confidence level in each case. The regression model is statistically significant in terms of overall goodness of fit (F = 86.887, P < 0.05).

5. Discussion

The results of the study were discussed based on the hypotheses as follows:

The result obtained for the test of hypothesis one (Table 2: Correlation matrix of students variables and students' academic performance in biology) shows that there is significant relationship between student variables and students' academic performance in biology of Secondary Schools in Ikere Local Government Area of Ekiti State. The overall results revealed that the student study habit has the highest relationship with student academic performance in biology with r-cal = 0.443, followed by student attitude with r-cal = .392 and followed by gender with r-cal = .060. This result agreed with the findings of [36] that attitude is a critical factor in learning. It also agreed with the assertion of [28] and [2] that students' positive attitude to science correlate high with their science achievement. Moreover, [5] also reported that learners bring the attitude they acquired into the classroom and this has the capacity to facilitate or hinder learning rate. Furthermore, the findings also in line with [15] that students' positive attitude in science correlate highly with their science achievement.

The result obtained for the test of hypothesis two (Table 3: Multiple regressions of the student variables and academic performance of secondary school students' in biology) shows that there is significant contribution of student variables to the academic performance of secondary school student in biology. The result revealed that the students' gender is the single best predictor of student academic performance in biology with beta weight 0.133 (13.3%). Student study habit is the second best predictor of student academic performance in biology with beta weight 0.069 (7%). This is followed by students' attitude towards biology with beta weight 0.022 (2.2%) . But this result negate the assertion of [13] and [14] that gender seen not be important in students' achievement as their innate ability. The result supports the assertion of [4] that teachers should perceive girls as same source of intellect like boys.

6. Conclusion

As a result of the findings of this study, it is concluded that students' variables (students' attitude towards biology student study habit) were significantly important to students' academic performance in biology.

7. Recommendations

Based on the findings of this study, it was recommended that: Students of biology must cultivate right attitude towards the learning of the subjects. They should have the mind that biology is fascinating; view it as something around them every day and not as an abstract subject. Also, Students of Biology must cultivate good study habit and good interest in the subject. They should learn how to go over what they were being taught for that day in biology at night and make consultation to other text to widen their knowledge on the topic.

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