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Assessing Determinants of Students' Achievement in Senior Secondary School Biology

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Abstract

The study is a correlational research type. The sample for the study comprised 200 respondents from 5 public schools in Ibadan North West Local Government Area of Oyo State. Three instruments namely: Parental Role Scale (α =0.71), Grasha-Riechmann Student Learning Style Scale (α = 0.87) and Biology Achievement Test (KR_{20} = 0.88) were used to collect data from the respondents and data collected were analyzed using multiple regression analysis. Results indicated that a statistically significant linear relationship exists between the predictor variables (parental roles and students learning style) and the criterion variable (students' academic achievement in biology). Parental roles accounted for 4.9% of the variance in students' achievement in biology while learning styles account for 4% of the total variance observed in students' achievement in biology. Based on the findings, it is recommended that parents should be deeply committed to activities that connect with the schooling process of their children to foster academic achievement.

Keywords: Science education, Biology, Parental role, Learning style, Achievement in biology

Introduction

Quality higher science education (HSE) is an important factor in building a stable, standard and competitive society. Science education is a relatively broad and dynamic tool essential for economic as well as national development. This is because science education looks well into the future growth and development, by advancing the various developmental efforts. One cannot access HSE without having the prerequisite knowledge as stipulated by the admission body. The prerequisites include minimum credit pass in the core subjects: English language, mathematics and the science subjects of which biology is one of them.

The health of billions of people depends on medical practitioners who use the knowledge and attitude which they derived from the study of biology to save lives of people suffering from diseases (Babatunde & Elemide, 2014). Araoye, (2009) reported

that exposure to biology education offers learners a wide range of relevance in all aspects of life. Akindele, (2009) also confirmed this by saying that the study of biology is relevant to man's successful living. As appealing as these benefits of biology are, the performance of students in the subject in West African Senior Secondary Certificate Examinations (WASSCE) remains poor (Sowole, 2006). Similarly, Ibe and Maduabum (2001), argue that biology has the poorest results over the years among other science subjects. Students' performance from 2007 to 2017 in biology is presented in Table1.

Table1: Summary of Students' Entries and Results in Biology for West African Senior Secondary School Certificate Examination: 2007 –2017

Year	Students' Enrolment	Total Credit Passes		Total Failure	
	No	No	%	No	%
2007	1,238,163,	413,211	(33.37)	824,952	(66.63)
2008	1,259,964	427,644	(33.94)	832,320	(66.06)
2009	1,340,206	453,928	(33.87)	886,278	(66.13)
2010	1,300,418	427,644	(33.90)	872,774	(66.10)
2011	1,505,199	579,432	(38.50)	925,767	(61.50)
2012	1,672,224	649,156	(38.82)	1,023,068	(61.18)
2013	1,646,741	850,706	(51.66)	796,035	(48.34)
2014	1,677,849	638,998	(37.59)	1,038,851	(62.41)
2015	1,181,567	628,684	(53.20)	528,357	(46.80)
2016	1,087,698	802,539	(73.78)	261,164	(26.22)
2017	1,093,597	263,134	(65.79)	342,276	(34.21)

Source: West African Examination Council (WAEC) Annual Report 2007-2017

Table 1shows that less than 50% of the total number of students who enrolled for Biology had credit in the examination. This means that less than 50% of the total enrolment had the opportunity of getting admission into higher institutions to study science related courses. The increasing level of poor performance of students in biology calls for a need to ascertain students' learning styles that promote their academic achievement (Babatunde & Elemide, 2014).

There is a wide range of definitions that have been adopted to describe the construct of learning style. The definition varies depending on the perspective of the researchers. It has been argued that, customizing learning materials and learning modules according to different types of learners increases learning outcomes(Liegle & Janicki, 2006;Yazici,

2005).Learning styles reflect the personal differences of learners in receiving and processing information during instruction (Johnson, 2002). Most simply, the term learning style refers to the way or approach a student follows in the course of learning. It is, therefore, essential for every teacher to learn about students' learning styles before preparing materials and designing learning activities for the teaching learning process.

The most important use of learning styles is that it makes it easy for teachers to develop teaching strategies that will promote academic achievement of the students. Teaching is made adaptive to the differences which exist among the learners. Chou and Wang (2004) affirm that each individual has his or her own preferred way of organizing and retaining information. Classroom observation reveals that students react differently to learning task, the amount, frequency and type of motivation they require in dealing with a given task. In other words, the manner of learning of students will either make them to maintain or restrain information.

Similarly, the role and place of parents in determining the achievement of the child is an important issue within the educational sector. It is necessary to define the meaning of 'parents'. According to Lunts (2003), the word includes parents, guardians, stepparents, siblings, members of extended family, and any other adult who might carry the primary responsibilities for a child's health, development and education. Tella and Tella (2003), assert that parents play an invaluable role in laying the foundation for children's learning. Parental role is a multidimensional concept comprising different kinds of activities engaged in by parents and other family members both at home and at school that are intended to foster academic success as well as a secured and fulfilling life.

When a parent plays his role as expected, it is assumed that the academic achievement of the child is guaranteed. Gadson (2003) says greater parental role at early stage in a child's learning positively affects the child's school performance. Theisen (2009), reports that inability of parents to meet the basic needs of their children can have wide-range and long lasting negative effects. Dubois, Lang and Prade (2000) reveal that financial support and quality parent-child relationship significantly predicts school achievement. Children tend to succeed when parent provide the necessary funds towards their development as well as give decent and adequate feeding. When a child is not properly fed, he or she might find it difficult to concentrate in class. Parents who provide library facilities like textbooks and other necessary academic materials such as newspapers, journals and magazines for their children can motivate the children to perform better academically. They are also likely to have a wider vocabulary and develop language fluency. Exposure to electronic media, computer and internet can also be a contributing factor to academic achievement. It is also important that parents attend parent – teacher association (P. T. A.) meetings where various issues relating to parents, teachers, students and school are discussed to improve students' academic achievement. Will it, then, be logical to claim that learning style and parental support play prominent role in the achievement of students in senior secondary school biology?

Statement of the Problem

Students' achievement in biology has been fluctuating over the years. Many researchers have studied different causal variables as they try to come up with better and lasting solutions to the poor performance. Literature reveals that parental involvement as a single factor has contributed to students' achievement in biology. When parents work together with schools to support learning, children are more likely to succeed, not just in secondary school, but as they pursue higher education and throughout life. Studies have also shown that the learning styles of students play an important role in determining students' achievement. However, the extent of the combined contribution of parental role and students' learning styles on students' academic achievement, particularly in Biology remains abysmal. Therefore, this study investigated parental roles and students' learning styles as determinants of students' achievement in senior secondary school biology.

Research Questions

1. (a) To what extent will parental roles (home activities, provision of textual materials, attendance of P.T.A meetings, monitoring/supervision and financial support) jointly contribute to students' academic achievement in biology?
   (b) What is the relative contribution of each of the parental roles (home activities, provision of textual materials, attendance at P.T.A meetings, monitoring/supervision and financial support) on students' academic achievement in biology?
2. (a) To what extent will students' learning style (independent, dependent, collaborative, competitive, contributive and avoidant) jointly contribute to students' academic achievement in biology?
   (b) What is the relative contribution of each of the learning styles (independent, dependent, collaborative, competitive, contributive and avoidant) to students' academic achievement in biology?

Methodology

(i) Research Design

This study employed correlational research type of non-experimental design. No variable was manipulated in the study. Only their correlations were assessed.

(ii) Sampling Technique and Sample

Multi-stage sampling technique was adopted and simple random sampling was used to select Ibadan North West Local Government Area from the 33 local government areas in Oyo State. Purposive sampling technique was used to select senior secondary school two class. Thereafter, five public schools were randomly selected and 40 students from each

of the selected school were randomly selected to participate in the study. The total sample for the study comprised 200 participants from the five public schools.

(iii) Instrumentation

Three instruments namely: parental role scale (α =0.71), Grasha-Riechmann student learning style scale (α = 0.87) and biology achievement test (KR_{20} = 0.88) were used to collect data from the respondents. The parental role scale instrument is designed to elicit information about the role played by parents towards academic achievement of their wards. It has two sections comprising demographic information of the participants such as age, gender, educational qualification etc while the second section elicits information about the construct with twenty items. Grasha-Riechmann is an adapted with 27 items in a modified Likert scale of 'Very true', 'True', 'Almost true', 'Not true'. Biology achievement consists of 30 multiple choice test items with four options A,B,C,D.

(iv) Data Collection Procedure

The researchers collected the data with the assistance and cooperation of the biology teachers of the sampled schools. Data collection exercise lasted for five weeks

(v) Data Analysis

The data collected were analysed using multiple regression.

Results

Research Question 1a: To what extent will parental roles (home activities, provision of textual materials, and attendance of P.T.A meetings, monitoring/supervision and financial support) jointly contribute to students' academic achievement in Biology?

Table 2: Model Summary and Regression ANOVA of Parental Roles on Students' Academic Achievement in Biology

R= 0.271
R^2 = 0.073
Adjusted R^2 = 0.049

Model	Sum of square	Df	Mean square	F	Sig
Regression	261.906	5	52.381		
Residual	3310.574	194	17.065	3.070	0.011*
Total	**3572.480**	**199**			

*Significant at $p < 0.05$ level

The multiple regression correlation coefficients (R) show the linear relationship between parental roles and students' academic achievement in biology as shown in Table 2. The R value is 0.271, the multiple R square is 0.07 while the adjusted R square is 0.05. From the table, parental roles (home activities, provision of textual materials, and attendance at P.T.A meeting, monitoring /supervision and financial support) were moderately related to students' achievement in biology (0.3). Furthermore, the table shows that parental roles(home activities, provision of textual materials, and attendance at P.T.A meeting, monitoring /supervision and financial support) jointly predicted students' achievement in biology significantly ($F_{(5,194)} = 3.07$, $p < 0.05$). Parental roles accounted for 4.9% of the variance observed in students' achievement in biology. It can be concluded that the joint influence of parental roles (home activities, provision of textual materials, and attendance of P.T.A meetings, monitoring/supervision and financial support) contribute to student academic achievement in biology.

Research Question 1b

What is the relative contribution of each of the parental roles (home activities, provision of textual materials, and attendance at P.T.A meeting, monitoring /supervision and financial support) to students' academic achievement in biology?

Table 3: Summary of Relative Contribution of each of the Parental Roles to Students' Academic Achievement in biology

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig	Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
(Constant)	11.732	1.515		7.743	0.000					
Home activities	1.232	0.484	0.381	2.546	0.012*	0.046	0-.026	0-.026	0.686	1.457
Provision of Textual Materials	-1.006	0.399	-0.382	-2.525	0.01*	0.178	0.170	0.169	0.704	1.419
Attendance at PTA meeting	0.034	0.297	-0.008	0.116	0.91 NS	-0.047	-0.037	-0.036	0.703	1.423
Monitoring-supervision	0.7248	0.288	-0.182	2.510	0.01*	-0.099	-0.101	-0.099	0.776	1.289
Financial-support	0.042	0.082	0.037	0.508	0.61 NS	0.054	0.035	0.034	0.685	1.460

- Significant at $p<0.05$; NS= Not significant

Table 3 presents the regression coefficient of each parental role (home activities, provision of textual materials, and attendance at P.T.A meetings, monitoring /supervision and financial support) to students' academic achievement in biology. The table indicated

that home activities contributed significantly to students' academic achievement in biology (β =0.381; $t_{(194)} = 2.546$; $p <= 0.05$). Monitoring and supervision by parents, ($\beta = 0.182$; $t_{(194)} = 2.510$; $p <= 0.013$) and provision of textual materials ($\beta = -0.382$; $t_{(194)} = -2.525$; $p <= 0.05$) also contribute significantly to students' academic achievement in biology. Other parental roles had no significant contribution to students' academic achievement in biology. These are attendance at P.T.A meetings, and financial support. The implication of this result is that students must be engaged in home activities and parents should provide textual materials for their children to ensure improved achievement.

Research Question 2a:

To what extent will students' learning style (independent, dependent, collaborative, competitive, contributive and avoidance) jointly contribute to students' academic achievement in biology?

Table 4: Model Summary and Regression ANOVA of Students' Learning Style on Students' Academic Achievement in Biology

$R = 0.262$
$R^2 = 0.069$
Adjusted $R^2 = 0.040$

Model	Sum square	Df	Mean square	F	Sig
Regression	245.039	6	40.840		
Residual	3327.441	193	17.241	2.369	0.31*
Total	**3572.480**	**199**			

*Significant at $p < 0.05$ level

The multiple regression correlation coefficients (R) shows the linear relationship between students' learning style and students' academic achievement in biology as shown in Table 4. The R value is 0.262, the multiple R square is 0.069 and the adjusted R square is 0.040 which is 4%. This means that the students' learning style accounted for approximately 4% variance in students' academic achievement in biology. Further indicated in the table is the regression ANOVA which shows that the six students' learning styles (independent, dependent, collaborative, competitive, contributive and avoidance) jointly produce ($F_{(6, 193)} = 2.369$; $p < 0.05$). Since p value is less than 0.05, it can be concluded that there is significant contribution of learning style to students' academic achievement.

From Table 4, the multiple correlations R shows a linear relationship between the six predictor variables of students' learning styles (dependent, collaborative, competitive, contributive and avoidance) and students' academic achievement in biology. The variance observed in students' academic achievement can be partly attributed to students'

learning style. This implies that there are other variables that can affect students' academic achievement apart from learning styles of students.

Research Question 2b: What is the relative contribution of each of the learning styles (independent, dependent, collaborative, competitive, contributive and avoidance) to students' academic achievement in Biology?

Table 5: Summary of Relative Contribution of each of Students' Learning Styles to Students' Academic Achievement in Biology

Model	Unstandardized Coefficients		Standardized Coefficients			Correlations			Collinearity Statistics	
	B	Std. Error	Beta	T	Sig	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	12.083	1.541		7.840	0.000					
Independent	-0.235	0.319	-0.061	-0.736	0.46^{NS}	0-.042	0-.103	0-.101	0.540	1.853
Dependent	-0.053	0.299	-0.136	-1.949	0.05^{NS}	0.019	0-.020	0-.019	0.589	1.697
Collaborative	-0.211	0.254	-0.058	-0.830	0.41^{NS}	0.051	0.040	0.039	0.749	1.336
Competitive	0.845	0.344	0.212	2.458	0.02*	0.024	0.073	0.071	0.557	1.795
Contributive	-0.380	0.335	-0.102	-1.135	0.26^{NS}	0.027	0.040	0.039	0.562	1.780
Avoidance	0.298	0.271	0.102	1.100	0.27^{NS}	-0.174	-0.182	-0.181	0.944	1.060

- Significant at $p < 0.05$; NS= Not significant

Table 5 shows the regression coefficient of each of the learning styles on students' academic achievement in biology. Competitive learning style contributed most significantly to students' academic achievement ($\beta = 0.212$; $t_{(194)} = 2.458$; $p = 0.05$). The other five learning styles: independent learning style; dependent learning style; collaborative learning style; contributive learning style; avoidance learning style did not contribute significantly to students' academic achievement.

Discussion

The result of this study shows that the relationship between the five predictor variables (home activities, provision of textual materials, and attendance at P.T.A meeting, monitoring /supervision and financial support) and the criterion variable (students' academic achievement) is linear and statistically significant. Moreover, the overall model of the five predictor variables significantly predicts students' academic achievement in biology. This then implies that all the predictor variables are important in predicting students' academic achievement in biology when taken together. However, the model summary table shows that the predictor variables accounted for a fraction of the variance in students' academic achievement. This result may be due to the fact that students'

academic achievement is dependent upon so many other variables which are not considered in this study.

The result of this study supports that of Adiotome (2006) who found that children whose parents are not involved in their studies perform poorly in academics. In order words, children achieve higher academically when their parents are involved in their studies. It is also in agreement with the findings of Uzoechina and Obidike (2008) that parental roles enhance academic achievement. Hence, it is strongly advised that parents should be more involved in activities relating to students learning to enhance academic achievement. The regression coefficient for parental roles shows that home activities, monitoring and supervision as well as provision of textual materials contributed significantly to students' academic achievement in biology. Attendance at P.T.A meetings and financial support did not contribute significantly to students' academic achievement.

This finding supports that of Mapp (2003) that home activities enhance academic achievement of students. Similarly, the result is in line with that of Fan and Chen's (2001) that parents who closely monitor the home-work of their children and other aspects of their children's lives facilitate greater academic achievement. However the result contradicts that of Deplanes *et al* (2011) who claim that parental supervision does not contribute significantly to academic achievement. The result on provision of textual materials is in line with that of Malibiche (2011) that parents' provision of essential textual equipment and materials contributes highly to the academic achievement of their children.

This study does not support the claims of Ferguson (2008); Olatoye and Ogunkola (2008) that regular attendance of Parents Teachers Association meetings significantly predicted students achievement. The study corroborates McNergey (2001) who revealed that provision of textual materials influenced good performance. The result of attendance at PTA meeting disagrees with the finding of Uzoechina and Obidike (2008) that parents' attendance at PTA meetings is linked to greater achievement of students.

Learning styles (independent learning style; dependent learning style; collaborative learning style; contributive learning style; avoidance learning style)jointly predicted students' academic achievement in biology, hence, no single variable can be used in isolation to predict students' academic achievement. These findings support that of Johnson and Price (2000) that learners' unique styles and academic achievement are highly related. The result aligns with those of Abidin *et al* (2011) and Balogun (2014) that there is significant relationship between learning styles and students' academic achievement.

Competitive learning style, out of all the learning styles, significantly contributed to students' achievement. The other learning styles namely independent, dependent, collaborative, contributive, and avoidance learning styles did not contribute significantly to academic achievement. This result is in line with findings of Snyder (2000) that each of the learning styles contributed differently to students' achievement. This result

contradicts the findings of Grasha and Hicks (2000) that competitive learning styles do not contribute significantly to students' achievement.

Conclusion

The inference drawn from the findings of this study generally are that parental roles or involvement in the overall academic activities of teaching and learning within and outside the school is paramount to the achievement of students. It was revealed that only home activities contributed significantly to students' academic achievement in biology. Positive and moderate correlation existed between monitoring and supervision and student's academic achievement. Also the learning styles of students can determine their academic achievement. Out of the six learning styles of Grasha-Riechmann, only competitive learning style contributed significantly to students' achievement. In conclusion, the findings established a significant relationship between parental roles and students' achievement as well as between learning styles and students' achievement.

Recommendations

In view of the findings of the study the following recommendations are made:
Stakeholders in education should create more opportunities and encourage channels where parents could be better informed and have a significant involvement in the educational process of their children. Parents should be committed to home activities measures as well as creating time to monitor and supervise their children as much as possible.

Teachers should incorporate strategies that are student - centered. They should give room for active participation of students, and create opportunities for feedback on difficult areas. They should also be able to match their teaching styles with the learning styles of students. Furthermore, students should take into consideration their learning styles so that they can understand how best they learn. They should be encouraged to cooperate with the teachers and school administrators in the use of these learning approaches.

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