



Relative Contributions of Selected Teachers' Variables and Students' Attitudes toward Academic Achievement in Biology among Senior Secondary School Students in Ondo State, Nigeria

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This study investigated the relative contributions of selected teachers' variables and students' attitude towards academic achievement in biology among senior secondary schools in Ondo State, Nigeria. It involved descriptive survey research and ex-post facto research designs. The sample, 360 respondents which consists of 180 biology teachers and 180 senior secondary school three students were randomly selected from 36 senior secondary schools from the three Senatorial Districts of Ondo State using stratified random sampling technique. Teachers' teaching attitudinal scale, Science oriented attitudinal scale and an inventory which requested for data from records on students' senior secondary school certificate examination grades in biology were used for data collection. Data collected for the study were analyzed using correlation matrix and multiple regression analysis. The results showed that significant relationships existed among the independent variables and students' academic achievement in biology. Also 62.5% of the variance observed in students' achievement in biology was explained by linear combination of the five predictor variables. Students' attitude was the most potent contributor to the prediction. Teachers' workload was the least contributor to the prediction. It was recommended that constant workshops and seminars should be made available by government for teachers to attend for the improvement of their teaching skills. Teachers and students were also charged to change their attitudes positively towards the teaching and learning of biology.

Keywords: relative contributions, teachers' variables, students' attitude, prediction, biology, academic achievement, secondary school students

Success in certain endeavors may be contingent upon certain factors. This may also be true of achievement in schooling. Good achievement in schooling could be the partial contributions of an individual's gender sensitivity, cognitive, affective (attitude) and psychomotor domains. Adodo (2007) argued that one key overriding factor for the success of students' academic achievement is the teacher. In the same vein, Ibrahim (2000) believed that teachers' qualifications and exposure can go a long way to bring

about pupils' high academic achievement. It is probably for this reason, Ibukun (2009) asserted that no education system can rise above the quality of its teachers. Considering the assertions of Ibrahim (2000), Adodo (2007), and Ibukun (2009), it implies that teachers' role in the preparation of students to succeed in examinations cannot be undermined.

Usman (2003) argued that shortage of qualified teachers is responsible for the poor academic achievement observable among the students while Ademulegun (2001)

argued that students taught by more qualified and experienced teachers in terms of knowledge of the subject matter perform better than those taught by less qualified but experienced teachers. The educational analysis recently carried out in Nigeria by the National Economic Empowerment and Development Strategy (NEEDS, 2005) indicated that more than forty nine percent (49%) of the teachers in Nigeria are unqualified. This revealed the quality of teachers teaching various school subjects to the secondary school students. The teachers teaching biology as a subject in the various secondary schools would probably be among the said over forty nine percent unqualified teachers.

As important as knowledge of biology is to human beings, it appears students' achievement in this subject at the secondary school level is becoming worse than in the other science subjects. Ibe and Maduabum (2001) argued that candidates performance at the senior school certificate examinations (SSCE) conducted by West African Examination Council have consistently remain poor, with biology having the highest enrolments and the poorest results over the years. Looking at the importance of biology to the national development and considering the state of poor academic achievement in this very subject at the secondary school level which incidentally serves as the foundation for advance learning and professional courses in fields such as medicine, pharmacy, nursing and other allied courses, the poor academic achievement observable in the biology results of the students should be a thing of serious concern to any citizen of Nigeria. The teachers' attitude (TA), teachers' qualifications (TQ), teachers' workload (TW) in terms of number of students handled by teachers and the experience possessed by teachers (TE) teaching biology as a subject to the students coupled with the students' attitude (SA) toward the subject may be responsible in part for the downward trend in achievement observed in the results of the students in the subject.

Attitude as a factor could be viewed as the totality of an individual's inclination towards object, institution or idea. Attitude could be learned or formed and acquired from members of the family, teacher and peer group. The learner acquires from the teacher's disposition to form attitude towards learning which could positively or negatively affect his performance. Teachers are role models to the students because as they act, so do the students demonstrate and perfect such act or behaviour. It is very unfortunate that little did many teachers realize that the manner they handled the teaching of biology as a subject, behave and interact with the students as biology teachers could produce major effect on students' achievement. For instance, when teachers frequently absent from the classroom, such negative attitude can cause the students at the foundation laying to lose interest in science as the delivery of the subject matter handled by such teacher has to be done by an array

of substitute teachers who may not be a specialist in basic science. According to Finlayson (2009), the resultant effect of such teacher's absents from school is negative correlation between students' performance and high teacher absenteeism. Some teachers seem to have developed negative attitude towards teaching the students this subject (biology) that is very vital to human living. This may have been responsible for the negative attitude developed towards learning biology by the students. Other factors, according to Adodo (2005), identified to be related to students' attitude in science include: teachers' teaching method, teachers' attitude, age, students' cognitive style, interest of students and social implication of science among others.. Ali and Aigbomian (1990) have argued that the extent a student prefers a subject, to that extent the student works hard to achieve in it. A close examination of the submissions of Ali and Aigbomian (1990) and Adodo (2005) revealed that academic achievement may be dependent upon positive attitude from the teachers and the students in the teaching/learning processes.

In his contribution, Okebukola (1986) pointed attention to the quality of biology teachers as the prime factor attributed to the cause of students' consistent poor academic achievement in examinations. Teachers' effectiveness in a subject may be prime determinant of students' performance in the subject. Ineffective teaching in secondary schools arises probably from the quality of teachers recruited to teach science. In many secondary schools, science subjects are taught by people who are neither interested nor qualified in teaching the subject. For instance, undesirable situations showed engineers teaching mathematics and physics, biochemists teaching chemistry and microbiologists teaching biology. In this kind of situation, students who undertake science and mathematics at school may either end up disillusioned or greatly hampered in the development of the mental discipline which acquisition of scientific knowledge demands. Secondary school science teachers need to be professionally qualified to enable them work effectively with pupils in stimulating and directing their growth in desired directions.

There are various approaches a teacher can employ to bring about effective teaching. The science of teaching, according to Ogunboyede (2011), is referred to as pedagogy while McCaughtry (2005) and Sidhu, Fook, and Kaur (2011) stressed that pedagogical content knowledge refers to the teaching and learning of the subject. Houston, Haberman and Sikula (2002) and Sidhu et al. (2011) claimed that even at the integration of pedagogical knowledge into the teachers' education in Malaysia, the methodology being used by some science teachers in schools are not child-friendly, hence, effective learning of science could not take place in the classroom. It is not surprising; therefore, that Oloyede (1992) argued that a significant difference exists in the achievement of

the students taught by professionally trained and non-professionally trained teachers in the art of teaching biology.

Researchers have carried out studies on teachers' demographic variables such as qualifications, age, experience, gender, attitude and students' academic performance. For instance, Adepoju (2002) reported that a significant relationship exists between teachers' variables such as gender, area of specialization, possession of academic qualification in education and the learning outcomes of secondary school students, but Igwe (1990) found no significant relationship between teachers' qualifications and students' achievement in biology, chemistry and physics at senior secondary school certificate level. While Ayodele (1997) found a positive relationship between teachers' qualifications and students' academic achievement, Khan and Bertecher (1988) found out that there is a high and significant relationship between teachers' qualifications and global wastage ratio in basic education in Madagascar. Nevertheless, Ajewole (1990) did not completely agree with these findings and showed passive reservation concerning the relationship between teachers' qualification and students' achievement but concluded that there is need to carry out more careful investigations about it.

Studies have also shown that teachers experience exerts a great influence on the academic achievement of students. Banjoko (2001) argued that a good foundation in science is necessary to attract more students into the field of science while Oke (2003) stressed that performance in separate science subjects at the senior secondary school may be due to the foundation laid on integrated science learnt at the elementary and junior secondary school level. Ilugbusi, Falola, and Daramola (2007) showed that teaching experience in schools count significantly in the determination of students' achievement in external examinations such as West Africa Senior School Certificate Examination (SSCE), National Examination Council (NECO), National Business and Technical Education Examinations and the Unified tertiary Matriculation Examination. According to them, inexperienced teachers are easily upset and destabilized by unfamiliar situations. This may imply that inexperienced teachers could get confused, mixed up the content of the topics taught to the students and hence the students will receive wrong information which would definitely lead to poor achievement among the students, while the experienced teachers are already immune to classroom provocative situations and have developed resistance and several solutions against classroom confusion inducing agents. In the same vein, Gibbons, Kimmel, and O'shea (1997) reported that there was a significant relationship between teachers' experience and students' academic achievement since students taught by

more experienced teachers achieved at a higher level due to the fact that the experienced teachers have mastered the subject content and acquired cumulated classroom management skills and strategies to handle and cope with different classroom problems.

Literature has also indicated that teachers' attitude and students' attitude have exerted some influence on the academic achievement of students. For instance, Yara (2009) reported that teacher's attitude towards science has a strong relationship with students science achievement as well as the students' attitude towards science. Onocha (1985) and Ogunwuyi (2000) showed that teachers' attitude towards science is a potent predictor of students' academic achievement in science and attitude towards science learning, but Igwe (1985) reported that the effect of students' attitude on achievement in mathematics is not as strong as the effect of teachers' attitude on students' achievement in mathematics. Studies of researchers such as Ajayi (1999), revealed that no significant relationship exists between teachers workload and students academic achievement while Kolawole (1982) found that a negative relationship exists between the academic performance of students and class size, but Walberg (1969) argued that a significant and consistent relationship exists in the academic achievement of students in small classes of between 1-20 students that obtained higher scores in science tests than their counterparts in large classes of more than 20 students. The rate of interaction between teachers and students in the classroom where students' population is far above the normal or recommended number of pupils per class by UNESCO would be very stressful. A situation where sixty or more students are packed in one classroom does not provide for effective teaching and learning to take place. In situation as this, work might become cumbersome for the teachers in terms of attending to individual student's needs, marking students' class work, home-works / assignments, hence, the teacher may decide to continually reduce the amount of work that should be given to the students to avoid been stressed. The over loading of teachers with congested classes would invariably end up in high reduction of efficiency while students' performance bears the consequences. Olaleye (2006) claimed that some schools have the problem of overcrowded classroom. This has serious implication for academic performance of the students. Teaching process involves planning learning activities, preparing learning materials, using time and keeping general order. Teaching effectiveness, according to Agharuwhe and Nkechi (2006) has assumed a multidimensional construct because it measures different aspects of teaching such as subject mastery, effective communication, lesson preparation and presentation. In the contribution of Ofoegbu (2004), poor academic performance of students in Nigeria could be due to poor

teachers' performance in terms of accomplishing the teaching task, negative attitude to work and poor teaching habits which have been attributed to poor motivation.

Statement of the Problem

It has been shown that researchers have investigated many factors considered to affect students' learning (Ayodele, 2009). At the heart of this line of inquiry is the core belief that teachers make a difference, but the extent to which the extant teacher-effectiveness can be trusted to identify characteristics of effective teachers become obscured. Few attempts have been made to directly measure the influence of individual teachers on the academic progress of large population of students using database of measurement available from records.

It is observed that previous studies also centered attention mainly on investigating the difference or relationship between individual (single) teachers' variables and students' academic achievement. Apparently, further studies are required to investigate the combined contribution of teachers' qualification (TQ), teachers' attitude (TA), teachers' workload (TW), teachers experience (TE) and students' attitude (SA) towards students' academic achievement at the senior secondary school level. Therefore, the problem of this is will academic achievement in biology, at the SSCE level, be better explained by the combined influence of teachers' qualification, teachers' workload, teachers' experience, teachers attitude and students' attitude? In addressing this situation, the following research questions were generated to guide the study.

- (i) Are there any relationships among teachers' qualifications, teachers' workload, teachers' attitude, teachers' experience, students' attitude and students' academic achievement in biology at the SSCE level?
- (ii) To what extent would teachers' attitude, students' attitude, teachers' workload, teachers' experience and teachers' qualifications when taken together predict students' academic achievement at the SSCE level?
- (iii) What is the relative contribution of each of the teachers' workload, teachers' attitude, students' attitude, teachers' experience, and teachers' qualifications to the prediction of academic achievement of the Senior Secondary School Students at the SSCE level?

Methodology

This study is designed along the line of both descriptive research of the survey type and ex-post-facto research design. The descriptive research of the survey type was adopted by using questionnaire to obtain information about the teachers' attitude, work load, qualification, experience and students' attitude towards the teaching / learning of biology in the school. Ex-post-facto was used because the researcher does not have

control on both the independent and dependent variables. The ex-post-facto design is neither completely descriptive nor completely experimental but involves a systematic procedure that utilizes observation of variables as found in their actual natural state (Bandebe, 2004). This type of design was employed by Campbell and Stanley (1966) in a desperate bid to solve the problem of randomization and control of variables in educational research. Part of the data involved in this study (Senior School Certificate Examination results) was observed and used as found in their natural state because the cause and the effect have already occurred. There was no treatment and manipulation of subjects rather it involved collection of data from records.

The population of the study comprised all the biology teachers and the senior secondary school class three (SSS III) students in Ondo State, Nigeria. The sample for the study consisted of 360 respondents made up of 180 teachers and 180 SSS III students randomly selected from the three senatorial Districts of Ondo State (Ondo South, Ondo Central, and Ondo North) using Stratified random sampling technique. The 180 teachers selected for this study have at one class been assigned to teach the content of the syllabus of West African Examination Council on biology to the sampled students between 2007 – 2010 either in senior secondary school class one (SSS1) or senior secondary school class two or class three (SSS2 or SSS3) to prepare the students ready for external examination in the year 2009/2010 academic session. The results of these students also served as database for this study. The instruments used for the study were: Science Oriented Attitudinal Scale (SOAS) adopted from Omirin (1999), Teachers Teaching Attitudinal Scale (TAS) adapted from Craig, Franklin, and Andrew (1984) locus of control of behaviour scale, and Tschannel-Moran and Woolfolk-Hoy (2001) Teacher sense of efficacy scale and an inventory, which requested for data on students' senior secondary school certificate examination grades in biology. Both the teachers teaching attitudinal scale and the SOAS were re-validated by the researcher. The estimates of construct validity and internal consistency reliability for the TAS and SOAS as depicted by the Cronbach coefficient alpha values were 0.68 and 0.72 respectively. The academic achievement of the participating students was measured by their grades in the senior secondary school certificate examination collected from records.

Procedure

Each of the 360 respondents (180 teachers and 180 students) was given a copy of their questionnaire respectively to respond to for thirty-five minutes. For the purpose of data analysis, the completed copies of the questionnaire were collected from the respondents and scored while the senior secondary school certificate letter grade for biology was converted to point for each participating student. The range of scores of the

respondents in the TAS and SOAS fell between 20-100 and 30-135 respectively.

Data Analysis

The following statistical methods were used to answer the research questions. Correlation analysis (matrix) was used to estimate the relationships between teachers' experience, teachers' workload, teachers' qualification, teachers' attitude, students' attitude and students' final grade (SGB) in biology. Multiple regression analysis was used to determine the extent to which the independent variables explain the criterion (final grade in biology) variable. Standardized regression coefficients (Beta) showed the relative contributions of the predictor variables to the criterion variable while unstandardized β weight shows the predictive strength of the predictor variables on the criterion variable.

Results

The results of the analysis are shown in Tables 1, 2 and 3. In Table 1, it is observed that a moderate and positive significant relationship exists between teachers' variables (TA and SGB, TQ and SGB), and students' grade in biology with TA versus SGB = 0.536 and TQ versus SGB = 0.579. Students' attitude also depicted that significant relationship exists between it and students' grades in biology. However, teachers' workload and teachers' experience exhibited low significant relationship with students' grades in biology (TW versus SGB = 0.420 and teachers' experience versus SGB = 0.407) at 0.05 level of significance.

Table 2 shows that there is linear positive

relationship between the predictor variables (teachers' workload, teachers' attitude, students' attitude, teachers' experience, and teachers' qualifications) and the criterion variable (SGB) achievement in biology among the senior secondary school students. The table indicates that the multiple R was 0.792 which implies that there is high positive relationship among the predictor variables and the criterion variable. As much as 62.5% (as indicated by R square of 0.625) of the variation observed in the achievement in biology among secondary school students was explained by the combination of the predictor variables while the standard error of 0.55612 indicates that on the average the predicted achievement in biology will deviate from true value by 0.55612 limits of that measure. The analysis of variance for the multiple regression data yielded an F-ratio of 152.14 which was significant at $P < 0.05$. This implies that the combination of the five predictor variables (TW, TA, SA, TE and TQ) have significant influence on achievement in biology among secondary school students.

From Table 3, the regression equation derivable is: achievement in biology (SGB) = 5.716E.02 (TW) + 0.194 (TA) + 0.342 (SA) + 0.127 (TE) + 0.185 (TQ) – 0.110. Hence, students' attitude indicates the best predictor to achievement in biology. The table also reveals the relative contribution of each of the predictor variables to the prediction as shown in the values of the regression coefficients which ranged from 0.070 (7%) to 0.453 (45.3%) while the standard error ranged from 0.020 to 0.030 and the t-values ranged from 1.830 to 12.282.

Table 1
Correlation Matrix Showing the Intercorrelation Among the Variables

	TW	TA	SA	TE	TQ	SGB
TW	1.00					
TA	0.417	1.00				
SA	0.413	0.563	1.00			
TE	0.264	0.305	0.241	1.00		
TQ	0.249	0.318	0.205	0.325	1.00	
SGB	0.420	0.536	0.615	0.407	0.579	1.00

Table 2
Summary of Regression Analysis of the Predictor Variables on the Criterion Variables (SGB)

Multiple R	0.792	Source of variance	SS	Df	Ms	Fc	Ftab
R ²	0.625	Regression	188.216	5	47.054	152.14	2.23
Adjusted R ²	0.623	Residual	111.956	354	0.309		
Standard Error	0.55612	Total	300.172	359			

Table 3
Test of Significance of Regression Coefficients

	B	SEB	Beta	t
Teachers workload (TW)	5.716E.02	0.030	0.070	1.830
Teachers Attitude (TA)	0.194	0.022	0.317	8.346
Student Attitude (SA)	0.342	0.027	0.453	12.282
Teachers Experience (TE)	0.127	0.020	0.209	6.015
Teachers Qualification (TQ)	0.185	0.021	0.394	8.853
Constant	-0.110	0.139		-0.787

P < 0.05 critical t = 1.960

The t-values associated with teachers’ attitude, students’ attitude, teachers’ experience and teachers’ qualification were significant at 0.05 alpha level.

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Discussion

The results above showed that the predictor variables in predicting academic achievement in biology among the senior secondary school three students could not be attributed to chance factor. The relationship between the predictor variables (TW, TA, SA, TE and TQ) in predicting academic achievement in biology among senior secondary school students is reflected in the value of coefficient of multiple regressions (0.792) and in the adjusted R-square (0.623) as shown in Table 2. The F-ratio value of 152.14 which is significant as the 0.05 level of significance attested to the fact that predictive capacity of the independent variables could not be attached to the effect of chance factor. The findings of this study showed that there were positive significant relationships among the teachers’ variables and students’ attitude. This finding

is in agreement with the findings of Yara (2009) and Adodo (2005) who claimed that teachers and students attitude toward teaching and learning respectively go side by side to record achievement in science. This is because good or bad professional conduct on the part of the teachers goes a long way to stimulate, influence and encourage student to develop positive or negative attitude respectively to the studying of biology. Demonstration of good professional teaching behaviours probably stirred up the potentials in the students to manifest positive attitude to learning. By implication, positive and effective relationship between the teacher and the pupils will perhaps show positive interrelationship with educational performance in the school subjects on the part of the pupils.

The findings also revealed that moderate and positive relationships exist between the teachers' variables and students' academic achievement and grade points in biology. Statistically, students achievement and teachers attitudes are both tending towards the same direction, this may not signify high academic achievement because negative attitude on the part of teachers would also breed negative attitudes on the parts of the students that can lead to lackadaisical behaviour and frustration in learning the subjects. Hence, the students will automatically return poor achievement in their academic work in the subject. Again, attitude towards learning a subject may be positively correlated with achievement in the subject but that is not enough a yardstick to conclude that the cause of such achievement is completely attitude. It could be that such achievement assisted in shaping the students attitudes towards the subjects. The findings did not undermine Omotayo (2002) argument that students bring into classroom acquired attitude which could hinder or facilitate learning. By implication, pedagogical teachers, should as a matter of necessity, make great effort and sacrifice in terms of time to design and inculcate attitude-shaping behaviours into the teaching/learning processes for the benefit of the learners in the school. This finding is in line with the finding of Adepoju (2002), Ogunwuyi (2000), and Gibbons et al. (1997). The low and significant relationship observable between teachers' workload, teachers experience and students achievement in biology could be due to lack of commitment on the part of the teachers, as well shallow knowledge of application of methodology and psychology of imparting the biology course content by the teachers into the students. This finding further gave credence to the fact that attitude towards teaching subject is a strong and potent weapon that can influence achievement in learning.

The result of this study further indicated that 62.5% of the variance in the academic achievement in biology among secondary school students was explained by linear combination of the teachers' attitude,

qualification, experience, workload and students' attitude. It also shows that students' attitude has the most potent contribution to the prediction followed by the teachers' qualification and the teachers' attitude while the teachers work load shows the least contribution to the academic achievement in biology. This finding corroborate the findings of (Onocha, 1985; Mukerjee, 2002; Houston et al., 2002; and Sidhu et al., 2011) who reported that attitude to Mathematics explained more of the total variance than the children intelligence and that attitude of students towards science were linked with some personality factors through relationship with teachers. This finding have shown that students' attitude, teachers' qualification and teachers' attitude were the most important factors than the other independent variables in the prediction of academic achievement in biology among senior secondary school students. The result that students' attitude showed to be the most potent contributing factor among the variables to the prediction can be explained from inter-relationship between the students and the teachers. Teachers are supposed to be a role model to the students, and if teachers' attitude towards studying biology is positive, such teacher(s) should device all methods entice students to develop positive attitudes to learning the subject. This suggests that teachers should not bring into the teaching/learning situations behavior that can jeopardize the development and acquisition of positive attitudes towards the learning by the students.

Teacher qualifications are another factor identified as making contribution to the prediction. The contribution is not as weighty as students' attitudes because teachers' qualifications deal with the mastery of secondary school biology content alone and could not guarantee appropriate and effective transmission of acquired body of knowledge. Yet, the combination of appropriate training of personnel and application of appropriate methodology of teaching can achieve it. Teachers, therefore, need to develop positive healthy work ethics, attitude and zeal towards their teaching job, and by implication, it becomes imperative that a would-be teacher should receive training on pedagogical teaching and educational psychology to guide would-be teachers in the "art of teaching".

Conclusion

Therefore, there is need for both the students and teachers of biology in senior secondary schools to have positive attitudinal change towards learning and teaching of biology accordingly to improve on the learning outcomes of secondary school students in biology. Government, both at the Federal and States Ministry of Education level, should as a matter concern, organize regular seminar and workshops for the teachers to refresh their memories about new developments and skills currently in use in the field of teaching biology to

secondary school pupils in order to improve the quality of teaching strategies of the teachers as well as improving the learning processes of the students.

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