

Impact of Teachers' Educational Qualification on Senior Secondary Students' Academic Achievement in Biology in Bayelsa State

Etebu, Ebimieowei
Faculty of Science

Amatari, Veronica Odiri
Faculty of Education

Niger Delta University, Wilberforce Island Bayelsa State, Nigeria

ABSTRACT: The study examined the impact of Biology teachers' educational qualification defined by their education qualification route, highest academic qualification and years of teaching experience on the academic achievement of senior secondary students of public secondary schools in Bayelsa State, Nigeria. It employed survey research design. A sample of 744 participants comprising 35 Biology teachers and 709 students offering Biology in the senior secondary schools was selected by simple random and purposive sampling techniques. Biology Achievement Test (BAT) and Teacher's Quality and Experience Questionnaire (TQEQ) were the instruments of data collection. The instruments were tested and certified to be reliable at 0.73 coefficients. Descriptive and inferential statistics which included frequency counts, percentages, F-test. Means arising from significant analysis of variance (F-test) were separated using Tukey's Highly Significant Difference (Tukey HSD) test. Findings showed teachers' qualification routes significantly influenced students' achievement rate and achievement test scores in biology of science students. Alternatively qualified teachers impacted more on students' achievement than traditionally qualified teachers. Based on these findings it was recommended that the educational policy be revised such that traditionally trained education graduates, in addition to acquisition of pedagogical skills, would have an appreciable depth of knowledge in their subject areas commensurate to their non education counterpart. Conclusively, students' achievement rate predicated on teachers' educational qualification is underscored in this study.

KEYWORDS: Achievement rate, Achievement test score, Alternatively prepared teachers, Informally prepared teachers, Traditionally prepared teachers.

Date of Submission: 23-03-2020

Date of Acceptance: 10-04-2020

I. INTRODUCTION

Science is the fulcrum upon which sustainable development pivots (Araoye, 2016; Teng, 2012). All sectors of human development and society such as health, agriculture, transportation, communication, banking, housing, trade and commerce, sports, tourism and entertainment etc are driven by science and technology (Eshiet, 1991). It is a truism that no country, State or Society can thrive and compete favorably with others without a solid foundation for Science and Technology (Ojebiyi and Fasakin, 2014).

Similarly, education is a very important human activity that helps any society fashion and model individuals to function well in their environment. According to UNESCO (2000), education could be said to mean the totality of processes aimed at developing human ability and behaviours. It is an organized and sustained instruction designed to both communicate and transfer combination of knowledge, skills and understanding value for all activities of life. Wolfenson (2000) stated that education arms an individual with set skills which enhances confidence, and helps him make decisions that engender a productive future. Thus Education is a means to achieving success in life and enables one to utilize skills in a constructive way. Explaining further, Boit, *et al* (2012), reiterated that education equips the citizenry to reshape their society and eliminate inequality.

Without exception, all nations of the world rely on education for effective national development. Interestingly, secondary school education is a very important sector that contributes significantly to national and individual development (Achoka *et al*, 2007). This is because the secondary educational sector plays a vital role in creating a country's human resource base at a level higher than primary education, and it forms the basic

requirement for selection into tertiary institutions and further skills training. Like Science and technology, education has also been described as the fulcrum around which every activity pivots; constitutes the major platform for sustainable human and national development (Tahir, 2006). This clearly shows the inalienably, intricately woven trio of Science, Technology and Education (summed up in Science and Technology Education) as the backbone of sustainable human and national development.

Ojebiyi and Fasakin, (2014), whilst reviewing the development of science and technology Education in Nigeria from an historical perspective defined Science and technology education as "All the learning experiences, activities, planned, designed, and organized for the disciplines- Biology, Microbiology, Biochemistry, Chemistry, Physics, computer science, Health science, Agricultural science, Basic science, Integrated science, Basic technology, Introductory technology and so on by the school or an institution to achieve not only the aims and philosophy of science and technology but also the over-all goals of the national development".

Three subjects, namely biology, chemistry and physics together with education form the bulk of what is referred to as Science education (Kola, 2013). Biology education, in particular, is the act of teaching and learning aimed at inculcating or transferring knowledge of biology to students (Okenyi, 2012). Biology is a unique and fundamental branch of science that deals with the study of living things (Akanji, *et al.*, 2003). Living things in biology as a discipline is broadly divided into botany (Plants), zoology (Animals, including man) and Microbiology (such as bacteria, fungi, archaea etc).

Biology and biology education are sure ways to promoting economic development, eliminating poverty and introducing social welfare (Nwagbo, 2005). This is because Biology is one of the pre-requisite subject for many field of learning including botany, anatomy and physiology, microbiology, medicine, agriculture, pharmacy, biotechnology, genetics, molecular genetics, modern cell biology forensic, bioremediation and pollution management etc. Biology and biology education promotes sustainable economic development, prosperity and strengthens the social welfare system of nations that recognize and pursues its goals and objectives (Nwagbo, 2005). A minimum of credit pass which is equivalent to a 50% overall score in Biology in a nationally recognized prescribed examination such as WAEC and NECO at the Secondary School level is required for admission into any tertiary institution in Nigeria to study advanced disciplines such as botany, anatomy and physiology, microbiology, medicine, agriculture, pharmacy, biotechnology, genetics, molecular genetics, modern cell biology forensic, bioremediation and pollution management etc.

Accordingly, Policymakers in Nigeria have often given biology the attention it deserves in their policy formulations. For example, the minimum standards set for teachers with National Certificate of Education captured as the major objectives of biology education in Nigeria are:

- ✓ To provide the youth with sound knowledge of the basic principles and techniques of biology.
- ✓ To produce knowledgeable, highly motivated, professional and effective teachers of biology who will be able to develop in students an appreciation and understanding of biological processes and principles.
- ✓ To develop confidence in biology teachers and enhance the ability to adapt to the changing situation in science and the technological oriented society.
- ✓ To view biology as a processes of inquiry into the living world.
- ✓ To analyze the activities of living things in their environment.
- ✓ To demonstrate practical skills in handling scientific apparatus.
- ✓ To demonstrate excellence and professional competence in teaching secondary school biology.
- ✓ To inculcate positive scientific attitude and value in the society and promote positive disposition towards biology, science and the scientific enterprise.
- ✓ To apply concepts and methods acquired in new areas of study and in everyday situation (NCCE, 2008).

Expatriating further on the position of Policy making Organs of Nigeria, the National Policy on Education (FRN, 2014), stipulates that learning of Biology will provide the students with suitable laboratory and field skills in biology, meaningful and relevant knowledge in Biology, scientific knowledge that is applicable, in health, agriculture, personal and community daily life matters and development of functional scientific attitudes.

These policy thrusts and positions of various policy formulation organs of the government underscores the pride of place biology occupies in our Nation's drive for all round sustainable development. However, notwithstanding the onerous importance of biology and the apparent laudable policies aimed at enhancing the teaching and learning of biology, students' performance and academic achievements have continually taken a downward turn (Ali, *et al.*, 2014; Abimbola, 2013: WAEC Chief Examiner Report, 2013). Students' poor performance in biology has variously been linked to numerous factors, some of which are overcrowded classrooms, heterogeneity of students in terms of ability levels, ill-equipped laboratories, too extensive biology syllabus (Obomanu, and Akporehwe, 2011), financial status of student's parents/guardians, inappropriate curriculum (Okenyi, 2013), corruption, shortage of qualified teachers, science students taught by teachers without professional qualification, continued application of archaic, irrelevant and uninteresting teaching methods etc (Kola, 2013).

Of the various factors identified as reasons for the poor performance of students in biology in secondary schools across different States in Nigeria, poor teacher quality is considered the greatest culprit (Kola, 2013). Meanwhile, the Nigerian educational system stipulates that only the professionally and academically qualified is allowed to teach (Hamilton-Ekeke, 2013). It has been often argued that Teachers' qualifications are more than just holding a certificate of any institution. Kola and Sunday (2015) posited that possessing a teaching certificate without knowledge of the subject matter invariably makes one an unqualified teacher. In the same vein, one who does not have a proper knowledge of pedagogy or someone who spent few years in training (Darling-Hammond *et al.*, 2001) without completing the required years would not be considered to possess teacher qualifications.

Conversely, professional development and experience are also counted for teachers' qualifications because several studies have revealed their positive impact on students' performance (Helk, 2007). This further strengthens the position of those who opined that teachers' qualification is not only defined by the certificate one possesses but it is the totality of the skills a teacher requires to teach effectively (Kola and Sunday, 2015). Such skills according to Zuzovsky (2009) would include formal education, experience, subject matter knowledge, pedagogy studies, duration of training, certificate/licensing and professional development. These according to her, formed the seven indicators of Teachers' qualifications.

In Nigeria, a person must have either a bachelor's degree in education or a bachelor's degree in a subject field combined with a postgraduate diploma in education to be qualified to teach in senior secondary schools (Kola and Sunday, 2015; Akindutire and Ekundayo, 2012). In addition, he/she must be certified and licensed by the Teacher's Registration Council of Nigeria (TRCN) which is the authorized regulatory body in Nigeria. Only those who successfully graduated from accredited teacher education programs are certified and licensed by TRCN on completion of an induction program or pass a national teacher examination (TRCN, 2004; Zuzovsky (2009). Those who studied and graduated with a bachelor's degree in education are often categorized as 'Traditionally prepared teachers' (Ruthland and Bremer, 2002; Moss, 2012).

However, owing to dearth of highly qualified teachers and the huge demand of their services, those who would like to teach but do not want to go through the traditional methods of obtaining certification are able to get certified through credible alternative means (Moss, 2012). It is reported that about one-third of teachers in the United States of America are being certified through alternative routes (Feistritzer, 2007). Alternatively prepared teachers are filling the vacancies of teacher shortages, especially in those areas where it is difficult to find teachers (Feistritzer, 2007; Humphrey *et al.*, 2008). This group or category of teachers are those who studied and graduated with bachelor's and/or higher degree in a non education degree program but later went on to have a teacher certificate (Ruthland and Bremer, 2002; Moss, 2012). The postgraduate diploma in education program run in Nigeria would fit into this description.

Amongst the different drivers of biology and biology education, teachers are generally considered to be the major contributors to student learning and academic achievement in the subject (Ahmad *et al.*, 2018; Boyi, 2013). Academic achievement of students is assessed by test and examination scores or marks assigned by the subject teachers (Adediwura and Tayo 2007), and numerous empirical studies have shown the importance of teachers in explaining observed differences in student performance (Darling-Hammond, 2000a; Hanushek, 2011; Zuelke, 2008) but researches on teaching and learning of biology among students in public schools, particularly in Bayelsa State are scanty. Even among those published in public domains, majority of their findings regarding teacher quality and competence were majorly based on students' opinion about their teachers (Akinfe, *et al.*, 2012). This approach would often be tainted with bias and subjectivity, and as such may be incorrect as pointed out by Hamilton-Ekeke (2013). Academic achievement (test scores), on the other hand is widely believed to have the most validity in indicating whether or not an educational institution or its teachers are excellent (Cochran-Smith *et al.*, 2017; Hamilton-Ekeke, 2013). Furthermore, majority of those that assessed teacher quality based on students achievement scores relied on national exams, which are often compromised and maligned with examination malpractices (Anyiin, 1998; Oniye and Alawaye, 2008). It would be worthwhile to assess the academic achievement of students using standard questions and in an environment setting devoid of examination malpractice.

A recent study which focused on factors affecting the teaching and learning of biology in one of the Local Government Areas of Bayelsa State was carried out by Daworiye *et al.* (2015). Their findings showed that teachers' competence did not significantly influence students learning. Meanwhile, several studies had reported that achievement in biology among students depends, to a large extent, on the quality of teachers (Soyibo and Ezeiroma 1987; Adeyemo, 2010). The discrepancies between the findings of Daworiye and Associates (2015) and those of other similar studies could have arisen from the fact that Daworiye and Associates (2015) did not consider teachers educational qualification as a function of competence. It would be interesting therefore to study the potential impact of teachers educational qualification on the academic achievement of Senior Secondary School students of Bayelsa State public Schools in Biology.

The importance of biology and biology education is obvious to, and appreciated by all and sundry; being a panacea for sustainable development and growth of any nation (Ahmad, *et al.*, 2018; Araoye, 2016; Nwagbo, 2005) Notwithstanding the enviable position biology occupies in the secondary school educational curricula; students have continually performed poorly in the subject at the Secondary School Certificate examinations (Ali, *et al.*, 2014; Abimbola, 2013; Umar *et al.*, 2018; WAEC Chief Examiner Report, 2013). Amongst numerous factors posited by several authors low teacher quality is considered the most important factor responsible for the low academic achievement in biology among Senior Secondary school students. Numerous educational reforms and policies are therefore often directed towards improving teacher quality. Putting it very succinctly, the National Policy on Education states, "No Education system can rise above the quality of teachers in the system" (FGN 2014).

The Nigerian educational system requires all teachers in all schools to be professionally and academically qualified (Hamilton-Ekeke, 2013). To teach in senior secondary schools in Nigeria, a person must have either a bachelor's degree in education or a bachelor's degree in a subject field combined with a postgraduate diploma in education (Kola and Sunday, 2015; Akindutire and Ekundayo, 2012). However, the following categories of biology teachers are often encountered as teachers in our senior secondary schools in Bayelsa State.

Category A: These are considered traditionally prepared teachers (Ruthland and Bremer, 2002 Moss, 2012).

Category B: These are considered alternatively prepared teachers (Beach and Littleton, 1991; Feistrizer, 2007; Moss, 2012; Ruthland and Bremer, 2002). Their educational certifications are based on coursework in pedagogy and subject area without a degree in education. Examples of teachers in this category in Nigerian Secondary schools teaching biology would be those who have a Bachelor of Science degree in the Biological or life Sciences and Postgraduate diploma in Education (PGDE) or Technical Teachers Certificate (TTC). Teachers in this category are considered to have both reasonable depth of knowledge of subject and teacher skills.

Category C: These could be referred to as informally prepared teachers who teach biology in Secondary schools. They have Bachelor of Science degree in the Biological or life Sciences without any form of certification in education. They are considered to have reasonable depth of knowledge of their subject area but deficient in minimum set skills required for teaching (Kosgei *et al.*, 2013). Educational skills, if any, for this category of teachers were obtained informally through relationship with experienced teachers, conferences, workshops and/or on the job (Kosgei *et al.*, 2013). The Nigerian educational policy does not subscribe to this, but this was included in this work to determine the level of impact of the accepted forms of teacher certification. The purpose of this study was therefore aimed to assess exactly whether or not the different categories of teachers (traditionally prepared teachers, alternately prepared teachers, and informally prepared teachers) impact student academic achievement in biology differently at the senior secondary school level. This research study also examined how years of teaching experience and level of academic degree obtained by the teacher impact student achievement in biology at the senior secondary school level. Students' achievement was assessed based on test scores obtained from biology test questions administered.

II. RESEARCH QUESTIONS

The specific research questions this work sought to answer were:

1. Do the different routes of teacher education (Traditional, Alternative and Informal) significantly, differently influence the achievement rate in biology among senior secondary (SS2) students in Bayelsa State public secondary schools?
2. Do the different routes of teacher education (Traditional, Alternative and Informal) significantly, differently influence the achievement test score in biology of senior secondary students' (SS2) attending public secondary schools in Bayelsa State?
3. Do teachers' academic qualifications (NCE/OND, HND/BSc/BSc(Ed), PGDE/MSc/MSc(Ed) and PhD if any) influence the achievement rate in biology among senior secondary (SS2) students in Bayelsa State public secondary schools?
4. Do teachers' academic qualifications (NCE/OND, HND/BSc/BSc(Ed), PGDE/MSc/MSc(Ed) and PhD if any) influence the achievement test score in biology of senior secondary students' (SS2) attending public secondary schools in Bayelsa State?
5. Does teachers' teaching experience influence the achievement rate of senior secondary school students (SS2) in biology in Bayelsa State?
6. Does teachers' teaching experience influence the achievement test score in biology of senior secondary students' (SS2) attending public secondary schools in Bayelsa State?

Hypotheses

The following hypotheses were tested:

Ho1: There is no statistically significant difference in students' achievement rate in biology exam scores among senior secondary school (SS2) students in Bayelsa State taught by teachers of the different teacher educational routes

Ho2: There is no statistically significant difference in achievement test score in biology among senior secondary school (SS2) students in Bayelsa State taught by teachers of the different teacher educational routes

Ho3: There is no statistically significant difference in achievement rate in biology exam scores among senior secondary school (SS2) students in Bayelsa State Public Schools taught by teachers with different teachers' academic qualification

Ho4: There is no statistically significant difference in achievement test score in biology among senior secondary (SS2) school students in Bayelsa State Public Schools taught by teachers with different teachers' academic qualification

Ho5: There is no statistically significant difference in achievement rate in biology exam scores among senior secondary school (SS2) students in Bayelsa State Public Schools taught by teachers with different years of teaching experience

Ho6: There is no statistically significant difference in the overall achievement score in biology exam score among senior secondary school (SS2) students in Bayelsa State Public Schools taught by teachers with different years of teaching experience

III. METHODS

The study employed a survey type of descriptive research which involved the comparative analysis of students' academic achievement based on the teachers' qualification route, academic qualifications and teaching experience. The target population of this study was 744 participants consisting 35 teachers and 709 of all SS2 Science students offering Biology in thirty five (35) schools visited across six (6) Local Government Areas of Bayelsa State. Mixed sampling methods were used at different stages. Random sampling method was applied in selecting thirty five (35) schools, a minimum of 4 schools from six Local Government Areas of Bayelsa State, while Purposive random sampling was used in selecting teachers and students for study. The researcher was interested in testing only SS2 Science students who offer biology. Similarly independent variables were gathered only from teachers who taught senior secondary school students (SS2) students biology in the specific public secondary schools to enable the researchers assess the influence of teacher quality on the students' academic achievement in biology of that school. However, the schools were selected by simple random sampling without prior knowledge as neither to teachers' quality of schools nor performance of students in biology. Students' academic achievement was measured from two angles: Achievement rate and Achievement test score. Achievement rate is the percentage of students with a minimum score of 50% from Biology Achievement Test (BAT). 50% is equivalent to credit level pass in Senior Secondary School Certificate National Examinations. The Achievement test score is the number of questions a student answered correctly out of 14 questions contained in the Biology Achievement Test.

Instruments employed in the study included a self-designed Teacher's Quality and Experience Questionnaire (TQEQ) and Biology Achievement Test (BAT). The TQEQ addressed the questions concerning academic qualification prior to certification, highest academic qualification and years of teaching experience. An instrument designed and developed from past WAEC questions by the researchers known as Biology Achievement Test (BAT) was appropriately validated and certified to be reliable at 0.73 coefficients. The BAT comprised fourteen (14) questions that were attempted within 15 minutes by SS2 Science students of each school. The students' academic achievement test scores used in this study involved ratio data which brings out their differences and the hypotheses stated in Null form. On the basis of these criteria, teacher qualification variables and students' achievement test scores were managed in Excel computer package and analyzed with a computer statistical software Minitab version 14 using descriptive and inferential statistics which included frequency counts, percentages, F-test. Means arising from significant analysis of variance (F-test) were separated using Tukey's Highly Significant Difference (Tukey HSD) test.

IV. RESULTS

Research Question 1:

Do the different routes of teacher education (Traditional, Alternative and Informal) significantly, differently influence the achievement rate in biology among senior secondary (SS2) students in Bayelsa State public secondary schools?

Table 1: Comparative impact of various Teacher Qualification Routes on Achievement rate of SS2 students in Biology in Bayelsa State

Teacher Qualification Route	Number of Teachers	MPAR ^x	Standard Error
Alternative	4	63.32 ^b	13.60
Traditional	23	29.10 ^a	3.15
Informal	8	26.72 ^a	7.98

Key:

MPAR = Mean Percentage Achievement Rate

^x Fields with the same letters in each column are not significantly different at 5% probability level; those with different letters are significantly different at 5% probability level

Table 2: Comparing the difference of impact of various Teacher Qualification Routes on Achievement rate of SS2 students in Biology in Bayelsa State

	TQR (I)	TQR (J)	Mean Difference (I-J)	S.E	Level of Significance
Tukey HSD	Alternative	Informal	36.60**	11.27	0.01
		Traditional	34.21**	9.97	0.01
Tukey HSD	Informal	Alternative	-36.60**	11.27	0.01
		Traditional	-2.39ns	7.55	0.95
Tukey HSD	Traditional	Alternative	-34.21**	9.97	0.01
		Informal	2.39ns	7.55	0.95

Key:

TQR = Teachers' Qualification Route

S. E = Standard Error

** = Mean Difference is significant at the 0.01 probability level

Tables 1 and 2 showed that different teachers' qualification routes significantly, differently influenced the achievement rates of students that participated in the Biology Achievement Tests. In particular, Table 2 showed that the achievement rate of students taught by teachers who got trained through the Alternative route of teacher qualification was separately, significantly different from the achievement rates of students taught by teachers who were either qualified through the traditional or informal routes as described in this study. The difference in achievement rate between students taught by teachers who qualified through the traditional or informal routes were not significant at the 5% probability level.

A significantly ($P=0.01$) higher percentage of students taught by Teachers qualified through the alternative route had a minimum of 50% score in BAT compared to those taught by traditional or informal routes of teacher qualification. In particular, results showed that 63.32% of students taught by teachers who got qualified through the alternative route had a minimum of 50% score in the Biology Achievement Test administered to them. Similarly only 29.10% and 26.72% of students taught by teachers qualified through traditional and informal routes respectively had same scores. The percentage of students with a minimum score of 50% that were taught by teachers who either got qualified through traditional or informal routes was not significant at the 5% level.

Research question 2:

Do the different routes of teacher education (Traditional, Alternative and Informal) significantly, differently influence the Biology Achievement Test score of senior secondary students' (SS2) attending public secondary schools in Bayelsa State?

Table 3: Comparative Impact of Teacher Qualification Route on Biology Achievement Test Score of SS2 Students in Bayelsa State

Teacher Qualification Route	Number of Teachers	Mean BAT Score ^x (Max. Score 14)	Standard Error
Alternative	4	7.16 ^a	2.19
Traditional	23	5.28 ^b	1.02
Informal	8	5.24 ^b	1.18

Key:

BAT = Biology Achievement Test

^x Fields with the same letters in each column are not significantly different at 5% probability level; those with different letters are significantly different at 5% probability level

Table 4: Comparing the difference of impact of various Teacher Qualification Routes on Biology Achievement test score of SS2 students in Bayelsa State

	TQR (I)	TQR (J)	Mean Difference (I-J)	S.E	Level of Significance
Tukey HSD	Alternative	Informal	36.60**	11.27	0.01
		Traditional	34.21**	9.97	0.01
Tukey HSD	Informal	Alternative	-36.60**	11.27	0.01
		Traditional	-2.39ns	7.55	0.95
Tukey HSD	Traditional	Alternative	-34.21**	9.97	0.01
		Informal	2.39ns	7.55	0.95

Key:

TQR = Teachers' Qualification Route

S. E = Standard Error

** = Mean Difference is significant at the 0.01 probability level

Tables 3 and 4 showed that different teachers' qualification routes significantly, differently influenced the mean Biology Achievement Test scores of students that participated in the study. In particular, Table 4 showed that the mean score of students taught by teachers who got qualified through the Alternative route of teacher qualification was separately, significantly different from those taught by teachers who were either qualified through the traditional or informal routes. The difference in achievement rate between students taught by teachers who qualified through the traditional or informal routes were not significant at the 5% probability level

Results showed that students taught by alternatively taught students had a mean score of 7.16±2.19 out of a maximum of 14 marks. This was significantly ($P \leq 0.05$) higher than scores of students taught by teachers who qualified through traditional (5.28±1.02) or informal (5.24±1.18) routes (Table 4.8). The mean BAT scores

for students taught by teachers qualified through the latter two routes were not significant at the 5% probability level.

Research Question 3:

Do teachers' academic qualifications Category A (NCE/OND), Category B [HND/BSc/BSc(Ed)] and Category C [PGDE/MSc/MSc(Ed)] influence the achievement rate in biology among senior secondary (SS2) students in Bayelsa State public secondary schools?

Table 5: Comparative Impact of Teacher Academic Qualification on Achievement rate of SS2 Students in Biology in Bayelsa State

Highest Academic Qualification	Number of Teachers	MPAR ^x	Standard Error
Category A	5	25.74 ^a	7.28
Category B	24	28.94 ^{ab}	3.59
Category C	6	52.20 ^{bc}	11.70

Key:

MPAR = Mean Percentage Achievement Rate

Category A= NCE

Category B = HND/BSc/BSc(Ed.)

Category C = PGDE/MSc/MSc(Ed.)

^x Fields with the same letters in each column are not significantly different at 5% probability level; those with different letters are significantly different at 5% probability level

Analysis of the impact of academic qualifications of teachers on achievement rate in biology showed the percentage of students who scored a minimum of 7 questions correctly out of 14 (i.e. 50%) varied significantly ($P \leq 0.05$) among students taught by the different categories of teachers Whilst 25.74±7.28 percent of students taught by Category A (NCE holders) teachers, 28.94±3.59 percent and 52.20±11.70 percent of students taught by Category B (Higher National Diploma/Bachelor degree holders) and Category C (Postgraduate diploma/degree holders) respectively, scored a minimum of 50% in the Biology Achievement Test administered in this study.

Results further showed that the difference in impact on students achievement rate by Categories A and B teachers was not significant ($P \leq 0.05$) with respect to the percentage of students that had a minimum of 50% score from the BAT administered in this study. Similarly, the impact on students' achievement rate by Categories B and C teachers was also not significant at $P \leq 0.05$. However, teachers of Category C academic qualifications was observed to significantly impact students' achievement rate more than teachers of Category A academic qualification .

Research Question 4:

Do teachers' academic qualifications Category A (NCE/OND), Category B (HND/BSc/BSc(Ed), and Category C (PGDE/MSc(Ed.)/MSc/PhD) influence Biology achievement test score of senior secondary students' (SS2) attending public secondary schools in Bayelsa State?

Table 6: Comparative Impact of Teacher Academic Qualification on Biology Achievement Test Score of SS2 Students in Bayelsa State

Academic Qualification	Number of Teachers	Mean BAT Score ^x (Max. Score 14)	Standard Error
Category A	5	5.15 ^a	0.49
Category B	24	5.32 ^a	0.21
Category C	6	6.46 ^a	0.87

Key:

Category A = NCE

Category B = HND/BSc/BSc(Ed.)

Category C = PGDE/MSc/MSc(Ed.)

^x Fields with the same letters in each column are not significantly different at 5% probability level

Results from the survey showed that none of the teachers who taught biology to SS2 science students in any of the schools sampled had a PhD degree. The Category C teachers therefore included PGDE, MSc and MSc(Ed.). Consistent with the one way ANOVA results, separation of Mean BAT scores of students taught by teachers of Categories A, B and C academic qualifications were observed to be 5.15 ± 0.49 , 5.32 ± 0.21 and 6.46 ± 0.87 respectively out of a maximum of 14 marks. Means separation relying on Tukey's HSD showed no significant difference in academic impact between any two of the three categories studied in this research.

Research Question 5:

Does teachers' teaching experience influence the achievement rate of senior secondary school students (SS2) in biology in Bayelsa State?

Table 7: Comparative Impact of Teacher years of teaching experience on Achievement rate of SS2 Students in Biology in Bayelsa State

Years of teaching Experience	Number of Teachers	MPAR ^x	Standard Error
Category A	7	24.27 ^a	8.12
Category B	2	48.21 ^a	26.80
Category C	12	34.45 ^a	5.18
Category D	14	32.63 ^a	5.93

Key:

MPAR = Mean Percentage Achievement Rate

Category A = Less than or equal to 5 years

Category B = 6 - 10 years

Category C = 11 - 15 years

Category D = Greater than or equal to 16 years

^x Fields with the same letters in each column are not significantly different at 5% probability level

Teachers' years of teaching experience were grouped into four (4) different categories. These included Category A (≤ 5 years of experience); Category B (6-10 years of experience); Category C (11-15 years of experience) and Category D (≥ 16 years of experience). Results from the survey showed that the percentage of students who

scored a minimum of 7 out of 14 marks (50%) as influenced by teachers Categorized into A, B, C, and D categories of teaching experiences were 24.275 ± 8.12 , 48.21 ± 26.80 , 34.45 ± 5.18 and 32.63 ± 5.93 respectively. Means separation relying on Tukey's HSD showed no significant difference in academic impact between any two of the four categories of teachers' years of teaching experience studied in this research.

Research Question 6:

Does teachers' teaching experience influence the achievement test score in biology of senior secondary students' (SS2) attending public secondary schools in Bayelsa State?

Table 8: Comparative Impact of Teacher years of teaching experience on Biology Achievement Test Score of SS2 Students in Bayelsa State

Years of teaching Experience	Number of Teachers	Mean BAT Score ^x (Max. Score 14)	Standard Error
Category A	7	5.05 ^a	0.51
Category B	2	6.04 ^a	0.96
Category C	12	5.43 ^a	0.39
Category D	14	5.68 ^a	0.36

Key:

BAT = Biology Achievement Test

Category A = Less than or equal to 5 years

Category B = 6 - 10 years

Category C = 11 - 15 years

Category D = Greater than or equal to 16 years

^x Fields with the same letters in each column are not significantly different at 5% probability level

Results from the survey showed that mean Biology Achievement Test scores of students taught by teachers Categorized into A, B, C, and D categories of teaching experiences were 5.05 ± 0.51 , 6.04 ± 0.96 , 5.43 ± 0.39 and 5.68 ± 0.36 respectively out of a maximum of 14 marks. Results further showed that none of the four categories of teachers' years of teaching experience studied in this research significantly ($P \leq 0.05$) impacted more on students' academic achievement measured as mean Biology Achievement Test scores than any other category of teachers' years of teaching experience.

Test of Hypotheses

Ho1: There is no statistically significant difference in students' achievement rate in biology exam scores among senior secondary school (SS2) students in Bayelsa State taught by teachers of the different teacher educational routes

Table 9: One Way Analysis of Variance of impact of Teacher Qualification Route on Achievement on SS2 Students in Biology

Source of Variation	DF	Sum of Squares	Mean Square	F-Ratio	Level of Significance
Teacher Qualification Route	2	4332	2166**	6.4	0.01
Error	32	10832	339		
Total	34	15164			

** = Significant at the 0.01 probability level

Table 9 showed that the different routes of teacher qualification significantly, differently influenced the percentage of students who scored a minimum of 7 out of 14 marks (50%) which is equivalent to Credit Grade.

The level of significance was observed to be 1% probability. The Null's hypothesis that says there is no statistically significant difference in students' achievement rate in biology exam scores among senior secondary school (SS2) students in Bayelsa State taught by teachers of the different teacher educational routes is therefore

REJECTED.

Ho2: There is no statistically significant difference in achievement test score in biology among senior secondary school (SS2) students in Bayelsa State taught by teachers of the different teacher educational routes

Table 10: One Way Analysis of Variance of impact of Teacher Qualification Route on Biology Achievement Test Score of SS2 Students in Bayelsa State

Source of Variation	DF	Sum of Squares	Mean Square	F-Ratio	Level of Significance
Teacher Qualification Route	2	12.58	6.29*	4.30	0.02
Error	32	46.76	1.46		
Total	34	59.34			

* = Significant at 0.05 probability level

The results arising from the ANOVA show that teacher qualification route significantly ($P=0.02$) influenced mean score of students that participated in the Biology Achievement Test. Therefore the Null's hypothesis that says there is no statistically significant difference in achievement test score in biology among senior secondary school (SS2) students in Bayelsa State taught by teachers of the different teacher educational routes is **REJECTED**

Ho3: There is no statistically significant difference in achievement rate in biology among senior secondary school (SS2) students in Bayelsa State Public Schools taught by teachers with different teachers' academic qualification

Table 11: One Way Analysis of Variance of impact of Teachers' highest academic Qualification on Achievement rate of SS2 Students in Biology

Source of Variation	DF	Sum of Squares	Mean Square	F-Ratio	Level of Significance
Teacher Academic Qualification	2	2856	1428*	3.71	0.04
Error	32	12307	385		
Total	34	15164			

* = Significant at the 0.05 probability level

Table 11 showed that teachers' highest academic qualification significantly ($P=0.04$), differently influenced the percentage of students who scored a minimum of 7 out of 14 marks (50%), otherwise termed achievement rate in this study. The level of significance was observed to be <54% probability. The Null's hypothesis that says there is no statistically significant difference in achievement rate in biology exam scores among senior secondary school (SS2) students in Bayelsa State Public Schools taught by teachers with different teachers' academic qualification is **REJECTED**.

Ho4: There is no statistically significant difference in Biology achievement test score among senior secondary (SS2) school students in Bayelsa State Public Schools taught by teachers with different teachers' academic qualification

Table 12: One Way Analysis of Variance of impact of Teachers' highest academic Qualification on Biology Achievement Test Score of SS2 Students in Bayelsa State

Source of Variation	DF	Sum of Squares	Mean Square	F-Ratio	Level of Significance
Teacher Academic Qualification	2	6.90	3.45ns	2.11	0.14
Error	32	52.43	1.64		
Total	34	59.34			

ns = Non significant at the 0.05 probability level

Mean scores of science students administered with the Biology Achievement Test in the different public schools showed that on the overall teachers academic qualification did not significantly ($P \leq 0.05$) influence students' performance or achievement. Therefore the Null's hypothesis that says there is no statistically significant difference in Biology achievement test score among senior secondary (SS2) school students in Bayelsa State Public Schools taught by teachers with different teachers' academic qualification is **ACCEPTED**

Ho5: There is no statistically significant difference in achievement rate in biology exam scores among senior secondary school (SS2) students in Bayelsa State Public Schools taught by teachers with different years of teaching experience

Table 13: One Way Analysis of Variance of impact of Teachers' years of teaching Experience on Achievement rate of SS2 Students in Biology

Source of Variation	DF	Sum of Squares	Mean Square	F-Ratio	Level of Significance
Teachers' years of teaching Experience	3	1014	338ns	0.74	0.54
Error	31	14150	456		
Total	34	15164			

ns = Non significant at the 0.05 probability level

Table 13 showed that the four Categories (A-D) of teachers' years of teaching experience as part of teachers educational qualification did not significantly ($P=0.04$), differently influenced the percentage of students who scored a minimum of 7 out of 14 marks (50%), otherwise termed achievement rate in this study. The level of significance was observed to be 54% probability. The Null's hypothesis that says There is no statistically significant difference in achievement rate in biology exam scores among senior secondary school (SS2) students in Bayelsa State Public Schools taught by teachers with different years of teaching experience is therefore **ACCEPTED**.

Ho6: There is no statistically significant difference in Biology Achievement Test score among senior secondary school (SS2) students in Bayelsa State Public Schools taught by teachers with different years of teaching experience

Table 14: One Way Analysis of Variance of impact of Teachers' years of teaching Experience on Biology Achievement Test Score of SS2 Students in Bayelsa State

Source of Variation	DF	Sum of Squares	Mean Square	F-Ratio	Level of Significance
Teachers' years of teaching Experience	3	2.53	0.84ns	0.46	0.71
Error	31	56.81	1.83		
Total	34	59.34			

ns = Non significant at the 0.05 probability level

Similar to Ho5 one way ANOVA showed that the four Categories (A-D) of teachers' years of teaching experience as part of teachers educational qualification did not significantly ($P \leq 0.05$), differently influenced the mean Biology Achievement Test scores of students. The level of significance was observed to be $P = 0.71$. The Null's hypothesis that says there is no statistically significant difference in Biology Achievement Test score among senior secondary school (SS2) students in Bayelsa State Public Schools taught by teachers with different years of teaching experience is therefore **ACCEPTED**.

V. DISCUSSION OF FINDINGS

Findings showed that teachers trained through the alternate means of qualification were able to bring about better learning outcomes among biology students in SS2. Ballou *et al.* (1998) had contended that most alternate route teachers are just as effective as their traditionally prepared counterparts with regards to student achievement but findings on this work rather showed that the alternately qualified teachers were more effective than their traditionally prepared counterparts. Whilst the mean score for students taught by alternate teachers was 7.16, the mean score for students taught by traditionally and informally trained teachers were 5.28 and 5.24, respectively. Several earlier reports have shown that teacher qualifications are related to student learning in many countries, and assessing students' achievement have become targets of education reform in such countries (Aina *et al.*, 2015; Cochran-Smith *et al.*, 2017; Kola and Sunday, 2015; Zuzovsky, 2009). A number of researchers opined that the fundamental problem of the educational sector is inadequate teacher preparation programmes. (Darling-Hammond *et al.*, 2001; Darling-Hammond *et al.*, 2002).

Teacher qualification has been reported to include certification and teacher personal quality (Kola and Sunday, 2015; Stronge *et al.*, 2011). Accordingly, whilst both factors are considered to influence learning, some researchers are of then opinion that the learning outcome (students' achievement) could either be positive or negative majorly depending on "teacher personal" quality (Kola and Sunday, 2015; Stronge *et al.*, 2011). This position seemed to place squarely the bulk of blame or praise on the teacher's personal quality, but some researchers have also argued that it is not important to deliberate certification of a teacher at the expense of his or her personal quality (Kola and Sunday, 2015). Proponents of this view are of the considered opinion that a teacher who is deficient in good teaching strategy will always produce poor students, just as a teacher who is unable to motivate his/her student to learn would produce poor students

In view of the aforementioned informed positions of several researchers, one could deduce reasons why the impact of traditionally prepared teachers on students' achievement in this study was not significantly greater than the impact on same by informally prepared teachers, who by law should not even teach in a formal school. It could be that traditionally qualified biology teachers, being teachers with an education certificate do not have in-depth knowledge of the biology subject matter as much as those who undertook a bachelor's degree in biology or any of the Life Sciences. What such graduate (informal teachers) seemed to have lost in pedagogical skills regarding students' achievement they gained from depth of knowledge. On the other hand what biology education teachers (traditional teachers) gained in pedagogy over their informal counterpart, they lost for lack of in-depth knowledge in subject matter in relation to non education biology graduates turned teachers. This further strengthens the widely held opinion of several workers who had noted the equal importance of in-depth knowledge in both subject matter content and pedagogical skills (Darling-Hammond 1998).

This probably explains why the alternately qualified teachers, as described in this work, impacted more on the students' academic achievement in biology. Alternately prepared teachers described in this work are people who graduated with a non education bachelor's degree in biology or related Life Science and then proceeds to acquire pedagogical skills in a Postgraduate diploma programme in education. That way they had both in-depth knowledge of subject matter and adequate pedagogical skills to impact students' learning, performance and achievement. This possibly explains why alternately prepared teachers had significantly ($P \leq 0.05$) greater impact on students academic achievement in biology than traditionally or informally prepared teachers. Findings in Table 6 showed that students taught by teachers of Category C qualification significantly impacted on students' achievement rate in biology than those taught by Category A, the difference in impact between Category C and B teachers were not significant at $P \leq 0.05$.

Findings in this regard were similar to those reported by Huang and Moon, (2009). These workers had earlier on showed that more students taught by teachers with higher academic qualifications passed biology when compared to the number of students taught by teachers with lower academic qualifications. Explaining further, Huang and Moon, (2009) reiterated that teacher qualification accounted for as much as 40 to 60 percent of the variance in average of students' achievement in assessment. Several works have shown that students in urban cities often performed better than those in rural settings (Richardson 2008). Reason for this has been adduced to the availability of enough qualified teachers in urban areas as compared to rural towns and villages.

It is pertinent to mention that findings related to teachers' academic degrees (for example; bachelors or masters among others) are inconclusive. Whilst some workers observed positive effects of advanced degrees, some other did not (Kosgei *et al.*, 2013; Rice; Wayne and Youngs, 2003).

Findings of this work showed that SS2 students' academic achievement in biology was not significantly, differentially influenced by teachers' teaching experience. These findings are at variance with the submissions of several earlier workers. Teacher quality, often measured in terms of years of experience and subject matter certification, has been noted to affect learning within the classroom, and also influences future student learning (Helk, 2007; Zuzovsky, 2009). Several reports show that students taught by more experienced teachers tend to achieve more than those taught by less experienced ones. Reasons advanced for this finding are based on the apparent fact that teachers, over the years, tend to master the content of subjects they teach and also acquire classroom management skills to deal with different types of classroom problems (Gibbons *et al.*, 1997). Besides, experienced teachers are able to differentiate the vital factors from the not so important ones, and are considered to be more able to dwell on the most appropriate way to teach particular topics to students who differ in their abilities, prior knowledge and backgrounds (Stringfield and Teddlie, 1991).

The demographic survey findings of this study showed that over 74% of the teachers in the study already had over 10 years teaching experiences, meaning that the majority of teachers involved in teaching SS2 students biology are experienced. This possibly explains why the relatively expected impact of teachers' experience on students' achievement was not seen in this work. These findings apparently show that biology teachers have not been recruited in our secondary schools in the recent past in secondary schools in Bayelsa State.

VI. RECOMMENDATIONS

1. Results also showed that teachers with higher academic qualifications made greater impact on the academic achievement of students in biology. This simply boils down to training and acquisition of knowledge. It is therefore, herein recommended that Government and drivers of the secondary school system in particular, and the educational subsector in general, should as a matter of policy ensure that teachers are regularly trained to acquire relevant knowledge and skills.

2. Very importantly, results showed that alternately prepared teachers significantly impacted students' academic achievement than other categories of teachers, including traditionally qualified teachers. Based on this finding, it is recommended that the educational policy be revised such that traditionally trained education graduates, in addition to acquisition of pedagogical skills, would have an appreciable depth of knowledge in their subject areas commensurate to their non education counterpart.

3. Flowing from the above recommendation, the undergraduate education programme in Nigeria should be extended to Five (5) years culminating at a conferment of a Masters degree. The first 4 years should be devoted to subject area in the appropriate Faculties and departments where such subjects/disciplines are domiciled, and such programme should lead to a bachelor's degree. Thereafter, graduates with a bachelor's degree can then proceed to acquire pedagogical skills in Faculty of Education in relevant Institutions.

4. Consequent upon the above recommendation, this study also recommends that the start salary scale of teachers should be Grade level 09 when recommendation No. 3 is implemented.

VII. CONCLUSION

Impact of teachers' educational qualification on students' academic success in schools cannot be overemphasized. Therefore, the need for teachers' training and retraining on a regular basis supported by good welfare package to improve the quality of teachers in our educational system.

VIII. ACKNOWLEDGEMENTS

The Authors are grateful to the Bayelsa State Science and Technical Education Board for funding this research.

REFERENCES

- [1]. Abimbola, I. O. (2013). The one hundred and twenty-third (123rd) inaugural lecture: The misunderstood word in science: Towards a technology of perfect
- [2]. Achoka, J. S. K., Odebero, S., Maiyo, J. K. and Mualuko, N. J. (2007). Access to Basic Education in Kenya: Inherent Concerns. *Educational Research and Review*. 2
- [3]. Adediwura, A. A. and Tayo, T. (2007). Perceptions of Teacher Knowledge, Attitude and Teaching Skills as Predictor of Academic Performance in Nigerian. *Educational Research and Review*. 2(7): 165-17
- [4]. Adeyemo, D. A. (2010). Educational transition and emotional intelligence, moving stories around the world. In: (ed) Jindal-Snape, *Educational Transitions Moving Stories from Around the World* pp.33-47.
- [5]. Ahmad, S. I., Abubakar, B. B. and Yau, S. (2018). Biology Education a Panacea for Sustainable National Development. *Frontiers in Environmental Microbiology*. 4(2): 71-74
- [6]. Aina, J. K., Olanipekun, S. S. and Garuba, I. A. (2015). Teachers' effectiveness and its influence on student learning. *Advances in Social Sciences Research Journal*. 2(4)-88-95

- [7]. Akanji, C., Bababunmi, K., and Bewaji, N. (2003). Using new technology in creating excitement in Biology laboratory activities. *Educational Research and Review*. 3(10): 11-15
- [8]. Akindutire, I.O. and Ekundayo, H.T. (2012). Teacher education in a democratic Nigeria: Challenges and the way forward. *Educational Research*. 3(5): 429-435
- [9]. Akinfe, E., Olofinniyi, O. E. and Fashiku, C. O. (2012). Teachers' Quality as Correlates of Students Academic Performance in Biology in Senior Secondary Schools of Ondo State, Nigeria. *Online Journal of Education Research*. 1(6): 108-114
- [10]. Ali, A. R., Toriman, M. E. and Gasim, M. B. (2014). Academic Achievement in Biology with Suggested Solutions in Selected Secondary Schools in Kano State, Nigeria. *International Journal of Education and Research*. 2(11): 215-224
- [11]. Anyiin, T. J. (1998). *Examination Malpractice in Benue State Schools: The Way Forward*. Seminar paper by the Cultism Committee, Makurdi, 1998
- [12]. Araoye, M. I. (2016). Biology education and national productivity: implication for transforming Nigerian educational system. *International Journal of Advanced Academic Research*. 2 (7): 1-6
- [13]. Ballou, D. and Podgursky, M. (2000). Reforming teacher preparation and licensing: What is the evidence? *Teacher College Records*. 102(1): 5-22.
- [14]. Beach, D. M. and Littleton, M. (1991). Staffing secondary schools. *A successful alternative*. *Clearing House*, 65(1): 29-34.
- [15]. Boit, M., Njoki, A. and Chang'ach, J. K. (2012). The Influence of Examinations on the Stated Curriculum Goals. *American International Journal of Contemporary Research*, 2(2): 179-182
- [16]. Boyi, A. A. (2013). Education and Sustainable National Development in Nigeria: Challenges and Way Forward. *Mediterranean Journal of Social Sciences*. 4 (8): 147- 152
- [17]. Cochran-Smith, M., Baker, M., Burton, S., Chang, W., Carney, M. C., Fernández, M. B., Keefe,
- [18]. Darling-Hammond, L. (1998). Teachers and teaching: Testing hypotheses from a national commission report. *Educational Researcher*. 27(1): 5-15.
- [19]. Darling-Hammond, L. (1999). Teacher quality and student achievement: A review of state policy evidence (Research Report R-99-1). Washington DC: Center for the Study of Teaching and Policy, University of Washington.
- [20]. Darling-Hammond, L. (2000a). Teacher quality and student achievement: A review of state policy evidence. *Education Policy Analysis Archives*, 8(1): 1-44
- [21]. Darling-Hammond, L., Berry, B. and Thoreson, A. (2001). Does teacher certification matter? Evaluating the evidence. *Educational Evaluation and Policy Analysis*. 23(1): 57-77
- [22]. Darling-Hammond, L., Chung, R. and Frelow, F. (2002). Variation in teacher preparation: How well do different pathways prepare teachers to teach? *Journal of Teacher Education*. 53(4): 286-302
- [23]. Daworiye, P. S., Alagoa, K. J., Enaregha, E. and Eremasi, Y. B. (2015). Factors Affecting the Teaching and Learning of Biology in Kolokuma/Opokuma Local Government Area, Bayelsa State, Nigeria. *International Journal of Current Research in Biosciences and Plant Biology*. 2(4): 151-156
- [24]. Eshiet, I.T. (1991). Science Education in Nigeria Schools. A paper delivered at the National School Curriculum Reviell Conference Proceedings. 2nd -6th September Federal Ministry of Education, Lagos.
- [25]. Feistritzer, C.E. (2007). Profile of alternate route teachers. Washington, D.C.; National Center for Education Information. Retrieved from <http://www.ncei.com/PART.pdf>
- [26]. Federal Government of Nigeria (2014) *Nigeria National Policy on Education* (Revised edition) Lagos: Federal Government Press.
- [27]. Gibbons, S., Kimmel, H. and O'Shea, M. (1997). Changing Teacher Behaviour through Staff Development: Implementing the Teaching and Content Standards in Science School Science and Mathematics; 976 (1):302-340.
- [28]. Grejson, S. (2013). Nature of Science; The complex interaction of systems of biological molecules. *International Journal of Science Education* 41(2): 411-422.
- [29]. Hamilton-Ekeke, J. (2013). Conceptual framework of teachers' competence in relation to students' academic achievement. *International Journal of Networks and Systems*, 2(3): 15-20
- [30]. Hanushek, E. A. (2011). The economic value of higher teacher quality. *Economics of Education Review* 30(3): 466-479.
- [31]. Helk, R.H. (2007). Examining the Relationship between Teacher Quality as an Organizational Property of Schools and Students' Achievement and Growth Rates. *Educational Administration Quarterly*. 43(4): 399-432.
- [32]. Humphey, D., Wechsler, M and Hough, H. (2008). Characteristics of effective alternate teacher certification programs. *Teachers College Board*, 110(4): 1-3.
- [33]. Kola, A. J. (2013). Importance of Science Education to National Development and Problems Militating Against Its Development. *American Journal of Educational Research*. 1(7): 225-229

- [34]. Kola, A. J. and Sunday, O. S. (2015). A Review of Teachers' Qualifications and Its Implication on Students' Academic Achievement in Nigerian Schools. *International Journal of Educational Research and Information Science*. 2(2): 10-15
- [35]. Kosgei, A., Mise, J. K., Odera, O and Ayugi, M. E. (2013). Influence of teacher characteristics on students' academic achievement among secondary schools. *Journal of Education and Practice*. 4(3): 76-82
- [36]. Moss, P. L (2012). Teacher Certification and Student Achievement. Thesis submitted to the University of Southern Mississippi in partial fulfillment of the requirements for the award of Doctor of Philosophy Degree
- [37]. National Commission on Teaching and America's Future (NCTAF). (1996). What matters most: Teaching for America's future. New York: Author.
- [38]. Nwagbo, C.R. (2005) Attainment of Professionalism in Science Education: Competencies and Skills needed by Biology Teachers. 46th Annual Proceeding of Science Teachers Association of Nigeria PP 183-189.
- [39]. Obomanu, B. J. and Akporehwe, J. (2011). Resources for Teaching Secondary School Biology In Bayelsa State of Nigeria. *Information and Knowledge Management*. 1 (2): 28-35
- [40]. Ojebiyi, A. A. and Fasakin, L. S. (2014). An Historical Survey of the Development of Science and Technology Education in Nigeria. *Academic Journal of Interdisciplinary Studies MC SER Publishing, Rome-Italy*. 3 (6): 285-294
- [41]. Okenyi, C. I. (2013). The challenges and prospects of biology education in Nigeria. *Journal of Assertiveness*, pp 1-9.
- [42]. Okenyi, C.I. (2012). Science and Technology Education for Entrepreneurship Development, Proceeding of the 7th National Conference of Schools of Sciences FCEE PP. 15-19.
- [43]. Oniye, O.A. and Alawaye, S.A (2008). Female Students Perceived Causes of and Solution to Examination Malpractice in Asa Local Government: Implication for Counseling. *Sokoto Educational Review* 10(2), June 2008.
- [44]. Ruthland, S. K. and Bremer, C. D (2002). Alternative Teacher Certification Procedures and Professional Development Opportunities for Career and Technical Education Teachers' Washington D.C.: ERIC Clearinghouse on Teacher Education
- [45]. Soyibo, K and Ezeiroma, C. O. (1987). Influence of teaching equipment and teacher supply on the school certificate biology results of fourteen schools in Anambra State, 1982, 1984. *International Journal of Educational Research* 1(1): 56-66.
- [46]. Stringfield, S. and Teddlie, C. (1991). School, Classroom and students' Level Indicators of Rural School Effectiveness. *A Journal of Research in Rural Education*. 7(1):15-28.
- [47]. Stronge, J. H., Ward, T. J and Grant, L. W. (2011). What Makes Good Teachers Good? A Cross-
- [48]. Case Analysis of the Connection between Teacher Effectiveness and Student Achievement. *Journal of Teacher Education*. 62(4): 339-355.
- [49]. Tahir, G. (2006). Federal Government Intervention in U.B. E. Form 1(1) 1-12 Kaduna, Nigeria.
- [50]. Teng, P.S. (2012). Linking Education to Socially Relevant Bioentrepreneurship for Sustainable Education. In: Mijung, K and Diong, C.H. (eds) *Biology Education for Social and Sustainable Development*: 5-18. Sense Publishers
- [51]. TRCN (2004). *Teacher's Registration Council of Nigeria* (2004). Teachers code of conduct. Kano: TRCN.
- [52]. Umar, H. M., Fugu, Y. A and Aliyu, H. M (2018). Prediction of Academic Performances in Biology Among Public Senior Secondary School Students in Kwara state, Nigeria. *International Journal of Education and Research*. 6(12): 79-90
- [53]. UNESCO (2000). Nigerian Human Resource Development and civilization: Education and world Affairs, New York.
- [54]. Wayne, J. and Youngs, P. (2003). Teacher characteristics and student achievement gains:
- [55]. A review. *Review of Educational Research*, 73(1): 89-122.
- [56]. Yahaya, J. L. (2017). Biology Education as a tool for Achieving Sustainable Development and Sustainability. Being a paper presented at 2nd National science education conference held at Saadatu Rimi College of Education, Kumbotso, Kano, on 31st October-3rd.
- [57]. Zuelke, L. A. (2008). Relationships among science teacher qualifications, Instructional practices, and student science achievement. Thesis submitted to the University of Florida in partial fulfillment of the requirements for the award of Doctor of Philosophy Degree
- [58]. Zuzovsky, R. (2009). Teachers' qualifications and their impact on students' achievement findings from TIMSS-2003 data in Israel. IERI Monograph Series: *Issues and Methodologies in large scale Assessment*. 2: 37-62.