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Research Article

Enhancing Students Academic Achievement in Basic Science in Public Secondary Schools: The Contributions of Teachers Academic Qualification and Subject Specialization

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Abstract: The study investigated the contributions of Teachers' variables- qualification and subject specialization, to the academic achievement of students in basic science in selected secondary schools. The population of the study comprised all the students and all the science teachers from all the public secondary schools. A sample of 200 students and 100 teachers was selected from the population, using the proportionate stratified random sampling techniques. Two research questions were raised to guide the study, while two null hypotheses were formulated and tested at 0.05 levels of significances. The study used two validated instruments to collect data. The mean and standard deviation were used to answer the research questions while the null hypotheses were tested using ANOVA. The findings revealed that: teachers' higher academic qualification significantly influenced students' achievement; teachers' subject major significantly contributed to students achievement in basic science; the findings also revealed no significant difference in the mean achievement scores of students taught by teachers with different educational qualifications, The study shows both positive and negative effects of interaction of teacher background variables on students 'academic achievement. Based on the findings, it was recommended that employment of basic science teachers should be based on qualification and subject specialization, basic science teacher should be encouraged by government to attend professional training regularly, and Government agencies saddled with the recruitment of teachers should step up recruitment efforts by hiring teachers who have high academic qualification so that students' academic achievement and interest can be sustained.

Keywords: Student, Academic achievement, Basic science, Secondary school teacher, qualification, subject major or specialization.

INTRODUCTION

Students' achievement in the sciences may be contingent upon an array of the complex interplay of many factors which hitherto are contributing to the various degrees of students' academic outcomes. Some of these envisaged factors perceived to have contributed to the student's successes either positively or negatively include the factors related to teachers, the students and parental factors. However, the paper strictly focused on two variables that are related to teachers' factors, which contributes to students' academic achievement. Teachers' factors as used here refer to teachers' qualification, teaching experience, teachers' subject specialization, and teachers' classroom behavior. It was in the light of the importance of teachers in the students' academic journey that Gbore [1], explained that the predominance of teachers without the prerequisite qualification are teaching in our schools is one of the major reason for the endemic poor academic achievement of students in the sciences. The author further explained that the unqualified teachers may be possibly among those handling our students in our secondary schools especially in basic science that serves as the foundation for higher science and technology specializations. This conjecture is hinged on the premise that the science teacher is very significant and has important role in the teaching learning processes [2]. The teacher indeed occupies the center circle of the teaching and learning activities at any level of education because the teacher is the implementer of the curriculum and at the same time one that guides the students to achieve the set out objectives. The significance of teachers therefore, in the students' academic progress is displayed as teachers determine to a significant level the students achievement and as well as creating and sustaining students interest in the subject. Okah [3] also indicated in her study that the influence of a teacher whether bad or good is cumulative; that is, building up and having an indelible, and measurable effects on students' academic achievement in either positively or negatively. According to them, this may be one of the reasons for the differences in the academic achievement levels observed amongst students in secondary schools in the present time. Wright, Horn and Sanders [4] in their study confirmed that the factor most influencing student learning has been the teacher, because the teacher is the one that interfaces with the students in the classroom as

he transmits knowledge, values and skills in the teaching and learning processes. Therefore, given the importance of teacher in the teaching learning process, it will be impossible to achieve the aforementioned, if the teachers are ineffective and lack the credentials. There is the tendency that students under an ineffective teachers' tutelage may be victims of their academic endevour notwithstanding, the differences in students' potentials, SES, background and academic abilities. Rivkin, Hanushek and Kain [5] noted that there has never been any conclusion on the specific teacher's variables that actually determine students' academic achievement. Although few researches reviewed so far have revealed that teachers' background variables; Teacher's Sex, Educational qualification and Teaching Experience are strong predictors of students' achievement. Akiri and Ugbonugbo [6] also provided a clear evidence of a significant relationship between teachers' sex and academic achievement of students. Yala and Wanjohi [7] on the other hand, found that teaching experience and the educational qualification a teacher has is the greatest predictors of academic success. These varied and conflicting findings are not enough to draw conclusion on the impact of teachers' qualification on students' achievement.

Teacher's academic qualification in this work means the measure of educational level of the teacher while in the teaching profession. It refers to the highest qualification obtained by any teacher in his/her subject of specialization before he/she was employed. Different countries or nations classify their educational qualification differently. However, in the Nigerian context, and for the purpose of this paper, educational qualifications are classified into the following order, Diploma in Education, Certificate, that is, the Nigeria Certificate in Education (NCE); Postgraduate Diploma in Education (PGDE), Bachelors,(B.Sc, BA, B.Sc.Ed, BA,Ed, B. Ed), Master,(M.Sc, MA, M.Ed, M,PHIL) and Doctoral Degree.(Ph.D). These qualifications make a teacher at whatever level of education to be both a professional and a trained teacher. There is the believe that the qualification a teacher acquires has noticeable influence on how a teacher engages in the teaching as well as influences achievement of the students he/she handles. There is a Plethora of literature of how teacher's academic qualification influences the academic achievement of student in the school particularly those at the secondary school level [8, 3]. Many of the literature showed that teachers' qualification has positive relationship with students' achievement. For instance, Betts, Zau and Rice [9] found that teacher's highest degree has a positive relationship with student's academic achievement in the sciences. Also, he further showed a significant relationship between teachers' qualifications and students' achievement especially when a teacher acquires an advanced degree in his/her teaching subject. In other words, the teacher's level of education promotes tremendously the students' achievement. Zhang [10] also corroborated the former and posited a positive relationship between teachers' degrees or academic qualification and student's achievement in mathematics and science. The implication of the above assertion was that teacher academic qualification is a predictor of students' achievement. That is, if any teacher acquires a degree in the subject he /she teaches, the academic achievement of students is likely to improve Furthermore, they revealed that the level of students achievement differ significantly with teachers level of educational attainment. Students taught by teachers who have bachelors or master's degree in the field had better achievement than those students whose teachers' educational level were lower. In a similar study conducted by Adodo [11] and that of Ibukun [12]. They argued that one important and overriding factor for the success of students achievement is the teacher. They said that a good teacher is one who is exposed to good pedagogical and professional training in the area of his subject specialization. The teacher is the epicenter for all the activities in the classroom. Therefore, the qualification of the teacher is essential to the teacher quality, in addition to other affective traits such as attitude, self-efficacy and experiences. They concluded that teachers' academic qualification positively correlates with students' achievement in mathematics and science respectively, thus corroborating the earlier finding. Wenglinsky [13] showed that teachers' educational level and experience are only proxies of teacher knowledge and skills about how to teach effectively. In other words, such background teacher characteristics will influence their behavior which could in turn affect student achievement either positively or otherwise.

In assessing the aforementioned teachers' factors, Doselt and Munoz [14] categorized the teachers' factors that have been shown to have promoted or enhanced student's achievement in the sciences into three major categories: i) school related factors or variables, 2) students-related factors and (3) teacher-related factors. Consequently, of the three, Goldhaber [15] found that teachers characteristics such as teachers qualification, experience, subject specialization, sex, self- efficacy and attitude were some of the teachers factors that influenced or promote students achievement in the sciences, Zhang [10] in a follow up study, analyzed the teacher educational level as one aspect of the teacher factors which either enhances or reduces the academic achievement of students in sciences. He again found that an advanced degree in science or science education was an advantage and significantly impacts students' science achievement positively when better teaching behaviour such as good attitudes, positive self- efficacy and interest are effectively utilized. Although, the

relationship makes intuitive sense that more highly educated teachers were found to indeed be more successful teachers in terms of students' achievement in science, such findings are contradicting the previous studies of Adodo and Goldhaber. Also, it might not really be the case in the present study. It is against this backdrop therefore, this paper takes a closer look at few of those teachers' factors with a view to understanding their possible impact on students' academic achievement in basic science.

Several factors have been identified for example; Agyeman [16] reported that a teacher who does not possess both the academic and the professional teaching qualifications would undoubtedly not be able to impact the teaching and learning of his subject significantly. Consequently, it is expedient that teachers background characteristics and their influence be fully examine to establish the individual contributions of these variables. Although in this study the aim is to examine only two (teachers' qualification and teachers subject specialization) characteristics of the teacher on students academic achievement

Teacher Qualification

Great teachers are determined in terms of the impact they create in students' academic progress, and achievement projectiles. Again how they boost and sustain the students' interest in the subject and learning. The degree and extant qualification a teacher has while in job is believed to have very reasonable contribution to students' academic activities. However, its impact and contributions have not been fully established. Consequently, different studies have been carried out to ascertain the contributions of this teachers' characteristic on the overall process of the students' academic progress. Koledeye [17] studied the impact of teachers' qualification on students' achievement and found that teachers with higher academic qualification have more knowledge of the subject matter, competences and skills for teaching the subject and would consequently enhance students' achievement. He therefore, concluded that teachers with higher academic degree in the areas of specializations would likely have more impact on the teaching learning process and would enhance the students' achievement positively than those with lower degree and or with those that did not specialized in the subject discipline. Goldhaber and Brewer, in Zeudu and Utaazi [18] reported that highly qualified teachers make more impact in the teaching-learning process than those with less qualification. Corroborating the above, Okah [3] Joseph & Ikechukwu [8] found similar situation where teachers with higher or advanced degree produced higher scores compared to those with less qualification in basic science.

Teacher years of teaching experience and teacher educational qualification are rated [7, 19] as the major teachers' factors or predictors of student's academic achievement. The findings of the above proponent revealed a positive relationship between student's academic achievement and teachers' higher qualification in mathematics and sciences. These findings was consistent with the findings of Nwachukwu [20] who also revealed that teachers' qualification and area of specialization are essential to students' achievement in basic science. Greenwald, Hedges and Lain [21] also found a significant and positive relationship between teacher qualification and students achievement in the sciences. While Gbore [1] also found a high and significant relationship between teachers qualification and students outcome. Abraham [22] reported that the teacher qualifications and experiences are the requisites for students' high academic achievements and implies that the teacher main role in the preparation of students to succeed academically is crucial and cannot be overlooked, hence would require higher degree of the knowledge of the subject. Consequently, Usman [2] argued that shortage of qualified teachers may be responsible for the observed poor academic achievement among students in the sciences. The findings of Ademulegon, as cited by Gbore [1] supported the previous findings that students taught by more qualified and experienced teachers who major in the teaching subject do better than students taught by the teachers who are less qualified. Adepoju [23] found a significant relationship between teacher variables (teacher qualification, experience, and subjects' specialization) and academic achievement of students in sciences. Other findings that supported the above stance include Wenglinsky [13] and Greenberg [24] they found that having a higher degree or qualification does not significantly influenced the students achievement. Also, the findings of, Okah [3] that students taught by a teacher with a master or other higher degree does not produce better achievement than those students taught by teachers with low qualifications. Despite the conflicting findings of the previous researches, it is likely that teachers' qualifications have a significant influence on the academic achievement of students in science in secondary schools. Thus, this research was designed to investigate whether teachers' academic qualification significantly influences students' achievement and contributes to the students' interest in science. This current study therefore, aims at further investigating the impact of these teachers' variables, on students' overall academic progress in Basic science.

On the contrary, Ajewole [20] Joseph and Ikechi [8] did not completely agree with the assertion made above. According to them, teachers higher decree does not in any way promote the achievement of students in science. In a recent study carried out by Joseph [8].The finding revealed that NCE holders in subject areas influenced the student's achievement than

those who holds higher degrees and therefore invalidates the earlier findings. The reason, according to the finding may be due to the extra responsibilities administratively saddled on those with the higher qualification and having higher experience which makes them have more duties.

Teacher subject specialization

Teachers' knowledge about the subject he/she teaches propels interest both in the teacher and the students as well as yields positive results in terms of students' academic achievement. The students would benefit from the wealth of knowledge the teacher has and built from it a good schema to develop mastery in the students. How has teachers subject specialization enhances students' academic achievement has been the concern of many researchers and educators.

To better understand the role of teachers' subjects' specialization in the academic achievement of students in the school, Thomas and Raechelle [25] investigated the impact of teacher's subject major on students' achievement and found that Subject specialization has a serious link with academic achievement of students in schools. This position has been acknowledged by prominent education groups such as the Education Trust, the Education Leaders Council, and the National Commission on Teaching and America's Future Also, Esu [26] asserted that one of the competences teachers needed for effective teaching in schools is a deep knowledge of the subject matter. Similarly, Okah [3] carried out a study on teachers' effectiveness and students' achievement in tertiary institutions. The result revealed that students who perceived that teacher deep knowledge in their subject matter enhances learning better than students who did not believe in teachers' deep knowledge which also confirmed the of the study of Isangedigbi 2007 who maintained that a competent teacher needs to be grounded in the subject matter or specialization if he/she must put up a good performance and enhance students' achievements in the subject.

Effective instruction requires skills and knowledge for teachers to be able to perform well and actively transmits the right knowledge to the students under him/her. Several researches supported the idea that teacher understanding of content knowledge is important. They need not just the pedagogical knowledge but more of the content knowledge because it makes the teacher to have command of the subject as well as command mastery or expertise in the field. Teachers with stronger content knowledge are more effective and may likely teach in ways that will promote students understanding, construct knowledge, asking appropriate questions, suggest alternative explanations and propose additional inquiries [27].

A competent teacher is one qualified in a given field or area of specialization and such a teacher understands the central concepts, methodology and the subject matter which helps the teacher to handle the subject with an advanced level of knowledge and improves the students learning and academic achievement in the subject Also, Kalodoye [7] found that English language teachers who have Master degree in the field with teaching qualification do excellently better than their counterparts without a higher qualification or degree. He concluded that a teacher knowledge about the subject affects their teaching competences and improve their attitude thus improves students' achievements. Although, this finding was not in the sciences, neither was it the teaching subject, basic science or the area where the current study was carried out. Although, it happened in the various locations where the previous studies where carried out may not have the same characteristics and as such the effect of these teachers' factors may not yield the same result, but it is convenient to extrapolate, the situation may be the same in the sciences. On the contrary, Abioye [7] asserted that area of discipline or specialization does not have a positive relationship with the academic achievement of students in physics. With these literatures reviewed so far, it is clear that no adequate research has been carried out in the study area; therefore, this current study is necessary in order to clearly understand the role of teachers' qualification and teachers' subject major on the overall academic activities of students in basic science in secondary schools. In the light of this conflicting background, the current study was raised to ascertain the contributions of teachers' qualification and subject specialization on students' academic achievement in basic science in secondary schools.

Research Questions

1 Is there any difference in the mean achievement scores of students taught by teachers with different educational qualifications in Basic science
2 Is there any difference in the mean achievement scores of students taught by teachers with different subject specializations in basic science?

HYPOTHESES

Ho_1: There is no significant difference in the mean achievement scores of students taught by teachers with different qualifications.

Ho_2 There is no significant difference in the mean achievement scores of students taught by teachers with different subject specializations

METHODOLOGY

The study adopted an ex-post facto research design and was guided by three (3) research questions

and three null hypotheses were formulated and tested at 0.05level of significance. The population for the study consisted of all the students and Basic Science teachers in the junior section (UBE) public secondary schools in Rivers State. Rivers State has 278 secondary schools, 100,533 students and 5019 teachers. The sample for the study consisted of six hundred (600) Basic Science students and one hundred (100) Basic science teachers from junior secondary section (UBE) selected through stratified random sampling technique. The research instruments use for collection of data in this study. Was Teacher Background and Professional Training Questionnaire (TBPTQ), adopted from the one the author prepared and validated. The data collected were analyzed using appropriate statistics. The mean and standard deviation were used to answer the research questions while t-test statistics was used to test the null hypotheses

RESULTS AND DISCUSSIIONS

Research question 1: Is there any difference in the mean achievement scores of students taught by teachers with different educational qualifications in basic science?

Table-1: The difference in the mean achievement scores of students taught by teachers with different educational qualifications in basic science

Teacher qualification	Mean and SD	Academic Achievement
Certificate	Mean	60.08
	N	12.00
	SD	16.14
Bachelor	Mean	58.13
	N	68.00
	SD	17.64
Master degree	Mean	57.41
	N	17.00
	SD	12.99
PhD	Mean	55.00
	N	3.00
	SD	12.12

Table 1 shows the difference in the mean achievement scores of students taught by teachers with different educational qualifications in basic science. The table revealed that the mean achievement score of students whose teachers hold certificate is 60.08, SD=16.14. The mean achievement score of students whose teacher holds bachelor degree was 58.13, SD=17.74. The mean achievement score of students taught by teachers holding Master's degree was 57.41, SD=12.99. The mean achievement score of students taught by teachers holding PhD was 55.00, SD=12.12.

H_{01}: There is no significant difference in the mean achievement scores of students taught by teachers with different educational qualifications in Basic Science.

Table-2: Summary of ANOVA on the difference in the mean achievement scores of students taught by teachers with different educational qualifications in Basic Science

Variable	Source of variation	Sum of Squares	Df	Mean Square	F	Sig.	Eta	Eta Squared
Academic achievement	Between Groups	83.907	3	27.969	.101	.960	.056	.003
	Within Groups	26706.843	96	278.196				
	Total	26790.750	99					

Table 2 shows the summary of ANOVA on the difference in the mean achievement sscores of students taught by teachers with different educational qualifications in basic science. It shows that there is no significant difference in the mean achievement (F3, 96=.101, p=.960, partial eta squared =.003) scores of student taught by teachers with different educational qualifications in basic science. The null hypothesis one, there is no significant difference in the mean achievement scores of student taught by teachers with different educational qualifications in Basic Science was retained at .05 alpha levels.

Research question 2: Is there any difference in the mean achievement scores of students taught by teachers with different subject specializations in basic science?

Table-3: The difference in the mean achievement scores of students taught by teachers with different subject specializations in Basic Science

Teachers Subject Specialization		Academic performance
Agric Science	Mean	56.54
	N	41.00
	SD	17.20
Integrated Science	Mean	67.50
	N	16.00
	SD	15.46
Biology	Mean	59.96
	N	24.00
	SD	15.02
Physics	Mean	56.00
	N	7.00
	SD	13.75
Chemistry	Mean	48.83
	N	12.00
	SD	14.73

Table 3 shows that the mean achievement scores of student differ according to teachers' subject major. The mean achievement scores for students whose teachers specialized in Agricultural science was (56.54, SD=17.20). The mean achievement scores of students taught by teachers who major in Integrated science achievement mean score was 67.50, SD=15.46. For biology major, students mean achievement score 59.96 SD=15.02. The mean achievement scores of students taught by teachers who major in Physics was 56.00, SD=13.75. For Chemistry major, students mean achievement score was 48.83 SD=14.73

H_{02}: There is no significant difference in the mean achievement scores of students taught by teachers with different subject specializations in Basic Science.

Table-4: Summary of t-test on the difference in the mean achievement scores of students taught by teachers with different subject specializations in Basic Science

		Sum of Squares	Df	Mean Square	F	Sig.
Science students Interest	Between Groups	99.781	4	24.945	.255	.906
	Within Groups	9280.969	95	97.694		
	Total	9380.750	99			
Academic Achievement	Between Groups	2657.930	4	664.482	2.616	.040
	Within Groups	24132.820	95	254.030		
	Total	26790.750	99			

Table 4 shows the summary of ANOVA on the difference in the mean achievement scores of students taught by teachers with subject specialization in basic science. It shows that, there is a significant difference in the mean achievement score (F4, 95=2.616, p=.040) of student taught by teachers with different subject specialization in basic science. The null hypothesis three, there is no significant difference in the mean achievement scores of students taught by teachers with different subject specializations in Basic Science was rejected at .05 alpha levels over achievement.

DISCUSSION

There was an interesting result revealed by the study. The two teachers' characteristics under review in this article showed very intriguing findings. On students' academic achievement the results showed that the Students taught by teachers with higher qualification performed better than those taught by teachers with lower qualification. From table 6 the higher mean score of students was (75.88, SD = 7.58) indicating that students better achievement was due to the teachers qualification. In addition, the Analysis of Variance in Table 2 shows no significant different in the mean scores of students based on teachers qualification. The study therefore indicated that teachers' qualification enhances students' academic achievement and a predictor of academic achievement of students. The findings of the study was consistent with the findings of Betts, Zau and Rice [9] and Rice [9] Joseph and Ikechukwu [8], Ye, [28] who found that teachers advanced degree or qualification does influenced students' academic achievement no matter what the subject discipline was, in science. However, the results of the descriptive statistics on table 3 showed that 12 percent of teachers had lower qualification while 88 percent of teachers had higher qualifications. The

result in table 1 clearly showed that the students mean scores were higher with lower qualification, for instance, students taught by teachers whose highest qualification was NCE had better mean scores than even those students whose teachers had higher qualification (Bachelor,68; Master,57; and PhD, 55). The result is still a puzzle, perhaps due to the presence of high caliber of teachers may have been responsible for the high mean achievement scores observed in the study. On the impact of teachers area of subject specialization, the result revealed that teachers whose specialization were outside integrated science contributed minimally to the academic achievement of students in basic science. In order words, when students are taught by teachers who are experts in the subject, no matter their qualification, there is the high tendency that students achievement would be improved as exhibited in the present study. For instance, table 2 revealed that teachers from five different subject specialization or major taught the students in the various schools used in this study; and the result indicated that teachers who specialized in Agricultural science, the students had a mean achievement scores of 56.54 Integrated Science, for Biology teachers, the mean achievement scores of students was 59.96; Physic teachers, the students mean score was 56.00 and Chemistry teachers, the students mean achievement scores was 48.83 While for Integrated science teachers, the student mean achievement score was 67.50. The descriptive result showed that 16 percent of the total teacher major in Integrated Science while 84 percent major in other science disciplines. The table further revealed that students whose teachers major in integrated science had higher and improved mean scores due to the expertise of the teachers who perhaps had better and deeper content knowledge of the subject which enhances teaching as well as the student's achievement. In the same vein, when the null hypothesis was tested, the result further proved that teacher's subject specialization significantly and positively enhanced the academic achievement of students in basic science. The result therefore, confirmed the studies of Thomas and Raechelle [25] Joseph and Ikechukwu [8] who found that teachers subject specialization does have a positive influence and enhances students' academic achievement whether in the sciences or other disciplines of learning achievement scores than those in the other disciplines. The findings corroborates the study of ogbonnaya [29] who found that teachers who major in mathematics influences students interest in mathematics and at the same time had significant relationship with student academic achievement. Also, Kalodoye, confirmed the position of the former, that teachers knowledge about the subject affects their teaching competences and attitudes thus improves students achievements. This finding further validates the findings of Abioye [7] who asserted that area of subject major of the teacher does have a positive influence on students' academic achievement in the sciences.

CONCLUSION

The study established that teachers' qualification enhances students'academic achievement in basic science and has also established that teachers who majored in integrated science enhances their students' achievement positively in Basic Science more than those teachers who specialized in other subjects' disciplines. The study further established that beginning teacher who possessed high academic qualification and major in integrated science were very effective and thus influenced students' academic achievement of students in basic science. Therefore, it can be concluded that:

- Teachers' academic qualification influences student academic achievement scores of student basis science;
- There was strong evidence that teachers subject major contributes significantly to students' academic achievement in basic science. It is therefore concluded that the teacher academic qualification and subject specialization are major determinant of students' academic achievement in basic science.

RECOMMENDATION

1. Since the study showed that teachers qualifications influenced the interest and academic achievement of students, it is important that government agencies saddled with the recruitment of teachers should step up recruitment efforts by hiring teachers who have high academic qualification so that students academic achievement and interest can be sustained.
2. Basic science is a unique discipline that cannot be effectively handled by anyone outside the discipline therefore it is recommended that only teachers who major in integrated science should be engaged to handle the subject at this level of education.
3. Teachers teaching basic science should be encouraged to undertake in-service coursed by providing sponsorship and other incentive which can help them to improve on their profession and such professional training should be tailored to content knowledge and pedagogy.
4. Basic science teachers should be encouraged and motivated to further their studies in the subject areas in respective of their discipline by providing study leave and other financial incentive to them.

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