



Teachers' Characteristics as Correlates of Pupil's Achievement in Basic Science and Technology in Primary Schools in Ogun State

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Abstract

This paper focused on the relationship between teacher variables and pupils' achievement in basic science and technology in primary schools in Ogun state, Nigeria. This paper sought to establish the significant roles of teachers in providing quality education in the area of basic science and technology among primary school pupils. Two thousand and ninety pupils were sampled across one hundred and seven (107) schools from four Local Government Area of Ogun State, Nigeria. The instruments used in collecting data were; teachers' classroom observation rating scale (TCORS) and pupils' achievement test in basic science and technology (PATBST). Data collected were analysed using multiple regression. The result revealed that the combination of the independent variables significantly predicts the dependent variable. Meanwhile, out of the five independent variables, three variables contributed significantly to pupils' achievement in basic science and technology, which are teaching experience, ($\beta = 0.175$, $t(2085) = 2.117$, $P < 0.05$), area of specialization ($\beta = 0.180$, $t(2085) = 2.245$; $P < 0.05$) and teachers' qualification ($\beta = 0.146$, $t(2085) = 2.137$, $P < 0.05$) respectively. In conclusion, teacher variable factors (gender, qualification, teaching experience, age, and area of specialization) jointly contributed to pupil's academic achievement in basic science and technology. This shows the importance of teachers in pupils' academic achievement.

Keywords: Teachers' Characteristics, Pupil's Achievement, Basic Science and Technology, Primary Schools, Ogun State, Nigeria.

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INTRODUCTION

Education plays a crucial role in shaping the intellectual and social development of individuals, providing individuals with the foundation for future success. Teachers are the primary facilitators of learning experiences within the classroom. Teachers' role in determining quality education is highly germane and cannot be overlooked. Teachers with the responsibility of implementing the curriculum and serving as a guide to the learners, as of necessity must know what to teach, how to carry out teaching, and ensuring that learning holds. The teacher needs to be current on emerging local, national, and global issues and be able to accommodate these in the curriculum. Aina and Ayodele (2018) opined that primary school teachers who handle the basic science in most primary schools do not possess a speciality in science.

Teachers' characteristics play a crucial role in shaping the educational experience and outcomes of students. Understanding and studying teachers' characteristics can provide insights into effective teaching methods, classroom dynamics, and student achievement. The interaction and combination of these teacher variables create a unique teaching profile, influencing the overall educational experience for pupils. Research and educational policies often consider these variables when designing teacher training programmes, professional development initiatives, and strategies for improving teaching effectiveness and pupils' performance. Ali (2019) argued that the teacher is one key dominant factor for the successful academic achievement of pupils.

Academic achievement of pupils in core subjects like basic science and technology majorly in primary schools level of Nigeria is poor. This has been said to frustrate the pupils and the parents with its effect on the society at large in terms of inadequate manpower in the nation's politics, economy, and educational sector. Bello (2017) argued that a teacher's qualification and exposure level significantly contribute to the quality of pupils produced. There is much difference between the pupils' taught by less qualified teachers and those teachers with high qualifications and experience when considering the knowledge of the subject matter (Carty, 2014).

Onose et al. (2009) posited that inexperienced teachers teach science in abstraction, thereby making science lessons boring and the students finding it difficult to grasp some of the scientific skills, concepts, and principles. This corroborated Chaca's (2016) findings who argued that the shortage of qualified teachers contributes to the observable poor academic achievement of pupils. The emphasis in science-related subjects has been on how to get the pupils to learn the prescribed content, do things the way the scientists did in the past, and acquire necessary skills. Going by what is happening in the classroom by the teachers, the pupils' poor performances in the external examinations have become essential in the Nigerian educational system. Studying the relationship between teachers' characteristics and pupils' achievement in Basic Science and Technology in primary schools involves exploring various factors related to educators and how they may impact pupils' academic success in these subjects. Several teacher-related variables may be considered in this context.

According to Okafor (2015), quality teaching lies in the teacher's capacity to transform written knowledge into forms that are pedagogically powerful and yet adaptive to the student's abilities and backgrounds. Meanwhile, Ayodele (2006) identified the use of inappropriate ineffective teaching methodology as a major factor hindering students' understanding and achievement in science. The teaching and learning of science do not require theoretical and lecture approaches. Onose et al. (2009) posited that many experienced teachers teach science in abstraction, thereby making science lessons boring and the students finding it difficult to grasp

some scientific concepts, skills, and principles. Effective teaching occurs when pupils learn and achieve many scientific goals and not just being able to repeat scientific knowledge (Omoifo, 2012). During effective learning, pupils learn how to learn and develop conceptual understanding and thinking skills, thus helping pupils change their intuitive, everyday ways of explaining the world around them to incorporate scientific concepts and ways of thinking into their frameworks.

Academic qualification is a very important quality of a teacher that makes a significant impact on pupils' academic performance. Academically qualified teachers have more authentic knowledge about the relevant subject than the academically less qualified teachers have. In addition, Molnar (2002) reported some studies in which students taught by certified teachers consistently outscored those taught by uncertified teachers. He posited that a poorly trained teacher will likely produce a poor doctor, engineer, architect, fellow teacher, and the like. Also, Ada (2020) investigated teachers' variables and learning outcomes of students with physical and health impairments in selected secondary schools in Obudu Local Government Area of Cross River State. The study revealed educational qualification significantly relates to the learning outcome of students with physical and health impairment in school, that is, the higher the teachers' educational qualification, the higher and better the learning outcome of students with physical and health impairment in school.

In addition, Filgona and Sakiyo (2020) concluded that students' academic achievement was predicted by teachers' qualifications, and the predictive value was significant. All too often, the purpose of these is to support the professional growth of education and always think of the immediate task of the teachers as they face the students in the class (Ikwen & Igba, 2016). Thus, teachers' qualification is a very strong single factor that must first be achieved before their sense of self and method of teaching the subject influence the learning outcome of students. The Federal Ministry of Education in conjunction with the Teachers Council of Nigeria has categorized individuals with the following certificates and degrees as those professionally qualified to teach in our primary and secondary school system as a teacher: NCE, DIP. Ed., B. Ed, S.A(Ed), B.Sc.(Ed), PGDE and M.Ed. This means that a teacher whose qualification and certificate are not in the field of education above is not a qualified teacher. Monsoon (2001) in Ada (2020) theorized that quality "output" demands the quality "input".

Teaching experience is the time spent by a teacher in the teaching profession. With time teachers get command of their subjects and become competent in the art of teaching through experience. In other words, teaching experience improves the teaching skills and methodologies adopted. According to the study conducted by Ewetan and Ewetan (2015), which investigated how academic performance in Mathematics and English Language is being influenced by teachers' teaching experience in some selected public secondary schools in Ogun State, Nigeria. The result of the findings shows that better results were achieved by schools that had more than 10 years of teaching experience; these schools had better outcomes when compared to schools with a lesser number of teaching experiences among their teachers.

Topchyan and Woehler (2021) posited that experience increases teachers' effectiveness of the teacher. They agreed that effective teaching is accomplished by practice, inferring that the longer one teaches, the better the teacher and the better the student's learning outcome in examination.

Wood (2015) in Olabode et al. (2023) defined an experienced teacher as one who has learned to teach his subject most effectively, writing the definition imposed by the problem and the structures of the system. This implies that a good teacher develops new techniques of communicating knowledge and interest in teaching with passing years on the job. Teachers' Area of specialisation is also germane in this study. Teacher who specialize in a particular subject area

often have a deeper understanding of the content, pedagogy and instructional strategies related to that subject.

The specialization may be positively impact pupils' performance especially in the specific subject the teacher is specialized in. This fact prompted Aluede and Ikechukwu (2003) to say that the general deterioration and collapse of the educational system have resulted in a guild of teachers who are not science oriented but ask to teach the subject, unqualified and even uncommitted to leading the learners to their expected destination. Teachers with a specialization in a specific subject are likely to possess specialized skills tailored to that subject. These skills can include effective lesson planning differentiated instructions and the ability to create engaging and contextually relevant learning experiences.

Teachers who are passionate about and specialized in a particular subject may be more successful in instilling interest and curiosity in their students. A teacher enthusiasm for a subject can contribute to students' motivation and engagement potentially leading to better performance. It is important to note that the relationship between teachers' specialization and pupils' performance is complex, and various factors including teaching quality, instructional methods, and school context plays significant roles.

The influence of teacher age and gender on pupils' performance in sciences is a complex and multifaceted topic. Research in this area have produced various findings and it is important to note the impact of teacher age and gender can depends on numerous factors including teaching practices classroom management and individual student characteristics. Older teachers' bring more of his years of experience to the classroom while teaching (Okoye, 2016). This experience may translate into a deeper understanding of a pedagogy, subject matter knowledge and effective teaching strategies. Younger teachers may be more familiar with and adaptable to newer teaching technologies and instructional methods. However, older teachers can also adapt and integrate new approaches with their experience. Additionally, some studies suggest that having both male and female role models in the classroom may positively impact students, challenging gender stereotypes and fostering a more inclusive learning environment.

Statement of the Problem

Education is an essential part of life that fosters development generally. Primary education serves as the bedrock of the educational system across the globe. The quality of science and technology education in primary schools is a matter of great concern, as it lays the foundation for pupil's future engagement with these critical disciplines. It is the expectation of education stakeholders in Nigeria; that learners, especially at the primary school, performed brilliantly in Basic Science and Technology. Unfortunately, this is farther from the present reality, as learners' academic performance has continued to decline in core subjects like Basic Science and technology. Factors causing this decline in learners' achievement in Basic Science may stem from teachers' related variables. Consequently, this study investigated teachers' variables (gender, years of teaching experience, qualification, and area of specialization) as correlates of Pupil's Achievement in Basic Science and Technology in Primary Schools in Ogun State.

Research Questions

Based on the stated problem, this study provided answers to the following questions:

- What are the teacher-related variables (gender, qualification, teaching experience, age, area of specialization) that may have a significant correlation with pupils' achievement in basic science and technology in primary schools?
- What is the composite and relative contribution of the teachers' variables (gender, qualification, teaching experience, age, area of specialization), on the Pupils' achievement in Basic Science and Technology?

METHODOLOGY

The study used an ex-post-facto design and survey research type. This is because the researcher does not have direct control of the independent variables. After all, they have already occurred. The population for this study comprises all UBE teachers' i.e. primary school teachers that attended the NTI manpower retraining programmes (2006-2019) in Ogun State, Nigeria. Multistage sampling techniques were adopted in this study. Twenty Local Government Areas have twenty Educational Authorities and three senatorial districts in Ogun state. A simple random sampling technique was used in selecting four local government areas from the three senatorial districts. Two LGAs were randomly selected from the East senatorial district being the largest. Random selection was used in selecting twenty-seven (27) schools in Ogun West, thirty-two (32) from Ogun Central, and thirty-eight (38) schools from Ogun East making a total of ninety-seven (97).

Purposive sampling was used in selecting an intact class across the sampled schools which gave a total of two thousand and ninety (2090) pupils participating in this study. Two instruments used for this study are the "Teachers' Classroom Observation Rating Scale (TCORS)" and "Pupils' Achievement test in Basic Science and Technology (PATBST)". The Teacher Classroom Observation Rating Scale (TCORS) consisted of two sections. Section sought information on the observed teachers' bio-data such as the teacher's age, gender experience, qualifications, and area of specialization. Section 'B' was designed to observe teachers using innovative strategies and competence in different behaviours and promotion of positive self-concept in learners. This instrument was validated using Scot-Pie inter-rater reliability and it was 0.74.

The Basic Science and Technology Pupils Achievement Test (BSTPAT) contained questions designed to test the cognitive level of pupils' achievement. The first part (Section A) which is for bio-data comprises the name of the school and gender of the student. Section B consists of the instructions and the time to be allowed. It contained 40 multiple choice items with four options lettered A to D. The correct response attracted a score of 1, while the wrong response attracted 0. The MAT was pilot-tested on 120 pupils from a Co-educational school similar to the target samples to establish both the difficulty indices and discriminating indices of each item and the scores obtained were subjected to Kuder Richardson K-R 20 in obtaining the reliability coefficient. The K-R 20 gave a coefficient of 0.78, an indication that the BSTPAT was reliable. These instruments were administered and the completed copies were retrieved for data analysis. Descriptive (mean and standard deviation) and inferential statistics (Multiple regression analysis) were used in analyzing the data for the study and answering the research questions therein with SPSS version 23.

RESULTS

Research Question One: What are the teacher-related characteristics (gender, qualification, teaching experience, age, area of specialization) that may have a significant correlation with pupils' achievement in basic science and technology in primary schools?

Table 1: Relationships among Teacher-related variables and pupils' Achievement in Basic Science and Technology

	Pupils ABST	Gender	TQ	TE	TA	AS
Pupils ABST	1.000					
Gender	.021	1.000				
Teachers' Qualification	.392**	.034	1.000			
Teaching Experience	.127**	.245**	.532**	1.000		
Teachers' Age	.312	-.520	.111**	.231**	1.000	
Area of Specialization	.438**	.408**	.201**	.110**	.105**	1.000
Mean	19.05	1.84	2.71	3.54	2.96	2.12
Std.D	8.646	.403	.907	1.431	.932	.855

*Correlation is significant at 0.05 level (2 tailed)

About pupils' achievement in Basic Science and Technology in Primary schools, the result revealed that there were significant and positive relationships between teachers' qualifications ($r = .392$), Teaching Experience ($r = .127$), teachers' area of specialization ($r = .438$), and pupils' achievement in Basic Science and Technology in primary schools. The strongest relationship was between teachers' area of specialization, successively followed by teachers' qualification and their teaching experience. However, the table reveals no significant relationship between teachers' gender ($r = .021$), teachers' age ($r = .312$), and pupils' achievement in Basic Science and Technology in primary schools. From this result, it can, further be explained that teachers with higher qualifications and more experience may positively correlate with higher pupil achievement. As well, educators with advanced degrees and substantial teaching experience often possess a deeper understanding of the subject matter, effective teaching strategies, and classroom management skills.

Research Question Two: What is the composite and relative contribution of the teachers' characteristics (gender, qualification, teaching experience, age, area of specialization), on the Pupils' achievement in Basic Science and Technology?

Table 2: Regression summaries and ANOVA of Pupils' Achievement in Basic Science and Technology and Beneficiaries' Teacher Variables

Multiple R = .464 ^b RSquare = .216, Adjusted R Square = .188 Standard Error = 6.283 Analysis of Variance					
Source of Variance	SS	Df	MS	F	Sig.
Regression	593.427	5	118.685	26.23	.000 ^b
Residual	9435.847	2085	4.525		
Total	10029.274	2090			

Table 2 shows the multiple correlation coefficients (R) of all the combined independent variables with pupils' achievement in Basic Science and Technology is 0.464. The adjusted R², which estimates the variance accounted for by the combined independent variables to the dependent variable measure is 0.188, which implies that 18.8% contribution of all the independent variables (gender, qualification, teaching experience, age, area of specialization) on the pupils' achievement in Basic Science and Technology, which represents the dependent variable). It also shows that the combination of the independent variables is significant in predicting pupils' achievement in Basic Science and Technology (F(5, 2085) = 26.23, p < 0.05). This means that the relationship is linear and therefore all the predictor variables specified in the models significantly predict the Dependent Variable (i.e. pupils' achievement in basic science and technology). This is an indication of the test of significance of the model using an ANOVA.

Table 3: Coefficient of pupils' achievement in basic science and technology

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	7.608	3.893		1.955	.052
Gender	-.007	.066	-.006	-.100	.920
Qualification	.097	.045	.146	2.137	.034
Teaching Experience	1.355	.640	.175	2.117	.002
Age	-.934	.602	-.132	-1.551	.122
Area of Specialization	1.178	.525	.180	2.245	.003

a. Dependent Variable: pupils' achievement in Basic Science and Technology

Table 3 shows the teacher-related variables that may have a significant correlation with pupils' achievement in basic science and technology in primary schools. Out of the five variables, the three variables that contributed significantly to pupils' achievement in Basic Science and Technology are teaching experience, ($\beta = 0.175$, $t(2085) = 2.117$, $P < 0.05$), beneficiary area of specialization ($\beta = 0.180$, $t(2085) = 2.245$; $P < 0.05$) and beneficiary teachers' qualification ($\beta = 0.146$, $t(2085) = 2.137$, $P < 0.05$) respectively. While beneficiary teachers' gender and age ($\beta = -0.006$, $t(2085) = -0.100$, $p = 0.920$, ($\beta = -0.132$, $t(2085) = -1.551$, $P = 0.122$) does not significantly influence the pupils' achievement in Basic Science and Technology.

DISCUSSION

The result reveals that there were significant and positive relationships between teachers' qualifications ($r = .392$), Teaching Experience ($r = .127$), teachers' area of specialization ($r = .438$), and pupils' achievement in basic science and technology in primary schools. However, the table reveals no significant relationship between teachers' gender ($r = .021$), teachers' age ($r = .312$), and pupils' achievement in basic science and technology in primary schools. From this result, it can be further explained that teachers with higher qualifications and more experience may positively correlate with higher pupil achievement. The result of the findings is in agreement with the findings of Ewetan and Ewetan (2015), their results showed that schools whose teachers have more than 10 years of teaching experience have better outcomes when compared to schools with a lesser number of teaching experience among their teachers. Similarly, Betts et al. (2003) found a significant correlation between teacher variables and pupil achievement while Clotfelter

et al. (2009) found strong positive effects. One difference in these studies is that Clotfelter et al. utilize course-specific end-of-course exams while the other studies rely on more general achievement exams. Except for positive correlations between possession of a master's degree and elementary mathematics achievement found by Betts et al. (2013), recent research indicated either insignificant or in some cases even negative associations between possession of graduate degrees by a teacher and their students' achievement in either mathematics or reading.

Findings from the study show that teachers' variables (gender, qualification, teaching experience, age, area of specialization) significantly influence pupils' achievement in basic science and technology. The combination of the independent variables (gender, qualification, teaching experience, age, area of specialization) significantly predict pupils' achievement in basic science and technology ($F(5, 2085) = 26.23, P < 0.05$). This means that the relationship is linear and therefore all the predictor variables specified in the models significantly predict the Dependent Variable (i.e. pupils' achievement in basic science and technology). Also, the findings reveal the relative contribution of predictor variables to criterion variables. Out of the five variables, the three variables that contributed significantly to pupils' achievement in basic science and technology are teaching experience, beneficiary area of specialization ($\beta = 0.180$), and beneficiary teachers' qualification respectively.

Beneficiary teachers' gender and age do not significantly influence the pupils' achievement in basic science and technology. The findings of this research work are in agreement with the findings of Adeniyi et al. (2013) on teachers' factors and pupils' academic performance. The findings are in consonant with Ada (2020), whose findings posited that the more the teachers' teaching experience, the better and higher the academic achievement of students in school. The finding is congruent with the position of Filgona and Sakiyo (2020) whose regression statistic indicated that teachers' qualifications did predict students' academic achievement, and the predictive value was significant. In addition, the result is in support of the findings of Ada (2020), who revealed that the higher the teachers' educational qualification, the higher and better the learning outcome of the pupils' performance. Harris and Sass (2014) equally observed that when teachers are productive, it enhances students' learning. This implies that teachers' variables are statistically significant in influencing pupils' achievement in basic science and technology.

CONCLUSION/RECOMMENDATIONS

This study revealed that teachers-variable factors (gender, qualification, teaching experience, age, area of specialization) jointly contribute to pupil's academic achievement in basic science and technology. Relatively, the study revealed that teaching experience, area of specialization, and teachers' qualification respectively contribute significantly to pupil's achievement in basic science and technology. This depicts how important the teachers-variables are to pupils' achievement in basic science and technology in Ogun state.

Since teachers' variable factors were found to jointly contribute significantly to basic science and technology having teachers' experience, area of specialization and teachers' qualifications also have a significant relative impact on pupils' achievement in basic science and technology. The teaching of basic science and technology at the primary school level should be handled by qualified science teachers, well-grounded in the subject, and possess the pedagogy to make it interesting and attractive to pupils. Also, experienced teachers with specialty should be

used in teaching basic science and technology as teachers' experience with specialization plays an important role in pupils' achievement in basic science and technology.

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