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TEACHERS' CHARACTERISTICS AS DETERMINANTS OF STUDENTS' PERFORMANCE IN SECONDARY SCHOOL PHYSICS IN SAKI, OYO STATE, NIGERIA

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ABSTRACT

The knowledge of physics is crucial for effective living in the modern age of science and technology. The academic performance of students in physics is low and is a major concern for stakeholders in the field of education. The characteristics of physics teachers who are major facilitator of academic excellence are important in

INTRODUCTION

Physics is crucial for effective living in the modern age of science and technology. It is the systematic study of the nature, the behaviour of materials and physical universe based on observations, experiments, measurements and formulation of laws to describe these facts in general terms. Stokking (2000) described the crucial nature of physics by stating that it is indispensable in many professions and for economic development. Gambari (2010) posit that physics has proven its benefits to mankind as almost every human activity and virtually every profession involves some elements of Physics.

determining the effectiveness and efficiency of physics teaching and learning. This study therefore examined the influence of some teachers' characteristics on students' academic performance in physics. Descriptive survey research design was adopted. Physics teachers and students in 40 randomly selected secondary schools were sampled for the study. A self-developed, structured and validated questionnaire and a Physics Students Performance Test (PSAT) extracted from the Previous SSCE Questions were used as instruments to collect relevant data. The data collected were analyzed using frequency, percentage and t-test. The study revealed a significant influence of physics teachers' methods of teaching on students' academic performance. Based on the results, it was recommended that Physics teachers should employ student-centred methods and government/proprietors should periodically organise teachers' professional development programmes through which relevant skills and knowledge would be regularly acquired.

Keywords: *Teachers' Qualification, Teaching Experience, Professional Development Training, Students, Academic Performance.*

Physics education is a field of study concerned with producing a scientifically literate society. Physics education lays the foundation for future work in physics and physics-related fields by acquainting the students with certain basic knowledge, skills and attitudes (Omosewo, 2012). Ikwa (2000) stated that physics education has been and will continue to be of tremendous benefit to humanity for its ability to explain natural phenomena, everyday occurrence as well as its central role in the world's current technological advancement.

The teaching and learning of a subject at any level of Nigerian educational system is guided by a curriculum. The content of the Nigerian Senior Secondary School Physics Curriculum was developed by Nigerian Educational Research and Development Council. The revised edition of the physics curriculum was designed to meet targets of the reform in the

context of National Economic Empowerment and Development Strategies (NEEDS) and the Millennium Development Goals (MDGs). The targets of the reform were summarised as: value-reorientation, poverty eradication, job creation, wealth generation and using education to empower the people (NERDC, 2009).

The general objectives to be satisfied by the senior secondary school physics curriculum as stated in the curriculum secondary school curriculum (NERDC, 2009) are;

i. To provide basic literacy in physics for functional living in the society.
ii. To acquire basic concepts and principles of physics as a preparation for further studies.
iii. To acquire essential scientific skills and attitudes as a preparation for technological application of physics. and
iv. To stimulate and enhance creativity (pp. ii).

To achieve the stated objectives, teachers have a significant role to play because they are the implementer of the physics curriculum contents in the classroom setting.

Awe (2004) asserts that the teacher serves as the most important science curriculum implementer in the classroom. Lassa (2000) claimed that education cannot be provided by just anybody, it requires a teacher who plans and delivers the lessons or instruction in such a way that objectives can be achieved. Ike and Iheberenu (2008) observed that teachers all over the world are recognized as critical factors in the delivery of quality education at whatever level. According to Adentwi (2005), a subject specialist or professionally trained teacher is one who has pursued detailed formal and systematic study of a particular subject.

The role of such a subject specialist is to act as storehouse of essential and well processed information leading his students to gain deep insights into the various subjects to be taught. The characteristics of the teachers are major key players that determine the effectiveness and efficiency in the teaching learning process. Afe (2001) posit that teachers have been known to have important influence on students' academic achievement and they

also play a crucial role in educational attainment because the teacher is ultimately responsible for translating educational policies and principles into actions based on practice during interaction with the students.

Tella (2008) opine that teachers must have mastered the basic skills of teaching and possess the ability to continuously adjust their teaching strategies to meet the diverse needs of their pupils. Adeogun (2001) and Adeyemi (2010) remarked that the quality of education and performance of students depends on the teachers as reflected in the discharge of their duties. Uchefuna (2001) was of the opinion that both teaching and learning depend on teachers: no wonder an effective teacher has been conceptualized as one who produces desired results in the course of his duty as a teacher.

Research reports of Ajayi (2004) and Adedayo (2008) revealed that the performance of students in Physics is very appalling, hence, calls for attention. Gambari (2010); Ahiakwo (2003); Ajayi, (2007); Farayola (2003); Lee and Shute (2009); Adaramola and Obomanu (2011) and Bajah (2000) attributed poor performance of students in science, particularly in physics to lack of qualified teachers, poor instructional strategies, poor infrastructure, non-availability of standard laboratory, non-availability of equipment, poor utilization of instructional materials and abstract nature of some topics in physics.

Statement of the Problem

In spite of the importance of physics as a requirement for many specialized science and engineering courses in the universities and other tertiary institutions, students' performance in the subject in secondary school certificate examinations (SSCE) is poor. The performance is as shown in table 1.

Table 1

Secondary School Students' Performance in Physics at May/June Senior School Certificate Examination (2006-2016).

Year	Total Sat	Total Credit A1 – C6	%
2006	375824	218199	58.05
2007	418593	180797	43.19
2008	415113	200345	48.26
2009	465636	222722	47.83
2010	463755	237756	51.27
2011	563161	360096	63.94
2012	624,658	429,415	68.74
2013	637,023	297,988	46.77
2014	635,729	386,270	60.76
2015	648,124	410,543	60.01
2016	705,125	415,655	58.98

Source: WAEC (2017). Research and Statistics Unit, Oko-Olowo, Ilorin, Kwara State.

Table 1 revealed secondary school students' performance in physics conducted by West Africa Examinations Council (WAEC) between the years 2006 to 2016 in Nigeria. From table 1, it is inferred that students' performance in the examination in each year was not consistently about average. Gambari (2010) observed that the performance of students in physics at SSCE level is not beyond average. Ofoegbu (2004) posit that poor academic performance of students in Nigeria has been linked to poor teachers' performance in terms of accomplishing the teaching task, negative attitude to work and poor teaching habits which have been attributed to poor motivation.

Akiri (2013) observes that there was statistically significant relationship between teacher characteristics and student academic achievement. Adeyemo (2005) notes teacher characteristics influenced teaching and learning in classrooms. Olaleye (2011) establishes that there was relationship between teachers characteristics and pupils performance. Gravestock and Gregor-Greenleaf (2008) states that the explanations for good or poor

student's academic performance have been quite exhaustive yet controversy still exists among scholars as to what contribute singly or jointly to students' poor performance. The teacher characteristics found to be dominant in cross-country studies are related to; qualification, experience, attitude and personality.

Ogunleye (2001) maintained that lack of adequate qualified and experienced physics teachers and of laboratory equipment as two major recurring problems of teaching physics in secondary schools. Moon, Mayes and Hutchinson (2004) opine that there are three main factors within teacher's control that significantly influence pupil achievement. These factors according to them are professional characteristics, teaching skills and classroom climate. Abraham and Morrison (2006); Marzano, (2007); Mrozowski (2002) reports a linkage between teacher quality and student progress in a study of students and teachers in grades 3-8 under the Cincinnati Public Schools' teacher evaluation system. The study by Fryer et al (2002) revealed that improved teacher quality might affect the troubling gap between white and black students in academic achievements.

Martin, and Iheanachor (2009) found a significant relationship between teachers' qualification and specialized knowledge in mathematics and students' achievement in mathematics. Huang and Moon (2009) documents that teacher qualification accounted for approximately 40 to 60 percent of the variance in average of students' achievement in assessment. Richardson (2008) suggests that the availability of enough qualified teachers must have been a determinant for students' performance. Maundu (1986) found that there was significant correlation between teacher qualification and pupil performance. The good performance was attributed to excellent instructions given by qualified teachers in addition to other inputs. Maundu (1986) establishes that teachers who had graduated from Kenya Science Teachers College were more practically oriented than those who had degrees from public universities.

Wilson et al. (2001) suggest that even with the shortcomings of current teacher education and licensing, fully prepared and certified teachers are more successful with students than teachers without this preparation.

Ashton (1996) notes that teachers with regular state certification receive higher supervisor ratings and student achievement than teachers who do not meet standards, but this observation was based on data with virtually no statistical controls having been imposed. Achufusi (2015) found that there is a high relationship between the teacher's academic qualification and students' performance in physics.

Goldhaber and Brewer (2002) observed that students do better in math if taught by a teacher with a bachelor's or master's degree in mathematics. The researchers also found that, although advanced degrees in general were not associated with higher student achievement, an advanced degree that was specific to the subject area that a teacher taught was associated with higher achievement. In contrast, other studies did not indicate that teachers with graduate-level training in a content area performed better than did teachers having an undergraduate degree in their content area (Rivkin, Hanushek & Kain, 2005; Rockoff, 2004).

Awogbemi (2013) found that significant difference exists between students performance in further mathematics on account of their teachers' qualifications. A survey conducted by Ogbonnaya and Okunamiri (2008) on administrative effectiveness of male and female principals Nigeria revealed that female principals are more effective than their male counterparts in the management of instructional programmes, staff personnel administration, students personnel administration, management of finance and management of physical resources while the male principals are better in school-community relationships.

Adeyemi and Owolabi (2012) found that students taught by teachers with higher qualifications performed better than those taught by teachers with lower qualifications. It was also found that students performed better in physics when taught by professional teachers. The result also showed that teacher's gender has no effect on their ability to impact knowledge on the students, much as he/she is a skilled teacher in that field of study. However, the experience of the teacher is significant at impacting the students' academic performance in Physics.

Fuller and Alexander's (2004) found that students taught by certified teachers scored better on the state math achievement test. Laczko-Kerr and Berliner (2002) examined the math achievement of elementary students and reported that students taught by new, uncertified teachers did significantly worse on achievement tests than did those taught by new, certified teachers. Darling-Hammond (1999) found a significant positive association between achievement and teacher certification; the researcher also found a significant negative association between achievement and the presence of a high proportion of new or uncertified teachers in the school. However, Osokoya (1999), Oladele (1991) and Igwe (1990) found little or no significant relationship between teacher qualification and achievement.

Maguswi (2011) found that teachers' methods of teaching and educational qualifications significantly influenced students' academic achievement. Bilesanmi (1999) found that teacher experience has the second most effective causal effect on students' achievement. Okonwa (1999) found that teachers' teaching experience had significant effect on students' achievement in science. Also, Fetler (1999) found that teaching experience as measured by years of service correlated positively with student test results.

Akinsolu (2010) found that teachers' qualifications, experience and teacher-student ratio were significantly related to students' academic performance. Mkpanang (2015) found that there was a low significant relationship between teachers' personality profile and students' academic achievement in physics. Adedayo (2010) found that professional teachers affect the students' performance in Physics positively more than the unprofessional teachers. However, some studies revealed that Professional qualifications and teaching experience are not significantly related to students' academic achievement (Mbugua et al., 2012; Kimani et al., 2013; Musau et al., 2013).

Koedel and Betts (2007) found that specific teacher qualification (experience, quality of undergraduate college, education level, and college major) had little effect on elementary school students achievement in San Diego. Zuzovsky (2009) found that the field of teaching, years of teaching experience, and intensive participation in professional development

activities (all assumed to be cardinal teacher qualifications) were indeed positively associated with student achievement in mathematics and science.

Buddin and Zamarro (2009) found that teacher experience was weakly related to student achievement, and the level of education attained by teachers has no effect on student achievement in their learning endeavours. Buddin and Zamarro (2009) further argue that experienced or better educated or more skilled teachers (as measured by licensure exams) may inherently be better able to teach, but they may not consistently deliver their best performance in the classroom.

Bilesanmi (1999) and Okonwa (1999) found that teacher's experience was highly significant on students' academic achievement in mathematics. A comprehensive analysis by Greenwald, Hedges, and Laine (1996) examined data from 60 studies and found a positive relationship between years of teacher experience and student test scores. Similarly, the UTD Texas Schools Project data showed that students of experienced teachers attained significantly higher levels of achievement than did students of new teachers (those with one to three years of experience) (Rivkin, Hanushek, & Kain, 2005). Middle and high school students learn more from teachers who hold Bachelor's or Master's degrees in the subjects they teach and from experienced teachers than they do from less experienced ones (Darling- Hammond, 2000).

Some studies show positive effects of advanced degrees (Betts, Zau, & Rice, 2003; Goldhaber & Brewer, 2000); others show negative effects (Ehrenberg & Brewer, 1994; Kiesling, 1984). Some researchers maintain that the requirement for teachers to have a second degree raises the cost, financially as well as in time, of teacher education, which may prevent quality candidates from choosing this profession (Murnane, 1996). Several studies show a positive relationship between teachers' preparation in the subject matter they later teach and student achievement (Darling-Hammond, 1999, 2000b; Goldhaber & Brewer, 2000), while others have less unequivocal results. Monk and King (1994) found both positive and negative effects of teachers' in-field preparation on student achievement.

Purpose of the Study

This study was carried out to examine the influence of teachers variables on students academic performance in physics. Specifically, the study was carried out to find out if

i. Teachers' gender influence students performance in physics
ii. Teachers' qualification influence students performance in physics
iii. Teachers' experience influence students performance in physics
iv. Teachers' teaching method influence students performance in physics
v. Teachers' professional development influence students performance in physics

Research Questions

i. Is there any difference between the performance of students taught by male physics teachers and those taught by female physics teachers?
ii. Is there any difference between the performance of students taught by qualified physics teachers and those taught by unqualified physics teachers?
iii. Is there any significant difference between the performance of students taught by experienced, moderately experienced and less experienced physics teachers?
iv. Is there any difference between the performance of students taught using student-centred methods and those taught using teacher-centred methods in physics?
v. Is there any difference in the performance of students taught by physics teachers who attended professional development programs and those that did not?

Research Hypotheses

Ho_1: There is no significant difference between the performance of students taught by male physics teachers and those taught by female physics teachers.

.Ho_2: There is no significant difference between the performance of students taught by qualified physics teachers and those taught by unqualified physics teachers.

.Ho_3: There is no significant difference among the performance of students taught by experienced, moderately experienced and less experienced physics teachers.

Ho_4: There is no significant difference between the performance of students taught using student-centred methods and those taught using teacher-centred methods in physics.

Ho_5: There is no significant difference in the performance of students taught by physics teachers who attended professional development programs and those that did not.

Method

Research Type

The study is a descriptive research of the survey type. It involves the collection of data on the teachers' experience, gender, qualifications, teaching methods and professional development and finding its influence on students' performance in the selected schools. A 50-item multiple choice physics performance test was administered to physics students from the schools selected in Saki, Oyo State, Nigeria.

Sample and Sampling Technique

The study was targeted at all senior secondary schools in Saki, Oyo State, Nigeria. 40 senior secondary schools were selected for the study using a simple random sampling technique. The available students and teachers in each of the selected senior secondary schools were given the research instruments to respond to. The researcher alongside a research assistant administered the instrument to the respondents.

Research Instruments

Two research instruments were employed for the study. The first was a researcher's self-developed, structured and validated questionnaire

designed to collect information about physics teachers such as gender, qualifications and years of experience, teaching methods and professional development programs attended. The second was a Physics Students Performance Test (PSAT) extracted from the Previous SSCE Questions used to determine the academic performance of the students. The items of the test are considered standardised and there is no need for revalidation by the researcher.

Procedure Data Collection

The researcher personally visited the selected schools. The researcher sought the permission from the appropriate school authority and then administered the research instruments on the students and the teachers involved. The researcher waited through for the respondents to respond to the items of the research instruments and was able to retrieve all.

Data Analysis

The research questions were analysed using frequency count and means. The research hypotheses were analysed using *t*-test and Analysis of Variance (ANOVA) .

Results

Research Question 1: Is there any difference between the performance of students taught by male and female teachers in physics?

Ho_1: There is no significant difference between the performance of students taught by male physics teachers and those taught by female physics teachers.

Table 2 showed that the mean score of students taught by male teacher is 36.70 while that of female teachers is 31.29. Therefore, students taught by male physics teachers performed better than those taught by female physics teachers. But there was no significant difference in the performance of students based on teachers' gender as revealed in Table 2 as *t*-test statistics $t_{(38)}$=1.37at p>0.05. Since the *p*-value of 0.18 is greater 0.05 α level of significance, the hypothesis Ho_1 was accepted.

Table 2

Result of t-test Analysis of Teachers' Gender

Gender	N	Mean	Standard deviation	df	t	Sig.	Remark
Male	33	36.70	10.04				
				38	1.37	.18	NS
Female	7	31.29	5.59				

p>0.05

Research Question 2: Is there any difference between the performance of students taught by qualified physics teachers and those taught by unqualified physics teachers?

.Ho_2: There is no significant difference between the performance of students taught by qualified physics teachers and those taught by unqualified physics teachers.

Table 3 showed the mean and standard deviation of the scores of students taught by qualified and unqualified physics teachers. The result revealed that students taught by qualified physics teachers had higher mean score 40.19 compared with those taught by unqualified physics teachers 35.29. This means that students taught by qualified physics teachers performed better than their counterparts taught by unqualified physics teachers.

The *t* value in Table 3 indicated that there was no significant difference between the performance of students taught by qualified and unqualified physics teachers. This is because $t_{(38)}$ =0.16 at *p*>0.05. Since the *p*-value of 0.12 is greater 0.05 α level of significance, therefore, hypothesis H_{O1} was accepted.

Table 3

Result of t- test Analysis of Teachers' Qualification

Teachers' qualification	N	Mean	Standard deviation	df	t	Sig.	Remark
Qualified	16	40.19	10.46				
				38	.16	.12	NS
Unqualified	24	35.29	8.78				

p>0.05

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Research Question 3: Is there any significant difference between the performance of students taught by experienced, moderately experienced and less experienced physics teachers?

Table 4 showed the mean and standard deviation of the scores of students taught by less experience, moderately experience and experienced physics teachers. The result revealed that the students taught by experienced physics teachers had highest mean scores 37.38 while those taught by less experienced and moderately experienced physics teachers have closed mean scores values of 35.86 and 34.38 respectively.

Table 4

Mean and Standard Deviation of Less Experience, Moderately Experience and Experienced Physics Teacher based on Students' Scores

Teachers' experience		Mean	Standard Deviation
Less-experienced	14	35.86	8.80
Mod- experienced	10	34.80	6.07
Experienced	16	37.38	9.62

HO_3: There is no significant difference in the academic performance of students taught by less experienced, moderately experienced and experienced physics teachers.

Analysis of Variance (ANOVA) was used to determine if there exists significant difference among the performance of students taught by the experienced, moderately experienced and less-experienced physics teachers. The result in Table 5 revealed no significant difference $F_{(37, 2)}$= 0.29 at p= 0.75. Hence, hypothesis HO_3 was accepted. .

Table 5

Result of Analysis of Variance (ANOVA) of Teachers' Experience					
	Sum of Squares	Df	Mean Square	*F*	Sig.

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Between Groups	43.34	2	21.67	.29	.75
Within Groups	2727.06	37	73.70		
Total	2770.40	39			

p>0.05

Research Question 4: Is there any difference between the performance of students taught using student-centred methods and those taught using teacher-centred methods in physics?

Ho_4: There is no significant difference between the performance of students taught using student-centred methods and those taught using teacher-centred methods in physics.

Table 6 showed the mean and standard deviation of the scores of students taught using student-centred methods and those taught using teacher-centred methods. The result revealed that students taught using student-centred methods had higher mean score 38.02 compared with their counterpart taught with teacher-centred methods 30.71.

Also, the *t*-value in Table 6 indicated that there was significant difference between the performance of students taught using student-centred methods and their counterpart taught with teacher-centred methods. $t_{(38)} = 3.21$ at $p>0.05$. Since the *p*-value 0.01 is less than 0.05 α level of significance, therefore, hypothesis H_{O4} was rejected. This means that there was significant difference in the academic performance of students taught with student-centred methods and those taught with teacher-centred methods, in favour of students taught with student-centred methods.

Table 6

Result of t- test Analysis of Methods of Teaching

Methods of Teaching	N	Mean	Standard deviation	df	*t*	Sig.	Remark
Student-centred	16	38.02	9.54				
				38	3.21	.01	S

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Teacher-centred	24	30.71	8.92				

p>0.05

Research Question 5: Is there any difference in the performance of students taught by physics teachers who attended professional development programs and those that did not?

Ho_5: There is no significant difference in the performance of students taught by physics teachers who attended professional development programs and those that did not.

From Table 7, the mean scores of students whose physics teachers attended professional development programme is 38.09, while that of those who did not is 36.13. This showed that students whose teachers attended professional programs performed better than those students whose teachers did not attend any professional development program.

The *t*-test statistics in Table 7 showed that there was no significant difference in the academic performance of students taught by physics teachers who attended development programs, and those who did not as the *p*-value 0.61 is greater than 0.05 α level of significance. $t_{(38)}$=.52 at *p*>0.05. Therefore, H_{05} was not rejected, indicating there was no significant difference in the academic performance of students taught by teachers who attended professional development programs and those teachers who did not.

Table 7

Result of t-test Analysis of Teachers' Development Programme Based on Students' Scores

Professional Development Program	N		Mean	Standard deviation	df	t	Sig.	Remark
Attended			38.09	8.03				
					38	.52	.61	NS
Not Attended			36.13	14.69				

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p>0.05

Discussion

The findings of this study revealed that, teachers' gender, qualification, experience, and in-service professional development training have no significant influence on students' academic performance in physics, though, there was observed slightly positive influence of each of these teachers' variables on students' academic performance in physics. This concur with Mbugua et al. (2012); Kimani et al. (2013) and Musau et al. (2013) who found that professional qualifications and teaching experience are not significantly related to students' academic achievement but contrary with Huang and Moon (2009) who noted that teacher qualification accounted for approximately 40 to 60 percent of the variance of students' achievement in assessment and that of Akinsolu (2010) who found that teachers' qualifications, experience and teacher-student ratio were significantly related to students' academic performance.

It was however revealed in this research that the methods employed in the teaching of physics has a significant influence on students' academic performance in physics as a significant difference was observed in the academic performance of physics students when taught with student-centred methods and when taught with teacher-centred methods in favour of student-centred methods of teaching. This agrees with the findings of Maguswi (2011) who found that teachers' methods of teaching significantly influenced students' academic achievement.

Conclusion

Importance should be given to student-centred methods when teaching physics due to its practical nature and relevance to everyday activities in order to achieve a better academic excellence. Teachers' in-service development programs, qualifications and experience should also not be left out, though there was no singly significant influence of each of these teachers' characteristics, they can jointly give a significant influence on students' academic performance.

Recommendations

Based on the findings of this research, the following recommendations are made:

i. Physics teachers should employ student-centred methods such as demonstration, discovery, enquiry, experimentation, etc during teaching in order to better the students' understanding of the concepts being taught.

ii. Irrespective of physics teachers' qualification, experience and gender, school authorities and government should periodically organize teachers' development programs such as seminars, workshops and conferences through which relevant skills and knowledge would be regularly acquired by physics teachers.

iii. Government and school proprietors should ensure that only qualified physics teachers are entrusted with the teaching and learning of physics.

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