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Influenceof Teacher Qualification and Experience on Secondary School Physics Students' Enrolment And Academic Attainmentin Rivers State, Nigeria

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Abstract: *The study investigated the influence of teacher qualification and experience on Physics students' enrolment and academic attainment in selected secondary schools in Rivers State, Nigeria. The study adopted mixed research methods involving both quantitative and qualitative methods. 378 subjects selected purposively, comprising 116 non-physics students, 248 physics students and 14 physics teachers recruited from 8 schools participated in the study. The results show a positive correlation between students' attainment and teachers' qualification. Resource availability and teachers' resource utilization also correlated positively with students' attainment. Teacher qualification and experience did not significantly correlate with students' attainment by gender. Also, students' enrolment was not influenced Teachers' qualification and experience. The study recommended the need for teachers to enhance their teaching by engaging in Continuous Professional Development activities that could improve their pedagogical content knowledge for better learner experiences in physics classrooms.*

Key words: *Teacher qualification, Teacher experience, Physics, Enrolment, Attainment*

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I. Introduction

Many educational policy makers are increasingly using students' attainment and development as a tool for assessing the effectiveness of teachers (Zuzovsky, 2005; Darling-Hammond, 2012). Zuzovsky (2005) justified this use of students' attainment in assessing teacher effectiveness when she argued that with cultural differences in ethical, logical and psychological perceptions, "the tendency to evaluate teacher qualities on the basis of student performance is given even greater emphasis" (p. 38). The point here is that different cultures may have their varying standards and perceptions of what is ethical and acceptable even in terms of the general goals of education and what basic infrastructure is provided for effective teaching and learning which portends a difficulty of accessing standards of attainment across cultures or even systems or institutions.

The concern of those in school effectiveness research is to see how well learners achieve stated goals as a basis to assess the effectiveness of the teacher. It is therefore important to focus on certain characteristics of the teacher that may enhance his effectiveness by promoting learners' classroom experiences. Darling-Hammond (2012), distinguished between 'teacher quality' and 'teaching quality'. According to her, "teacher quality might be thought of as the bundle of personal traits, skills, and understandings an individual brings to teaching, including dispositions to behave in certain ways" (p.2), while "teaching quality refers to strong instruction that enables a wide range of students to learn"(p.3). The result expected from every worthwhile educational investment is that students learn more effectively and progress further to achieve success not only in both internal and external examinations, but also outside the four walls of the school. School reforms and educational policy changes are all driven by the desire to better the learning outcomes of students in line with set societal goals. According to Zuzovsky (2005), "With the increased demands for accountability in line with performance standards and with the growing demand for evidence-based policymaking, student attainment is considered an accurate measure of teacher effectiveness and has become a basis for value-added teacher assessment systems" (p. 38).

The place and importance of the teacher in the school enterprise cannot be over emphasized as teachers remain the key asset of the school system (Hanushek, 2011). Teachers are the drivers of the actualization of the national broad policies of any nation. This is so as the educational policies of any nation reflect the needs of that society and the aspiration of its people. In the school, students interact basically with teachers and research has shown some association between teacher quality and students' attainment. For instance, Rivkin, Hanushek & Kain (2005) reported 'large differences among teachers in their impacts on attainment' and that 'high quality instruction throughout primary school could substantially offset disadvantages associated with low socioeconomic background' (p.419). Many researchers have therefore stressed the necessity of improving

teacher quality and interpersonal behavior to enhance students' performance in schools (Brok, Brekelmans& Wubbels, 2004; Hanushek & Rivkin, 2006). For instance, Brok, Brekelmans& Wubbels (2004), reported that "between 7 and 15% of the variance in student outcomes is related to differences between schools, teachers, and classes" (p. 407) and that difference between teachers account for most of the percentage. It is therefore important to identify those qualities of teachers that significantly influence learner outcome. Not only in their identification, but also that teachers in training would need to know these qualities and conscientiously inculcate, develop and build on those qualities so as to improve in the learning outcomes of students.

Schooling is one of the most vital endeavors of every individual that brings together both teachers and students in a learning environment with the later at the center of instruction. Research evidence shows that the quality of education people receive is highly dependent of the quality of the teacher in terms of his/her content knowledge, academic/cognitive level, quality of instruction, classroom management, teacher beliefs and professional behaviours (The Sutton Trust, 2011; Metzler &Woessmann, 2010, Darling-Hammond, 2000). Darling-Hammond reviewed the effect of teacher quality on student attainment from a survey of data on policies of 50 states in the United States of America and reported that "the percentage of teachers with full certification and a major in the field is a more powerful predictor of student attainment than teachers' education levels (e.g., master's degrees)" (p.32). The implication here is that, what is important in the quality of a teacher that positively impacts on his teaching and that enhances effective student learning is not the chain of degrees and certifications the teacher has acquired that are not the subject he teaches but those that are relevant to his teaching subject. Similarly, Metzler &Woessmann (2010) investigated the effect of the subject knowledge of teachers on their students' attainment among 6th grade Peruvian students on mathematics and reading and reported that "a one standard-deviation increase in teacher subject knowledge raises student attainment by about 10 percent of a standard deviation." (p. 20). What this means is that teachers with better knowledge of the subject content are most likely to support their students' understanding with appropriate classroom activities than those with less knowledge and mastery of the subject matter.

It is a common observation that most parents and students are attracted to schools with high quality teachers where their students make consistent good grades in external examinations. Hanushek, Kain & Rivkin (2004) captured these concerns and showed that 'teachers switching schools or districts tend to move systematically to places where student attainment is higher' and that 'this movement suggests the possibility of a simultaneous equations bias – that higher student attainment causes more experienced teachers or at least that causation runs both ways' (p.1059). Whatever the concerns may be, generality of researchers seems to find a place in assessing the effectiveness of teachers, educational policies, reforms, investments and interventions by the learner outcomes or students' attainments.Some of the characteristics of teachers that have been considered necessary to investigate and that might have some effect on the teachers' effectiveness are his/her qualification and experience (Zuzovsky, 2005; Owolabi &Adedayo, 2012; Aliyu, Yashe&Adeyeye, 2013). In this study therefore, some teacher qualities elicited from research instruments and methods are investigated and correlated with students' attainment.

Purpose of the study

The main aim of the study was to investigate the influence of teacher qualification and experience on physics students' enrolment and attainment in secondary schools in Rivers State. Specifically, the study intends to investigatethe relationship between:

i. teacher qualification and experience with enrolment in physics
ii. teacher qualification and experience with attainment in physics
iii. resource availability and utilization with students' physics enrolment
iv. resource availability and utilization with students' physics attainment
v. gender and physics enrolment and attainment.

Research Questions

The study was guided by the following Research Questions

i. What is the relationship between teacher qualification and experience with secondary school students' enrolment in physics?
ii. What is the relationship between teacher qualification and experience with secondary school students' attainment in physics?
iii. What is the relationship between resource availability and utilization with students' physics enrolment?
iv. What is the relationship between resource availability and utilization with students' physics attainment?
v. What is the relationship between gender and physics students' enrolment and attainment?

II. Methodology

The study utilized mixed methods to comprehensively investigate the effect of Teacher qualification and experience on Physics students' enrolment and attainment in secondary schools in Rivers State. Particularly, this research adopted the descriptive survey together with the case study design. As a survey, questionnaires and tests were used to obtain information from schools in the area of study with the aim of establishing the status quo in the various schools, making comparisons and drawing some assumptions about the observed conditions without manipulating any variable in the study.Questionnaires for physics teachers, and physics and non-physics students, together with SSCE physics results and the researcher-made 'Physics Attainment Test' (PAT) were utilized to elicit data for the survey. This type of research addresses the 'what' of numerical and quantitative data from questionnaires and the 'how' and 'why' of qualitative data from interviews and observations (Cohen, Manion & Morrison, 2011; Johnson, Onwuegbuzie & Tuner, 2007). Interviews with physics teachers and physics and non-physics students and physics classroom observations were used to generate qualitative data for the case study.In scoring the teachers for their qualification, teachers gain the following points for any of the qualifications obtained: Nigeria Certificate in Education, NCE (Physics) – 1, Higher National Diploma, HND – 1, Non Physics degree – 2, Physics degree – 3, Post Graduate Diploma in Education (+1), Non-Physics Master's degree (+1), Physics Master's degree (+2) and PhD (+2). The teaching experience of physics teachers was divided into 2 segments – years of teaching and years of teaching physics. For each of the segments, a teacher is scored 1 point for 0-2 years of teaching, 2 for 3 – 5 years, 3 for 6-8 years, 4 for 9-11 years, 5 for 12-14 years and 6 points for teachers with 15 years or more of teaching experience. The total score from both segments is then divided by 2 to obtain the teachers' 'teaching experience'. A range of 2 years has been considered for the computation of teacher's years of experience as teachers are normally considered for promotion in Nigeria in their third year having considered to have gained some experience. Also, the actual years of teaching was not simply adopted as the years of teaching since both the 'years of teaching' and the 'years of teaching physics' which vary for some teachers were combined in the computation. Similarly, the resource availability and utilization indices were computed for each school from the questionnaire responses of the teachers.

The Resource Availability index was computed from teachers' responses to questions on availability of a physics laboratory, level of equipment of the laboratory, whether or not the school has a laboratory assistant, availability of required teaching and learning resources for the various core topic areas of the senior secondary physics curriculum in Nigeria. Similarly, the Resource Utilization index was computed from the teachers' response on the QPT to questions on the usage of physics teaching and learning resources, frequency of usage and such related items. The Teacher's qualification, Experience, Resource Availability index and the Resource Utilization Index were then correlated with the PAT attainments and physics enrolment of students in the various schools. Interval data were elicited from the PAT and questionnaire responses for the teacher and resource factors.The Spearman rank order correlation has been considered more appropriate and utilized to investigate the association between students' attainment with teacher qualification, teacher experience, resource availability and resource utilization. The statistic is most appropriate with non-parametric data that are not normally distributed with ordinal or scale data (Cohen, Manion & Morrison, 2011; Bryman, 2012; Field, 2013).

III. Results and Discussions

The normality test was conducted to ascertain the normality or otherwise of the data for the utilization of the appropriate statistics for the analysis of data. The result as shown in Table 1 indicates that for both Kolmogorov-Smirnov and Shapiro-Wilk test statistics, $p < 0.05$ indicating that the data for all variables were not normally distributed. The correlations are shown in Table 2.

Table 1: Test for Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
Variables	Statistic	Df	Sig.	Statistic	df	Sig.
PAT scores	.137	171	.000	.924	171	.000
Teacher Qualification	.287	171	.000	.715	171	.000
Teaching Experience	.374	171	.000	.682	171	.000
Resource Availability Index	.237	171	.000	.835	171	.000
Resource Utilisation Index	.200	171	.000	.903	171	.000

The number of physics students relative to the total number of students in SSS 3 in the schoolsthat participated in the study is shown in Table 2.

Table 2: Total SSS 3 and physics enrolment in sampled schools

Zones	Schools	Total Enrolment	No of physics students	Percentage
Zone 1	A	26	9	34.6
	B	36	15	41.7
	C	72	12	16.7
	D	31	10	32.3
Zone 2	A	116	50	43.1
	B	249	72	28.9
	C	98	35	35.7
SC	SC	172	172	100

The students' enrolment for physics was correlated with teacher characteristics such as teaching qualification and experience and school resource factors as shown in Table 2. The percentage of the total number of students in the SSS 3 classes that enrolled for physics as shown in Table 2 was used for this computation. Considering the non-normality of the data distribution, smallness of the sample size of schools (8) used in the study, and the 'outlier' in the physics enrolment of 100% in one of the schools, the Spearman rank order correlation has been utilized to investigate the measure of association between students' enrolment and factors such as teacher qualification, teaching experience, resource availability and resource utilization. Field (2013) posited that for data having outliers or is not normal with small sample size; ranked correlations such as the Spearman rank order should be used.

Table 3: Spearman rho's Correlation of Students' Enrolment with Teacher and Resource Factors

		Teacher Qualification	Teaching Experience	Resource Availability Index	Resource Utilization Index
% of total students in SS3 enrolled for Physics	Spearman rho's correlation	.346	.038	-.024	.157
	Sig. (2-tailed)	.401	.928	.955	.711
	N	8	8	8	8

The result shows low positive correlations (Rumsey, 2011), between students' enrolment in physics and teacher qualification, teaching experience and resource utilization with r-values of 0.346, 0.038 and 0.157 respectively. The correlations were however not statistically significant with all p-values > 0.05 as shown in the Table. The result also shows very weak negative correlation between physics enrolment and resources utilization with r –value of -0.024. Again, this correlation was also found to be statistically insignificant with p = 0.711.

The percentage of enrolled physics students by gender was computed for the 8 schools and correlated with teacher and resource factors. Like the overall trend without the split by gender, no significant correlations were found between male or female physics students' enrolment with teacher qualification, teaching experience, resource availability index and resource utilization index as shown in Tables 4 and 5.

Table 4: Spearman rho's Correlation of Male Students' Enrolment with Teacher and Resource Factors

		Teacher Qualification	Teaching experience	Resource availability index	Resource utilization index
% of male Physics students in SS3	Spearman rho's correlation	.031	-.735	-.145	-.224
	Sig. (2-tailed)	.953	.096	.784	.670
	N	6	6	6	6

Table 5: Spearman rho's Correlation of Female Students' Enrolment with Teacher and Resource Factors

		Teacher Qualification	Teaching experience	Resource availability index	Resource utilization index
% of Female physics students in SS3	Spearman rho's correlation	-.243	-.441	.348	.265
	Sig. (2-tailed)	.643	.381	.499	.612
	N	6	6	6	6

The correlation of PAT scores (students' attainment) with teacher and resource factors were computed to investigate their associations. The results are presented in Tables 6.

Table 7: Spearman Rank Correlation of Students' Attainment with Teacher and Resource Factors

		Teacher Qualification	Teaching Experience	Resource Availability index	Resource Utilization index
PAT Scores	Spearman rho's Correlation	.552**	.131	.534**	.423**
	Sig. (2-tailed)	.000	.088	.000	.000
	N	171	171	171	171

The result shows a significant positive correlation, r = 0.552, p<0.05 between PAT attainment and teacher qualification. A very weak positive correlation, r = 0.131 that is however not significant, p = 0.088(>0.05), is reported between the PAT attainment and teaching experience of physics teachers. The Table also shows that PAT attainment scores have significant positive correlation with resource availability, r = 0.534, p < 0.05 and resource utilization with r = 0.423, p < 0.05. The r-value for resource utilization however indicates a weak positive correlation (Rumsey, 2011).

The correlation of PAT scores with teacher and resource factors were also computed separately for boys and girls to investigate the association between each of the factors and attainment in terms of gender. The results are presented in Tables 8 and 9.

Table 8: Spearman Rank Correlation of boys' physics Attainment with Teacher and Resource Factors

		Teacher Qualification	Teaching Experience	Resource Availability index	Resource Utilization index
PAT Scores	Spearman rho's Correlation	.527**	.107	.466**	.352**
	Sig. (2-tailed)	.000	.299	.000	.000
	N	96	96	96	96

The results as shown in Table 8 reveal positive and highly significant correlations between boys' attainment scores in the PAT and Teacher Qualification, r = 0.527, p < 0.05; Resource Availability index, r = 0.466, p < 0.05 and Resource Utilization index, r = 0.352, p < 0.05. For Attainment and Teaching Experience, the result shows a very weak positive correlation that is not statistically significant, r = 0.107, p > 0.05. These results of correlations for the boys are similar to those obtained for all students irrespective of their gender as shown in Table 7.

Table 9: Spearman Rank Correlation of girls' physics Attainment with Teacher and Resource Factors

	Teacher	Teaching	Resource	Resource

		Qualification	Experience	Availability index	Utilization index
PAT	Spearman rho's				
		.675**	.151	.757**	.564**
Scores	Correlation				
	Sig. (2-tailed)	.000	.195	.000	.000
	N	75	75	75	75

Table 9 shows the correlation of girls' physics attainment with teacher and resource factors. The result reveals a positive significant correlation between girls' physics attainment with teacher qualification, $r = 0.675$, $p < 0.05$. Similarly, positive significant correlations were obtained for both Resource Availability index, $r = 0.757$, $p < 0.05$ and Resource Utilization index, $r = 0.564$, $p < 0.05$. The correlation between girls' attainment and teachers' teaching experience was weak positive. These results obtained for the girls are similar to those obtained for the boys and the overall student attainment irrespective of gender. However, a careful look atthe correlations for the boys and girls on physics attainment with resource availability index shows a stronger correlation for the girls than for the boys.

Data from interviews

The study utilized mixed methods and data were obtained from interviews from both students (physics and non-physics) and physics teachers. Studentsbared their mind in their interviews on the effect of teacher qualification, experience and resource factors on both attainment and enrolment. For instance, student A2P/2 explained that many students dropped physics in their SSS 1 class as a result of the lack of a competent teacher.

"Well, starting from our SS I classes, we did not have a physics teacher then we had a Corper, a Corper that was to take us on physics, but you know the situation of Nigeria, the Corper was as in … he didn't know what he was doing, he only comes to the class just to chat with students, that is the Corper, when we were in SS I, so that made so many students in SS I to enrol away from physics" (A2P/2).

On the other hand, some students in some schools associated their continued enrolment in physics to the teaching competencies of their teachers. This is what a student said:

"I choose to be a physics student because of the teachers we have in this school and due to the facilities. At times too in the class when you walk into the class you understand physics clearly because he makes the formula, the definitions and every other thing very simple" (B1P/2).

For this student, the teacher's competency, teaching strategy and use of available resources are main reasons for her continuity in the physics class. She also explained how the teacher makes the understanding of the subject easy which no doubt would enable better performance in the subject. According to the student, the teacher facilitates students understanding of physics by making 'very simple', the formulas and definitions.

Most students who do not offer physics or who had dropped off from the physics class expressed that the lack of practical activities in the teaching and learning of physics was a major factor in their not enrolling in the subject. For instance, this position is captured in the words of this student:

"When I was in JSS (*Junior Secondary School*) our physics teacher was the basic science teacher, he always talked about... also the basic technology teacher… they talked of light, he talked of plus and minus, maximizing things and they don't do practicals, they don't do it, they just say it, they just say it theory and we don't even understand what they are saying and they don't even care, they just say it… And that is why I didn't find physics interesting because I like things that are clear to me (B2N/1).

Some physics teachers also attributed the low enrolment in physics to lack of laboratory facilities in schools for the teaching and learning of physics. For instance, this is what a physics teacher had to say:

"…you talk about the resources for teaching physics. I don't think if there is, because for two years I've been here and they have not mentioned laboratory, there is nothing to show that there are resources for teaching physics, so that one too is contributing to… to… non-compliance to physics" (A2T).

The impression from the above quote is that the lack of resources for the teaching and learning of physics has contributed to the unpopularity of the subject among students in the post-compulsory classes of secondary education.

Some students explained how the utilization of resources in teaching enhanced their understanding of physics. This student in a single-sex girls' school gave a vivid description ofhow the teacher's use of demonstration enabled her understanding of 'electric field' which was not understood when taught theoretically.

"…we were learning electric field; he came with some materials which he wanted to use as examples to show us, because the last time he came, we told him we wanted to practicalize it because we were like finding it difficult to flow… So when he came, the class was like noisy, so when he entered, we saw him and we saw the materials he was holding so we decided to keep quiet and know what he was about to do. So, when he started teaching, he told us, he referred us back to what he told us the other time, we said yes, then he brought out the

instrument and showed us and said well, this is what I was talking about. This is how it works, this is what to do, everybody was like surprised, oh, I've seen that before, oh, that's what you were teaching about though I do not know it, now I know… So when the teacher comes into the class with materials to teach, it makes the students to understand more" (C2P/2).

Another student lamented the poor state of learning physics without adequate facilities and attributed that to students' low performance in the subject.

"the problem is that the secondary school we have now-a-days they are not helping matters because there is no standard laboratory, nothing to back up the study of physics that is why students have low performance in physics so these thing are factors that are pushing students away" (A2P/4).

Some teachers argued that physics cannot be taught effectively just by theory without practical activities and that the use of resources in teaching physics would improve the performance of students in the subject.

"Physics is a practical subject, you don't teach only theoretical aspect of it. It makes the students not to understand more" (B2T).

"Available resources being utilized, yes, if the available resources are being utilized, I think the attainment would be better" (C2T).

"Yeah, the resources are what really hinder the subject in some other way too, em… good laboratory apparatus and all the rest they are good resources for learning the subject… I think it's of the other side bringing these things together,and this will help students to have good performance in the subject (A1T).

These positions as portrayed by some students and teachers support the finding as presented earlier that there is a correlation between students' attainment and teachers' qualification, attainment and resource availability and attainment and resource utilization. In term of physics enrolment, although a statistical significance in the correlations was not achieved, it is possible to infer from the responses of the students that more students would enrol for physics and have improved performance if qualified teachers are recruited and adequate teaching resources are made available for the teaching and learning of physics.

IV. Concluding Remarks

From the foregoing, it can be concluded that evidence both qualitative and quantitative data from students and teachers involved in the study show that physics has a low popularity among secondary school students and that teacher factors contribute to the low popularity of the subject among secondary school students in Nigeria. According to Williams et al, (2003), when students perceive a subject as being difficult, they also tend to develop a negative attitude towards the subject and would like to choose subjects which they find interesting. It therefore follows that students would be motivated to develop interest in physics when teachers make conscientious efforts to make their teaching real by exploring all resources to make their lessons relevant with applications to students' daily experiences in the environment. Teachers should therefore enhance their teaching by engaging in Continuous Professional Development activities that could improve their pedagogical content knowledge for better learner experiences in physics classrooms. Students who develop the desired interest in the subject and are well supported by the school and teachers are mostlikely to present a positive attitude towards physics which may result in increased enrolment andattainment in the subject.

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