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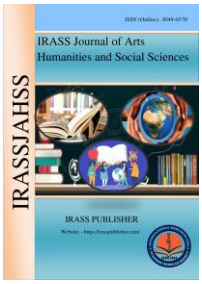

TEACHERS' QUALITY AS PREDICTOR OF SECONDARY SCHOOL STUDENTS ACADEMIC ACHIEVEMENT IN PHYSICS

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Abstract: Despite physics' significance to society, there are many flaws and variations in secondary school students' performance in the topic, which is why this study focused on teachers' quality as predictor of secondary school students' academic achievement in physics. The study was led by two objectives, two research questions, and two hypotheses that were examined at the 0.05 alpha level. The design of the correlation survey was chosen. 2720 senior secondary two (SS 2) physics students from all public secondary schools in the Onitsha Education Zone made up the study's population. A Sample size of 408 SS 2 students offering physics in the Education Zone was drawn using two stage sampling procedure. Students Rating of Teachers' Quality (SRTQ) and the achievement scores which was obtained from physics teachers' grade book for 2023/2024 academic session from the sampled schools were used as instruments for data collection. Three specialists verified the instruments. To determine the instrument SRTQ's dependability, the Cronbach alpha method was used. A reliability coefficient of 0.71 was determined for SRTQ. Data collection was done using the two equipment. In order to answer the study questions, the coefficient of R and R2 were employed, and the hypotheses were tested using regression ANOVA (both linear and multiple). The findings from the results revealed no discernible effect on either male or female students. The study also discovered a minimal positive predictive value between the academic achievement of secondary school students in physics and the quality of their teachers. Regardless of gender, it advises educators and the government to find more variables affecting student accomplishment besides teacher quality.

Keywords: Education, Physics and Teacher Quality

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Introduction

Science education cultivates curiosity, promotes evidence-based reasoning, and prepares individuals for a technologically advancing world. Orakwue and Okigbo (2023) asserted that effective science education is crucial for fostering innovation, solving global challenges, and play an important role in shaping students' academic success, both in the immediate term and throughout students' lifelong learning journey. This is to say that acquisition of these science education skills not only equips students to navigate the challenges of academic life but also empowers them to confront the dynamic scenarios they may encounter in their educational and professional pursuits (Liontas, 2023; Çelen, 2022). Also recognizing the importance of contextual reinforcement and influential factors of science education becomes imperative, as these elements contribute positively to students' educational experiences, particularly in the domain of physics as one of the branches of science education.

Physics is a fundamental science that explores the principles governing matter, energy, space, and time which serves as a cornerstone in shaping students' academic achievement. According to Žák and Kolář (2023) physics is fundamental to understanding the universe's laws and principles. This means that physics underpins technology, drives innovation, and addresses societal challenges.

In spite of the all these importance of physics to humanity there are still lots of reports on students' weaknesses to the subject as reported by West African Examination Council (WAEC) Chief Examiner's Report from 2015 to 2024. This could be the reason why secondary school student academic achievement has not been entirely satisfactory. Report has it that there has been a fluctuating academic achievement between 40% - 60% in grade level of C_6 – A_1 in West African Examination Council (WAEC) organized examination from year 2015-2024. The question now is what could be the causes of these weaknesses and fluctuations in physics

academic achievement of secondary school students in WAEC examination from year 2015- 2024?

According to WAEC Chief examiners recommendation report for averting weaknesses as observed among physics candidates from 2015- 2024, the Chief examiners recommended that qualified and experienced physics teachers should be engaged in teaching physics to enhance teachers' quality. This could help to improve students' academic achievement in the subject. Furthermore, some scholars also believed that improved teachers' quality could boost the physics academic performance of secondary school pupils (Roa & Fajardo, 2022).

Teacher quality is widely recognised as one of the most significant factors influencing student achievement and play a critical role in shaping the educational experiences of the students. Assem, et. al. (2023) averred that teacher quality is paramount for improving student achievement. The authors further averred that relationship is multifaceted, involving educational background, teaching experience, and evaluation practices. According to studies, variations in teacher quality can account for substantial differences in student achievement. For instance, Emoefe and Achufusi-Aka (2022) argues that having a high-quality teacher can lead to significant long-term gains, including higher lifetime earnings for students. This relationship is evidenced in multiple studies where a one-standard deviation increase in teacher quality effectiveness correlates with improved test scores in most secondary schools practical subjects, there by increases students' academic achievement (Oyinvivi & Ojimaojo, 2020; Wang et al., 2024).

Furthermore other studies averred that teacher quality, teacher characteristics, and teacher teaching experience positively influence school quality, which in turn, impacts on student performance (Amie-Ogan & Omunakwe 2020; Rospita & Bhenu 2023). However, Adeolu and Mohamed (2021), Amie-Ogan and Omunakwe (2020) and Odunga, et. al. (2023) in there difference studies in non-physics subject reported a moderate positive relationship between teachers' quality and students' academic performance, while Tugume et. al. (2024) observed a clear and significant correlation between high levels of professionalism and strict adherence to the code of conduct with exceptional performance in various teaching duties on students' academic achievement without gender consideration.

Yakubu (2021) who observed that significant difference exist between the performance of male and female students, and that male students performed better than female students in physics. The author who earlier opined a low positive predictive value between teachers' quality and academic achievement, suggesting that various factors like students' self-efficacy, environmental context, and peer interactions significantly impact academic outcomes, often overshadowing teacher quality among male and female secondary students thereby influence learning when inculcated with Social Cognitive Theory (SCT). But Amie-Ogan and Omunakwe (2020) reported no significant difference between the performance of male and female public school students in Port Harcourt with female students performing better than their male counterpart.

So from the studies reviewed, there have been inconsistencies in contemporary understanding on the teachers' quality as predictor of secondary school students' academic achievement in most secondary school subjects. Also the issues of gender is still inconclusive in most secondary school science subjects including physics which most of the reviewed literature were done outside the present area and scope of study. Thus, there was need to demonstrate a clearer understanding between teachers quality and secondary school students academic achievement in physics, so as to unravel the mystery behind the continued weaknesses and fluctuating academic achievement of physics students just as reported by West African Examination Council (WAEC) Chief Examiners report from year 2015-2024. Against this backdrop, this study investigated teachers' quality as predictor of secondary school students' academic achievement in physics in Onitsha Education Zone of Anambra State, Nigeria.

Purpose of the Study

The purpose of this study was to investigate the teachers' quality of academic achievement in Physics in Onitsha Education Zone, Anambra state, Nigeria. Specifically, the study investigated the:

- Teachers' quality as a predictor of academic achievement of secondary school students in physics.
- Teachers' quality as a predictor of academic achievement of male and female secondary school students in physics.

Research Questions

The following research questions guided the study:

- To what extent does teachers' quality predicts the academic achievement scores of secondary school students in physics?
- To what extent does teachers' quality predicts academic achievement of male and female secondary school students in physics?

Hypotheses

The following hypotheses were tested at 0.05 1evel of significance:

- Teachers' quality is not a significant predictor of academic achievement among secondary school students in physics.
- Teachers' quality is not a significant predictor of academic achievement of male and female secondary school students in physics.

Method

The predictive correlation design was used in this investigation. The study was conducted in Anambra State's Onitsha Education Zone. 2720 Senior Secondary two (SS2) physics students from public secondary schools in Anambra State made up the study's population. 408 SS2 physics students from Anambra state's Onitsha Education Zone made up the study's sample size.

According to` Nworgu in Abumchukwu (2023), a sample size of about 15% to 50% of the population depending on the population size is adequate for a survey research. Thus, 15% of total population (2720) is 408 was used for the study due to the targeted population (co-education schools). Two stage sampling procedure involving two different techniques were used in the study.

First using stratified random sampling, co-educational government own schools were drawn reason was to ensure equal representation of male and female students because gender is a

variable under consideration in this study as one of the moderating variables.

Second, four coeducational schools each were selected from each of the local governments that made up the Onitsha Education Zone, for a total of twelve schools, using the proportionate sampling technique. The purpose was to guarantee that the sample reflected the proportions of the population and that there were an equal number of schools represented in the local governments that comprised the education zone.

Instrument

The sampled schools' average termly physics scores from the instructors' grade book for the 2023–2024 academic year and the Students Rating of instructors' Quality (SRTQ) serve as the data gathering tools. Shihab Jimaa's Students' Rating was adapted. It a Measure of an Effective Teaching or Best Gauge of Learning? (2013) served as the model for the Students Rating of Teachers' Quality (SRTQ).

Learning, excitement, organization, group interaction, individual rapport, breadth, exams, assignments, and total are its nine (9) clusters. Its dependability coefficient is 0.9 as well. In SRTQ, the following modifications were made. Respondents are asked questions in Section A about their school's name, gender, and location. The respondents' answers about the quality assessment of teachers are gathered in Section B. Is it the best indicator of learning or a measure of effective teaching among the nine (9) groups from students' ratings? According to Shihab Jimaa (2013), six (6) was organized and utilized.

Due to their varied representation of teaching quality, the six (6) clusters were selected. Responses were given on a four-point scale, 1 denotes extremely low extent, 2 denotes low extent, 3 denotes high extent, and 4 denotes very high extent. Each questionnaire was given once to 50 SS2 students who were chosen at random from a Community Secondary School in Nnewi, Nnewi Education Zone, Anambra State, in order to determine the reliability coefficient of the surveys. The research area does not include the school. The internal consistency of the instruments' items was assessed using the Cronbach's alpha approach. Because the questionnaire items are not dichotomous and no response is considered right or incorrect, Cronbach's alpha is used. Each respondent's set of scores was then coded for computer analysis using SPSS. According to the analysis's findings, the Cronbach alpha coefficient for the Students Rating of Teachers' Quality (SRTQ) was 0.71.

The 2023–2024 academic year's physics teachers' grade books from the selected schools provided the achievement scores. The achievement test was based on the average scores from the teachers' grade book. Experts from the zone and the head of physics at the schools that were sampled verified and certified the results, which detailed the pupils' accomplishments.

Results

Research Question 1: To what extent does teachers' quality predicts the academic achievement scores of secondary school students in physics?

Table 1: Regression Analysis of the Predictive Value of Teachers' Quality and Secondary School Students Academic Achievement in Physics

Model	N	R	R^2	Adjusted R^2	Std. Error	Decision
Teachers' Quality Academic Achievement	408	.020	.010	.002	20.96964	low correlation

a. Predictors: (Constant), Teacher's Quality

Table 1 reveals predictive value of teachers' quality and secondary school students' academic achievement in physics as 0.020. It reveals that correlation coefficient R between teacher's quality and students' academic achievement in physics is 0.020 indicating a low positive predictive value with associated coefficient of determination R^2 0.010. The predictive value, or coefficient of determination (0.010), indicates that 1.0% of students' responses regarding the caliber of their teachers explained the variation in physics students' academic performance. This suggests that factors other than the caliber of their professors account for 99 percent of the difference in students' academic achievement in physics.

Research Question 2: To what extent does teachers' quality predicts academic achievement of male and female secondary school students in physics?

Table 2: Regression Analysis of the Predictive Value of Teachers' Quality and Secondary School Students Academic Achievement in Physics as Moderated by Gender

Model	N	R	R^2	Adjusted R^2	Std. Error	Decision
Teachers' Quality Academic Achievement						
Male	133	.004	.010	.0083	42.67444	low correlation
Female	275	.027	.011			

a. Predictors: (Constant), Gender Response on Teacher Quality

The result in Table 2 shows predictive value of teachers' quality and secondary school students' academic achievement in physics as moderated by gender. It reveals that correlation coefficient R between teacher's quality and male students' academic achievement in physics is 0.04 indicating a low positive predictive value with associated coefficient of determination R^2 in

male as 0.010. The coefficient of determination (0.010) also known as the predictive value means that 1.0% of male students' response on their teachers' quality accounted for the variation in academic achievement of male students in physics. This is an indication that 99% of variation in male students' academic achievement in Physics is attributed to other factors other than their teachers' quality. This demonstrates that raising the caliber of teachers would result in a little rise in the academic performance of both male and female students in physics. Also in Table 3 shows correlation coefficient R between teacher's quality and female students' academic achievement in physics is 0.027 indicating a low positive predictive value with associated coefficient of determination R^2 in female students as 0.011. The coefficient of determination (0.011) also known as the predictive value means that 1.1%of female students' response on their teachers' quality accounted for the variation in academic achievement in physics. This is an indication that 98.9% of variation in female students' academic achievement in Physics is attributed to other factors other than their response in teachers' quality.This shows that improvement in teachers 'quality would lead to small increase in both male and female students' academic achievement in Physics.

Hypothesis 1: The academic success of physics students in secondary school is not significantly predicted by the caliber of their teachers.

Table 3: Regression ANOVA Analysis of Predictive Significant of Teachers' Quality and Academic Achievement of Secondary School Students in Physics

Model	Sum of Squares	Df	Mean Square	F	Sig
Regression	74.701	1	74.701	.170	.680[b]
Residual	178528.630	406	439.726		
Total	178603.331	407			

Regression ANOVA study of the predictive significance of secondary school students' academic performance in physics and the caliber of their teachers is shown in Table 3. There is no discernible change in the outcomes. The results show that the quality of teachers is not a significant predictor of secondary school students' academic achievement in physics (F (1, 406) =.170, p =.680>.05). The conclusion reached is that secondary school pupils' academic success in physics is not significantly predicted by the caliber of their teachers.

Hypothesis 2: Teachers' quality is not a significant predictor of academic achievement of male and female secondary school students in physics.

Table 4: Regression ANOVA Analysis of Predictive Significant of Teachers' Quality and Academic Achievement of Secondary School Students in Physics as Moderated by Gender

Model	Sum of Squares	Df	Mean Square	F	Sig
Regression	587.059	3	195.686	.444	.722[b]
Residual	178016.272	404	440.634		
Total	178603.331	407			

Regression ANOVA study of the academic achievement of male and female secondary school students in Physics and the predictive significance of the instructors' competence is shown in Table 4. There is no discernible change in the outcomes. F(1, 404) =.444, p =.722 >.05, suggesting that the academic performance of male and female secondary school students in Physics is not significantly predicted by the quality of their teachers. The conclusion reached was that the academic success of male and female secondary school pupils in physics is not significantly predicted by the caliber of their professors.

Discussion of Findings

Impact of teachers' quality on secondary school pupils' physics achievement

The study's results in Table 1 indicate a weak positive predictive relationship between the academic success of secondary school pupils in Physics and the caliber of their professors. Therefore, in Table 3, the academic performance of secondary school pupils in Physics is not significantly predicted by the quality of their professors.This research suggests that the caliber of teachers has a significant impact on students' academic performance in physics, either by influencing or predicting it. The study's results corroborate those of other earlier researchers, including Amy-Ogan and Omunakwe (2020) and Rospita and Bhenu (2023), who discovered that teacher quality, teacher attributes, and teacher teaching experience have a positive impact on school quality, which in turn affects student performance. However, the results of this study contradict those of other earlier researchers, including Adeolu and Mohamed (2021), Amie-Ogan

and Omunakwe (2020), and Odunga et al. (2023), who found a moderately positive correlation between students' academic performance and the quality of their teachers in their respective fields of study. More so, the finding of the study is not in line with Tugume et. al. (2024) who observed a clear and significant correlation between high levels of professionalism and strict adherence to the code of conduct with exceptional performance in various teaching duties on students' academic achievement which is against the present finding of this study. The teachers' quality not a significant predictor of the academic achievement of secondary school students in Physics as observed in this study may be as a result that the complexities of student-teacher interactions and individual learning needs overshadow teacher qualifications in influencing academic out comes of the students. Moreover, systemic factors beyond teacher's quality, including family involvement and school resources may have played a significant roles in influencing students in way they responded to the instrument provided to them. The results of this study have led to the conclusion that the quality of teachers is not a significant predictor of secondary school students' academic success in physics.

Impact of teachers' quality on physics students' academic performance in secondary school, as mediated by gender

The study's results, which are displayed in Table 2, indicate a weak positive link between the academic success of male and female secondary school students in Physics and the caliber of their professors. However, Table 4 shows that the academic success of male and female secondary school students in Physics is not significantly predicted by the quality of their professors. The findings in consonance with Social Cognitive Theory (SCT) which explained low positive predictive value between teachers' quality and academic achievement by suggesting that various factors influence learning. Examples factors like students' self-efficacy, environmental context, and peer interactions significantly impact academic outcomes, often overshadowing teacher quality in male and female secondary students.

The study's results, however, contradict those of Yakubu (2021), who noted that there is a notable disparity between male and female students' performance and that male students outperformed female students in physics. The reason teachers' quality not significantly predict the academic achievement of secondary school students in physics as observed in the study could be due to factors like the lack of practical application in teaching, students' pre-existing misconceptions, and educational environments that lack resources. Also, external influences may often overshadow teacher quality, affecting student outcomes. This research has joined the school of thought that has found that the academic achievement of male and female secondary school pupils in Physics is not significantly predicted by the quality of their professors.

Suggestions

These suggestions were offered in light of the study's findings:

- Teachers of Physics ought to indicate other factors that can influence students' achievement more significantly than teachers' quality irrespective of students' gender and school base.
- Government and school administrators should organize service training, workshops, seminars and conferences as this will enable teachers grow and maintain good teaching quality that can positively influence students' academic achievement in physics.

Conclusion

The findings indicate a modest positive predictive value between the academic achievement of secondary school students in Physics and the caliber of their teachers. Thus, the quality of the teachers does not significantly predict the academic success of secondary school students in Physics, and there is a negative correlation between the academic achievement of male and female secondary school students in Physics and the quality of their teachers. Therefore, there is no significant prediction between the academic achievement of male and female secondary school students in Physics and the quality of their teachers.

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