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SCHOOL LOCATIONS AND GENDER MODERATED VARIABLES ON TEACHERS' QUALITY AS PREDICTOR OF SENIOR SECONDARY SCHOOL SCIENCE STUDENTS' ACADEMIC ACHIEVEMENT

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Abstract: *Following the potentially informing educational policy and practices across the globe, this study investigated school locations and gender moderated variables on teachers' quality as predictor of senior secondary school science students' academic achievement. Two research questions guided the study while two hypotheses were tested at 0.05 alpha level. The correlation survey design was adopted. The population of the study comprised 2720 senior secondary two (SS 2) students offering science subjects in all the public secondary schools in Onitsha Education Zone. A Sample size of 408 SS 2 science students offering biology, chemistry, data processing, physics and mathematics in the Education Zone was drawn using multistage procedure. Students Rating of Teachers' Quality (SRTQ), and the achievement scores which was obtained from biology, chemistry, data processing, physics and mathematics teachers' grade book for 2023/2024 academic session from the sampled schools were used as instruments for data collection. The instruments were validated by three experts from Nnamdi Azikiwe University, Awka. The reliability of SRTQ was established using Cronbach alpha method. The reliability coefficients of SRTQ was found to be 0.71. Both SRTQ and the academic achievement scores of senior secondary school science students offering biology, chemistry, data processing, physics*

and mathematics were used as a method for data collection. Coefficient R and R2 were used to answer research question while regression ANOVA (linear and multiple) were used to test the hypotheses. The findings from the results revealed that low positive predictive value exist between teachers' quality and academic achievement in science subjects among urban and rural based senior secondary school students. However, teachers' quality is not a significant predictor of the academic achievement of urban and rural secondary school students in science subjects. Low positive predictive value exist between teachers' quality and academic achievement of male and female senior secondary school students in science subjects. However, teachers' quality is not a significant predictor of the academic achievement of male and female senior secondary school students in science subjects. From the findings it was recommended that senior secondary school science teachers should endavour to indicate other factors that can influence students' achievement in senior secondary school subjects more significantly than teachers' quality irrespective of students' gender and school base. Base on the recommendation conclusions were made.

Key words: *senior secondary school science; teachers' quality; school location and gender.*

Introduction

Senior secondary school science students are typically adolescents in the final years of high school, focusing on scientific disciplines like biology, chemistry, computer, data processing, geography, mathematics and physics. They prepare for higher education or vocational training, developing critical thinking and practical skills necessary for future careers in science, technology, engineering, or related fields (Abumchukwu et al., 2024).

Senior secondary school is crucial for building a strong foundation for higher education and future careers in scientific fields especially among science students. Senior secondary school science students typically enhance their analytical and critical thinking skills through experiments and problem-solving activities. Additionally, they're encouraged to engage in scientific inquiry and participate in projects, fostering creativity and collaboration (Abumchukwu et al., 2024). But despite that senior secondary school is crucial for building a strong foundation for higher education and future careers in scientific fields among students there are still reports of weakness and fluctuating achievement among senior secondary school students in science subjects as reported by West

African Examination Council (WAEC) Chief Examiner's Report in recent years. Report has it that there has been a fluctuating academic achievement in grade level of C6 – A1 in West African Examination Council (WAEC) organized examination in senior secondary school science subjects like biology, chemistry, computer, data processing, geography, mathematics and physics in Nigeria. What could be the causes of the weakness and fluctuations in academic achievement in these senior secondary school science subjects?

Some scholars believe that what may be one of the causes of senior secondary school students' weaknesses and fluctuation in academic achievement in West African Examination Council and National Examination council organized examination is teachers' quality (Assem et al., 2023; Emoefe & Achufusi-Aka, 2022). According to Smith et. al. (2021) teachers' quality is possessing a unique blend of qualities that inspire and empower students. Teachers' quality includes effective communication, empathy, and patience which help are vital for understanding diverse learning needs not minding the nature of school and school location.

School location refers to the specific geographical context in which a school is situated, such as whether it is in a rural or urban environment. It encompasses considerations of the community, including proximity to students' homes, which can influence access to education. For example, guidelines may suggest that schools should ideally be located within a certain distance from children's homes. Some authors believed that distance can be used to determined school location with respect to individual students (Obiorah, et al., 2021). Obiorah et. al. (2021) further averred that if a child can work up to three kilometre and beyond, that is an indication that the school is situated at urban or rural location to the student. While Unimna, et. al. (2019) was of the opinion that school location can not only be identified base on distance but including the nature of the facilities in the school and quality of teachers in those schools also known as teacher quality. No wonder Smith et. al. (2021) observed a high predictive value between teachers' quality and academic achievement of mathematics students in city town but observed a low predictive value between teachers' quality and academic achievement of mathematics students in nob city town. Similarly, Awodun and Oyeniyi (2018) reported no statistically significant difference in the academic achievement mean scores of students in the urban school areas and also no statistical significant difference in the academic achievement mean scores of male and female students in the rural school areas?

However, Okoye and Onwuachu (2018) observed that cognitive styles and school location had a significant influence on students' interest mean achievement in biology in the use of Social Cognitive Theory (SCT) which the authors explains that the low positive correlation

between teachers' quality and academic achievement among urban and rural secondary school students is due to perceived self-efficacy, environmental contexts and gender identity.

Gender identity is a deeply personal aspect that may align with a person's sex assigned at birth or differ from it, as seen in transgender individuals. The understanding of gender has evolved, recognizing that it exists beyond a binary system and can include non-binary and gender queer identities. Gender influence teacher quality through biases and expectations, affecting how teachers perceive and interact with students (Unimna, et al., 2019). For instance, male and female teachers may employ different teaching styles, impacting student engagement and motivation. This could the reason Social Cognitive Theory SCT suggests that positive role models can enhance self-efficacy and academic performance. Thus, diverse teacher representation is important, as quality educators of varying genders can inspire students, foster equitable learning environments, and promote resilience and aspiration across gender identities. While Samuelsson and Samuelsson, (2016) reported that boys feel that they have an influence over the content and are more involved during the lesson than girls. That is why there is a high predictive value between teacher quality and boys' academic achievement in mathematics as against low predictive value in girls but there is no significant difference when moderated by both genders (Samuelsson & Samuelsson, 2016).

From the conceptual and the theory from the literature reviewed so far, it could be noticed that the issues of school location and gender issues as regards to teachers' quality is rare. Also, the issue of general academic achievement of senior secondary school students in science subjects is something is seriously missing. Having in mind that senior secondary school science subjects is crucial for building a strong foundation for higher education and future careers in scientific fields. Meaning, if there is growth in senior secondary school science subjects there will be growth in careers in science field but there is decline, reverse will be the case. It is against this backdrop that the researchers investigated school locations and gender moderated variables on teachers' quality as predictor of senior secondary school science students' academic achievement in Onitsha Education zone of Anambra State.

Purpose of the Study

The purpose of the study was to investigate:

1. Teachers' quality as a predictor of academic achievement in senior secondary school science subjects among urban and rural based schools.

2. Teachers' quality as a predictor of academic achievement of male and female senior secondary school science students.

Research Questions

The following research questions guided the study:

1. To what extent does teachers' quality predict academic achievement in science subjects in urban and rural based senior secondary school?
2. To what extent does teachers' quality predict academic achievement of male and female senior secondary school science students?

Hypotheses

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

1. Teachers' quality is not a significant predictor of the academic achievement of urban and rural based senior secondary school students in science subjects.
2. Teachers' quality is not a significant predictor of the academic achievement of male and female senior secondary school students in science subjects

Method

This study adopted the predictive correlation design. The area of the study was Onitsha Education Zone of Anambra State. The population of the study comprised of 2720 Senior Secondary two (SS2) science students in public secondary schools in Anambra state were used. The sample size for the study consisted of 408 SS2 senior secondary school science students in Onitsha Education Zone of Anambra state.

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 survey research. Thus, 15% of total population (2720) is 408 was used for the study due to the targeted population (co-education schools). Multistage sampling procedure involving different techniques were used in the study.

First using purposive sampling technique, the local government were drawn according to locations (urban and rural). Onitsha North and Onitsha South local governments' area were drawn as urban location while Ogbaru local government area was drawn as rural location. Secondly 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.

Finally, using proportionate sampling technique, four co-educational schools each were drawn from each of the local government that comprised Onitsha Education Zone making it a total of twelve schools.

Reasons were to ensure equal number of school representation in these local government that made up the education zone and also to ensure that sample reflected population proportions.

Instrument

The instruments for data collection are Students Rating of Teachers' Quality (SRTQ) and average termly biology, chemistry, data processing, physics and mathematics scores from teachers' grade book for 2023/2024 academic session from the sampled schools. Students Rating of Teachers' Quality (SRTQ), was adapted from Students' Rating: Is it a Measure of an Effective Teaching or Best Gauge of Learning? by Shihab Jimaa (2013). It consists of nine (9) clusters namely; learning, enthusiasm, organization, group interaction, individual rapport, breadth, examinations, assignments and overall. It also has reliability coefficient of 0.9. The following adaptations were made in SRTQ. Section A elicits information like school name, gender and school location from the respondents. Section B elicit responses from the respondents on teachers' quality assessment. Out of the nine (9) clusters from Students' Rating: Is it a Measure of an Effective Teaching or Best Gauge of Learning? by Shihab Jimaa (2013), six (6) was structured and used. The six (6) clusters were chosen because of diverse representation of teaching quality in those clusters. Four-point scale response format was used which ranging from very low extent (1 point), low extent (2 point), high extent (3 point) and very high extent (4 point). The reliability co-efficient of the questionnaires was established by administering each of the questionnaires once on 50 SS2 senior secondary science students randomly selected from a Community Secondary School at Nawfia in Awka Education Zone, Anambra State. The school is outside the area of the study. Cronbach's alpha technique was used to determine the internal consistency of items in the instruments. Thereafter, set of scores for each respondent were coded for computer analysis using SPSS. The result of the analysis shows that Students Rating of Teachers' Quality (SRTQ) yielded a Cronbach alpha coefficient of 0.71.

The achievement scores were obtained from biology, chemistry, data processing, physics and mathematics teachers' grade book for 2023/2024 academic session from the sampled schools. The average scores from the teachers' grade book were used as the achievement test. The results specified the students' achievement and was confirmed and validated by experts from the zone and the head of biology, chemistry, data processing, physics and mathematics subjects in the sampled schools.

Results

Research Question 1: To what extent does teachers' quality predict

academic achievement in science subjects in urban and rural based senior secondary school?

Model		N	R	R^2	Adjusted R^2	Std. Error	Decision
Teachers' Quality							
Academic Achievement							
Urban		257	.019	.011			
	low				0.011		
	41.6645	Correlation					
Rural		151	.009	.010			

Table 1: Regression Analysis of the Predictive Value of Teachers' Quality and Senior Secondary School Students Academic Achievement in Science Subjects as Moderated by School Based

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

The result in Table 1 shows predictive value of teachers' quality and senior secondary school students' academic achievement in science subject as moderated by school based. It reveals that correlation coefficient R between teacher's quality and urban based senior secondary students' academic achievement in science subjects is 0.019 indicating a low positive predictive value with associated coefficient of determination R^2 in urban based school as 0.011. The coefficient of determination (0.011) also known as the predictive value means that 1.1% of urban based school students' response on their teachers' quality accounted for the variation in academic achievement in senior secondary school science subject. This is an indication that 98.9% of variation in urban based school students' academic achievement in senior secondary school science subject is attributed to other factors other than their teachers' quality. This shows that improvement in teachers 'quality would lead to small increase in both urban and rural based school students' academic achievement in senior secondary school science subject. Also, in the same Table 1 shows predictive value of teachers' quality and senior secondary school students' academic achievement in science subjects as moderated by school based. The correlation

coefficient R between teacher's quality and rural based students' academic achievement in senior secondary school science subjects is 0.009 indicating a low positive predictive value with associated coefficient of determination R^2 among rural students as 0.010. The coefficient of determination (0.010) also known as the predictive value means that 1.0% of rural students' response on their teachers' quality accounted for the variation in academic achievement in senior secondary school science subjects. This is an indication that 99% of variation in rural based students' academic achievement in senior secondary school science subjects 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 urban and rural based school students' academic achievement in senior secondary school science subjects.

Research Question 2: To what extent does teachers' quality predict academic achievement of male and female senior secondary school science students?

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

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

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

The result in Table 2 shows predictive value of teachers' quality and senior secondary school students' academic achievement in science subjects as moderated by gender. It reveals that correlation coefficient R between teacher's quality and male students' academic achievement in senior secondary school science subjects 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 senior secondary school science subjects. This is an indication that 99% of variation in male students' academic achievement in senior secondary school science subjects is attributed to other factors other than their teachers' quality. This shows that improvement in teachers 'quality would lead to small increase in both male and female students' academic achievement in senior secondary school science subjects. Also, in Table 2 shows correlation coefficient R between teacher's quality and female students' academic achievement in senior secondary school science subjects 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 senior secondary school science subjects. This is an indication that 98.9% of variation in female students' academic achievement in senior secondary school science subjects 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 senior secondary school science subjects.

Hypothesis 1: Teachers' quality is not a significant predictor of the academic achievement of urban and rural based senior secondary school students in science subjects.

Table 3 reveals regression ANOVA analysis of predictive significant of teachers' quality and academic achievement of urban and rural senior secondary school students in science subjects. The results show no significant difference $F(1, 404) = .390$, $p = .760 > .05$ indicating that teachers' quality is not a significant predictor of the academic achievement of urban and rural senior secondary school students in science subjects. The inference drawn was that teachers' quality is not a significant predictor of the academic achievement of urban and rural senior secondary school students in science subjects.

Model	Sum of Squares	Df	Mean Square	F	Sig
Regression	515.740	3	171.913	.390	.760[b]
Residual	178087.591	404	440.811		
Total	178603.331	407			

a. Dependent Variable: Achievement

b. Predictors: (Constant), Teacher's quality, School Based

Table 3: Regression ANOVA Analysis of Predictive Significant of Teachers' Quality and Academic Achievement of Senior Secondary School Students in Science Subjects as Moderated by School Based

Hypothesis 2: Teachers' quality is not a significant predictor of the academic achievement of male and female senior secondary school students in science subjects

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			

a. Dependent Variable: Achievement

b. Predictors: (Constant), Teacher's Quality, Gender

Table 4: Regression ANOVA Analysis of Predictive Significant of Teachers' Quality and Academic Achievement of Senior Secondary

School Students in Science Subjects as Moderated by Gender

Table 4 reveals regression ANOVA analysis of predictive significant of teachers' quality and academic achievement of male and female senior secondary school students in science subjects. The results show no significant difference F (1, 404) = .444, p = .722 > .05 indicating that teachers' quality is not a significant predictor of the academic achievement of male and female secondary school students in science subjects. The inference drawn was that teachers' quality is not a significant predictor of the academic achievement of male and female secondary school students in science subjects.

Discussion of Findings

1. Influence of teachers' quality on senior secondary school students' academic achievement in science subjects as moderated by school location
2. Influence of teachers' quality on senior secondary school students' academic achievement in science subjects as moderated by gender.

Influence of Teachers' Quality on Senior Secondary School Students Academic Achievement in Science Subjects as Moderated by School Location

The findings of the study in Table 1 reveal a low positive predictive value exist between teachers' quality and academic achievement in science subjects among urban and rural based senior secondary school students. However, teachers' quality is not a significant predictor of the academic achievement of urban and rural secondary school students in science subjects in Table 3. The finding is in conformity with Social Cognitive Theory (SCT) which explains that the low positive correlation between teachers' quality and academic achievement among urban and rural secondary school students is due to perceived self-efficacy and environmental contexts.

The finding is also in line with Awodun and Oyeniyi (2018) who found no statistically significant difference in the academic achievement mean scores of students in the urban school areas and also no statistically significant difference in the academic achievement means scores of male and female students in the rural school areas. The finding is not in conformity with Smith et.al. (2021) who observed a high predictive value between teachers' quality and academic achievement of mathematics students in city towns but observed a low predictive value between teachers' quality and academic achievement of mathematics students in non-city towns but not in conformity with Okoye and Onwuachu (2018) who observed that cognitive styles and school location had a significant influence on students' interest mean

achievement in biology. The lack of significant predictive power of teachers' quality on urban and rural senior secondary school students' academic achievement in science subjects may be attributed to various factors. For example, in both urban and rural contexts, socioeconomic disparities impact the effectiveness of quality teaching. For instance, teachers might face challenges like inadequate resources, isolation, and varying responsiveness to students' needs, influencing their teaching capabilities and undermining their potential impact on student achievement. By virtue of this finding, this research has joined the school of thought that observed that teachers' quality is not a significant predictor of the academic achievement of urban and rural senior secondary school students in science subject.

Influence of Teachers' Quality on Senior Secondary School Students Academic Achievement in Science Subjects as Moderated by Gender.

The findings of the study in Table 2 shows low positive correlation exist between teachers' quality and academic achievement of male and female senior secondary school students in science subjects. However, teachers' quality is not a significant predictor of the academic achievement of male and female senior secondary school students in science subjects in Table 4. 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.

However, the finding of the study is not in line with Samuelsson and Samuelsson (2016) who observed a high predictive value between teacher quality and boys' academic achievement in mathematics as against low predictive value in girls but in line with assertion that there is no significant difference when moderated by both genders. Also, the finding is not in line with Yakubu (2021) who observed that significant difference exists between the performance of male and female students and that male students performed better than female students in physics. The reason teachers' quality not significantly predict the academic achievement of senior secondary school students in science subjects 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. By virtue of this finding, this research has joined the school of thought that observed that teachers' quality is not a significant predictor of the

academic achievement of male and female senior secondary school students in science subject.

Recommendations

Based on the findings it was recommendations that senior secondary school science teachers should endeavor to indicate other factors that can influence students' achievement in senior secondary school subjects more significantly than teachers' quality irrespective of students' gender and school base.

Conclusion

It was generally concluded that low positive predictive value exists between teachers' quality and academic achievement in senior secondary school science subject among urban and rural based secondary school students. Thus, teachers' quality is not a significant predictor of the academic achievement of urban and rural secondary school students in senior secondary school science subjects.

In addition, a low positive predictive value exists between teachers' quality and academic achievement of male and female senior secondary school students in science subjects. Thus, teachers' quality is not a significant predictor of the academic achievement of male and female senior secondary school students in science subjects.

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