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TEACHERS' PEDAGOGICAL PRACTICES AND SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY IN NORTHERN GEOPOLITICAL ZONE, TARABA STATE, NIGERIA.

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ABSTRACT

This study investigated the teachers' pedagogical practices and secondary school students' academic achievement in chemistry in Northern geopolitical zone, Taraba State, Nigeria. The study used correlational research design, two research questions and two hypotheses guided the study. The population for the study was 42,960 (84 chemistry teachers and 42,876 students). The sample size for the study was 1,029 (24 chemistry teachers and 1005 students). Multistage sampling technique was used. Two instruments used in the study are Pedagogical Practices Observation Schedule (PPOS) and Chemistry Achievement Test (CAT) with reliability index of 0.94 and 0.72 respectively. Data for the study were analyzed using Statistical Package for Social Science (SPSS) version 23. The research questions were answered using descriptive statistics of mean and standard deviation and the research hypotheses were tested using regression analysis and analysis of variance ANOVA. The findings of the study revealed a statistically significant relationship between the pedagogical practices of secondary school chemistry teachers and student academic achievement with private schools associated with higher performance. A weak and non-significant negative correlation between teacher gender and students' achievement was revealed.

Keywords: Pedagogy, Pedagogical Practice, Social Pedagogy. Critical Pedagogy, Culturally Responsive Pedagogy. Socratic Pedagogy, Teacher-Centered Pedagogy. Learner-Centered Pedagogy, Learning-Centered Pedagogy, Achievement and Gender.

INTRODUCTION

Chemistry is among the core science subjects that form the bedrock for all science and science related-courses in secondary and tertiary institutions in Nigeria. The subject is concerned with the gaining of knowledge on properties, components, transformations and interactions of matter. Chemistry is important because everything we do is chemistry, our body is made up of chemicals and chemical reactions occur when we breath, eat or just reading. That's why Virendra (2019) stated that all forms of matter are chemistry.

Chemistry improved the quality of lives in the areas of development of new drugs, food production, production of daily household products such as soap and detergent, environmental protection and economic growth. The development of the nation is usually measured by the degree and the extent of growth brought to it through the enterprise of science and which is largely supported by chemistry knowledge. Chemical knowledge is important in understanding the quality and quantity of matter in terms of composition, properties and behavior changes that matter undergoes. The teaching of the subject aims at developing scientific concepts, principles and skills that enable students learn important aspects of scientific concepts that would enable them live, interact and adapt to the changes in their immediate environment, becomes useful members of the society and prepare for global competitiveness.

Despite the importance of chemistry and the efforts made by teachers and science education researchers to improve students' achievement in the subject, the number of students securing a credit pass in the Public examinations conducted by the West African Examinations Council (WAEC) still leaves much to be desired. Lack of credit pass in SSCE chemistry disqualifies many students from getting admission into tertiary institutions to further their studies in the sciences.

The implication of this is a reduction in the number of qualified candidates that can pursue science related courses at the tertiary level of education. This is attributed to many factors including complex or abstract nature of chemical concepts (Ibrahim et al. 2022), poorly motivated teachers and students (Mehmet, 2021), lack of scientific equipment for teaching the subject (Mukaniyonsenga, 2023) and inappropriate pedagogical practices employed by chemistry teachers (Clores, 2023). If all the factors affecting achievement are controlled with the exclusion of appropriate pedagogical practices used by chemistry teachers, achievement would still not improve. If the trend of low credit pass in SSCE Chemistry is to be reversed, pedagogical practices capable of yielding higher achievement through the use of student critical thinking ability, social interaction and freedom in learning has to be employed. This study intents to correlate pedagogical practices of chemistry teachers and students' academic achievement in the subject.

Pedagogy is the science of teaching. According to Montclair (2022) pedagogy refers to the methodology and process of how instructors approach teaching and learning using a specific curriculum with specific goals in mind. Pedagogy is shaped by the teaching beliefs of a teacher and relates the interplay between culture and a variety of methods of teaching. Syed and Subki (2023) argued that Pedagogy plays a crucial role in determining the learning outcomes of students adding that a well-designed pedagogical approach can foster critical thinking, problem-solving skills, creativity, digital skills and collaboration among students.

To improve the quality of education especially secondary schools, teachers should engage in professional development to change classroom pedagogical practices. However, researches have shown that despite investment, advocacy, and emphasis on teacher Professional Development, education is yet to see changes in pedagogical practice in most classrooms worldwide (Yakavets et al., 2022; & Hirsh-Pasek, 2022). On the other hand, a poor pedagogical approach can lead to disengagement, boredom, and lack of motivation among students. That's why Abudu et al. (2024) suggest that modern classroom should focused on creating a supportive and engaging learning environment that is conducive to student success which may include the use of active and collaborative learning strategies and educational activities, such as group work and team-based projects to encourage students to work together and support each other's learning.

A pedagogical practice emphasizes the importance of creating a supportive and engaging learning environment that is conducive to student success. Innovative pedagogical practices are constructivist in nature, which emphasizes the importance of active learning and student engagement in the learning process. Ten pedagogical practices were involved in this study: statement of objectives, skill of presentation, communication skills, classroom management skills, lesson integration, assessment techniques, skill of closure, personal qualities, and nature of the learning environment and method of teaching. Examples of pedagogical practices expected to be observed by teachers include statement of behavioral objectives (relevance, specific and behavioral) classroom management (time management and use of chalkboard) and skills of communication (clarity of voice, appropriate use of language and use of non-verbal gesture).

Pedagogical practices are teaching techniques and strategies that a teacher applies to support student learning. Teachers select the teaching practice most suited to the current level of knowledge of the students, the concept being studied, and the stage in the learning journey of the students. Kanga (2016) posited that quality curriculum without appropriate strategies fails to bring learning opportunities to life. An effective teacher most innovative and creative teaching strategies to teach academic concepts and meet the individual needs of students. It is important to explore innovative pedagogical practices that have the potential to expand teachers' skills and expertise in the classroom which may result in higher achievement.

Academic Achievement is a measure of the extent to which the stated goals of teaching chemistry are achieved. According to (Nwatu, 2018) academic achievement represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and tertiary institutions. Academic achievement is important for the successful development of the

students. Students who perform well in school would be able to make transition in to adulthood and are expected to achieve occupational and economic success. Therefore, it's imperative that chemistry teachers must engage appropriate pedagogical practices to enhance students' achievement. For a shift from traditional teacher-centered learning environment practiced by most science teachers which is one of the factors attributed to poor academic achievement among secondary school students, there is need to improve the teaching and learning style.

The intent of this study is to find out the relationships between chemistry teachers' pedagogical practices and secondary school students' academic achievement in chemistry irrespective of gender. Several initiatives geared towards achieving a higher female participation rate in science and technology in Africa, statistics showed that female engagement in science and technology remains low (Nicia & Luisa, 2020). Najoli (2019) reported that, despite the recognition accorded to females by the Commonwealth Association of Polytechnics in Africa (CAPA) as an important factor for innovation and sustainable development, it is widely believed that male students perform better in science-based subjects as compared to their female counterparts. This fact also stems from the recurring gender difference in the performance of secondary school students in science subjects particularly, in chemistry at external examinations (WAEC Chief Examiner's report, 2021-2023). Filgona et al. (2017) investigate the effect of gender on senior secondary school students' academic achievement and reported that the female students had the highest mean score in Geography.

Oladejo et'tal. (2021) in a study suggested that teaching methods can influence gender differences in chemistry education by incorporating computer simulation where the difference in performance between male and female students was not statistically significant when computer simulation were used. The widening gap in gender difference can be viewed to have taken its root from home and the perception and expectation of the society about gender (Nzewi, 2020). The effects of this stereotype mindset play a major role in both the participation and performance of female teachers and students in science. The chemistry teachers at the senior school level are encouraged to engage themselves in personal professional development programs particularly on the use of modern technologies to deliver lessons.

Research Questions

1. Find out the relationship the Pedagogical Practices of Public and Private schools' chemistry teachers and students' achievement in chemistry
2. Determine the relationship between the pedagogical practices and gender of teachers in public schools and students' achievement in chemistry

Research Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance

Ho_1 There are no statistically significant relationships between the pedagogical practices of public and private secondary school teachers and students' achievement in chemistry

Ho_2 There is no significant relationship between the pedagogical practices and gender of teachers in public secondary schools and students' achievement in chemistry

Literature

Teachers' Pedagogy is the theory and practice of teaching, method and practices of a teacher or how the teacher delivers the curriculum to the class. Pedagogy according to Montclair (2022) refers to the methodology and process of how instructors approach teaching and learning using a specific curriculum with specific goals in mind. Pedagogy is the art, occupation or practice of teaching. Instructional methods or function or work of a teacher; teaching. Pedagogy is the combination of teaching methods (what instructors do), learning activities (what instructors ask their students to do), and learning assessments (the assignments, projects, or tasks that measure student learning).

Pedagogical practice refers to the methods, approaches, and strategies that educators use to facilitate learning and support students' intellectual, social, and emotional development. Effective pedagogical practices are grounded in educational theories, research, and evidence-based strategies. They take into account students' diverse learning needs, prior knowledge, and cultural backgrounds. Pedagogical practices encompass various aspects of teaching, including lesson planning, instructional delivery, assessment methods, classroom management, and the use of educational technologies. A strong pedagogical practice fosters active student engagement, critical thinking, collaboration, and a passion for creativity. Pedagogical practice is the union of theory and practice in the exercise of teaching and apprehending knowledge, in pedagogical action. These practices involve being aware of the entire educational process and the tools used by teachers to make it happen. It involves the reflection of teachers about their knowledge and duties for the development of good pedagogical practice. This also leads us to permeate our educational memory.

Amorin-da-Silva (2018) opined that when planning a lesson, teachers consider the best way to communicate the relevant information to enable students the best possible learning experience. Teachers take into account the context of the subject and also their own teaching preferences. This depends on the age of the learners and the classroom setting. There are various approaches to pedagogy which aim to support learners through their academic so they can achieve the maximum outcome. Employing effective pedagogy approaches enables teachers to reach their full potential and provides a strong foundation for learning to learners. An appropriate pedagogy enables students to develop higher order skills.

Persaud (2019) enumerate the different types of Pedagogy which includes: Social Pedagogy: The goal of social pedagogy is to help students develop their social awareness and overall well-being. Moral instruction and the teaching of values are essential, **c**ritical Pedagogy: It aims to comprehend and dissect various problems and issues that arise in daily life. It motivates the student to delve further and attempt to comprehend their thoughts and beliefs on a particular subject, culturally Responsive Pedagogy: This approach aims to take into account the cultural diversity of students. It aids in understanding cultural differences between students and raises awareness of such differences in the classroom. Socratic pedagogy**:** It encourages students to learn more from outside sources in addition to what is taught to them. This aids the students in coming up with new approaches to the issues.

Ramakrishna and Rama (2022) also state three forms of pedagogy. They are: teacher-centered pedagogy where teacher is the center and relies on lecture, memorization and group responses. This is criticized for taking up lower-order tasks and the merit lies in asking the students to demonstrate their understanding between the lectures. This include direct instruction and kinesthetic learning, learner-centered pedagogy in which learning activities revolve around the learner and they use previous knowledge and new exposure to create knowledge. Learner-centered pedagogy is very effective as it gives room for students to instructional differentiation, inquiry-based learning, expeditionary learning, personalized learning and game-based learning and learning-centered pedagogy: It is a mix of educator and student focused instructional methods. Instructors think about neighborhood setting, number of students in a class, actual climate, and accessibility of showing learning materials, etc. It is highly flexible, and adaptation is its key feature.

Pedagogy plays an important role in designing effective learning approaches and methods that has helped teachers and students to find interesting and effective ways of improving the quality of teaching and learning, assists in gaining an in-depth understanding of fundamental material of facilitating teaching and learning because it provides teachers with insight into the best procedures for a classroom environment. It enables teachers to comprehend how various students learn in order to modify their lessons to meet the desired needs.

The development of a better, more cooperative relationship between teachers and students is facilitated by an understanding of and application of sound pedagogy. Both parties have a mutual understanding, and are working towards a common objective. Therefore, teachers' pedagogical

practices and strategical skills are vital to academic success and failure of students. Seweje and Jegede (2017) noted that teachers' ability to teach is not only dependent on their academic background but upon their outstanding pedagogical skill acquired. OECD (2022) conducted a survey and revealed that many national policies endorse ongoing teacher training. Thirty out of 35 OECD countries require all general subject teachers to engage in professional development. Despite significant investments in teacher professional development in sub-Saharan Africa, there is little evidence of substantial change in classroom practices, (Tabulawa, 2023).

Darling-Hammond et al. (2017) also noted limited changes in teacher practice despite large financial investments in teacher professional development in four districts in the United States serving a largely low-income student population. This shows that there is a gap in research, policy, and practice even, when policies around the globe change, classroom practices remain the same (Hirsh-Pasek et al., 2022). David et al. (2019) emphasize the importance of innovative pedagogies for effective system transformation focused on the breadth and depth of skills. Additionally, the appropriate pedagogy enables teachers to track student's academic development, Teachers have a major role to play in ensuring full implementation of curriculum. The study therefore, investigated ten pedagogical practices as described below: behavioral objectives, lesson preparation, communication, classroom management, lesson integration, assessment technique, closure skill, teachers' personal qualities, nature of the earning environment and teaching methods

Method

Correlational research design was used in this study. Correlational research design is a non-experimental research technique that helps researchers established a relationship between two closely connected variables. Correlational research design requires two different groups. There is no assumption while evaluating a relationship between two different variables and statistical analysis techniques calculate the relationship between them. The study was carried out in Northern geopolitical zone of Taraba state because the region suffered set back in education and have high rate of out of school children due to inadequate personnel to teach the subject, poverty, distance to school and sustainable development.

The population of the study was 42,960 of secondary schools chemistry teachers and students. Out of the population, 84 were size of chemistry teachers and 42,876 were the population size of chemistry students for the year 2023/2024 academic session in Northern geopolitical zone of Taraba State. The population of teachers consist of 64 males and 20 females. The population of chemistry students comprises of 22,512 males and 20,364 females. The sample for the study was 1,029 SS II chemistry teachers and students. Multi stage sampling technique was used. Pedagogical Practices Observation Schedule (PPOS) was developed and Chemistry Achievement Test (CAT) was adopted by the researcher and serve as instruments used for data collection. The developed PPOS was validated by experts while CAT was not because the items were adopted from the standard body (WAEC). The PPOS reliability was determined using Cronbach alpha reliability and the reliability index was found to be 0.94. The reliability of CAT was determined using Kuder Richardson 20 (k r20) and the index was 0.72.

To ensure validity of the data collected by observation, two trained research assistants observed each chemistry lessons and used PPOS to collect data on pedagogical practices of chemistry teachers and CAT for the students. Each lesson was videotaped. The mean achievement scores of students were correlated with teachers' mean scores in practices. The data for the study was analyzed using Statistical Package for Social Science (SPSS) version 23. The research questions were answered using descriptive statistics of mean and standard deviation and the hypotheses were tested using regression analysis and ANOVA.

RESULTS

The result of the study revealed a significant relationship existed between school type and students' academic achievement with private schools associated with higher student achievement scores

compared to public schools. The result of the study also showed no significant relationship between teacher gender and student performance in public schools.

DISCUSSION

Research Questions

What is the relationship between the pedagogical practices of public and private secondary school teachers and students' achievement in chemistry?

Table 1

Model Summary

Mode	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.210[a]	.044	.043	4.96981

a. Predictors: (Constant),
b. teachgender, schtype

The results reveal significant insights about how school type (Public vs. Private) influences students' academic performance. The model summary (Table 1) indicates that the regression explains 4.4% of the variance in students' academic achievement scores (R-squared = 0.044). While the explanatory power is relatively low, it suggests that school type contributes modestly to predicting academic outcomes. The standard error of the estimate (4.96981) reflects the average deviation of observed scores from the predicted values.

Research Question 2

What is the relationship between the pedagogical practices and gender of teachers in public secondary schools and students' achievement in chemistry?

Table 2
Model Summary

Mode	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.009[a]	·000	-.002	4.71881

The regression analysis examined whether the pedagogical practices of male and female chemistry teachers in public schools are related to student's academic achievement. The results showed no significant relationship between teacher gender and student achievement. The analysis in Table 2 reveals that teacher gender accounts for 0.0% of students' academic achievement differences, as indicated by an R- squared value of 0.000 and an adjusted R-squared of -0.002. This means that teacher gender does not meaningfully influence variations in student achievement. The standard error of the estimate, 4.71181, reflects unexplained variability in academic performance.

Null Hypothesis 1 (Ho_1)

There are no statistically significant relationships between the pedagogical practices of public and private secondary school teachers and students' achievement in chemistry

Table 3
ANOVA[a]

Model	Sum of Square	df	Mean Square	F	Sig
Regression	906.931	1	906.931	36.719	.000[b]
Residual	19561.650	792	24.699		
Total	20468.581	793			

a. Dependent variable: stdscore
b. Predictor: (constant), schtype

The regression analysis examined whether the pedagogical practices of male and female chemistry teachers in public schools are related to student's academic achievement. The results show no significant relationship between teacher gender and student performance. The coefficients in the table able supports this conclusion, as the difference in student achievement between male and female teachers is minimal. On average, students taught by male teachers score just 0.109 points higher than those taught by female teachers a negligible and statistically insignificant difference. Additionally, the analysis shows no multicollinearity issues, as the Variance Inflation

Factor (VIF) is 1.000, ensuring the reliability of the results. Overall, the findings indicate that teacher gender does not meaningfully shape students' academic achievement in public schools.

Null Hypothesis 2 (Ho_2)

There is no significant relationship between the pedagogical practices and gender of teachers in public secondary schools and students' achievement in chemistry

Table 4

ANOVA[a]

Model	sum of squares	df	mean square	F	Sig
Regression	1.064	1	1.064	0.48	.827[b]
Residual	12410.466	559	22.201		
Total	12411.529	560			

The regression analysis examined whether the pedagogical practices of male and female chemistry teachers in public schools are related to student's academic achievement. The results show no significant relationship between teacher gender and student performance. The coefficients in the table able supports this conclusion, as the difference in student achievement between male and female teachers is minimal. On average, students taught by male teachers score just 0.109 points higher than those taught by female teachers a negligible and statistically insignificant difference. Additionally, the analysis shows no multicollinearity issues, as the Variance Inflation Factor (VIF) is 1.000, ensuring the reliability of the results. Overall, the findings indicate that teacher gender does not meaningfully shape students' academic achievement in public schools.

Discussion of Findings

The study investigated teachers' pedagogical practices and secondary school students' academic achievement in chemistry in Northern geopolitical zone of Taraba State, Nigeria. Pedagogical Practices of teachers serves as the independent variables while academic achievement was the dependent variable. The findings of this study are discussed under three major sub-headings: Pedagogical Practices and Students' Academic Achievement, School type and Pedagogical practices of Chemistry Teachers and Gender and Students Academic Achievement.

School type and Pedagogical practices of Chemistry Teachers

The results of the study revealed significant insights about how school type (public vs. private) influences students' academic achievement. Table 1 indicates that school type contributes modestly to predicting academic outcomes. Table 2 presents the ANOVA results confirming the regression model of Table 1 indicating that school type has a meaningful statistical significant relationship with student achievement scores. This suggests that differences between public and private schools, as captured by this variable, are relevant in understanding student performance providing further insights that, students in private schools scored higher than their counterparts in public schools. The study is in cordial with the reviewed study of Syed and Subki (2023) who showed overall level of practice skills among teachers in private schools with moderately high mean. The result of the study disagree with the study of Murekatete and Ezechiel (2022) who indicate that teacher's commitment leads to good student performance and the more a teacher is committed and engaged the more students learn from him /her new knowledge.

The findings confirm that school type positively influences student achievement, with private schools associated with higher performance.

Teacher Gender and Students Academic Achievement

The regression analysis examined whether the pedagogical practices of male and female chemistry teachers in public schools are related to student's academic achievement. The results showed no significant relationship between teacher gender and student performance. The analysis in Table 4 reveals that teacher gender accounts for 0.0% of students' academic achievement differences, as indicated by an R-squared value of 0.000 and an adjusted R-squared of -0.002. This means that teacher gender does not meaningfully influence variations in student achievement. The ANOVA results in Table 5 further confirm a negligible and statistically insignificant difference F (1,560) = 0048. The result of the study is in agreement with the study of Godpower-Echie and Sopuruchi (2017) who reported that gender does not have a significant influence on achievement of Integrated Science students. The result contradict the submission of Gongden (2022) and Kisogot et' al. (2021) who showed that a significant difference between the mean achievement scores of male and female students exist. This study therefore, revealed a non-statistically significant relationship existed between teacher pedagogical practices, teacher gender and students' gender.

CONCLUSIONS

This research aimed to investigate teachers' pedagogical practices and students' academic performance. The results of the research indicated that a statistically significant relationships exist between the pedagogical practices of chemistry teachers in public and private secondary schools and students' academic achievement in favor of private schools. This indicates that school type positively influences student achievement, with private schools associated with higher performance. The result of the study further revealed that teacher gender in public schools do not have influence on students' achievement. To improve public school teaching practices for students' success, it is crucial to provide the necessary resources and encourage collaboration between public and private schools teachers to identify and adopt effective teaching pedagogy. Public schools can be contacted for retraining and skill update and support for professional development. The results of this research cannot, however, be taken as conclusive as this research was constrained by some limitations. Therefore, more research are required to fill the gap by providing more detailed result on influence on teachers' pedagogical practices and students' academic achievement.

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