DOI: https://doi.org/10.67203/jerd.2026.l1l487ny

GENDER DIFFERENCE AND INFLUENCE OF SCHOOL TYPE ON STUDENTS' ACADEMIC ACHIEVEMENT IN CHEMISTRY IN SOME SELECTED SENIOR SECONDARY SCHOOLS IN KANO STATE, NIGERIA

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Abstract

This study aims at assessing whether there is a significant gender difference between the senior secondary school students' Academic achievement in chemistry of boarding and day students in some selected secondary schools in Kano, Nigeria. The study formulated three questions to answer (1) What is the level of Academic achievement of some selected female senior secondary school students in chemistry in Kano state, Nigeria? (2) What is the level of Academic achievement of some selected male senior secondary school students in chemistry in Kano state, Nigeria? (3) What is the Academic achievement of male and female secondary schools in chemistry in Kano state? And three null hypotheses H0: There is no significant gender difference between Academic achievement of boarding and day students in Chemistry in some selected schools in Kano. Based on the design of this study which is an ex-post facto and a cross-sectional design, empirical data were collected from eight senior secondary schools within Kano metropolitan comprising four schools each of boarding and day as well as for boys' and girls' schools. The sample size of 346 was proportionately selected from the total population of 3467 selected by stratified sampling. Results of chemistry Senior Secondary School Certificate Examination (SSCE) by National Examination Council (NECO) of 2015/2016, 2016/2017 and 2017/2018 sessions were used for the research. The data were analysed using mean and standard deviation. The relationship between the Academic achievement of the boarding and the day students was determined using Pearson-Moment Co - relation Co-efficient (PMCC) where the r - value showed strong positive relation, and based on the t-test it reveals that there is significant difference between the students' Academic achievement in chemistry of the boarding and the day students in Kano State, Nigeria. The null hypotheses were accepted based on the t-values of t-calculated that were less than t-critical values tested at 0.05 alpha - value, except that for females' achievement which revealed that type of school attended has influenced their achievement. Some recommendations were given to teachers, education managements, stakeholders in educations and Kano state government on how to increase teacher' and parents' awareness on girl child education, especially chemistry which is one of the basic requirement for studies in tertiary institutions.

Keywords: Gender difference, School type, Academic Achievement, Chemistry, Secondary School

Introduction

Gender includes the social, psychological, cultural and behavioral aspects of being a male or female. It entails social and cultural constructs which distinguish differences in the attributes of men and women (United Nations Children's Fund [UNICEF], 2020). It is a socially defined status as roles and actions ascribed to women and men so as to distinguish who they are; what is expected of them by the society, and how they relate to each other for meaningful co-existence (Eribe & Ande, 2021).

According to Armah et al., (2021) in Ghana males out performed females in mathematics and science when he carried out a research on the performance of the distant learners. Perhaps because science subjects attract more male students than female students due to the masculine branding of mathematics and science by socio-cultural background (Amedu, 2015). However, recent studies in developed nations have shown a reverse in academic performance between males and females, with females out performing males in almost all disciplines at various levels of education (Workman & Heyder, 2020). Females are more likely to possess high academic ethics than males and hence they posit to obtain higher academic achievement such as high grade and high GPA (Chee et al., 2005). On the other hand, Omenge and Nasongo (2010) negated the perception that one gender performs better than the other but rather both have equal capacity.

Many people uphold the opinion that, the school type has a very important significant influence on the students' academic achievement. There are various classifications of school-type such as public schools, private schools, day schools, boarding schools, faith schools, secular schools, grammar school, vocational school, urban schools, rural schools, community schools, special schools, specialist schools, etc., and each of these classifications has its different influences on learning outcome in a particular way, Ajayi (2000) opined.

According to Zechariah and Joshua (2016) long distance walk to school has negative impacts on the performance of day students as poor living condition that entails feeding, accommodation and sanitation, affects the performance of boarding students (Wibowo et al., 2023). In fact, availability of infrastructural facilities, to a large extent, enhances academic performances, (Urban & Daad, 2007) opined. But Jagero (2011) argued that open atmosphere in a day school helps students to develop physically and mentally. This implies that they shall have more chance of performing better than their counterparts in boarding school.

According to British Council (2020) boarding schools are educational institutions with dormitory facilities where students may live during the academic session. They have all facilities for residence - accommodation, lavatory, eating, study and recreational areas (Bista & Cosstick, 2005). But a kind of a regular school which students attend during the day and freely return to their homes after classes is a day school (Ajayi, 2000).

Nevertheless, this study will rather focus on the influence of the day and boarding schools on learning outcome of senior secondary students in chemistry on bias to gender of the students. Chemistry is a scientific study of structures of substances, their interactions when in contact with one another and how they behave under different conditions as explained by Onudibia et al. (2019). It has been recognized as an essential school subject and its significance in the scientific and technological growth of any country has remained extensively referred to (Chinda & Pepple, 2021).

Theoretical Framework

This study is anchored on two complementary theories. They are Social Constructivist Theory and Gender Schema Theory.

Social Constructivist Theory

Social Constructivist Theory as propound in 1978, by Lev Vygotsky, posits that learning occurs through social interaction and is influenced by the environment in which the learners are situated. The theory emphasizes that cognitive development is shaped by social contexts such as peer interaction, teacher support and learning facilities. In the contexts of this study, the type of school (boarding or day) represents different social and learning environments that may influence students' academic achievement in chemistry. Boarding schools, for instance, provide structured academic environment with maximum supervision and peer learning opportunities as opined by (Wibowo et al., 2023). This may consequently enhance academic performance as compared to day students.

Gender Schema Theory

On the other hand, Gender Schema Theory as developed by Sandra Bem in 1981, explains how individuals internalize societal expectations regarding gender roles. This, subsequently, influence behavior, interests and performance. In educational settings, gender based expectations may shape students' attitudes toward science subjects like chemistry. Traditionally, science subjects have been perceived as male-dominated which may affect female students' confidence and engagement. According to Wrigley-Asente (2023) this stereotypes contribute greatly in the difference in performance of male and female students at senior high school levels. However, changing societal norms and increased advocacy for girl-child education maybe altering this trend. In middle and high income countries girls in senior secondary schools score significantly high in science (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2022) reported.

The integration of these theories provides a framework for understanding how environment factor (school type) and socially constructed gender-roles interact to influence students' academic performance in chemistry.

Literature Review

There are numerous studies on students' performance in chemistry such as Gustavsan (2019) studied the influence of classroom level, social skills and gender ratio of students which reveals no significant gender influence on the

academic achievement of students in Norway. Similarly, Irungu et al. (2019) reported that there was no significant relationship between gender interaction and students' achievement in chemistry among 384 students sample of SS 3 in Kenya. This was explored through qualitative descriptive survey. Furthermore, Armah et al. (2021) compared the mean achievement scores of 292 students in Benue, Nigeria, that was obtained after teaching stoichiometry aspect of chemistry in a quasi-experimental design study and the data obtained was analyzed using ANCOVA. This study also revealed no gender difference in the performance of the students. Similarly, Mercy et al. (2021) concluded a study conducted in Enugu on 30 male and 42 female basic science students with no significant gender difference in the performance of the students. On the same line Dania (2014) ascertained no effect of gender in the performance of 180 students in social studies sampled out from Delta state students to whom Social Studies Achievement Test (SSAT) was administered. The study used quasi experiment of non-randomized pretest-posttest control group design.

There was significant difference found in mathematics performance between day and boarding Senior Secondary School Students in Sokoto State as concluded by Binji et al. (2020). Nevertheless, Ahmed et al. (2019) identified that male day students perform better than female day students in biology, although the mean difference was marginal (0.44). But Nnamani and Oyibe (2016) in their study at Abakaliki, Ebonyi state identified that female students out performed male students when 3479 JSII students were sampled from public schools. But Wrigley-Asente et al. (2023) ascertained that male students' performance was better than that of their female counterparts in Ghana high senior schools.

On the other hand, Dickson (2019) in his study to exploit the effect of school - type on students' achievement in social studies using post-test only experimental design identified that boarding school students significantly performed better than day school students in social studies when he analyzed the data using t-test. His study although investigated the effect of school-type on achievement but did not focus attention on gender. But Adebisi et al. (2017) identified that there was a significant difference between the performance of female boarding and day students in mathematics external examination. This implies that a type of school attended by female students influenced their performance. Nevertheless, Ahmed et al. (2019) concluded a study conducted in Ondo State, Nigeria that no significant difference that exists between the performance of male and female students in boarding and day secondary schools in biology.

Again Adebisi et al. (2017) compared the performance of boarding and day senior secondary students in biology at Owo LGA in Ondo, Nigeria. This study revealed that there was a significant difference in the students' performance in biology in private and public boarding and day secondary schools.

Also, study of student's performance of boarding and day secondary schools conducted at Nandi County of Kenya indicated that there was a significant difference in the performance of students in boarding and day secondary school's external examination. The study design was a cross-sectional survey research design that studied the students' performance from 2012 to 2015 (Ngetich, 2020).

On the other hand, Zachariah and Joshua (2016) concluded their studies that female students perform better than male in sciences (chemistry inclusive) in Kenyan Secondary Certificate Examination (KSCE). This is in contrast to what Stephen (2016) stated that there was no significant relationship between the performance of boarding and day senior secondary school students' in West African Senior School Certificate Examination (WASSCE). But similar to the conclusion of the study of Pindar et al. (2022) when they compared the 2017, 2018 and 2019 West African Senior Secondary Certificate Examination (WASSCE) results of English, Mathematics and science subjects of twelve boarding and day schools in Gwombe state, Nigeria. The data was treated using Pearson Moment Correlation Coefficient.

This study assesses whether there is a significant influence of gender difference and school-type on students' Academic achievement in chemistry from National Examination Council (NECO) examination results using the students' academic achievement of boarding and day students in chemistry within Kano metropolis that comprises eight local government areas of the state's 44 local government areas. This posits gaps from the previous work. For instance, Pindar et al. (2022) used SSCE results of the students of 2017, 2018 and 2019 as this study used but their research was carried out in different place. And unlike Adebisi et al. (2017) that compared public and private day and boarding senior schools, this study considered public schools only as to essentially have a justifiable yard-stick for comparison. Also this study differs from Binji et al. (2020) who considered their sample to be from SS-

2 rather than the SS-3 students and they used teacher made test rather than a standard examination like WASSCE or NECO. Thus this study used the result of NECO of the sampled schools

Despite numerous studies on gender and school type, there is limited integration of theoretical perceptive that explain why such differences occur particularly within the context of Kano state. Therefore, this study bridges this gap by examining gender differences and school-type influence through established learning and gender theory, thereby providing comprehensive understanding of students' performance in chemistry.

Research Objectives

This study has the following objectives.

i. To examine gender difference in chemistry Academic achievement of some selected male day and boarding Senior Secondary Schools in Kano State, Nigeria.

ii. To examine gender difference in chemistry Academic achievement of some selected female day and boarding Senior Secondary Schools in Kano State, Nigeria.

iii. To determine the relationship between Academic achievement in chemistry of students in boarding and students in day in some Selected Senior Secondary Schools in Kano State, Nigeria,

Research Questions

The following research questions guide the study:

i. What is the level of Academic achievement in chemistry of some selected male day and boarding Senior Secondary Schools in Kano State, Nigeria?

ii. What is the level of Academic achievement in chemistry of some selected female day and boarding Senior Secondary Schools in Kano State, Nigeria?

iii. What is the degree of relationship of gender difference in chemistry Academic achievement of some selected day and boarding Senior Secondary Schools in Kano State, Nigeria?

Research Hypotheses

Ho_1: There is no significant influence of school type on the Academic achievement in chemistry of some selected male Senior Secondary Schools in Kano State, Nigeria.

Ho_2: There is no significant influence of school type on the Academic achievement in chemistry of some selected female Senior Secondary Schools in Kano State, Nigeria.

Ho_3: There is no significant gender difference in students' academic achievement in chemistry among some selected boarding Senior Secondary Schools in Kano State, Nigeria.

Methodology

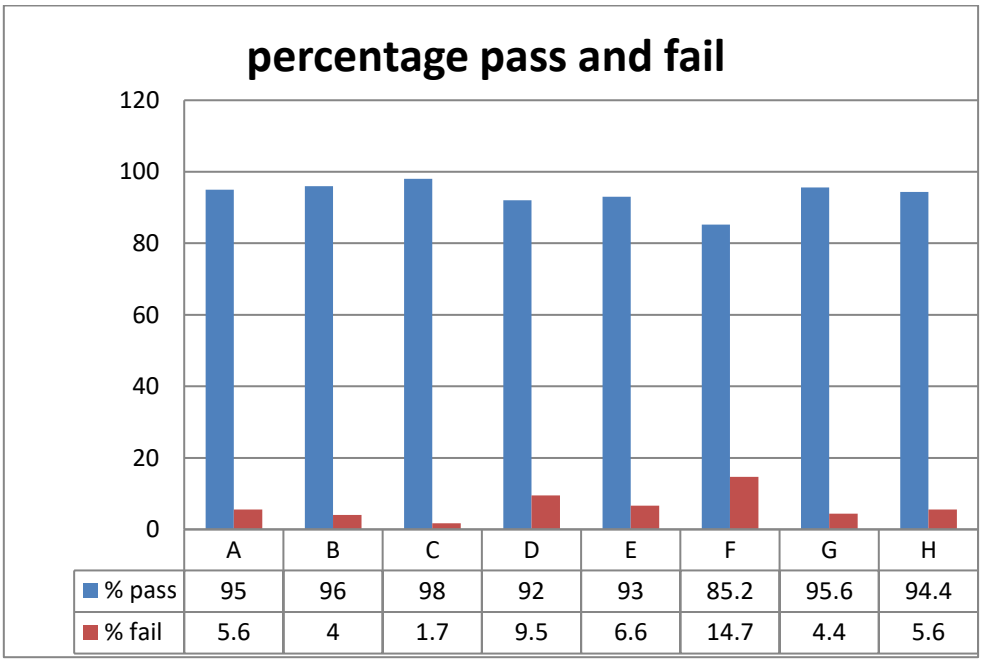
The research design used in this study is an ex-post facto and a cross-sectional descriptive study (Isiaq & Abdullahi, 2025; Akorede et al., 2023). This is because the study used recorded students' results which have already been conducted for their SSCE which does not allow any manipulation by the researcher. The population of the study consisted of SS 3 students offering chemistry in each of the eight Senior Secondary Schools selected purposely within the 8 Kano metropolitan local governments areas who sat for chemistry final year examination in 2015, 2016 and 2017 respectively. The periods were chosen so as to avoid including post Covid -19 epidemic periods as that could posit decline in performance generally due to the total lock down for long time (UNESCO, 2022) reported. There were three thousand and six hundred and sixty- seven (3,667) students from the eight schools of the study, purposively selected, which include male and female day and boarding schools who sat for the examination in Kano State within the period of the study. But among this population 3467 (94.55%) passed with grades of A to E while 200 (5.45%) failed, having F grades, hence this study considered its population to be only those who passed, that is 3467 students. This is because F grades is not considered as a qualifying grade (Kis, 2005).

The study used stratified and proportionate sampling techniques to sample out from all those who passed chemistry in National Examination Council (NECO) examination at the end of their three year studies. Based on this, eight strata were formed to ease categorization since the sample is not homogeneous. Thus three hundred and forty- six (346) students formed the sample based on the research advisors table of sampling size at 95% degree of confidence since the population is very close to 3500 and less than 5000 (Research Advisors, 2006). The sample size was proportionately distributed through the strata using proportionate formula below (Abubakar & Ahmad, 2020).

$$\text{PSS} = \frac{SS}{TP} \times \text{PS}$$

The instrument used for the data collection is a primary instrument- Extract from Spread Sheet of NECO Result (ESSNECOR). It was prepared from results summary collected from the exam officers of each school (four boy schools and four girl schools) as they sourced from the spread-sheet of examination received from the NECO, one of the examination bodies authorized for conducting external examination for SS-3 Students. Consent letters were taken to the principals of each school who introduced the researcher to their examination officer that allowed access to the print out results from which the extract of students results in chemistry was issued by the examination officer. Statistical analyses were carried out to test hypotheses in such a way that the significant difference of individual gender (male and female) with school type and the significant difference in performance between the school type (boarding and day) were evaluated.

Data Analysis and Result



	A	B	C	D	E	F	G	H
% pass	95	96	98	92	93	85.2	95.6	94.4
% fail	5.6	4	1.7	9.5	6.6	14.7	4.4	5.6

Figure 1: *Bar-chart from Data Sourced from Examination office of each of the sample schools*

The figure1 above shows the pass and fail percentage of the aggregate results of the students who sat for chemistry final year examination in 2015, 2016 and 2017 who sat the NECO examination in the sampled schools in a bar-chart. The results presented in the bar-chart shows that there is a distinctive difference between the pass and the fail of the students in chemistry in the sampled schools. It implies that good result has been recorded within the period of the study.

Table I: Population and sample size of the study

Strata of the Sample	Population	Sample Size	Sampling Technique	
A	419	40	Proportionate	Stratified Sampling
B	426	43	Proportionate	Stratified Sampling
C	260	27	Proportionate	Stratified Sampling
D	578	58	Proportionate	Stratified Sampling
E	279	27	Proportionate	Stratified Sampling
F	671	66	Proportionate	Stratified Sampling
G	568	56	Proportionate	Stratified Sampling
H	266	29	Proportionate	Stratified Sampling
	3,467	**346**		

Source: *Examination office of each school, 2023*

Strata A to D are the total population of the students who passed chemistry SSCE from male schools, while Strata E to H are the total population of the students who passed chemistry SSCE from female schools. The sample comprises all those who passed with grades A to E which are grades of pass recognized by the SSCE (Senior Secondary School Certificate Examination) in Nigeria.

Table 2: Sample size based on gender and school type

Strata of the of the Sample	Sample Size	School-type	Sex of the students
A	40	Boarding	Male
B	43	Boarding	Male
C	27	Day	Male
D	58	Day	Male
E	27	Boarding	Female
F	66	Boarding	Female
G	56	Day	Female
H	29	Day	Female
TOTAL	**346**		

Source: *Field data, 2023*

The table 2 above shows the demographic data of the students sampled out from each school by proportionate sampling according to the gender and the school type. There are four schools each for male and female; and four each for boarding and day schools. There were 346 students sampled out for the study, of which the female students are 178(51.4%) and the male students are 168(48.6%).

Testing Hypothesis:

Ho_1: There is no significant influence of school type on the Academic achievement in chemistry of some selected male Senior Secondary Schools in Kano State, Nigeria.

Table 3: Gender Influence and School type on the Academic Achievement of male students

Variables	School type	N	Mean	SD (σ)	Df	α	C calculated	C critical	Decision
Gender (Male)	Boarding	83	92.8	±5.59	166	.05	1.772	1.990	H_0 Accepted
	Day	85	93.0	± 5.98					

Source: Result analysis, 2023

The table 3 above shows the comparison of the t-value results to assess the influence of gender and school type on the Academic Achievement of day and boarding students. The calculated t-value 1.772 is less than the critical value 1.990 at the 0.05 significance level**.** Based on this result, the null hypothesis (Ho_1) was accepted. This implies that the difference between the mean achievement scores of male boarding and day students in chemistry which stood at 0.20 was not significantly influenced by the school type attended by the male students. This indicates that there was no significant difference in performance in chemistry between a male student been a boarding student or day student. Hence, the performance of a student may not be determined by the kind of school attended rather by his self-construction of knowledge. Again it shows that the male students had good performance

in chemistry in both day and boarding school, since the mean values of the % pass is high with small values of standard deviation, which are (92.8 ±5.59) and (93.0 ±5.98) respectively.

Ho_2: There is no significant influence of school type on the Academic achievement in chemistry of some selected female Senior Secondary Schools in Kano State, Nigeria.

Table 4: Gender Influence and School type on the Academic Achievement of Female students

Variables	School type	N	Mean	SD (σ)	Df	α	C calculated	C critical	Decision
Gender (Female)	Boarding	93	97.0	±2.71	176	.05	2.237	1.990	H_0 Rejected
	Day	85	92.2	± 9.50					

Source: Result analysis, 2023

The table 4 above shows the comparison of the t-value results to assess the influence of gender and school type on the Academic Achievement of day and boarding female students. The calculated t-value **2.237** is greater than the critical value **1.990** at the 0.05 significance level**.** Based on this result, null hypothesis (Ho_2) was rejected. This implies that the difference between the mean achievement scores of female day and boarding students in chemistry which stood at 4.80 was significantly influenced by the school type attended by the female students. This indicates that there was significant difference between the performance of a female boarding student and a day female student in chemistry. Hence, the performance of a female student may be determined by the kind of school attended. On the other hand, the result shows that the female students had good performance in chemistry in both day and boarding school, since the mean values of the % pass is high with small values of standard deviation which are (97.0 ±2.71) and (92.2 ±9.5) respectively.

Ho_3: There is no significant gender difference in students' academic achievement in chemistry among some selected boarding Senior Secondary Schools in Kano State, Nigeria.

Table 5: Relationship between the Performance of the boarding and day students in Chemistry

Variables x, y	N = 346
X = 4	r = +0.889
Y = 4	

Source: *Result analysis, 2023*

The table 5 above shows the comparison of the result of the boarding and day students using Pearson-Moment Correlation Co-efficient**.** The r - value equals to +0.889 where the cases X and Y represent the boarding and day schools respectively. This implies that there is strong linear relationship between the achievement scores of day and boarding students in chemistry which was shown by the r- value +0.889.

There are four schools each which comprise two for male and two for female in each group.

TABLE 6: Degree of Relationship between the Performance of the boarding and day schools in Chemistry

Variables	School- type	N	Df	α	r- value	t calculated	t critical	Decision
X	Boarding	4	6	.05	0.889	4.751	2.447	H_0 Rejected
Y	Day	4						

The table 6 above shows the comparison of the t-value results to assess the degree of the significance of the influence of gender and school type on the Academic Achievement of day and boarding students. The calculated t-value **4.751** is greater than the critical value **2.447** at the 0.05 significance level**.** Based on this result, null hypothesis (Ho_3) was rejected. This indicates that there was significant difference between the performance of boarding and day male and female schools, in chemistry. Hence, the performance of students may be determined by the kind of school attended.

Findings and Discussion

Based on the results obtained, the study revealed that:

1. The performance of both boarding and day students in chemistry at SSCE-NECO 2015, 2016 and 2017 was generally satisfactory, with no gender differences observed. This finding supports the work of Omenge and Nasongo (2010), Dania (2014), Armah et al. (2021) and Mercy et. al. (2021). But contradicts

Zachariah and Joshua (2016) and Nnamani and Oyibe (2016) who reported female superiority in science subjects.

2. The boarding students' performed better than their day counterparts in chemistry at SSCE during the same period. This aligns with Dickson (2019), but differs from Stephen (2016) who reported no significance difference based on school type.

3. The female day students' performed lower than female boarding students at the same period. This is in accordance with the finding of Nnamani and Oyibe (2016). This disparity may attribute to domestic responsibilities often assigned to female students in day schools, which can reduce available study time (Omenge & Nasongo, 2010). From a theoretical perspective, social constructivists theory suggests that structured learning environment- such as those found in boarding schools- enhance academic outcomes through supervised study, peer collaboration and regulated schedule. Hitherto, gender schema theory implies that reduced exposure to traditional domestic role in boarding settings allows female students to focus more on cognitive effort towards academic pursuits, thereby improving performance. In addition, students learning profiles are influenced by cognitive styles, intelligence, background, gender and culture (Wibowo et al., 2025) opined.

4. The study also established a significant difference in students' academic achievement between boarding and day students in Kano metropolis. This finding is consistent with Dickson (2019) and Adebisi et al. (2017), but contradicts Ahmed et al. (2019) and Pindar et al. (2022) who reported no significant difference in academic achievement between day and boarding students.

Limitations of the Study

This study is limited by its focus on selected secondary schools within Kano Metropolis where boarding schools are relatively few. This may restrict the generalizability of the findings to other regions. Additionally, reliance on secondary data may introduce response biases related to data accuracy and completeness

Recommendations for Future Research.

Future studies should adopt longitudinal designs to examine trends in students' academic performance over time. Expanding the scope to include other regions of Kano State and Nigeria at large will enhance comparability and improve generalizability. Further research may also incorporate qualitative approaches to better understand the underlying factors influencing students' performance.

Recommendation and Conclusion

Based on the findings of this study, the following recommendations were made:

1. Government should improve facilities in boarding schools including instructional, recreational and social resources.

2. More boarding schools, particularly for girls, should be established to provide conducive learning environments.

3. Additional schools should be built within communities to reduce travel distance for day students.

4. Parents and guardians should support students by reducing excessive domestic responsibilities and encouraging study time.

Conclusion

This study highlights the significant role of school type in students' academic achievement in chemistry. Boarding schools, when adequately equipped, provide structured environments that enhance learning outcomes. The findings also emphasize the importance of parental support and equitable access to educational resources. Ensuring improved facilities and balanced responsibilities for students will promote across boarding and day school systems. schools to enhance academic achievement of students in both day and boarding schools irrespective of gender difference so that equal opportunity can be given to all citizens as in accordance to goal of National Policy on Education (FME, 2013).

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