FAMILY BACKGROUND AND STUDENT-RELATED FACTORS AS PREDICTORS OF ACADEMIC ACHIEVEMENT IN CHEMISTRY AMONG SECONDARY SCHOOL STUDENTS IN ZARIA METROPOLIS, NIGERIA

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Abstract:
Academic achievement in chemistry remains a persistent concern among secondary school students in Nigeria, particularly within urban–rural transitional settings like Zaria Metropolis. This study examined the predictive influence of family background and student-related factors on senior secondary school students' academic achievement in chemistry. Investigation employed a descriptive survey design. The population comprised SSII Chemistry students in public secondary schools in Zaria Metropolis, from which a sample of 100 students was selected using purposive sampling techniques. Data were collected using three structured instruments: Family Background Questionnaire (FBQ), Student Factors Questionnaire (SFQ), and Chemistry Achievement Test (CAT). These instruments were validated by experts and yielded acceptable reliability indices via Cronbach's alpha. Data were analyzed using descriptive statistics and Pearson product-moment correlation at a 0.05 significance level. Findings revealed significant positive relationships between family background and academic achievement ($r = 0.80$, $p < .05$) and between student-related factors and academic achievement ($r = 0.91$, $p < .05$). Student-related factors emerged as the strongest predictors of success. The study concludes that while family background provides a crucial foundation, students' internal attributes exert a greater influence. It is recommended that school-based interventions targeting motivation and study habits be prioritized alongside parental support initiatives.

Introduction

Chemistry is a core scientific discipline that serves as a backbone for technological innovation, industrial growth, and scientific understanding globally (Omwirhiren, 2015; Omwirhiren & Ibrahim, 2016). As a "central science," it bridges the physical sciences with life sciences and applied disciplines, providing the conceptual framework necessary to understand the material world at a molecular level. In the Nigerian secondary school curriculum, chemistry occupies a pivotal position, acting as a mandatory prerequisite for students aspiring toward professional excellence in medicine, engineering, pharmacy, biochemistry, and other science-based vocations. The subject is designed not only to impart theoretical knowledge but also to foster analytical

thinking, problem-solving skills, and a practical appreciation for the chemical processes that govern industrial production and environmental sustainability (Blackie,2022; Waseem & Tanweer, 2025).

Notwithstanding its strategic significance, students' performance in chemistry has continued to be unsatisfactory in many regions of Nigeria, including the Zaria Metropolis. This trend is particularly concerning given that Zaria is a historical and contemporary centre of academic excellence in Northern Nigeria. The persistent decline in high-stakes examination results, such as the West African Senior School Certificate Examination (WASSCE) and the National Examinations Council (NECO), suggests a systemic challenge in the mastery of chemical concepts. When students fail to attain credit-level passes in chemistry, it creates a "bottleneck" effect, preventing many bright minds from entering STEM (Science, Technology, Engineering, and Mathematics) fields, which are crucial for the nation's socio-economic development.

Academic achievement in chemistry describes the degree to which students acquire, retain, and apply chemical knowledge, as reflected in their standardized examinations, continuous assessments, and practical laboratory work (Ogbeba & Ajayi, 2016; Alabi, 2018). It is a multifaceted construct that involves the transition from concrete observations to abstract symbolic representations, such as chemical equations and molecular structures. Previous studies have traditionally linked low achievement in chemistry to school-based factors. These include ineffective or purely didactic teaching strategies, inadequate instructional facilities like poorly equipped laboratories, persistent misconceptions regarding abstract topics like stoichiometry or thermodynamics, and unfavorable student attitudes toward the subject's perceived difficulty (Tumay, 2016; Omwirhiren & Ismail, 2022). However, while school-based interventions are necessary, recent evidence suggests that influences beyond the school gate—specifically the intersection of family background and student-related characteristics—play critical roles in shaping long-term learning outcomes.

Family background serves as the primary incubator for academic success. It encompasses diverse elements such as parental level of education, socio-economic status (SES), family composition, and the overall quality of the home-learning environment, all of which contribute to students' intellectual, emotional, and academic growth (Adeyemo, 2019; Rahali & Hamriche, 2023). Learners from supportive and financially stable homes often have greater access to "educational capital." This includes physical resources like home libraries, personal computers, extramural lessons and relevant chemistry textbooks,

as well as "hidden" advantages like academic supervision and high-quality nutritional support. Parents with higher educational attainment are often better positioned to act as mentors, demystifying complex scientific concepts and fostering a culture of inquiry (Tsou, 2020; Ohenyehu, 2022). Conversely, students from low-SES backgrounds may face "double jeopardy," where a lack of resources at home is compounded by the pressures of financial instability, which can detract from the cognitive energy required for rigorous science subjects (Di & Wu,2020)

In addition to these environmental influences, student-related factors such as motivation, study habits, self-efficacy, and interest in chemistry are crucial determinants of academic success. While family background provides the stage, the student is the lead actor. Academic self-efficacy—the belief in one's ability to successfully perform specific academic tasks—is a particularly potent predictor of success in chemistry. Evidence shows that students who exhibit positive learning dispositions, strong intrinsic motivation, and disciplined study habits often achieve higher academic outcomes regardless of their socio-economic starting point (Ogunleye, 2020; Nwosu, 2020). For these students, chemistry is not merely a subject to be memorized but a puzzle to be solved. Their interest drives them to engage in deep-level processing, leading to a more robust understanding of chemical principles.

Although numerous studies have examined the determinants of academic achievement in science within the broader Nigerian context, there is a paucity of localized empirical research that simultaneously examines the predictive influence of family background and student-related factors on chemistry achievement specifically within the Zaria Metropolis. Zaria presents a unique demographic mix of high-level academic professionals and low-income artisanal families, creating a diverse socio-economic landscape that warrants specific investigation. Many existing studies focus on one variable in isolation, failing to account for the symbiotic relationship between the home environment and the learner's internal psychology.

Therefore, this study aimed to address this gap by investigating the combined effects of these variables on students' academic achievement in chemistry, providing a more holistic view of the factors that drive academic excellence in this critical discipline.

Purpose of the Study

The main purpose of this study was to examine family background and student-related factors as predictors of academic achievement in chemistry among secondary school students in Zaria.

Specifically, the study sought to:

- determine the relationship between family background and academic achievement in Chemistry;
- examine the relationship between student-related factors and academic achievement in Chemistry;
- identify family background and student-related factors as the strongest predictors of academic achievement in chemistry.

Research Questions

Three research questions were posed for the study

- How does family background influence students' academic achievement in Chemistry?
- What relationship exists between student-related factors and academic achievement in Chemistry?
- Which of the variables (family background or student-related factors) was the strongest predictor of academic achievement in chemistry?

Research Hypotheses

The following null hypotheses were tested at the 0.05 level of significance:

- There is no significant relationship between family background and academic achievement in Chemistry.
- There is no significant relationship between student-related factors and academic achievement in Chemistry.
- Family background and student-related factors do not significantly predict academic achievement in Chemistry.

Methodology

Research Design

A descriptive survey research design was adopted to examine the existing relationships among variables without manipulation.

Population and Sample

The population comprised SSII Chemistry students in 19 public secondary schools in Zaria Metropolis, Kaduna State. A total of 100 students were selected using purposive sampling to ensure the representation of both male and female students from single-sex and co-educational schools.

Instruments for Data Collection

Three instruments were used: the Family Background Questionnaire (FBQ), Student Factors Questionnaire (SFQ) (both rated on a 5-point Likert scale), and Chemistry Achievement Test (CAT), consisting of 20 multiple-choice items (40 marks).

Validity and Reliability

The instruments were validated by experts in Chemistry Education and Measurement and Evaluation. The reliability coefficients obtained using Cronbach's alpha indicated satisfactory internal consistency.

Data Analysis

Descriptive statistics (mean and standard deviation) were used to answer the research questions, while Pearson Product-Moment Correlation (PPMC) was used to test the hypotheses at $p \leq .05$, using SPSS version 23.

Result

The table below summarizes the relationship between the independent variables (family background and student-related factors) and the dependent variable (academic achievement in chemistry).

Table 1: Pearson Correlation between Family Background, Student -Related Factors, and Academic Achievement in Chemistry

Variables	N	Mean	Std Dev	r-value	Sig.(p)
Family background	100	3.12	1.21	0.80	0.000
Student-related factors	100	3.24	1.80	0.91*	0.000
Academic Achievement	100	17.66	7.12	—	

The results presented in Table 1 indicate a strong positive and statistically significant relationship between family background and academic achievement in chemistry (r (98) = .80, p < .001). This result led to the rejection of the first null hypothesis, confirming that family background significantly influences chemistry achievement among secondary school students in Zaria.

Similarly, a very strong positive and significant relationship was observed between student-related factors and academic achievement in chemistry (r (98) = .91, p < .001). Consequently, the second null hypothesis was rejected, indicating that student-related factors are significant predictors of academic achievement.

A comparison of the correlation coefficients shows that student-related factors exert a stronger influence on academic achievement than family background does, suggesting that students' internal attributes play a more dominant role in determining chemistry performance.

Discussion

The results of this study provide compelling empirical evidence that both family background and student-related factors play significant roles in influencing academic achievement in chemistry among secondary school students in Zaria. By exploring these dual perspectives, the study offers a nuanced understanding of the forces that drive or hinder scientific literacy in a unique educational landscape like Zaria Metropolis.

The strong positive correlation between family background and academic achievement (r=0.80) emphasizes the importance of the home environment in shaping students' learning outcomes. This statistical relationship suggests that the home acts as the primary socialization agent, providing the foundational scaffolding upon which formal school instruction is built. Students from supportive family backgrounds—characterized by parental

education, stable socio-economic status, and consistent academic encouragement—tend to achieve higher performance in chemistry.

In Zaria Metropolis, this finding takes on a specific localized context. Zaria is a renowned hub of academic excellence, housing several tertiary and research institutions. Consequently, students whose parents are part of this academic workforce enjoy clear advantages. These parents are more likely to provide high-quality learning resources, such as home libraries, extramural lessons, reliable internet access, and specialized chemistry textbooks. Beyond physical resources, educated parents are often better equipped to assist with complex homework or to explain abstract chemical concepts, thereby bridging the gap between classroom theory and practical understanding. This outcome is consistent with earlier studies by Okeke (2017), Umeh and Abubakar (2019), and Ohenyehu (2022), all of which reported that parental education and socio-economic status significantly enhanced students' achievement in science-related subjects.

Furthermore, Onikoyi (2024) emphasizes that the home environment extends beyond financial capacity to include the quality of "academic socialization" provided by parents. When families place a high value on science education, students are more likely to internalize these values, viewing chemistry not just as a school requirement but as a pathway to prestigious professional careers in medicine, engineering, or pharmacy. Although the moderate mean score (3.12) suggests that many students in public schools still experience limited home support, the strong correlation indicates that even modest increases in parental involvement—such as monitoring study schedules or encouraging curiosity—can lead to substantial improvements in chemistry performance.

This finding supports Maslow's Hierarchy of Needs (1943), which argues that basic needs such as emotional stability and financial security must be satisfied before learners can effectively engage in higher-order cognitive tasks. In the context of this study, adequate home support satisfies these "deficiency needs," enhancing students' ability to focus, persevere, and succeed in cognitively demanding subjects like chemistry, which requires intense mental concentration.

While family background is influential, the study revealed an even stronger relationship between student-related factors and academic achievement ($r=0.91$). This suggests that variables such as intrinsic motivation, study habits, self-efficacy, and interest in chemistry have a dominant, almost decisive influence on students' academic success. This finding aligns with those of Ogunleye (2020), Nwosu (2020), and Nwosu and Okeke

(2020), who noted that internal learner characteristics often have a greater impact on achievement than external factors.

Practically, this implies that a student's personal agency—defined by their curiosity about chemical reactions, willingness to solve complex stoichiometric problems, and effective time management—can outweigh other contextual or environmental influences. In the specific context of Zaria's public secondary schools, where laboratory facilities may be inadequate or overcrowded, the "human element" becomes the equalizer. Students who demonstrate resilience and a proactive approach to learning—perhaps by seeking out supplementary materials or forming peer study groups—are more likely to excel regardless of the school's resource constraints.

This result is consistent with Nwosu's (2020) Path Analysis, which identified chemistry self-efficacy as a crucial link between the learning environment and performance. When a student believes they can master the Periodic Table or understand organic reaction mechanisms, their persistence increases. This indicates that while an unfavorable home background may pose significant challenges, it does not necessarily prevent academic success when students develop strong personal learning strategies.

Furthermore, the findings align with Bandura's Social Learning Theory (1977), particularly the concept of "Self-Efficacy." Bandura posits that individuals who believe they can perform a task are more likely to put in the effort required to succeed. In chemistry, where students often face "chemistry anxiety" due to the abstract nature of atoms and molecules, high self-efficacy acts as a psychological buffer. Students who adopt productive study behaviors, such as consistent practice and active recall, are more likely to persist through difficult topics and attain higher achievement levels.

A comparison of the correlation coefficients (0.91 vs. 0.80) further shows that student-related factors are stronger predictors of academic achievement than family background factors. Although family background provides the foundational conditions and the "tools" for learning, the student's internal attributes ultimately determine how effectively they exploit those opportunities. This is a powerful finding for educational equity in Zaria Metropolis; it suggests that students can overcome socio-economic disadvantages through psychological motivation and self-discipline. The implications for the Zaria educational community are profound: one, given that Chemistry demands high levels of abstract reasoning and sustained practice—qualities that are largely student-centred—teachers should shift some focus from students' home limitations toward fostering scientific interest and self-efficacy within the

classroom. Secondly, programmes aimed at improving study skills, time management, and "growth mindset" coaching may yield higher returns on academic performance than material resource provision alone, and third, while financial support by parents is vital, providing an environment that fosters interest and psychological resilience is equally, if not more, important.

Ultimately, the strong correlation (r=0.91) reinforces the idea that while the family may provide the stage and the props, the student remains the central agent and the lead actor in the process of learning chemistry to actualize desirable outcome.

Conclusion

The findings revealed that both variables significantly influenced academic achievement. The student-related factors emerged as the strongest predictors. Therefore, the study concludes that while family support remains essential, students' motivation, self-efficacy, and study habits play a more decisive role in achieving success in chemistry.

Recommendations

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

1. Teachers should adopt learner-centred instructional strategies that promote motivation, active participation, and positive attitudes toward Chemistry.
2. Parents and guardians should provide supportive home environments by monitoring the academic progress of their wards and encouraging positive study habits.
3. Academic support programs, such as study-skills workshops and mentoring schemes, should be organized by the school administration to strengthen students' self-efficacy and learning behaviours.
4. Policy makers should design interventions that target both home-based and school-based factors influencing Chemistry achievement.
5. Future researchers should employ multiple regression or structural equation modelling to further explore the combined predictive power of family- and student-related variables on diversified groups of respondents to compare findings**.**

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