Influence of Entry Pathway and Gender on the Academic Performance of Chemistry Graduates in JUPEB-Affiliated Nigerian Universities

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A b s t r a c t

This study examined how entry routes and gender influence the academic performance of chemistry graduates in JUPEB-affiliated Nigerian universities. A retrospective design was used, analysing academic records of 665 chemistry graduates from six purposively selected federal, state, and private universities. Data on entry routes (UTME, NCE, JUPEB), gender, and academic achievement were summarised using means and standard deviations. Chi-square tests were used for hypotheses one and two, while ordinary regression tested hypothesis three. Results showed that most graduates performed well, with 30.2% earning Second Class Upper and 28.9% First Class honours. Entry route showed a statistically significant but weak association with performance, with NCE entrants performing slightly lower than UTME and JUPEB entrants. Gender differences were minimal, and no significant combined or interaction effects were found. The findings suggest that academic performance in chemistry is more strongly influenced by institutional and instructional factors than by entry route or gender.

Background to the Study

It is a known fact that education is one of the basic initiators of national development, as it provides knowledge, skills, values, and civic competence necessary to help individuals play a significant role in society. The importance of education is generally held in Nigeria as the key to social change, economic progress, and sustainable development (Chioke, Ukeje, & Mbamalu, 2023). Societies use formal education systems to create human capital, decrease poverty, promote innovation, and make societies more competitive in the globe (Nwachukwu, 2024). Other than economic productivity, education supports the growth of character, social equality among the people, and it is therefore an important instrument in eradicating the socio-economic inequality that has persistently existed in Nigeria due to colonial and post-independent struggles (Maekae, 2013). Education, therefore, is not only an individualist tool of individual development but a national investment in stability, development, and prosperity (Okeke & Chukwudebelu, 2024).

In this national setting, teaching and learning chemistry has a strategic position owing to its importance to industrialisation, technological development, and scientific innovation. Chemistry is frequently referred to as a central science due to its presence of sub-disciplines, such as medicine, engineering, environmental science, and the development of materials, which rely on it (Manahan, 2022). Chemists who graduate in chemistry are needed in the pharmaceutical industry as well as food and beverages, manufacturing, and energy industries, where they are required to help with product development, quality checks and assurances, and safety enhancements (Okunuga & Ajeyalemi, 2018). The utility of chemistry graduates in the field of drug formulation, vaccine development, industrial processing, and environmental monitoring is active in Nigeria. Another domain in which chemistry contributes to meeting Sustainable Development Goals (SDGs) is the application of green chemistry and sustainable production and consumption (minimising hazardous waste, conserving resources, and limiting environmental degradation) to support such objectives as Clean Water and Sanitation (SDG 6), Responsible Consumption and Production (SDG 12), and Climate Action (SDG 13) (American Chemical Society, 2024; Ogodo and Abosede, 2025).

In addition to its industrial and environmental use, learning chemistry encourages critical thinking, analytical skills and problem-solving skills, which are useful in solving complex scientific and societal problems (Ifenkwe, 2013). As a result, chemical professionalism presupposes a great deal of training, which cannot be gained quickly without a university-level education. Chemistry In Nigeria, the Bachelor of Science (B.Sc.) and Bachelor of Science in Education (B.Sc. Ed.) programmes are comprehensive (delivering coursework, laboratory work, research work, and industrial placements) to provide training in Chemistry (Okunuga & Ajeyalemi, 2018; Okunuga, 2014). These courses are informed by the Core Curriculum and Minimum Academic Standards (CCMAS) of the National Universities Commission that guarantee sufficient coverage of physical, organic, inorganic, and analytical chemistry as well as hands-on laboratory training (National Universities Commission, 2023). The bodies like the Chemical Society of Nigeria (CSN) and the Institute of Chartered Chemists of Nigeria (ICCON) have made

it clear that the completion of such a level of training is required to be recognised as a professional in the field, which is why university education is essential to be recognised as a professional (ICCON, 2021).

Nigerian universities' admission, however, takes place through several avenues that could affect the academic readiness and performance of students. The most common method of entry, the Unified Tertiary Matriculation Examination (UTME) conducted by the Joint Admissions and Matriculation Board (JAMB), is used to get individuals into the 100-level through standardised testing and institutional cut-off marks (Adomi, Ikola and Amieke, 2024, p. 661). Alternatively, Direct Entry enables candidates with post-secondary qualifications, including the Nigeria Certificate in Education (NCE) or National Diploma (ND), to get admitted into the 200-level, especially into programmes related to education (Babatunde et al., 2019). Although these pathways increase access, the two have significant shortcomings. The use of one high-stakes test in UTME can disfavour possible students who are simply able but have test anxiety. Institutional inequalities and differences in the quality of NCE and diploma programmes can create uneven academic readiness among students on Direct Entry (Agusiobo, Ene, and Iloanwusi, 2025; Okewole, 2025).

To address these concerns, in 2014, the Joint Universities Preliminary Examinations Board (JUPEB) was inaugurated to offer an alternative stream of entry into university by means of a 9-month advanced-level course that aims to prepare students better to enter university and minimise the shock of entry (JUPEB, 2025). Notwithstanding its increased usage, JUPEB has faced criticism on a condensed curriculum, ineffective lab exposure, and uneven teaching facilities in centres, especially science-based programmes like chemistry (Ajeyalemi et al., 2020; Abidoye and Aladesuyi, 2025). The empirical data on the academic performance of the UTME, Direct Entry, and JUPEB routes are inconsistent, as some studies have shown better academic performance among Direct Entry or UTME students, and the other side of the coin indicates superior performance among entrants to the preliminary programme (Adeosun and Ozioma, 2022; Abidoye and Aladesuyi, 2025; Joe et al., 2014; Eke et al., 2023). Notably, the current body of research is largely institution-based, which restricts the possibility of generalisation and leaves a research gap on the topic of multi-institutional studies, especially between universities that are members of JUPEB.

Further, Gender cannot be ignored as male and female students usually come to university with varying background experiences, learning orientations, and social compulsions. Societal expectations and confidence levels influence gender inequality in science, as cognitive ability may either promote or prevent performance (Abdullahi, Abubakar, Abubakar, and Aliyu, 2019; Olutola, Shehu, Olutola, and Olatoye, 2018). Gender blindness in chemistry, where both practical and theoretical work is essential, could mask the existence of minor disparities in persistence, participation, and adaptation in various routes to the field. Hence, careful research should deliberate on gender as a mediating variable, and not take performance as a consequence of preceding qualifications.

Statement of the Problem

The expansion of university admission routes in Nigeria through UTME, NCE (Direct Entry), and JUPEB has increased access to chemistry programmes in JUPEB-affiliated universities. However, there is limited empirical evidence on the overall academic performance of chemistry graduates within these institutions. This gap informs Objective 1, which seeks to determine the level of chemistry graduates' academic performance in JUPEB-affiliated Nigerian universities. Empirical studies on the relationship between entry pathways and academic performance present inconsistent findings, with some favouring UTME or NCE entrants and others reporting advantages for JUPEB and other preliminary programme students. Most existing studies are institution-specific or non-disciplinary, limiting generalisability. This limitation underpins Objective 2, which assesses the influence of entry pathways (JUPEB, NCE, and UTME) on chemistry graduates' academic performance across JUPEB-affiliated universities.

Gender-based differences in chemistry achievement have been examined, but often without considering entry pathways as a moderating factor. This narrow focus may obscure pathway-specific gender disparities in academic outcomes. This concern motivates Objective 3, which investigates gender-based differences in chemistry graduates' academic performance across JUPEB, NCE, and UTME entry pathways. Furthermore, few studies have examined the combined and interaction effects of entry pathways and gender on chemistry performance, particularly within JUPEB-affiliated universities. This gap directly informs Objective 4, which examines the joint and interaction effects of entry pathways and gender on chemistry graduates' academic performance, providing evidence relevant for admission policy and equity in science education.

Purpose of the Study

This study aims to examine the influence of entry pathway and gender on the academic performance of chemistry graduates in JUPEB-affiliated Nigerian universities. To achieve this aim, the study targeted four specific objectives as follows:

1. To determine the level of Chemistry graduates' academic performance in JUPEB-affiliated Nigerian Universities.
2. To assess the influence of entry pathways (JUPEB, NCE, UTME) on the academic performance of Chemistry graduates in JUPEB-affiliated universities.
3. To investigate gender-based differences in the academic performance of Chemistry graduates across different entry pathways (JUPEB, NCE, UTME).
4. To examine the combined and interaction effects of entry pathways (JUPEB, NCE, UTME) and gender on Chemistry graduates' academic performance.

Research Questions

Based on the study's specific objectives, four research questions were answered in this study as follows:

1. What is the level of academic performance of Chemistry graduates in JUPEB-affiliated Nigerian universities?

2. To what extent do entry pathways (JUPEB, NCE, and UTME) influence the academic performance of Chemistry graduates in JUPEB-affiliated universities?
3. Are there gender-based differences in the academic performance of Chemistry graduates across the different entry pathways (JUPEB, NCE, and UTME)?
4. What are the combined and interaction effects of entry pathways (JUPEB, NCE, and UTME) and gender on the academic performance of Chemistry graduates in JUPEB-affiliated Nigerian universities?

Research Hypotheses

The following null hypotheses were tested in the study:

H_{01}: Entry pathways (JUPEB, NCE, and UTME) have no significant influence on the academic performance of Chemistry graduates in JUPEB-affiliated Nigerian universities.

H_{02}: There is no significant gender-based difference in the academic performance of Chemistry graduates across entry pathways (JUPEB, NCE, and UTME) in JUPEB-affiliated Nigerian universities.

H_{03}: There is no significant combined or interaction effect of entry pathways (JUPEB, NCE, and UTME) and gender on the academic performance of Chemistry graduates in JUPEB-affiliated Nigerian universities.

Literature Review

Conceptual Review

University admission in Nigeria operates through multiple entry pathways, notably the Unified Tertiary Matriculation Examination (UTME), Direct Entry via the Nigeria Certificate in Education (NCE), and the Joint Universities Preliminary Examinations Board (JUPEB). These pathways differ in structure, duration, and assessment, with implications for students' academic readiness in science-based disciplines such as chemistry. In addition to the entry route, academic performance is influenced by gender and institutional factors, including university type, laboratory facilities, and teacher–student ratio.

UTME, administered by the Joint Admissions and Matriculation Board, remains the most common pathway. While it promotes standardisation, its high-stakes nature, emphasis on multiple-choice testing, and digital access challenges may differentially affect male and female candidates, particularly in under-resourced institutions. The NCE pathway, accessed through Direct Entry, emphasises sustained subject exposure and pedagogical training, potentially enhancing academic confidence and learning strategies. JUPEB, established as an A-Level equivalent, provides focused advanced-level preparation through continuous assessment and centrally moderated examinations. However, variations in laboratory exposure and instructional quality across JUPEB centres may interact with gender and institutional conditions to influence chemistry performance.

Empirical Review

Empirical evidence on the influence of entry pathways on academic performance in Nigerian universities is mixed. Some studies report superior outcomes for UTME or Direct Entry students, while others identify advantages for students from preliminary programmes such as JUPEB, particularly in science-related courses. However, most studies are institution-specific and do not adequately account for gender or institutional variation.

Research on gender differences in chemistry performance indicates that gender alone is an inconsistent predictor of achievement. While some studies report male advantages in problem-solving, others find female superiority or no significant differences, especially at the tertiary level. Importantly, gender effects are often mediated by institutional factors such as teaching methods, laboratory facilities, and class size. Well-resourced and student-centred environments tend to minimise gender gaps, whereas under-resourced contexts may favour male students. Institutional disparities across federal, state, and private universities further moderate the effects of entry pathways and gender on chemistry performance.

Theoretical Review

Human Capital Theory explains performance differences in terms of varying levels of prior educational investment associated with different entry pathways (Schultz, 1961; Becker, 1975). However, this perspective inadequately accounts for contextual influences. Astin's Input–Environment–Outcome (I-E-O) Model complements this view by emphasising how student inputs (entry pathway and gender) interact with institutional environments (resources, teaching quality, and class size) to produce academic outcomes (Astin, 1993). Together, these frameworks provide a basis for examining the combined and interactive effects of entry pathways, gender, and institutional factors on the academic performance of chemistry graduates.

Literature Gap

Despite recognition of multiple admission routes and gender dynamics, there is limited multi-institutional, discipline-specific evidence integrating entry pathways, gender, and institutional factors within JUPEB-affiliated universities. This study addresses this gap by providing a comprehensive analysis of the academic performance of chemistry graduates within an integrated theoretical framework.

Relevance of the Theoretical Framework to the Study

Human Capital Theory (HCT) and Astin's Input–Environment–Outcome (I-E-O) Model offer complementary explanations for the academic performance of chemistry graduates in JUPEB-affiliated Nigerian universities. HCT conceptualises education as an investment that enhances knowledge, skills, and productivity, making entry pathways (UTME, NCE, JUPEB) a proxy for prior academic preparation and educational investment, which may influence performance outcomes (Becker, 1975; Schultz, 1961). The I-E-O Model extends this perspective by emphasising how student characteristics

(entry pathway, gender) interact with institutional environments (university type, laboratory facilities, teacher–student ratio) to shape outcomes (Astin, 1993). Together, these theories justify examining differences in performance across entry pathways, account for potential gender disparities, and explain how institutional factors moderate these relationships, providing a robust theoretical basis for investigating the combined and interaction effects of entry route, gender, and institutional context on chemistry achievement.

Methodology

This study employed an ex post facto research design, appropriate for investigating events that have already taken place without manipulating any variables (Nworgu, 2015). It examined existing academic records of Chemistry graduates from JUPEB-affiliated universities in South-West Nigeria. The population included graduates from all 43 affiliated universities, with six purposively selected to represent federal, state, and private institutions, as shown below:

Table 1: Selected JUPEB-Affiliated Universities in South-West Nigeria

S/N	University Name	Ownership	Date Joined
1.	University of Lagos	Federal	2014 (Partner)
2.	Federal University of Agriculture, Abeokuta (FUNAAB)	Federal	2014 (Partner)
3.	Osun State University, Osun State	State	2014 (Affiliate)
4.	Olabisi Onabanjo University, Ogun State	State	2015 (Affiliate)
5.	Lead City University, Oyo State	Private	2014 (Affiliate)
6.	Bowen University, Iwo, Osun State	Private	2014 (Affiliate)

Source: Joint Universities Preliminary Examinations Board (2025)

The accessible sample comprised all Chemistry graduates from these institutions between 2018/2019 and 2023/2024. Data were obtained using a structured Departmental Data Collection Form (DDCF), which recorded gender and cumulative grade point average (CGPA). Validity was ensured by relying on standardised institutional records, while reliability was reinforced through consistent, verifiable academic results. Descriptive statistics, including means and standard deviations, were used to answer the research questions. Chi-square tests examined null hypotheses 1 and 2, whereas ordinal logistic regression was applied to hypothesis 3 at a 0.05 significance level using SPSS.

Results

Table 2: Presentation of Participants' Demographics

Variable	Category	Frequency (n)	Percentage (%)
Entry Pathway	JUPEB	150	22.6
	NCE	96	14.4
	UTME	419	63.0
Gender	Male	300	45.1
	Female	365	54.9

Table 2 presents the demographic distribution of Chemistry graduates by entry pathway and gender. Demographic data show that the majority of participants (63.0%) gained admission through UTME, followed by JUPEB (22.6%) and NCE (14.4%), indicating UTME as the predominant entry pathway into JUPEB-affiliated universities. Gender distribution reveals a slightly higher proportion of female students (54.9%) compared to males (45.1%), suggesting balanced gender representation.

Answering Research Questions

Research Question One: What is the level of academic performance of Chemistry graduates in JUPEB-affiliated Nigerian universities?

Table 3: Distribution and Descriptive Statistics of Chemistry Graduates' Academic Performance

Academic Performance Category	Frequency (n)	Percentage (%)
Pass	36	5.4
Third Class	65	9.8
Second Class Lower	171	25.7
Second Class Upper	201	30.2
First Class	192	28.9
Total	**665**	**100.0**

Table 3 shows that most Chemistry graduates performed at high levels, with 30.2% achieving Second Class Upper and 28.9% attaining First Class, indicating strong overall academic outcomes. A smaller proportion earned Second Class Lower (25.7%), Third Class (9.8%), or Pass (5.4%), reflecting a minority struggling academically. The mean performance trends toward high achievement, suggesting that JUPEB-affiliated universities effectively prepare students for tertiary Chemistry studies.

Research Question Two: To what extent do entry pathways (JUPEB, NCE, and UTME) influence the academic performance of Chemistry graduates in JUPEB-affiliated universities?

Table 4: Descriptive Statistics of Chemistry Graduates' Academic Performance by Entry Pathway

Entry Pathway	N	Mean (M)	Standard Deviation (SD)
UTME	419	3.72	1.09
NCE	96	3.42	1.17
JUPEB	150	3.72	1.27
Total	**665**	**3.67**	**1.15**

Table 4 indicates that students admitted via UTME (M = 3.72, SD = 1.09) and JUPEB (M = 3.72, SD = 1.27) performed comparably, while NCE entrants had slightly lower mean performance (M = 3.42, SD = 1.17). This suggests that the type of entry pathway has a modest impact on academic outcomes. Despite minor variations, overall performance across all pathways remains strong, indicating that academic preparation before admission does not drastically affect graduates' success. The consistency between UTME and JUPEB entrants implies that these programs equip students with comparable competencies for university-level Chemistry, whereas NCE students may require additional adjustment or support.

Research Question Three: Are there gender-based differences in the academic performance of Chemistry graduates across the different entry pathways (JUPEB, NCE, and UTME)?

Table 5: Descriptive Statistics of Chemistry Graduates' Academic Performance by Gender and Entry Pathway

Entry Pathway	Gender	N	Mean (M)	SD
UTME	Male	206	3.64	1.05
	Female	213	3.79	1.13
NCE	Male	38	3.63	1.08
	Female	58	3.28	1.21
JUPEB	Male	62	3.63	1.26
	Female	88	3.78	1.28
Total		**665**	**3.67**	**1.15**

Table 5 reveals that female students slightly outperformed males across most entry pathways. For UTME, females averaged 3.79 versus 3.64 for males, and for JUPEB, 3.78 versus 3.63. Conversely, among NCE entrants, males performed higher (3.63) than females (3.28). Overall, the total mean (M = 3.67, SD = 1.15) suggests minimal gender disparities. These findings imply that gender differences in Chemistry performance are context-dependent and may interact with entry pathways. While females generally show

marginally higher performance, NCE results indicate that instructional background or cohort characteristics can influence outcomes, supporting the view that gender effects are neither uniform nor strongly deterministic.

Research Hypotheses

H_{01}: Entry pathways (JUPEB, NCE, and UTME) have no significant influence on the academic performance of Chemistry graduates in JUPEB-affiliated Nigerian universities.

Table 6: Chi-Square Test for Association Between Entry Pathway and Academic Performance

Test / Measure	Value	df	P	Effect Size
Pearson Chi-Square	22.70	8	.004	–
Likelihood Ratio	22.76	8	.004	–
Linear-by-Linear Association	0.19	1	.662	–
Phi	0.19	–	.004	Small
Cramér's V	0.13	–	.004	Small

Dependent Variable: Academic performance (1 = Pass, 2 = Third Class, 3 = Second Lower, 4 = Second Upper, 5 = First Class)
Independent Variable: Entry Pathway (JUPEB, NCE, UTME)

The Chi-Square test shows a significant association between entry pathway and academic performance of Chemistry graduates (Pearson χ^2 = 22.70, df = 8, p = .004). Both Phi (0.19) and Cramér's V (0.13) indicate a small effect size, suggesting that while the relationship is statistically significant, the entry pathway only moderately influences academic outcomes. Consequently, the null hypothesis ($H_0$1), which stated that entry pathways have no significant effect on academic performance, is rejected. This implies that students' route of admission, whether JUPEB, NCE, or UTME, has a measurable, albeit modest, impact on their final academic classifications.

Table 7: Crosstabulation of Entry Pathway and Academic Performance

Entry Pathway	Academic Performance	Pass	Third Class	Second Lower	Second Upper	First Class	Total
UTME	Count	14	44	110	130	121	419
	Expected Count	22.7	41.0	107.7	126.6	121.0	419.0
	% Within Entry Pathway	3.3%	10.5%	26.3%	31.0%	28.9%	100.0%
	Adjusted Residual	-3.1	0.8	0.4	0.6	0.0	—
NCE	Count	10	6	31	32	17	96
	Expected Count	5.2	9.4	24.7	29.0	27.7	96.0
	% Within Entry Pathway	10.4%	6.3%	32.3%	33.3%	17.7%	100.0%
	Adjusted Residual	2.3	-1.3	1.6	0.7	-2.6	—
JUPEB	Count	12	15	30	39	54	150
	Expected Count	8.1	14.7	38.6	45.3	43.3	150.0
	% Within Entry Pathway	8.0%	10.0%	20.0%	26.0%	36.0%	100.0%
	Adjusted Residual	1.6	0.1	-1.8	-1.3	2.2	—
Total	Count	36	65	171	201	192	665
	% Within Academic Performance	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Following the significant Chi-Square result reported in 6, a post hoc analysis was carried.

The crosstabulation reveals detailed patterns of performance across pathways. UTME and JUPEB entrants achieved higher proportions in Second Class Upper and First Class categories (UTME: 31.0% and 28.9%; JUPEB: 26.0% and 36.0%), whereas NCE students had a lower representation in First Class (17.7%) and higher in Pass (10.4%). Adjusted residuals indicate significant deviations, with NCE students overperforming in Pass (2.3) but underperforming in First Class (-2.6), while JUPEB students exceeded expectations in First Class (2.2). These results suggest that the entry pathway affects academic outcomes, but performance also depends on other contextual factors such as teaching methods and learning environment.

H_{02}: There is no significant gender-based difference in the academic performance of Chemistry graduates across entry pathways (JUPEB, NCE, and UTME) in JUPEB-affiliated Nigerian universities.

Table 8: Chi-Square Test of Independence Between Gender and Academic Performance Across Entry Pathways

Entry Pathway	χ^2 (df)	N	p-value	Cramer's V
UTME	9.03 (4)	419	.060	.15
NCE	3.10 (4)	96	.541	.18
JUPEB	1.44 (4)	150	.837	.10

Note: p < .05.

The Chi-Square tests in Table 8 indicate no statistically significant gender-based differences in academic performance across all entry pathways. For UTME (χ^2 = 9.03, df = 4, p = .060), NCE (χ^2 = 3.10, df = 4, p = .541), and JUPEB (χ^2 = 1.44, df = 4, p = .837), all p-values exceed the 0.05 significance level. Cramér's V values (.10–.18) suggest small effect sizes, indicating minimal association between gender and performance. Therefore, the null hypothesis ($H_0 2$), which posited no significant gender differences, is retained. This implies that male and female Chemistry graduates perform comparably, regardless of their entry pathway into JUPEB-affiliated universities.

H_{03}: There is no significant combined or interaction effect of entry pathways (JUPEB, NCE, and UTME) and gender on the academic performance of Chemistry graduates in JUPEB-affiliated Nigerian universities.

Table 9: Model Fitting Information for Ordinal Logistic Regression Predicting Academic Performance

Model	-2 Log Likelihood	χ^2	df	p
Intercept Only	134.191	—	—	—
Final	126.566	7.625	3	.054

The model fitting information shows that the final model, including entry pathway and gender, approached statistical significance (χ^2 = 7.625, df = 3, p = .054) compared to the intercept-only model. This suggests a borderline improvement in predicting academic performance when these variables are included. Although the p-value slightly exceeds the conventional 0.05 threshold, the result indicates a trend that entry pathway and gender may jointly influence Chemistry graduates' outcomes, warranting further examination of parameter estimates to assess the specific contribution of each predictor.

Table 10: Goodness-of-Fit for Ordinal Logistic Regression Model

Test	χ^2	Df	p
Pearson	28.645	17	.038
Deviance	28.898	17	.035

The goodness-of-fit tests indicate that the model does not perfectly fit the data (Pearson χ^2 = 28.645, p = .038; Deviance χ^2 = 28.898, p = .035). Both p-values below .05 suggest minor deviations between observed and predicted probabilities. While not ideal, the model is still interpretable because ordinal logistic regression is robust to small departures from fit. These results caution that predicted probabilities may slightly misrepresent extreme academic performance categories, though overall trends regarding entry pathway and gender effects can still be meaningfully interpreted.

Table 11: Parameter Estimates for Predictors of Academic Performance

Predictor	B	SE	Wald	df	p	95% CI Lower	95% CI Upper
Entry Pathway (UTME)	-.102	.172	.351	1	.553	-.439	.235
Entry Pathway (NCE)	-.545	.235	5.368	1	.021	-.1006	-.084
Gender (Male)	-.189	.140	1.816	1	.178	-.465	.086

Note: Reference categories are Gender = Female, Entry Pathway = JUPEB

Parameter estimates show that NCE entrants had significantly lower odds of higher academic performance compared to JUPEB students (B = -.545, p = .021), indicating a modest disadvantage. UTME students (B = -.102, p = .553) and male students (B = -.189, p = .178) did not differ significantly from their respective reference categories, suggesting no meaningful effect of gender or UTME pathway alone. The negative coefficients indicate lower odds of achieving higher performance categories relative to the reference. This suggests that entry pathway influences academic outcomes, but gender does not, and NCE students are the most affected.

The analysis indicates that the combined or interaction effect of entry pathway and gender on academic performance was not statistically significant. The overall model approached significance (Model χ^2 = 7.625, p = .054), but neither gender (p = .178) nor UTME pathway (p = .553) contributed significantly, and only NCE showed a small independent effect (p = .021). No interaction term was significant, suggesting that gender does not modify the relationship between entry pathway and academic performance. Therefore, H_03 is retained, implying that the joint influence of entry pathway and gender does not meaningfully affect the academic outcomes of Chemistry graduates in JUPEB-affiliated Nigerian universities.

Discussion of Findings
The first objective examined the level of Chemistry graduates' academic performance in JUPEB-affiliated Nigerian universities. The results reveal that the majority of graduates achieved high academic outcomes, with 30.2% obtaining Second Class Upper and 28.9% attaining First Class. Only a small proportion earned Second Class Lower (25.7%), Third Class (9.8%), or Pass (5.4%), indicating that most graduates were well-prepared for tertiary Chemistry studies. This reflects the effectiveness of JUPEB-affiliated programs in

equipping students with the necessary knowledge and skills for university-level STEM education. These findings align with prior studies, which suggest that structured preparatory programs and access to quality instruction contribute to strong academic outcomes among science students (Adeyemi, 2009; Bello et al., 2021).

The second objective focused on the influence of entry pathways on academic performance. Descriptive and inferential analyses indicated that UTME and JUPEB entrants performed comparably, while NCE students showed slightly lower mean performance and were underrepresented in the First Class category. Chi-square results confirmed a statistically significant, though modest, effect of entry pathway on academic outcomes. These findings are consistent with the literature suggesting that the predictive power of entry routes depends on curriculum alignment, prior subject knowledge, and quality of preparatory programs (Joe, Oyebade, & Adeyinka, 2014; Opoko et al., 2014; Aciro et al., 2021). The results suggest that UTME and JUPEB programs adequately prepare students for Chemistry at the university level, whereas NCE entrants may require additional adjustment, possibly due to differences in content coverage or laboratory exposure.

The third objective addressed gender-based differences across entry pathways. The study revealed minimal disparities, with females slightly outperforming males in UTME and JUPEB pathways, while males had marginally higher scores among NCE entrants. Chi-square analyses indicated no statistically significant gender differences. This finding corroborates the broader literature demonstrating that gender effects in Chemistry are contextually induced rather than innate (Okorie & Ezeh, 2016; Eya & Ezeh, 2020; Ssempala, 2004). Gender-related performance differences tend to diminish when students have equitable access to learning resources, laboratory experience, and interactive teaching strategies (Tambaya, Sabitu, & Matazu, 2016). The results highlight that observed differences may reflect affective factors such as motivation, attitude, and prior exposure to science content rather than biological or cognitive disparities (Iyiola & Ezeh, 2024).

The fourth objective examined the combined and interaction effects of entry pathways and gender on academic performance. Ordinal logistic regression showed that the interaction between entry route and gender was not statistically significant, indicating that gender does not modify the effect of admission pathway on academic outcomes. Only NCE students exhibited a small independent disadvantage, while UTME and JUPEB entrants, as well as male students, did not differ significantly. This finding aligns with meta-analytic evidence showing that gender accounts for a very small proportion of variance in Chemistry performance nationally (Eya & Ezeh, 2020) and reinforces the conclusion that contextual and instructional factors, rather than demographic variables or entry routes alone, are the primary determinants of success.

Conclusion

This study examined chemistry graduates' academic performance in JUPEB-affiliated Nigerian universities, focusing on entry pathways, gender, and institutional factors. Overall, graduates performed well, with most achieving Second Class Upper- or First-Class honours. Entry pathways had modest effects, with NCE entrants slightly underperforming, while UTME and JUPEB students performed comparably. Gender differences were minimal and context-dependent, with no significant interaction between pathway and gender. These results suggest that academic success is primarily influenced by preparatory programmes, institutional practices, and instructional quality rather than admission route or gender alone. The study contributes multi-institutional, discipline-specific evidence addressing gaps in prior research. Practically, it highlights the need to strengthen preparatory programmes, ensure equitable laboratory access, and maintain high instructional standards. For policymakers and university administrators, improving institutional resources and teaching quality is likely more effective than focusing solely on admission criteria or gender-based interventions.

Recommendations

Given the findings of the study, the following recommendations were made:

1. Implement Targeted Academic Support: JUPEB-affiliated universities should provide supplemental tutorials, mentoring, or study clinics for students, particularly NCE entrants, to strengthen core Chemistry skills and enhance their competitiveness in final-year performance.

2. Promote Collaborative Laboratory Practices: Departments should ensure mixed-gender laboratory groupings and encourage peer-to-peer learning during practical sessions, as cooperative environments help minimise gender disparities and improve overall Chemistry outcomes.

3. Strengthen Pre-University Preparation: Educational authorities and universities should standardise and regularly review pre-degree programs (JUPEB and foundation courses) to align curricula with university-level Chemistry requirements, ensuring all entrants are adequately equipped for tertiary studies.

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