

INFLUENCE OF THE MODE OF TEACHING CHEMISTRY AMONG SANDWICH AND REGULAR STUDENTS' ACADEMIC PERFORMANCE IN DEGREE EXAMINATIONS IN KWARA STATE COLLEGE OF EDUCATION

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Abstract

This study examined the influence of mode of study on the academic performance of chemistry students, with particular attention to differences between regular and sandwich degree programmes. A descriptive survey research design was adopted. The population comprised all chemistry students enrolled in the regular and sandwich degree programmes at Kwara State College of Education, Oro, affiliated with Ekiti State University. A stratified random sampling technique was used to select participants from both programme categories. Data were collected through a researcher-designed pro forma used to extract students' official examination scores in both theoretical and practical chemistry courses. The instrument was validated by experts in Educational Measurement and Chemistry Education. Data were analyzed using mean, standard deviation, and independent samples t-test at the 0.05 level of significance. The findings revealed a statistically significant difference in the academic performance of students enrolled in the regular and sandwich programmes ($t = 4.96, p < 0.05$), with regular students demonstrating higher performance. Significant difference was also found in the academic performance of male chemistry students across the two programme modes ($t = 2.16, p < 0.05$), favoring those in the regular programme. The results suggest that structural and instructional characteristics contribute to observed performance disparities. The study concludes that mode of study significantly influences academic outcomes in chemistry education. It recommends enhanced academic support, improved laboratory access, and structural review of sandwich programmes to bridge the performance gap and promote equitable learning outcomes.

Keywords: Academic performance, regular programme, sandwich programme, chemistry education.

Introduction

Higher education remains a fundamental driver of individual advancement and national development. Universities are expected to produce graduates equipped with intellectual competence, practical skills, and critical thinking abilities necessary to contribute meaningfully to society. To fulfill this mandate, higher education institutions have diversified their programme structures to accommodate learners with varying academic, professional, and personal commitments. Among the most prevalent formats are the regular (full-time) and sandwich (part-time or block-release) degree programmes. Although both pathways aim to achieve comparable academic standards, variations in structure, instructional delivery, time allocation, and learning environments may influence students' academic performance in distinct ways. The regular degree programme represents the conventional model of university education. It operates on a continuous full-time basis, requiring sustained student presence on campus throughout the academic session. Students participate in lectures, tutorials, continuous assessments, and laboratory sessions according to an approved academic calendar (Brooks & Timms, 2024). This structure typically spans three to four years depending on admission qualifications and field of study (Cai et al., 2022). The regular mode promotes consistent engagement with course materials, frequent interaction with lecturers and peers, and

uninterrupted access to institutional facilities such as libraries, laboratories, and digital learning platforms. Empirical studies support the effectiveness of this mode; Ajayi and Bello (2021) and Ogunleye and Adeyemi (2024) found that regular students consistently outperformed sandwich students in chemistry examinations, attributing the advantage to continuous instructional engagement, structured laboratory access, and sustained academic support.

In contrast, the sandwich degree programme is designed to expand access to higher education for non-traditional learners, including working professionals and individuals with family responsibilities. This model integrates academic instruction with work commitments through block teaching sessions or vacation-based classes (Nwokedi et al., 2024). In some contexts, such as the United Kingdom, sandwich programmes incorporate structured industrial placements to enhance employability and experiential learning (Brooks & Timms, 2024).

However, in Nigeria and several African countries, sandwich programmes are primarily designed for in-service teachers and working adults who attend intensive classes during school holidays (Eze et al., 2024). While this format improves accessibility and flexibility, it often involves compressed instructional periods and limited contact hours, which may present academic challenges. Research by Eze, Nwosu, and Ifeoma (2025) supports this, highlighting that sandwich students often juggle employment, family, and academic commitments, reducing effective study time and limiting mastery of complex concepts. Differences in programme structure raise important questions regarding their impact on learning outcomes, particularly in science-based disciplines.

Chemistry, as a core scientific field, underpins critical sectors such as pharmaceuticals, agriculture, environmental management, and manufacturing. Mastery of chemistry requires both a solid theoretical foundation and extensive practical laboratory competence. Students must develop analytical reasoning, problem-solving skills, and hands-on experimental proficiency. Consequently, the effectiveness of any chemistry programme is closely linked to the quality and continuity of instructional delivery, laboratory exposure, and academic support. Studies by Adeyemi and Musa (2023) demonstrate that repeated and structured laboratory sessions significantly improve theoretical understanding and examination performance, reinforcing the argument that regular programme structures offer measurable advantages in science education.

Laboratory experience is especially crucial in chemistry education. Regular students typically benefit from repeated practical sessions distributed across semesters, reinforcing theoretical concepts through experimentation. In contrast, sandwich students may encounter condensed laboratory schedules, potentially limiting opportunities for in-depth practical engagement (Nwokedi et al., 2022). Wheeler, Kofi, and Mensah (2023) further note that while sandwich programmes may provide experiential learning advantages through industrial placements, these benefits do not always translate to higher examination scores, suggesting a divergence between professional competence and academic achievement.

Beyond instructional structure, environmental and contextual factors also contribute to academic achievement. Regular students generally experience continuous immersion in an academic setting that fosters collaborative learning and consistent faculty mentorship. Sandwich students, however, frequently balance academic responsibilities with employment and family commitments, which may reduce study time and increase stress levels. Research across different regions has reported mixed findings: while structured placements can enhance professional competence and motivation (Wheeler et al., 2022), compressed schedules and

infrastructural limitations may negatively affect examination performance (Adzawla & Osei, 2022; Cai et al., 2022). In Nigeria, several studies indicate that regular students often outperform sandwich students in science-related disciplines due to uninterrupted instruction and extended laboratory access (Ajayi, 2024; Ogunleye & Adeyemi, 2022). Nonetheless, other findings suggest that adequate institutional support and integration of digital learning tools can mitigate performance gaps (Chukwuemerie et al., 2024).

In Nigeria, several studies indicate that regular students often outperform sandwich students in science-related disciplines due to uninterrupted instruction and extended laboratory access (Ajayi, 2024; Ogunleye & Adeyemi, 2022). Nonetheless, research suggests that appropriate institutional support and integration of flexible learning resources can reduce performance disparities (Chukwuemerie et al., 2024). This evidence underscores the relevance of investigating how different programme structures influence student outcomes in chemistry, particularly in a context where laboratory competence, theoretical mastery, and professional readiness are critical.

Despite growing literature on programme structure and student outcomes, limited empirical attention has been directed toward direct comparisons of sandwich and regular students within chemistry programmes, particularly in the Nigerian context. Given the demanding nature of chemistry and its reliance on sustained theoretical and practical engagement, examining whether mode of study significantly influences academic performance remains both timely and necessary. This study therefore seeks to compare the academic performance of chemistry students enrolled in sandwich and regular degree programmes, providing evidence-based insights to inform curriculum planning, laboratory scheduling, instructional strategies, and student support mechanisms. A clearer understanding of these dynamics will contribute to strengthening academic quality and ensuring equitable learning opportunities across programme formats.

Statement of the Problem

Academic performance in higher education is a key indicator of the effectiveness of different academic programmes. Many universities offer chemistry degree programmes in both regular (traditional full-time) and sandwich (part-time, often for working students or those upgrading qualifications) formats. However, concern exists regarding whether the mode of study significantly influences students' academic performance, particularly in chemistry, a discipline that demands intensive theoretical understanding and practical laboratory competence.

Several studies have examined factors influencing students' performance in science-related disciplines, identifying variables such as teaching methodologies, student engagement, learning environment, and availability of instructional resources. Despite these contributions, limited research has specifically focused on comparing the academic performance of chemistry students enrolled in sandwich programmes with those in regular degree programmes. This gap raises critical questions about the relative effectiveness of these two modes of study in equipping students with the knowledge, skills, and competencies required for success in chemistry examinations.

A major concern is whether differences in curriculum delivery, time allocation, student characteristics, and learning environments significantly affect academic achievement. Regular degree students typically experience continuous interaction with lecturers, sustained access to laboratory facilities, and a well-structured academic calendar throughout the year. In contrast, sandwich students often attend classes during condensed periods with limited contact hours,

which may affect their ability to fully comprehend complex chemistry concepts. Additionally, factors such as student motivation, prior academic background, professional experience, and the challenge of balancing work and study commitments may significantly influence outcomes. There is, therefore, a need to investigate whether sandwich students, who may benefit from practical or professional exposure, perform better due to real-world experience, or whether they encounter academic challenges arising from time constraints and workload pressures. Conversely, regular students, despite greater access to academic resources and structured learning environments, may face challenges such as limited professional exposure or distractions from extracurricular activities. This study seeks to examine and compare the academic performance of chemistry students enrolled in sandwich and regular degree programmes to determine whether significant differences exist in their examination results. Insights from this investigation will inform teaching strategies, curriculum design, laboratory scheduling, and student support systems, ultimately contributing to enhanced academic success for both categories of students.

Purpose of the Study

The primary purpose of this study was to examine the influence of mode of study on the academic performance of chemistry students. Specifically, the study sought to:

1. Compare the academic performance of chemistry students enrolled in the regular degree programme with those enrolled in the sandwich degree programme.
2. Determine whether differences exist in the academic performance of male chemistry students across the regular and sandwich degree programmes.

Research Hypotheses

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

H₀₁- There is no significant difference in performance of chemistry students running degree programme through regular and sandwich.

H₀₂ - There is no significant difference in performance of male chemistry students running degree programme through regular and sandwich.

Research Methods

The study employed a descriptive survey research design. This design was deemed suitable because it enabled the researcher to gather relevant data on the academic performance of chemistry students in both sandwich and regular degree programmes and to compare their examination results without manipulating any variables. The design focuses on describing and analysing the current situation as it naturally exists. The population comprised all degree chemistry students in the sandwich and regular programmes of Kwara State College of Education, Oro affiliated with Ekiti State University, Ado-Ekiti.

The sample for the study was drawn from chemistry students of the institution, covering both sandwich and regular programmes. A stratified random sampling technique was adopted. The students were first grouped into two strata—sandwich and regular—after which participants were randomly selected from each group. This approach ensured adequate representation of both categories and enhanced the generalizability of the findings to the entire population of chemistry students.

Data were collected using a pro forma record sheet developed by the researcher. The instrument was used to obtain students' examination scores in chemistry courses from departmental records, including both theoretical and practical components. The reliance on official academic

records ensured the accuracy and objectivity of the data collected. The instrument was validated by two experts in Educational Measurement and Evaluation and one expert in Chemistry Education from the affiliated institution. Their comments and suggestions were incorporated to ensure that the instrument effectively measured what it was intended to assess. An official letter of approval was obtained from the Head of the Department of Chemistry to access the students' results. With the assistance of the departmental examination officer, the researcher collected the scores of the sampled students. The results were documented on the pro forma record sheet and treated with strict confidentiality. Students' names were excluded, and only matriculation numbers were used for identification purposes.

The collected data were analysed using both descriptive and inferential statistics. Mean and standard deviation were used to summarise the academic performance of sandwich and regular students, while an independent samples t-test was employed to determine whether a significant difference existed between the two groups. The hypothesis was tested at the 0.05 level of significance.

Results

Hypothesis 1: There is no significant difference in performance of chemistry students running degree programme through regular and sandwich.

Table 1: Means, Standard Deviations and t-value of Respondents' view on the Basis of regular and sandwich

Gender	No.	Mean	SD	Df	Cal. t-val.	Crit. t-val.	p-value	Decision
Male	23	1.5652	.50687					
				34	4.96*	1.96	0.000	Rejected
Female	13	2.5385	.66023					

*Significant; $p < 0.05$

Table 1 revealed a statistically significant difference in academic performance between students in the two programme modes. The calculated t-value ($t = 4.96$, $df = 34$) exceeded the critical value ($t = 1.96$) at the 0.05 level of significance. The p-value ($p = 0.000$) was less than 0.05. Accordingly, the null hypothesis was rejected, indicating a significant difference in performance between chemistry students in the regular and sandwich degree programmes.

Hypothesis 2: There is no significant difference in performance of male chemistry students running degree programme through regular and sandwich.

Table 2: Means, Standard Deviations and t-value of Respondents' view on the Basis of regular and sandwich

Programme	No.	Mean	SD	df	Cal. t-val.	Crit. t-val.	p-value	Decision
Sandwich	4	1.5000	.57735					
				8	2.16*	1.96	0.003	Rejected
Regular	6	2.1667	.40825					

*Significant; $p < 0.05$

Table 2 shows results of the independent samples t-test for male students showed a statistically significant difference between the two programme modes ($t = 2.16$, $df = 8$). The calculated t-value exceeded the critical value of 1.96 at the 0.05 significance level, and the p-value ($p = 0.003$) was less than 0.05. Thus, the null hypothesis was rejected, indicating a significant difference in academic performance between male chemistry students in the regular and sandwich programmes.

Discussion

The findings of this study revealed that mode of study significantly influences the academic performance of chemistry students. The results obtained from the independent samples t-test indicated a statistically significant difference between students enrolled in the regular degree programme and those in the sandwich degree programme. This suggests that the structure and delivery pattern of the programme play an important role in determining students' academic outcomes in chemistry.

The result of the study showed that there is a significant difference in the academic performance of chemistry students in regular and sandwich programmes. The calculated t-value (4.96) exceeded the critical value (1.96) at the 0.05 level of significance, and the p-value was less than 0.05. This implies that the performance of students differs according to their programme mode. The finding supports earlier studies which reported that regular students often perform better academically than sandwich students in science-based disciplines. For instance, studies by Ajayi and Bello (2021) and Ogunleye and Adeyemi (2024) found that regular students achieved higher scores in chemistry examinations due to continuous instructional engagement, regular laboratory sessions, and sustained academic supervision. One possible explanation for this result is the difference in instructional structure and time allocation between the two programme formats.

Regular students participate in lectures, tutorials, laboratory sessions, and continuous assessments throughout the academic year. This sustained exposure allows them to reinforce theoretical knowledge through repeated practice and interaction with lecturers and peers. Chemistry, as a discipline, requires consistent engagement with both theoretical concepts and laboratory experimentation. Adeyemi and Musa (2023) emphasized that frequent laboratory exposure enhances students' conceptual understanding and problem-solving abilities, which ultimately improves examination performance. Regular students are more likely to benefit from this structured learning environment.

In contrast, sandwich students typically attend compressed or block-release classes, often during vacation periods. Although this structure provides flexibility for working professionals and in-service teachers, it may limit the amount of time available for thorough coverage of complex chemistry concepts. The compressed academic schedule may also reduce opportunities for extended laboratory practice. This observation aligns with the findings of Nwokedi et al. (2024) and Eze, Nwosu, and Ifeoma (2025), who reported that sandwich students frequently face challenges such as limited contact hours, competing work responsibilities, and reduced study time, all of which may affect their academic performance. Furthermore, environmental and contextual factors may also contribute to the performance differences observed in this study.

Regular students are usually immersed in an academic environment that promotes collaborative learning, continuous mentoring, and easy access to academic resources such as libraries, laboratories, and digital learning platforms. These factors can enhance motivation and

academic engagement. Sandwich students, on the other hand, often combine academic studies with professional duties and family commitments. Such responsibilities may increase stress levels and reduce the amount of time available for independent study and revision.

The findings from the study also revealed a significant difference in the academic performance of male chemistry students in the regular and sandwich programmes. The calculated t-value (2.16) was greater than the critical value (1.96), and the p-value was less than 0.05, leading to the rejection of the null hypothesis. This indicates that even among male students, programme structure plays a significant role in shaping academic performance. The higher mean score recorded by male students in the regular programme suggests that they may benefit more from the continuous instructional structure and frequent academic engagement associated with the regular mode of study. This finding is consistent with previous research which suggests that continuous academic exposure and structured learning environments improve performance regardless of gender. Studies have shown that when students have regular access to lecturers, laboratory facilities, and academic support systems, they are better able to understand scientific concepts and perform well in examinations. Conversely, students in compressed or flexible programmes may struggle to fully assimilate complex subject matter due to limited instructional time.

Another important implication of this finding relates to the practical nature of chemistry education. Chemistry learning involves experimentation, observation, and repeated practice. Regular programmes typically distribute laboratory activities across semesters, allowing students to progressively build practical skills. Sandwich programmes, however, may concentrate practical sessions within shorter time frames, which could limit the depth of experimentation and reflective learning. As Wheeler, Kofi, and Mensah (2023) observed, although sandwich programmes may enhance professional experience through workplace exposure, these experiences do not always translate directly into improved academic examination performance.

Conclusion

Based on the findings, it can be concluded that: Mode of study significantly influences the academic performance of chemistry students. Students enrolled in the regular degree programme demonstrated superior academic outcomes compared to those in the sandwich programme. This pattern was also evident among male students. The results suggest that structural and instructional characteristics inherent in each programme type contribute to variations in examination performance. Factors such as instructional continuity, laboratory access, contact hours, and learning environment appear to play critical roles in shaping academic outcomes.

Recommendations

In light of the findings, the following recommendations are proposed:

1. Institutions should strengthen academic support systems for sandwich chemistry students by increasing access to laboratory facilities, organizing supplementary tutorials, and providing structured academic workshops to mitigate performance disparities.
2. Universities should implement targeted mentorship and counseling programmes that address the unique challenges faced by male and female students within sandwich programmes to promote equitable academic achievement.
3. Higher education institutions should reassess the structure and delivery of sandwich degree programmes, with particular emphasis on expanding laboratory contact hours, improving

instructional continuity, and incorporating flexible learning technologies to enhance student engagement and academic performance.

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