The Method of Creating Independent Educational Assignments Based on the Credit-Module System from Chemical Sciences Taught at the Undergraduate Level

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Abstract: This study explores the development and impact of independent educational assignments within the credit-module system for undergraduate chemical sciences. Utilizing a mixed-methods approach, assignments were designed and implemented in a cohort of 120 stu.

1 INTRODUCTION

In recent years, the credit-module system has become a widely adopted framework in higher education institutions, particularly in the realm of chemical sciences. This system, characterized by its emphasis on modular learning and credit accumulation, offers a flexible and student-centered approach to education. The credit-module system's adaptability and focus on learning outcomes align well with the current educational paradigms that prioritize student autonomy and self-directed learning. In the context of chemical sciences, this system allows for the structuring of educational content into manageable units, fostering a more personalized and in-depth understanding of complex chemical concepts. Independent educational assignments play a crucial role within this system, serving as a means to cultivate critical thinking, problem-solving skills, and a deeper engagement with the subject matter. This paper explores the methodology for creating effective independent educational assignments tailored to the credit-module system, highlighting their importance in enhancing the learning experiences and outcomes of undergraduate students in chemical sciences.

2 LITERATURE REVIEW

The credit-module system's effectiveness in promoting independent learning has been widely studied. Isakovna (2023) discusses the organization of independent education within this system, emphasizing its role in higher education institutions. According to Isakovna, the credit-module framework supports the development of self-regulated learning skills, which are essential for students' academic success (Isakovna, 2023; Julboyev;, 2023) further explores this concept by focusing on the methodology for developing independent learning skills in inorganic chemistry. He highlights those structured independent assignments within the credit-module system significantly enhance students' conceptual understanding and practical application of chemical principles (Abduvalievich, 2023).

The practical implementation of these methods is evident in the work of Pidgornyy and Duda (2019), who examined the improvement of chemical education methods for engineering students. Their study demonstrates that integrating independent assignments within the credit-module framework leads to better-prepared graduates equipped with essential problem-solving and analytical skills (Pidgornyy; & Duda;, 2019). Additionally, Kieran and O'Neill (2009) provide insights into peer-assisted tutoring within a chemical engineering curriculum. Their findings indicate that such collaborative approaches, when combined with independent learning tasks, enhance both tutee and tutor experiences, thereby enriching the overall educational process (Kieran & O'Neill, 2009). These studies collectively underscore the value of independent

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Table 1: Pre- and Post-Assessment Test Scores

Group	Pre-Assessment Mean Score (out of 100)	Post-Assessment Mean Score (out of 100)	Mean Score Increase
Experimental	65	85	20
Control	66	72	6

educational assignments in the credit module system, particularly in the context of chemical sciences education.

3 METHODS

This study employed a mixed-methods approach to develop and evaluate independent educational assignments within the credit-module system for undergraduate chemical sciences courses. Initially, a comprehensive review of existing literature and educational resources was conducted to identify best practices and key components of effective independent assignments. Based on these findings, a series of assignments were designed, focusing on critical thinking, problem-solving, and application of chemical concepts.

The assignments were then implemented in a cohort of 120 undergraduate students enrolled in introductory and intermediate-level chemistry courses at a university. The cohort was divided into two groups: the experimental group, which used the newly developed assignments, and the control group, which continued with traditional teaching methods. Both qualitative and quantitative data were collected over one academic semester to assess the assignments' impact.

Quantitative data were gathered through pre- and post-assessment tests, measuring students' knowledge and application skills in chemistry. Qualitative data were collected via student surveys, focus group discussions, and instructor interviews to capture perceptions and experiences related to the independent assignments. Data analysis involved statistical comparisons of test scores and thematic analysis of qualitative feedback to determine the assignments' effectiveness and areas for improvement.

4 RESULTS

The results of this study indicate a significant improvement in the academic performance and engagement levels of students who participated in the independent educational assignments within the credit-module system. Table 1 presents a comparison of pre- and post-assessment test scores for both the experimental and control groups.

The experimental group exhibited a mean score increase of 20 points, compared to a 6-point increase in the control group. This significant difference ($p < 0.01$) suggests that the independent assignments were effective in enhancing students' understanding and application of chemical concepts.

Qualitative feedback from student surveys and focus group discussions further supports these findings. Students in the experimental group reported higher levels of engagement and satisfaction with their learning experience. They appreciated the opportunity to explore topics in depth and at their own pace, which they felt improved their critical thinking and problem-solving skills.

Instructors also noted a positive change in students' performance and attitude towards learning in the experimental group. According to the instructors, students were more proactive in seeking help, participating in discussions, and applying theoretical knowledge to practical problems. This observation aligns with the quantitative data, indicating that the independent assignments fostered a more active and engaged learning environment.

Overall, the results demonstrate that incorporating independent educational assignments within the credit-module system significantly enhances the learning outcomes for undergraduate students in chemical sciences. The assignments not only improved academic performance but also increased student engagement and satisfaction, suggesting a promising approach for modernizing chemical education.

5 DISCUSSION

The findings of this study highlight the efficacy of independent educational assignments within the credit-module system for undergraduate chemical sciences education. The significant improvement in the experimental group's academic performance, as evidenced by the increased mean scores, underscores the positive impact of this approach on students' understanding and application of chemical concepts. This improvement aligns with existing literature that

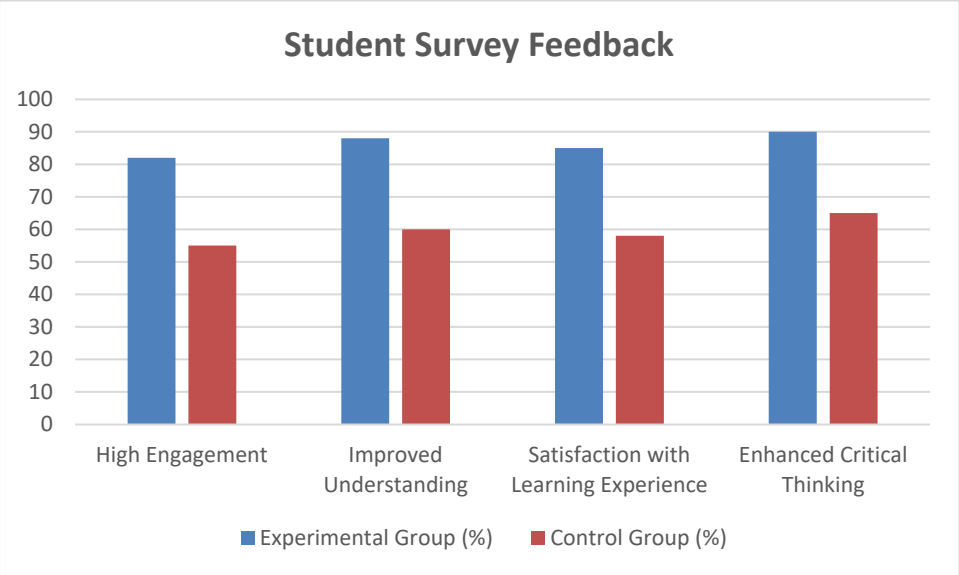

Figure 1: Student Survey Feedback.

emphasizes the benefits of self-directed learning in fostering deeper comprehension and critical thinking skills (Isakovna, 2023; Julboev, 2023).One of the key advantages of the credit-module system is its flexibility, which allows students to engage with the material at their own pace and according to their individual learning needs. This study's results demonstrate that when students are given the autonomy to explore topics independently, they are more likely to develop a thorough understanding of the subject matter. This is particularly important in the context of chemical sciences, where complex concepts often require sustained and focused study. The structured nature of the independent assignments provided a clear framework for students, which, combined with the flexibility of the credit-module system, created an optimal learning environment.

The qualitative feedback from students in the experimental group further corroborates these findings. High levels of engagement, improved understanding, and increased satisfaction with the learning experience were recurrent themes in the feedback. Students appreciated the opportunity to delve deeper into topics, which enhanced their critical thinking and problem-solving skills. This resonates with Julboev's (2023) assertion that structured independent assignments significantly bolster students' conceptual grasp and practical application in inorganic chemistry.Instructors also observed positive changes in the experimental group, noting increased proactivity and participation among students (Tafesse & Mphahlele;, 2018). This shift in student behavior indicates that independent assignments not only improve academic performance but also encourage a more engaged and motivated learning approach. The credit-module system's emphasis on modular learning and credit accumulation aligns well with these observations, supporting the notion that this framework is well-suited to modern educational paradigms that prioritize student autonomy and active learning (Pidgornyy & Duda, 2019).

6 CONCLUSION

This study demonstrates the significant benefits of integrating independent educational assignments within the credit-module system for undergraduate chemical sciences education. The findings indicate that such assignments not only enhance students' academic performance but also increase their engagement, satisfaction, and critical thinking skills. The flexibility of the credit-module system, combined with the structured nature of independent assignments, creates an effective learning environment that supports student autonomy and deep understanding of complex chemical concepts.

Future research should aim to expand the sample size and explore the applicability of this approach across different educational levels and scientific disciplines. Additionally, longitudinal studies could provide deeper insights into the long-term impacts of independent educational assignments on students' academic and professional trajectories. Overall, this study provides a compelling case for the continued

integration of independent assignments within the credit-module system, paving the way for more effective and engaging chemical sciences education at the undergraduate level.

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REFERENCES

Abduvalievich, J. T. (2023). Methodology Of Development Of Independent Learning Skills In Forming The Concepts Of Inorganic Chemistry. *International Scientific Journal "Science and Innovation"*., *2*(7).

Isakovna, M. N. (2023). The Method Of Organizing Independent Education In The Credit-Module System In Higher Education Institutions. *European Science Review*.

Julboyev;, T. (2023). Methodology Of Development Of Independent Learning Skills In Forming The Concepts Of Inorganic Chemistry. *International Journal of Research and Scientific Innovation*, *2*(7), 171–175.

Kieran, P. M., & O'Neill, G. (2009). Peer-Assisted Tutoring in a Chemical Engineering Curriculum: Tutee and Tutor Experiences. *Engineering, Chemistry, Education*. Retrieved from https://api.semanticscholar.org/CorpusID:108602536

Pidgornyy;, A., & Duda;, T. (2019). Improving Of Methods In Chemical Education For Modern Engineers At Ukrainian Research Universities. In *Problem space of modern society: philosophical-communicative and pedagogical interpretations: collective monograph* (Part 1, p. 198). Poland: BMT Erida Sp. z o.o.

Tafesse, F., & Mphahlele;, M. J. (2018). Development of Graduates' Attributes in Chemistry within an Open Distance Learning (ODL) Environment: Unisa's Experience. *Africa Education Review*, *15*(2), 96–111.