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Reform and Research of Applied Advanced Mathematics under the Background of Classroom Revolution

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Abstract: This paper, adopting the theoretical perspective of the "Classroom Revolution" and focusing on the "Applied Advanced Mathematics" course, investigates the practices and research in curriculum teaching reform in dual higher vocational colleges. By introducing new teaching methodologies, optimizing teaching resources, and employing diverse evaluation methods to comprehensively assess students' overall abilities, the aim is to enhance teaching effectiveness and quality. The research not only emphasizes changes within the classroom but also examines the broader impact of the "Classroom Revolution" on the overall educational reform in dual higher vocational colleges. Through analyzing practical outcomes, proposing reform strategies, and offering recommendations, this study aims to provide valuable experiences and references for curriculum teaching reform and research in dual higher vocational colleges, fostering academic exchange and promoting the improvement of teaching quality.

Keywords: Classroom Revolution; Vocational Colleges; Applied Advanced Mathematics; Teaching Reform; Research and Practice

1. Introduction

The primary objective of this study is to explore and research issues related to the teaching reform of the "Applied Advanced Mathematics" course in double high-level institutions. Taking a perspective of "classroom revolution," the study aims to design a new teaching model, optimize teaching resources, employ various assessment methods, comprehensively evaluate students' overall quality, and ultimately enhance teaching effectiveness and quality. Concurrently, the research will investigate the catalyzing role of the "classroom revolution" in the educational and teaching reforms of double high-level institutions. It will analyze the practical effects of educational and teaching reforms, propose strategies, and offer recommendations. The realization of these outcomes is expected to exert a positive impact and driving force on the curriculum and teaching reforms in double high-level institutions, promoting academic exchange and research. This study aims to contribute to the enhancement of teaching quality in double high-level institutions through its findings and recommendations.[1]

2. The Connotation and Significance of Classroom Revolution

The research significance of this project lies in the following aspects:

For the education sector: This study will provide practical ideas and methods for curriculum and teaching reforms in higher education institutions, promoting the improvement of teaching quality and effectiveness.

For double high-level institutions: The research will offer feasible and practical suggestions for educational reforms in double high-level institutions, fostering innovation and development in education.

For students: The study will explore new teaching models in instructional practice, offering potential benefits to students.

These contributions aim to advance the quality of teaching, support educational innovation and development in double high-level institutions, and enhance the overall learning experience for students.[2]

3. Overview of the 'Applied Advanced Mathematics'

Applied Advanced Mathematics provides a conducive learning environment for students in higher vocational colleges. Its aim is to cultivate learners who can systematically, comprehensively, and practically master mathematical knowledge, enhancing students' mathematical skills and their ability to tackle complex problems. Moreover, Applied Advanced Mathematics can assist higher vocational college students in understanding and mastering mathematical thinking, improving logical reasoning skills, thereby facilitating students in coping with intricate social environments. Additionally, Applied Advanced Mathematics can serve as a foundation for computer programming for higher vocational college students, supplementing capabilities for future innovation and creativity, further expanding application possibilities.[3]

4. Curriculum Reform and Research under the 'Classroom Revolution'

4.1 Elevating Teacher Digital Literacy

To enhance teachers' digital literacy in the context of "classroom revolution," it is crucial in the reform and research of curriculum design. Digital literacy encompasses proficient use of digital tools, leveraging digital resources to the fullest, and applying flexible digital teaching methods.[4]

Training and Professional Development: Provide regular training sessions and opportunities for professional development to ensure teachers become adept at utilizing various digital tools, online teaching platforms, and instructional resources. Training content may include online course design and the use of digital assessment tools.

Assessment and Feedback: Design effective mechanisms for assessing digital literacy, incorporating methods such as classroom observations, student feedback, and peer reviews to evaluate teachers' proficiency in digital teaching. Provide timely feedback and support based on the assessments.

Establishing a Digital Resource Repository: Create a digital teaching resource repository to facilitate teachers in accessing and sharing high-quality digital teaching resources. This repository can include teaching videos, online courses, digital textbooks, and other relevant materials.

Digital Collaborative Education: Promote interdisciplinary collaboration through online platforms, fostering the exchange of subject knowledge and technological skills. Utilize social media and online collaboration tools to encourage interaction and collaboration among students, establishing a digital academic community. Implement an online mentoring system to provide personalized guidance, assisting students in academic and career planning.

4.2 Integrating course content with professional knowledge

Analyzing using a management and business-related major as an example, students' comprehensive skills can be enhanced, showcasing the value of foundational disciplines through the following approaches: Financial Modeling and Investment Analysis, Marketing Data Analysis, Operations Research and Production Management, Business Decision-Making and Predictive Analysis and so on.

The specific application of advanced mathematics can be practically integrated through marginal analysis. Students need to grasp the fundamental concepts of calculus, especially an understanding of marginal concepts. Derivatives in calculus can be used to describe the impact of changes in one variable on another. Suppose students are researching the production and sales of products in economics. By using calculus, they can conduct marginal analysis to understand how changes in production levels or sales volumes affect costs or revenue. Students can choose a real business case, analyze the marginal cost and marginal revenue at different production levels or sales volumes. This helps businesses understand the optimal production or sales volume for decision-making to maximize profit. Students can apply calculus knowledge from advanced mathematics to the field of economics, understanding the practical applications of mathematics in economic analysis.[5]

Through these integrations, students can not only grasp the theoretical knowledge of advanced mathematics but also apply it to practical problems, enhancing their ability to solve real-world issues, fostering innovative thinking, and developing comprehensive skills. This not only helps students better understand the value of foundational disciplines but also makes these disciplines more practically applicable, guiding students to adapt more effectively to the needs of future career development.

4.3 Teaching Strategies - Experiential Learning and Flipped Classroom

The experiential teaching approach for Applied Advanced Mathematics can be implemented through the following methods:

Real-world Problem Solving: Engage students in solving real-world problems that require the application of advanced mathematical concepts. This hands-on approach allows them to experience the practical relevance of mathematical principles.

Interactive Simulations: Utilize interactive simulations and modeling tools to create virtual environments where students can explore mathematical concepts through experimentation. This method enhances their understanding by providing a visual and interactive learning

experience.

Case Studies: Introduce case studies that demonstrate the practical applications of advanced mathematical theories in various fields. Analyzing and solving these cases allows students to connect theoretical knowledge with real-world scenarios.

Project-Based Learning: Implement project-based learning activities where students work on mathematical projects that mimic real-world situations. This collaborative approach fosters teamwork and problem-solving skills.

Applied software and tools: Utilize mathematical modeling software, graphic tools, and other applications to enable students to master advanced mathematical knowledge through practical applications. This enhances students' ability to apply mathematical concepts in real-world scenarios.

The Flipped Classroom for Applied Advanced Mathematics can be taken as the following specific steps:

Design Preparatory Tasks: Before each class, design preparatory tasks for students, such as reading specific textbook chapters, watching relevant videos, or solving some simple problems. These tasks should focus on guiding students to preview the upcoming mathematical concepts.

Create Instructional Videos: Teachers can create short yet content-rich instructional videos covering key concepts and problem-solving methods for the day's lesson. Students watch these videos before class to establish a preliminary understanding of new knowledge.

Interactive Classroom Time: Utilize class time for more interactive activities, such as answering students' questions, organizing group discussions, and conducting case studies. This helps students apply the knowledge gained during the preview to real-world problems.

Real-time Problem-solving: During class, teachers can address students' questions in real-time, emphasize key concepts, and guide students in a deeper understanding of mathematical principles. This real-time feedback mechanism helps promptly correct any misunderstandings.

Group Activities and Collaboration: Arrange for students to participate in group activities, collaborating to solve problems or complete tasks. This fosters cooperation and communication among students, enhancing their teamwork skills.

During the implementation process, teachers need to flexibly utilize various teaching resources and tools, harnessing students' initiative and collaborative spirit to ensure the achievement of educational objectives. Additionally, timely adjustments to teaching strategies are essential to accommodate students' learning needs.

4.4 Optimizing the Curriculum Evaluation System

In order to comprehensively assess students' overall competence in the foundational course "Applied Advanced Mathematics," the classroom revolution not only necessitates a reform of teaching methods but also demands a revolutionary change in course evaluation. It is essential to optimize the existing assessment system, establishing a multidimensional evaluation framework with students and teachers as diverse evaluation subjects. Leveraging the learning analytics capabilities of platforms like LearningHub, the evaluation system will be designed based on students' performance in pre-class, in-class, and post-class segments, focusing on knowledge, skills, and qualities.[6]

The multidimensional evaluation criteria encompass both formative and summative assessments. In formative assessment, the breakdown is as follows: pre-class preparation 15%, attendance 10%, in-class performance 25%, group tasks 20%, homework completion 15%, and post-class tests 15%. The summative assessment includes a voting questionnaire accounting for 15% and stage tests making up the remaining 85%. These criteria aim to comprehensively reflect students' abilities in independent thinking, teamwork, and knowledge mastery.[7]

The goal is to construct a diverse, multidimensional, and scientific evaluation system that fosters sustained student engagement and facilitates the implementation of experiential teaching. The specific assessment scores are as shown in Table 1.

Multidimensional and Diversified Scientific Evaluation System

		Evaluation Indicators	Evaluation Dimensions	Evaluation Criteria	Evaluator	Evaluation Process
Total Score	Formative Assessment	Pre-class Learning15%	Independent learning	Learning duration for resources	Learning Platform	Offline Pre-class
		Class Attendance10%	Disciplinary awareness	Attendance record	Learning Platform	Offline In-class
		Classroom Performance25%	Positive thinking Willingness to express oneself	Classroom discussions Exercise participation	Teacher	Offline In-class
		Group Task20%	Autonomous exploration Collaborative teamwork	Group participation and contribution	Teacher,Student	Offline In-class
		Homework15%	Applied skills Mathematical knowledge	Homework grades	Teacher,Platform	Online After Class
		Post-class Testing15%	Mastery of knowledge Habit formation	Exam scores	Teacher,Platform	Online After Class
	Final Assessment	Questionnaire15%	Self-awareness	Subjective evaluation of learning effectiveness	Teacher,Platform	Offline After Class
		Examination85%	Exam-taking skills Skill acquisition	Scores on online learning platform	Teacher,Platform	Offline After Class

Table 1: Specific Assessment Scores

5. Conclusion

Through the reform practices in the course "Applied Higher Mathematics," this paper demonstrates innovation and progress in the teaching of courses at dual higher vocational institutions under the backdrop of the "Classroom Revolution." This not only contributes to the improvement of teaching quality but also provides valuable experiences and insights for future educational reforms.

References

[1] Chen Kun. (2021). Exploring Innovative Teaching Design Strategies in the Context of the "Classroom Revolution". Shanghai Educational Research, 000(007), 88-92.

[2] Romberg, T. A. (1988). Policy Implications of the Three R's of Mathematics Education: Revolution, Reform, and Research.

[3]Wang Xiyu, & Jin Yueqiang. (2021). Exploration of the "Classroom Revolution" Path in Higher Vocational Colleges — Taking Advanced Mathematics Courses as an Example. Science and Technology Vision. 000(025), 102-103.

[4]Wang Xuedong. (2009). Construction and Implementation of Experiential Teaching Mode. Journal of Leshan Normal University, 24(6), 3.

[5]Zhang, Q. (2022). Research and Implementation Suggestions for Vocational Classroom Revolution Based on Characteristics of Vocational Education Types. Journal of Chengdu Aeronautic Vocational and Technical College, 38(2), 4.

[6]Pei, Y. (2021). Motivation, Subject, and Strategies for Promoting Classroom Revolution in Higher Vocational Colleges under the Background of "Double High Plan." Education and Occupation, No.997(21), 108-112. DOI:10.13615/j.cnki.1004-3985.2021.21.018.

[7]Hodara, M. (2011). Reforming mathematics classroom pedagogy: evidence-based findings and recommendations for the developmental math classroom. ccrc.

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