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Exploration of a Blended Teaching Model for the "Multimedia Technology" Course Based on the CDIO Concept within the Context of Ideological and Political Education

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Abstract: *This paper explores an innovative teaching model for the "Multimedia Technology" course, integrating ideological and political education with professional knowledge through a CDIO-based blended learning approach. The model aims to cultivate students' comprehensive abilities, including practical skills, innovation, teamwork, and social responsibility. It comprises three phases: preparation, implementation, and evaluation, emphasizing student-centered learning and the integration of online and offline resources. The model's advantages include enhancing students' practical abilities, fostering innovation, and effectively combining knowledge transfer with ideological education. However, challenges such as complex instructional design and the need for improved evaluation methods are also addressed. Future research directions include refining teacher implementation skills, optimizing assessment systems, and expanding the model's application to other engineering courses. This approach shows promising prospects for promoting the quality of higher education and cultivating high-caliber, innovative talents.*

Keywords: *Ideological and Political Education, CDIO, Blended Learning, Multimedia Technology, Higher Education Reform*

1. Introduction

A strong educational system is foundational to national strength, and the prosperity of a nation is driven by the cultivation of talent. In China, higher education must address three core questions: "What kind of individuals should be cultivated? How should they be cultivated? And for whom should they be cultivated?" The 2020 "Guidelines for the Construction of Ideological and Political Education in Higher Education" further underscored the pivotal role of specialized courses in integrating ideological and political education, particularly within the fields of science and engineering. These courses must blend Marxist perspectives and methodologies with the promotion of scientific spirit [1].

As a core discipline in computer science, "Multimedia Technology" is both highly applied and practical, offering rich material for the integration of ideological and political education. This presents a unique opportunity to incorporate moral education into the curriculum. By extracting key ethical elements from the course content and employing diverse teaching methods to engage students emotionally and foster patriotism, the integration of ideological education with technical instruction can be achieved seamlessly [2]. However, the traditional teaching model for this course is challenged by factors such as excessive content, high complexity, and low student engagement. Although online learning platforms have provided some convenience, their effectiveness has been limited for students with lower levels of initiative. The emergence of blended learning models offers promising solutions to these issues, and the CDIO (Conceive, Design, Implement, Operate) engineering education framework, an internationally recognized model, stands as an effective pedagogical approach. In this context, exploring a blended teaching model for the "Multimedia Technology" course, grounded in the CDIO concept, holds significant potential for enhancing the effectiveness of ideological and political education while improving students' learning experiences and practical skills[3].

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2. Literature Review

Research on ideological and political education, often referred to as "Curriculum Ideology and Politics," has experienced notable growth in recent years, reflecting its increasing significance in higher education. This field emphasizes the integration of moral and ideological values into subject-specific teaching, aiming to foster students' comprehensive development. Despite the growing attention, the effective implementation of ideological and political education faces several critical challenges. Chief among these are misinterpretations of its fundamental concepts, which often lead to a superficial understanding and application of the approach. Additionally, the field encounters unique developmental constraints, including inconsistencies in institutional support and curriculum design, as well as limitations in teachers' expertise in seamlessly embedding ideological and political elements into their disciplines. These issues have significantly restricted the depth, breadth, and effectiveness of ideological and political education in practice. Consequently, there is an urgent need for more systematic research and innovative strategies to address these barriers, ensuring that ideological and political education fulfills its transformative potential in cultivating students' moral, intellectual, and social competencies [4].

Simultaneously, research on blended learning—a pedagogical model that integrates both in-person and online teaching methods—has been experiencing rapid global development, offering a more flexible, adaptive, and diverse learning experience. Blended learning effectively combines the strengths of traditional classroom teaching with the advantages of digital learning technologies, enabling students to engage with content in ways that accommodate different learning styles and paces. In China, however, blended learning research remains in its early stages, with most existing studies focusing on its conceptualization, theoretical frameworks, teaching models, and instructional design methods [5]. While these foundational studies have laid the groundwork for understanding blended learning, there is a noticeable gap in research concerning the evaluation of its effectiveness in achieving learning outcomes. A systematic assessment of blended learning's impact on students' academic performance, engagement, and skill development is critical to guide its widespread adoption and refinement in educational practice.

In parallel, the CDIO (Conceive, Design, Implement, Operate) framework, a globally recognized educational model, has profoundly influenced the landscape of engineering education. Initially developed to enhance the practical and professional competencies of engineering students, the CDIO model has since been adapted by educational institutions worldwide to align with their specific pedagogical needs and disciplinary contexts [6]. Within this context, this study innovatively integrates the principles of ideological and political education with the CDIO framework. By embedding ideological and political elements into the various stages of the CDIO process, this approach seeks to foster students' holistic development, combining technical proficiency with moral and ethical awareness. Moreover, this study employs a blended teaching model that merges online and offline resources and activities to create a more personalized, flexible, and interactive learning environment. This integrated approach not only aligns with the goals of connotative development in higher education but also addresses the broader objectives of enhancing educational quality and optimizing talent cultivation outcomes. By bridging the gaps between ideological and political education, blended learning methodologies, and the CDIO framework, this research contributes to the ongoing discourse on improving higher education's adaptability, relevance, and impact [7].

3. Guiding Principles for Curriculum Reform

3.1 Cultivating National Identity and Strengthening Social Responsibility

In the "Multimedia Technology" course, multimedia technology is widely applied across various societal domains, closely intertwined with national progress. For example, in areas such as national cultural dissemination and public image-building, multimedia plays an irreplaceable role. By incorporating case studies that highlight the influence of multimedia technology on national stature, students are encouraged to recognize the connection between their professional skills and national needs. This realization inspires them to align personal learning with national development goals, motivating them to use multimedia technology in the future for cultural preservation and social advancement, thereby fostering a stronger sense of social responsibility.

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3.2 Promoting Innovation and Cultivating Practical Innovation Abilities

Innovation is the central driving force behind societal progress. The multimedia technology field is rapidly evolving, with emerging technologies such as virtual reality (VR) and augmented reality (AR). The conception phase of the CDIO framework encourages students to challenge traditional thinking and explore novel ideas. The design and implementation phases guide students in transforming these ideas into practical outcomes. In the blended learning model, the integration of abundant online innovation resources with offline hands-on experiences helps students develop both innovative thinking and practical capabilities, preparing them to meet the demands of the fast-evolving multimedia technology landscape.

3.3 Fostering Teamwork and Enhancing Collaboration and Communication Skills

Multimedia technology projects are inherently complex and multidisciplinary, requiring teamwork for successful completion. This aligns with the CDIO framework's emphasis on interpersonal and team collaboration skills. In the course, students are grouped to work on comprehensive multimedia projects, from conception to design, implementation, and operation. Each team member contributes their unique skills while collaborating closely. This process cultivates teamwork awareness, communication skills, and collaboration capabilities, reinforcing the notion that effective teamwork is essential for the success of multimedia projects and is a critical competence for future professional success.

3.4 Inheriting Cultural Essence and Strengthening Cultural Confidence

Cultural confidence serves as a crucial source of strength for national development, forming the foundation for a society's continued growth and innovation. Multimedia technology is a powerful vehicle for cultural transmission, offering diverse and engaging ways to preserve and share heritage across generations. In the "Multimedia Technology" course, rich cultural elements, such as traditional Chinese art forms, classical literature, and historical artifacts, are seamlessly integrated into the curriculum. Students are encouraged to use multimedia technology to digitally represent and creatively disseminate cultural heritage, employing various digital tools and platforms to bring ancient wisdom into the modern era. This approach allows students to deeply appreciate the beauty of traditional Chinese culture, revitalizing it through modern technology while maintaining its authentic essence and profound significance. It fosters a strong sense of national pride and cultural identity, connecting students with their ancestral roots and historical legacy, motivating them to become active inheritors and promoters of their cultural heritage in an increasingly interconnected world. Through this innovative educational approach, students develop both technical skills and cultural awareness, preparing them to be confident ambassadors of Chinese culture in the digital age.

3.5 Optimizing Teaching Plans Based on Course Characteristics

The "Multimedia Technology" course is characterized by the integration of theory and practice, with a strong focus on cultivating practical skills. Course design should fully embrace these features. The theoretical portion should incorporate ideological and political elements by examining the course's historical development and real-world case studies, using methods like case analysis and class discussions for ideological education. The practical portion should be project-oriented, with ideological and political requirements embedded within the project themes, objectives, and evaluation criteria. By leveraging the blended teaching model, online resources for ideological education and technical learning are made available, while offline activities—such as hands-on projects, group discussions, and presentations—are organized. This approach facilitates the seamless integration of knowledge transmission, skills development, and value guidance through varied, interactive teaching methods.

4. Specific Practice Model

This teaching reform model is guided by the comprehensive CDIO (Conceive, Design, Implement, Operate) framework and consists of three distinct but interconnected stages: the preparation stage, the teaching stage, and the evaluation stage. The model emphasizes the systematic design and implementation of the entire teaching process, prioritizes the role of students as the central learning agents, integrates both online and offline teaching methods to create a blended learning environment, and incorporates ideological and political education (referred to as "Course Ideology and Politics")

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throughout the curriculum. Its aim is to comprehensively enhance teaching quality, promote student engagement, foster critical thinking skills, and develop students' overall capabilities in both technical and soft skills domains.

4.1 Preparation Stage

In the preparation stage, the teaching process begins with a detailed and systematic analysis of the students' learning conditions and backgrounds. This involves thoroughly assessing their existing knowledge base, identifying potential learning gaps, understanding their learning preferences and styles, and evaluating their specific learning needs to establish clear, specific, and practical learning objectives that are carefully aligned with their current level of understanding and future career aspirations. Based on this comprehensive analysis, teaching content is carefully designed and curated to ensure that it is tightly linked to real-world engineering applications and industry practices, making the learning experience more relevant and engaging for students. Detailed lesson plans and teaching designs are then developed through collaborative efforts, incorporating various teaching methodologies and technological tools, ensuring a well-structured and engaging flow for teaching activities. These meticulous preparations lay a strong foundation for subsequent teaching activities and help create an optimal learning environment for students.

4.2 Teaching Stage

The teaching stage emphasizes a dynamic and interactive two-way interaction between the teacher and the students, with a balanced emphasis on both "teacher-led learning" activities and "student-centered online learning" experiences. Teachers serve as knowledgeable guides and facilitators, leading students through course material by providing comprehensive training in effective learning methods, explaining key concepts and principles in depth, and helping students understand both the logical structure of the subject matter and its practical applications in real-world scenarios. The teaching content is carefully designed to be both logically coherent and practically relevant, ensuring that students can effectively connect theoretical knowledge to real-world practices and industry applications.

The student-centered design of the course actively encourages students to take an autonomous and proactive role in their learning journey. They are consistently encouraged to engage in thorough pre-class preparation, participate in collaborative group projects, and complete assigned tasks through various online learning platforms and digital tools. These carefully designed activities enhance the depth of students' understanding through meaningful interaction and collaborative learning experiences with their peers. During this stage, sophisticated real-time monitoring and feedback systems allow teachers to closely track student progress, identify areas of difficulty, and dynamically adjust teaching strategies as needed to optimize learning outcomes. In addition, structured classroom discussions, open communication channels, and interactive Q&A sessions further reinforce learning concepts and ensure that students can effectively clarify their doubts, deepen their understanding, and develop critical thinking skills through active participation and engagement.

4.3 Evaluation Stage

The evaluation stage adopts a blended assessment approach, combining online and offline methods to assess students' learning outcomes from multiple dimensions and levels. Online assessments include tests on course content (such as chapter quizzes and reflective questions) and task-based, process-oriented evaluations (such as group projects and lab reports). Offline assessments involve a final exam and comprehensive evaluations that assess students' practical abilities and overall competencies. Evaluation criteria are flexible and diverse, including factors like the duration of time spent viewing course materials, student engagement, homework quality, and classroom participation.

Additionally, the evaluation process incorporates the effectiveness of ideological and political education ("ideological and political education") into the overall assessment. This aligns students' academic achievements with the goals of moral and ideological development, promoting their holistic growth in areas such as ethics, intellect, physical fitness, aesthetic appreciation, and labor skills. This approach ensures that education goes beyond mere technical skills, fostering well-rounded individuals.

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4.4 Integration of CDIO Framework

The overall structure of this teaching model integrates the four main stages of the CDIO framework—Conceive, Design, Implement, and Operate—effectively. The model emphasizes the cultivation of comprehensive engineering competencies, helping students not only develop technical skills but also critical thinking, creative problem-solving, and teamwork abilities. The innovation of this model lies in its integration of online and offline teaching methods, which enhances teaching efficiency and promotes active student learning.

Moreover, by incorporating ideological and political education throughout the course, this model not only strengthens students' practical skills but also fosters a strong sense of social responsibility and national identity. Through diverse evaluation methods, the model enhances the comprehensiveness and effectiveness of teaching, ensuring that students' cognitive, practical, and ethical dimensions are all addressed.

In summary, this teaching reform model is scientific, systematic, and highly practical, providing robust support for efficient course delivery and comprehensive student development. By embracing the CDIO framework and blending online and offline teaching with ideological and political education, the model aims to significantly improve both teaching quality and the overall development of students. It represents a forward-thinking approach to engineering education that is not only focused on technical knowledge but also on the broader personal and social dimensions of learning.

5. Advantages and Limitations

The blended teaching model based on the CDIO (Conceive, Design, Implement, Operate) framework offers significant and far-reaching advantages in enhancing teaching quality and students' overall capabilities across multiple dimensions. By deeply and systematically integrating the four progressive stages of the CDIO framework with the course content, this innovative model brings teaching closer to real-world applications and industry practices, effectively enhancing students' practical skills, problem-solving abilities, and innovative thinking capacities. The carefully designed blended learning approach effectively combines diverse online and offline resources, creating a dynamic and interactive learning environment that offers students flexible, personalized, and efficient learning paths tailored to their individual needs and learning styles. Additionally, it seamlessly and naturally integrates knowledge transmission with ideological and political education ("ideological and political education"), effectively stimulating students' sense of national pride, cultural confidence, and social responsibility while developing their professional competencies.

However, the practical implementation of this comprehensive model also faces several significant challenges and inherent limitations that need to be carefully addressed. First, the complexity of instructional design is relatively high and multifaceted, requiring an exceptionally broad range of competencies and continuous professional development from the teaching staff. In particular, teachers need to be proficient not only in the technical aspects of multimedia technology and pedagogical methods but also in the nuanced integration of ideological education into their subject matter. They must constantly update their knowledge and skills to keep pace with rapidly evolving technological advances and educational theories. Second, some students may struggle with the demands of self-directed learning and time management in this new educational paradigm, and their engagement with online learning platforms and resources may not be as consistent or effective as expected. This challenge is particularly pronounced for students who are more accustomed to traditional teaching methods or those who lack strong self-regulation skills. The evaluation system also needs further optimization and refinement, particularly in terms of developing more sophisticated methods for quantifying the impact of ideological education and implementing more precise, comprehensive assessment methods that can effectively measure both knowledge acquisition and skill development. Additionally, the technological infrastructure and support systems need to be significantly improved and expanded, especially regarding the stability and reliability of online learning platforms, the integration of more advanced interactive features, and the development of more robust data analytics capabilities to better serve the diverse needs of both teaching and learning activities in this blended environment.

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6. Future Research Directions

Future research could focus on enhancing teachers' ability to implement both the CDIO framework and ideological education, addressing the dual challenges of technical and educational integration. The course evaluation system should be refined, with greater emphasis on the quantitative assessment of the effectiveness of ideological and political education. Furthermore, it would be valuable to strengthen the long-term tracking of students' learning outcomes to assess the sustained impact of the course.

Moreover, the model could be extended to other engineering and practice-oriented courses to test its applicability in various contexts. Technological innovation should also be a priority. Introducing emerging technologies, such as virtual reality (VR) and augmented reality (AR), can significantly enhance the interactivity and immersive experience of the course, making the learning process more engaging and impactful. Additionally, developing a more diverse and personalized online learning resource platform could better cater to the individual learning needs of students. Finally, drawing on international best practices in blended learning and the CDIO framework could provide valuable insights and strategies to further optimize teaching models and improve higher education quality.

7. Conclusion

The blended teaching model based on the CDIO framework has successfully integrated ideological and political education with professional education in the "Multimedia Technology" course. It has enhanced students' practical abilities, innovation awareness, and sense of social responsibility. By combining online and offline resources, the model has optimized teaching design and implementation, reinforcing students' autonomy in learning and fostering teamwork skills. At the same time, it has strengthened the ideological and contemporary relevance of the course.

While there is still room for improvement in areas such as the evaluation system and technological support, this model shows great potential in promoting the connotative development of higher education and cultivating high-quality, innovative talent. It provides valuable insights for future teaching reforms in related courses and offers a promising direction for improving the quality of higher education.

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