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Exploring and Evaluating a Blended Learning Model of Theoretical Mechanics under the Ideological and Political Education

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Abstract: *Integrating ideological and political education into theoretical teaching helps cultivate students' socialist core values and moral literacy. Online and Offline Blended Learning Model, facilitates the provision of rich learning resources for students, enhancing their ability for independent learning and analysis of practical problems. This study focuses on the course of Theoretical Mechanics, analyzes the current status of teaching, and proposes an effective integration of the blended learning approach under the ideological and political education. The study also evaluates the teaching effectiveness. The results show that students definitely recognize the blended learning model and the integration of ideological and political education into daily teaching methods. The overall satisfaction rate with three aspects (knowledge, abilities, and qualities) exceeds 70%, and students have shown improvement in their final exam results. This teaching model can provide references for future reforms and innovations in the course of Theoretical Mechanics.*

Keywords: *Ideological and political education; Theoretical Mechanics; Blended learning model; Effectiveness evaluation*

1. Introduction

In higher education, ideological and political education is a core component of teaching and educating students. Curriculum ideological and political education represents an important direction in universities in the new era. It emphasizes the organic integration of ideological and political education with professional courses, integrating ideological and political education into the entire teaching process [1]. In recent years, the Chinese Ministry of Education has issued and implemented a series of guiding documents related to the construction of curriculum ideological and political education. The aim is to integrate ideological and political education into the talent training system, comprehensively promote the construction of curriculum ideological and political education, and fully leverage the role of curriculum in educating students. In curriculum ideological and political education, the fundamental goal is to cultivate students' moral character. In the context of education in the new era, ideological and political education should not only be conducted in general education in universities but also integrated into professional education. Teachers of professional courses need to integrate ideological and political education into the teaching process, innovate teaching methods, stimulate students' sense of social responsibility and interest in learning, and cultivate students' correct worldview, outlook on life, and values [2].

According to the national development plan for education, it is stated that active promotion of the integration of education and teaching with Internet technology should be encouraged. Schools and teachers are encouraged to use online learning platforms to record students' online learning processes and innovate teaching management methods. Schools and teachers are also encouraged to collect, analyze, and provide feedback on teaching activity data using big data technology, to support personalized learning and targeted teaching. With the rapid development of Internet technology, the blended learning model combining online and offline instruction has gradually become well-known and implemented in universities [3]. Compared to traditional offline blended learning model, the blended learning model aims to combine traditional teaching approaches with online education. It leverages the role of teachers and the agency of students, emphasizing the students' subjective initiative in learning. This model provides students with richer educational resources, stimulates their interest in learning, and effectively promotes classroom interaction and feedback [4].

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Reform and innovation are the driving forces behind social development. For curriculum and teaching work, innovative teaching methods and improving teaching quality are important directions for exploring future teaching models [5]. In order to fully implement the educational policy, adhere to the fundamental goal of moral education and talent cultivation, and enhance students' civil literacy and awareness of social responsibility, the organic integration of ideological and political education with curriculum knowledge is imperative. To fully leverage the student-centric teaching philosophy, stimulate students' enthusiasm and initiative in learning, and effectively improve classroom efficiency, the blended learning model combining online and offline instruction has emerged in response to the trend of information technology development. Applying curriculum ideological and political education together with blended learning to curriculum and teaching work can comprehensively enhance the effectiveness of curriculum and teaching, allowing students to receive ideological and political education while learning theoretical knowledge, providing theoretical support and guidance for future curriculum learning and work. This article selects Theoretical Mechanics as the taught course, analyzes the basic information and characteristics of the course, conducts an in-depth analysis of the current status of curriculum and teaching under the traditional teaching model, combines the background of curriculum ideological and political education with the blended learning model, explores a multi-perspective curriculum and teaching model, and conducts teaching practice and evaluation, with the aim of providing references for future reform and innovation in the teaching of Theoretical Mechanics.

2. Basic Information and Characteristics of the Course

Theoretical Mechanics is a compulsory foundational course for undergraduate students majoring in mechanics and serves as a supporting course for cultivating top-notch engineering talents. Within the knowledge system of mechanical majors, this course plays a pivotal role in bridging prior and subsequent knowledge. It summarizes and expands upon foundational mechanics knowledge while also laying the theoretical groundwork for subsequent specialized courses. The content of Theoretical Mechanics is extensive, with a high level of difficulty, characterized by strict logic, strong systematicity, and theoretical depth. Through the course study, students should master solid fundamental mechanics knowledge, possess the ability to apply learned knowledge to solve practical engineering problems, establish correct worldviews, adopt a diligent and rigorous scientific attitude, and develop engineering cognitive thinking. This lays a solid theoretical, practical, and qualitative foundation for their future learning and work.Integrating ideological and political education into Theoretical Mechanics can cultivate students' patriotism, enhance their sense of mission and responsibility for rejuvenating country development, and allow students to experience the relentless exploration process of theoretical knowledge. At the same time, it can also make students aware of the importance of a rigorous and truth-seeking attitude and a spirit of continuous innovation.

3. Current Status of Course Teaching

3.1 Traditional Teaching Method

Currently, most Theoretical Mechanics courses follow traditional face-to-face offline learning methods, lacking informationization and modern teaching tools. The teaching approach is mostly teacher-led, with students passively receiving instruction. Under this method, student participation in the classroom is relatively low, making it difficult to stimulate student interest in learning and hindering their understanding and application of the knowledge learned.

3.2 Monotonous Teaching Content

The teaching content mainly consists of statics, kinematics, and dynamics knowledge. The teaching process focuses on conceptual memorization, mathematical derivation, and abstract understanding, with high demands on students' logical thinking, knowledge retention, and integration. However, the lack of elucidation on the significance of concepts and the introduction of engineering cases during the teaching process make it difficult for students to concentrate and understand the content learned.

3.3 Insufficient Integration of Ideological and Political Education

Due to the theoretical and logical nature of the teaching content of Theoretical Mechanics, coupled with the abundance of course content and compact class hours, there are relatively few elements of

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ideological and political education involved in the teaching process, resulting in insufficient integration of ideological and political education. Additionally, in setting course teaching objectives, the enhancement of students' qualities has been overlooked.

3.4 Single Form of Assessment

The assessment methods for Theoretical Mechanics courses mostly consist of regular grades and exam scores, with regular grades often based on attendance and completion of regular assignments. This assessment method lacks evaluation of students' learning processes, neglects the importance of process-based assessment in the teaching process, and makes it difficult to reflect students' comprehensive application abilities [6].

3.5 Insufficient Course Practice

During the teaching process of Theoretical Mechanics courses, there is insufficient consideration for students' practical application outside of class, resulting in students lacking the ability to solve practical engineering problems. Their understanding of specific theories is not deep enough, causing the learned content to remain at the knowledge level rather than the application level.

4. Exploration of Learning Mode

Taking into account the ideological and political background of the course and the application of blended learning, teachers need to change their mindset, innovate, and break free from the constraints of traditional teaching methods. We should explore new teaching modes that prioritize student-centeredness and aim to stimulate students' interest in learning and improve teaching quality. Since Theoretical Mechanics is taught to second-year university students, who are at the stage of establishing their worldview, values, and outlook on life, and whose thinking patterns are still developing, it is important to integrate ideological and political elements into the course content. This integration can help shape students' correct and healthy ideologies while they acquire theoretical knowledge. At the same time, ideological and political education in the course should adhere to the fundamental goal of moral character cultivation, aiming to foster students' scientific spirit and moral qualities. This paper explores a new teaching mode that integrates ideological and political education throughout the entire process of online and offline blended learning, based on the talent training program for the discipline. The aim is to comprehensively enhance students' knowledge, abilities, and qualities. The following sections will discuss the teaching mode for Theoretical Mechanics in the context of ideological and political education, focusing on clarifying teaching objectives, revising teaching plans, improving course content, enriching teaching methods, exploring ideological and political elements in-depth, optimizing exercise content, adopting multidimensional assessment and evaluation, exploring the internationalization of the course, and refining the teaching process.

4.1 Clarify Teaching Objectives and Revise Teaching Syllabus

As a fundamental course in the field of engineering, Theoretical Mechanics plays an important role in future professional study and practical work. Therefore, the course objectives should comprehensively reflect knowledge objectives, skill objectives, and quality objectives. The aim of this course is to enable students to master the basic knowledge of mechanics, possess the ability to solve engineering problems, and cultivate rigorous logical thinking and noble moral character. At the same time, the teaching syllabus needs to be revised and improved by reducing the cumbersome process of formula derivation, focusing on the explanation of engineering application cases, and combining daily engineering examples with abstract mechanical models. This will concretize abstract problems, increase student interest in learning, and enhance their ability to analyze and solve practical engineering problems.

4.2 Improve Teaching Content and Enrich Teaching Methods

The teaching content should start with specific engineering practical problems and explain the application of Theoretical Mechanics in engineering problems. Students should learn theoretical knowledge through problem-oriented learning and analyze problems using abstract thinking. At the same time, the importance of methods should be emphasized during the teaching process. Clear

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thinking is essential in problem-solving, enabling students to see the essence through phenomena and achieve comprehensive understanding of knowledge. Through this method, students will realize the importance of learning theoretical knowledge and improve their problem-solving skills. Considering the characteristics of the Theoretical Mechanics course, a blended learning approach combining online and offline methods should be adopted. This approach makes full use of online resources and advantages of information technology, enhances students' motivation for independent learning, strengthens online and offline interaction between teachers and students, stimulates students' enthusiasm and creativity, and allows students to become the main participants in the classroom.

4.3 Dig Deeper into Ideological and Political Elements

The course should integrate ideological and political elements throughout the entire process, with a focus on methods such as establishing a repository of ideological and political teaching materials, revising the teaching syllabus, and increasing ideological and political assessment of the course. The repository of ideological and political teaching materials can include the stories of mechanical figures in relation to theoretical knowledge, the development process of mechanical theorems, the reflection of philosophical elements, and the typical application of engineering cases [7]. By seamlessly incorporating ideological and political elements, students can develop a correct world view, outlook on life, and values. They can also establish a rigorous and serious scientific attitude, a pursuit of excellence as an engineer, and enhance their innovative spirit to actively tackle challenges and devote themselves to research [8]. For example, when teaching the synthesis method of coplanar force systems, as it involves the fundamental knowledge of vector synthesis, it is necessary to expand the application of mathematical knowledge learned in high school. By doing so, students should learn to integrate knowledge and apply theory to practice in their future learning and lives.

4.4 Optimize Exercise Content

Based on the characteristics of the course, the ideological and political background of the course, and the blended learning model methods, a blended exercise content should be established. The goal of exercise design is to enable students to approach problem-solving with questions in mind, understand the significance behind the problems, and recognize the importance of solving scientific and engineering practical problems. The existing exercise types and content of the course should be upgraded and optimized, incorporating elements of modern technology and engineering cases to reflect a constructive approach that combines practicality and abstraction. This will expand students' thinking, promote independent thinking, and equip them with methods and skills to analyze and solve problems. The online exercise content mainly consists of objective questions, including judgment, multiple-choice, and fill-in-the-blank questions. This part focuses on reviewing each knowledge point for students to master the basic knowledge of mechanics proficiently. The offline exercise content mainly consists of subjective questions, including calculation and short-answer questions. This part emphasizes practical engineering problems and requires students to have a higher understanding of knowledge, aiming to cultivate students' ability to analyze and solve engineering problems using theoretical knowledge.

4.5 Multidimensional Evaluation

In order to accurately assess students' learning and mastery of course content, and to improve the standardization and scientificity of course assessment and evaluation, a multidimensional assessment and evaluation of the entire teaching process is needed. Through the multidimensional assessment of students, comprehensive evaluations of their knowledge, skills, and qualities can be achieved. At the same time, the assessment of students in multiple dimensions needs to combine quantitative and qualitative evaluations closely, so as to fully reflect the multidimensionality of course evaluation and promote the achievement of the goal of building first-class courses. The assessment criteria include regular grades and exam grades, with appropriate emphasis on regular grades. The content of regular assessment should be refined to guide students to gradually attach importance to regular learning and cultivate the habit of learning and exploring questions. The assessment of regular grades should include all aspects of students' online and offline learning, interaction, and answering questions in the regular teaching process. It should also include attendance and classroom performance. Through this assessment method, comprehensive assessment of students' learning and mastery can be conducted throughout the teaching process, including pre-class, in-class, post-class, and outside class, in order to enhance students' role as the mainstay in the classroom and stimulate their self-directed learning

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abilities.

4.6 Exploring the Englishization of the Curriculum

The Englishization of key physical quantities is an important trend in curriculum development. It can help students master the professional English expression, facilitate their understanding of specialized English books and relevant software, and broaden their knowledge and international perspectives. In the Theoretical Mechanics, the index section includes the English expressions of mechanics concepts and physical quantities, which reflects the importance of Englishization. For example, the representation of absolute velocity in kinematics is denoted as "v_a" derived from its English expression; and relative velocity is denoted as "v_r" derived from its English expression. However, due to time constraints and the main content of the course, it becomes difficult to incorporate excessive Englishization into the curriculum. Therefore, in the teaching process of Theoretical Mechanics, it is appropriate to combine the translation of key physical quantities in mechanics, allowing students to grasp their English expressions and enhance their understanding of professional knowledge to a certain extent.

4.7 Refining Teaching Process

To clarify the specific process of blended learning under the ideological and political background, this article divides the teaching process into four stages: pre-class preparation, in-class instruction, post-class consolidation, and extra-class practice [9].

4.7.1 Pre-class Preparation

Before class, teachers strictly follow the teaching plan to upload self-learning videos corresponding to the content of this class on the online teaching platform, allowing students to arrange their time for previewing reasonably. Teachers also arrange corresponding conceptual test questions and thinking questions to help reinforce students' attention to knowledge previewing. At the same time, teachers promptly pay attention to students' previewing situation and track their progress. After previewing, students complete the released test questions and can discuss them in the class space. Teachers provide explanations and guidance, focusing on the key and difficult points of the previewing content. Teachers mark key issues discussed by students as the starting point for teaching in offline classes. This process reflects the significance of blended learning in the pre-class preparation stage, which can effectively utilize abundant online teaching resources, demonstrate effective teacher-student interaction, and allow students to focus on learning during class. Additionally, this process can cultivate students' ability for independent learning, critical thinking, and knowledge transfer.

4.7.2 In-Class Instruction

In-class instruction is a crucial component of the teaching process, aiming to enhance classroom efficiency and ensure students effectively grasp the taught content. It should adhere to student-centered teaching philosophy and the fundamental goal of moral education and nurturing talent. Firstly, lead students to recall the previewed content and discussion process before class, which serves as a segue into the in-class instruction content. Secondly, discuss and summarize the main knowledge points of this class with students, clarify key and difficult points, and analyze and summarize examples of confusing and ambiguous knowledge to deepen students' understanding of these points. During the teaching process, activities such as random questioning and in-class exercises can be conducted through online platforms to facilitate flipped classroom teaching. Additionally, interactive ideological and political education can be integrated into the teaching process, encouraging students to think independently and actively analyze and solve real problems. This process aims to increase inquiry-based learning time centered around students, promote heuristic teaching, and enhance students' classroom engagement. Moreover, it helps students improve their problem-solving abilities while acquiring theoretical knowledge and receiving ideological and political education.

4.7.3 Post-Class Consolidation

Post-class consolidation contributes to deepening students' understanding and mastery of the learned knowledge. After completing the teaching session, teachers can assign optimized exercise content both online and offline, encouraging students to complete them independently. For students with doubts, teachers can provide opportunities for teacher-student communication and Q&A online, fully utilizing post-class time for internalizing knowledge, consolidating what was learned in class, and achieving better teaching results. Teachers can also adjust subsequent teaching plans and content based

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on students' completion of exercises, focusing on areas where students may need further clarification. This process can enhance the activity of students' discussions outside of class, as well as improve their ability for independent learning and analyzing and solving real problems.

4.7.4 Extra-class Practice

To achieve the goal of linking theory with practice, it is advisable to appropriately increase extracurricular practice sessions, enhancing students' innovative entrepreneurial spirit and practical operational capabilities, thus realizing the organic combination of theoretical knowledge and practical issues. Teachers can utilize online and offline resources to find practical content for Theoretical Mechanics courses, such as mechanics competitions, mechanics modeling, simulation, and analysis of practical engineering problems. This process can enhance students' interest in learning and hands-on practice abilities, laying a solid practical foundation for their future work.

5. Evaluation of Teaching Effectiveness

5.1 Evaluation Methods

In order to validate the pedagogical effectiveness of the blended learning model, This study employed two evaluation methods, namely distributing surveys to students and conducting final exams in the Theoretical Mechanics course [10-12]. The survey was conducted online anonymously to understand and capture students' perceptions and opinions of the blended learning model. It assessed students' views on knowledge, abilities, and qualities. The final exam results evaluation involved two cohorts of students in the same major. The control group consisted of 91 mechanical engineering students from the 2021 grade who received traditional classroom instruction, while the experimental group consisted of 97 mechanical engineering students from the 2021 grade who received blended learning model. Both groups took the end-of-semester exam organized by the school, and the exam scores were analyzed and compared.

5.2 Analysis of Evaluation Results

The survey targeted mechanical engineering students from 2022 grade who underwent blended learning, which combined online and offline learning model. A total of 97 survey questionnaires were distributed, and all 97 responses were deemed valid. The survey results are presented in Table 1. It is evident that all participating students acknowledged the effectiveness of the blended learning approach and endorsed the integration of ideological and political education into daily teaching. Furthermore, the majority of students believed that this teaching method contributed to improvements in knowledge, abilities, and qualities, with satisfaction levels exceeding 70% for all aspects. Specifically, 92.78% of students recognized the practical application of theory and enhancement of their ability for independent learning and critical thinking. However, there was a relatively smaller proportion of students who felt that their analytical and problem-solving skills were improved. In future classroom instruction, it would be beneficial to introduce more real problems to help students develop a systematic approach to solving problems.

Table 1: Survey on acceptance of blended learning model.

Aspects	Survey Content	Satisfaction(%)
Knowledge	It helps in understanding theoretical knowledge.	91.75
	It broadens the knowledge base.	85.57
	It achieves the integration of theory and practice.	92.78
	It enhances the enthusiasm for learning.	78.35
Abilities	It enhances independent learning thinking abilities.	92.78
	It stimulates interest in practical activities.	88.66
	It improves analytical and problem-solving abilities.	72.16
Qualities	It cultivates a scientific and rigorous thinking style.	82.47
	It enhances creativity and innovation awareness.	87.63
	It fosters a sense of patriotism and a sense of mission.	82.47
Blended learning model acceptance.		100
Acceptance of integrating ideological and political education.		100

Final exam results are an important means to evaluate the effectiveness of course instruction.

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The distribution of final exam scores for the 2021 and 2022 grades is shown in Table 2. We can see that the average final exam score of the 2022 grade students is higher than that of the 2021 grade by 3.65 points. This indicates that the blended learning model can improve student performance in Theoretical Mechanics courses compared to traditional teaching methods. Additionally, there is a noticeable increase in the proportion of students scoring between 90-100 and 80-89, with improvements of 4.95% and 4.35% respectively. In the 2022 grade, no students scored between 0-59, suggesting that the blind learning model improved the final exam scores of most students.

Table 2: Distribution of final exam scores for the 2021 and 2022 grades.

Score Range	2021 Grade	2022 Grade	Difference
90-100	3.30%	8.25%	4.95%
80-89	29.67%	34.02%	4.35%
70-79	41.76%	43.30%	1.54%
60-69	21.98%	14.43%	-7.55%
0-59	3.30%	0.00%	-3.30%
Average Score	74.31	77.96	3.65

6. Conclusion

The Theoretical Mechanics course, as a compulsory foundational course in the professional talent program, plays a crucial role. Due to its logical, systematic, and theoretical nature, the course integrates ideological and political education with a blended learning approach incorporating both online and offline components. This integration is elaborated upon in terms of teaching objectives and plans, course content and delivery methods, as well as teaching processes and assessment, and its effectiveness is validated. The results demonstrate that the blended learning approach, within the context of ideological and political education, enhances students' knowledge, abilities, and qualities. It achieves the integration of theory and practice, enhances independent learning and critical thinking abilities, and students are willing to accept and recognize the blended learning model and the incorporation of ideological and political education. The blended learning model under the ideological and political education can provide methodological support for future reforms and innovations in the Theoretical Mechanics course.

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