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CONTENTS

Exploring the Teaching Model of College English Vocabulary from the Perspective of Etymology

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Abstract: With the acceleration of globalization, the importance of college English vocabulary teaching in cultivating students' comprehensive language abilities has become increasingly significant. However, traditional vocabulary teaching models tend to focus on memorization and application, often overlooking the internal structure and historical origins of words, leading to a lack of deep understanding and long-term memory in students' vocabulary learning process. This paper aims to explore a teaching model for college English vocabulary from the perspective of etymology. The research adopts a literature analysis method to systematically review relevant theories of etymology and analyze the similarities and differences, as well as the advantages and disadvantages, between traditional teaching models and etymology-based teaching models in current college English vocabulary teaching. Based on this analysis, a vocabulary teaching model that integrates etymology is proposed, including strategies such as teaching roots and affixes, introducing the historical development of vocabulary, and analyzing the logical relationships between words. Through theoretical exploration and model construction, the implementation steps and practical application methods of this teaching model are elaborated. The research results indicate that the etymology-based vocabulary teaching model can not only help students better understand the connotation and extension of vocabulary and enhance the persistence of vocabulary memory but also improve students' language analysis abilities and cultural awareness. This teaching model reveals the internal connections between words, making the teaching content more systematic and scientific, the teaching process livelier and more interesting, and effectively stimulating students' interest and enthusiasm for learning. Finally, the paper summarizes the challenges that may be faced during the implementation of the etymology-based vocabulary teaching model and proposes corresponding solutions, aiming to provide theoretical support and practical reference for the reform and innovation of college English vocabulary teaching. In conclusion, the teaching model of college English vocabulary from the perspective of etymology has significant theoretical value and practical significance, and it plays a positive role in enhancing college students' English vocabulary abilities and overall language literacy.

Keywords: Etymology; College English; Vocabulary Teaching; Teaching Model; Language Teaching

1. INTRODUCTION

In recent years, with the advancement of globalization and rapid development of the internet, the importance of English as the primary language of international communication has become increasingly prominent. Especially in China, more and more higher education institutions have made English a compulsory course, making the cultivation of students' English vocabulary abilities crucial. Vocabulary forms the foundation of language, and effective vocabulary teaching directly impacts students' language proficiency. The introduction of etymology provides a new perspective and approach for college English vocabulary teaching, and in recent years, several higher education institutions have begun to integrate etymology theory into vocabulary teaching. Etymology, as a branch of studying the origin

and evolution of words, involves word forms, meanings, and cultural backgrounds. Integrating etymology into college English teaching not only enhances students' understanding and memory of vocabulary but also helps them understand the language's evolution and the cultural factors behind it. This approach significantly complements traditional teaching methods, allowing students to grasp English at a deeper level. This research provides a protective umbrella for cultivating students' comprehensive language abilities and cross-cultural communication skills.

Internationally, etymology research began in the 19th century and has accumulated rich theoretical and practical achievements. Some educational institutions in the West have explored the application of etymology in foreign language teaching, and the results show that learning etymology helps students master new words and infer their meanings (Fries, 1945). However, research on vocabulary teaching in China lags. Although some scholars have examined word roots, prefixes, and suffixes, there is insufficient discussion on their practical application. Some studies have used etymological analysis to improve reading comprehension, achieving preliminary results [1][2]. However, systematic and theoretical research in this field is still scarce, and this research aims to fill this gap in China.

2. THEORETICAL FOUNDATION OF ETYMOLOGY

2.1 Basic Concepts of Etymology

Etymology is a discipline that studies the origin and evolution of words, aiming to reveal the meaning changes and related connotations by tracing the historical roots of words. Initially, etymology research was limited to the verification of ancient languages and texts, but with the development of modern linguistics, its research content has expanded, now including analysis in fields such as semiotics, sociolinguistics, and psycholinguistics, making etymology more widely applicable.

When discussing the concept of etymology, it is necessary to consider word formation, phonetic changes, and semantic evolution. Word formation refers to the principles of word construction, phonetic changes involve changes in pronunciation, and semantic evolution focuses on the process of meaning change. For example, "nice" originated from the Latin word "nescius," meaning ignorant, but its current meaning is quite different from the original meaning. Understanding this process helps students achieve a deeper understanding of vocabulary.

2.2 The Role of Etymology in Language Teaching

The introduction of etymology provides a more dynamic mode for traditional language teaching. It enhances learners' interest, and the novel historical background makes learning more diverse and colorful. Some complex vocabulary becomes easier to understand through tracing their etymology. In teaching, teachers can use historical examples to help students perceive the cultural connotations and evolution behind language, making isolated words no longer dull and boring.

Learning etymology strengthens learners' associative abilities and broadens their vocabulary cognition. Language learning is not simply about memorizing words; understanding their origins, construction, and changes can provide students with a methodological framework for independent thinking during their learning process. For example, mastering common prefixes and suffixes, such as "un-" and "-ly," helps students freely associate and transform words they encounter in the future, enhancing the flexibility of thinking and learning.

2.3 Analysis of Relevant Theoretical Models

Detailed theoretical support is urgently needed for teaching effectiveness. Some scholars have proposed integrating cognitive linguistics models with etymology, which greatly promotes vocabulary learning. Langacker's "conceptual categories" theory emphasizes learning centered on concepts, achieving the extension of commonly used vocabulary to complex word meanings [3]. This model helps explore an enlightening framework for implicit cognition in vocabulary learning, enabling students to effectively apply their existing knowledge structures when encountering new vocabulary, thereby reducing the computational cost of word meanings.

The integration of implicit learning theory and etymology is closely related. Relevant studies suggest that through repeated exposure to language expressions in natural contexts, learners gradually internalize rules and acquire implicit knowledge. This is conducive to understanding the composition of words, excavating their deeper layers of meaning, and is suitable for the design of practical training environments for vocabulary speculation and recall.

Teaching methods that focus on interactive prompts and using cultural backgrounds to understand vocabulary also align with the modern model that needs to be established in foreign language education. This is not only reflected in the interdisciplinary integration of curriculum objectives but also in encouraging learners to practice continuously in context and gain meaningful cognitive outcomes. The development of modern educational technology also provides possibilities for promoting integrated teaching. Innovative learning experiences can be created through mobile learning and flipped classrooms.

In the teaching practice of college English, developing topics that incorporate the perspective of etymology enriches the curriculum content and promotes students' analytical, evaluative, and exploratory abilities regarding English vocabulary. It not only enhances students' language application abilities but also explores vast linguistic conflicts and communication backgrounds, providing strategic guidance for students' identity and cultural recognition, creating a more profound cross-cultural communication context.

3. ANALYSIS OF THE CURRENT SITUATION OF COLLEGE ENGLISH VOCABULARY TEACHING

3.1 Overview of the Traditional Vocabulary Teaching Model

The current college English vocabulary teaching mainly adopts the traditional teaching model that combines memorization and recitation. This model emphasizes the accumulation of vocabulary and helps students master a large number of basic words in a short period through methods such as classroom explanations, vocabulary lists, and repeated practice. Teachers usually introduce the spelling, pronunciation, meaning, part of speech, and basic usage of vocabulary systematically according to textbooks or vocabulary level standards. The traditional teaching model focuses on the classification of vocabulary, organizing vocabulary according to themes, functions, or grammatical categories to help students use vocabulary in specific contexts.

In the teaching process, teachers often use methods such as explanations, analysis of example sentences, fill-in-the-blank exercises, and listening training to consolidate students' understanding and application of vocabulary. In the classroom, teachers may enhance students' memory through board writing, vivid examples, and diverse exercises. Students reinforce what they have learned through homework and vocabulary tests. However, this model often emphasizes surface memorization of vocabulary and lacks in-depth exploration of the internal connections and development patterns of vocabulary.

3.2 Advantages and Limitations of the Traditional Model

The traditional vocabulary teaching model has significant advantages in terms of vocabulary accumulation. Through systematic vocabulary lists and repetitive exercises, students can master many basic vocabularies in a short time, laying a solid foundation for their subsequent English learning. This model is easy to implement for teachers and applicable for most beginners. However, the traditional model also has several limitations, mainly reflected in the following aspects.

The traditional model relies too much on mechanical memorization and neglects the internal structure and linguistic origins of vocabulary. Research shows that understanding vocabulary not only depends on memorizing its surface form but also requires an understanding of its inherent meaning and composition (Anderson, 2006). However, traditional teaching often overlooks this point, resulting in students' inability to flexibly apply the learned vocabulary in practical situations.

The traditional teaching model lacks attention to individual differences among students. Students' vocabulary learning abilities and methods vary, but the traditional model usually adopts a one-size-fits-all teaching method that cannot meet the diverse needs of

different students. This single teaching approach may lead to poor vocabulary learning results for some students and even create a sense of aversion to learning.

The traditional model falls short in cultivating students' vocabulary application abilities. Although students can memorize many vocabulary words, their ability to apply these words in actual communication is often limited. This is mainly because traditional teaching lacks contextual teaching and interactivity, and students lack opportunities to use vocabulary in authentic contexts, leading to a disconnection between vocabulary learning and practical application.

3.3 Analysis of the Teaching Needs Based on Etymology

Etymology, as a discipline that studies the origin and evolution of words, can provide in-depth theoretical support and practical guidance for vocabulary teaching. From the perspective of etymology, vocabulary is not only a tool for language communication but also a carrier of culture and history. By understanding the etymology of vocabulary, students can better grasp the connotation and extension of vocabulary, enhance memory effects, and improve vocabulary application abilities.

Currently, with the accelerated process of globalization and English as an important tool for international communication, English vocabulary teaching faces new challenges and opportunities. Students need to not only master basic vocabulary but also understand the polysemy of vocabulary, the regularities of word roots and affixes, as well as the historical evolution of vocabulary. This not only helps improve students' language comprehension and expression abilities but also cultivates their cross-cultural communication abilities.

The development of modern educational technology provides new possibilities for the application of etymology in vocabulary teaching. Through multimedia resources and internet platforms, teachers can present the etymological background and evolution process of vocabulary in a more intuitive and vivid way, stimulating students' learning interest and enhancing learning effectiveness.

In conclusion, the teaching model based on etymology can effectively address the shortcomings of the traditional vocabulary teaching model and meet the needs of modern college English vocabulary teaching. This not only helps students accumulate vocabulary but, more importantly, enhances the depth and breadth of their understanding and application of vocabulary.

4. BUILDING A COLLEGE ENGLISH VOCABULARY TEACHING MODEL BASED ON ETYMOLOGY

4.1 Theoretical Foundation of the Teaching Model

The construction of a college English vocabulary teaching model based on etymology is mainly based on cognitive linguistics and constructivist learning theory. Cognitive linguistics emphasizes the close relationship between language and cognition, stating that language structure reflects human thinking patterns (Lakoff & Johnson, 1980). Understanding the etymology of vocabulary not only aids in memorizing words but also promotes a deeper understanding of their meanings.

Constructivist learning theory emphasizes learners' active and interactive role in the process of knowledge construction (Piaget, 1972). The vocabulary teaching model based on etymology guides students to explore the origin and evolution of vocabulary, stimulating their learning interest and facilitating active construction of vocabulary knowledge. The sociocultural theory points out that learning is a social and interactive process (Vygotsky, 1978). In etymology-based vocabulary teaching, activities such as group discussions and cooperative learning enhance interaction among students, improving learning outcomes.

Multimodal theory also supports the teaching model based on etymology. Multimodal theory suggests that information is processed and conveyed through multiple sensory channels, integrating visual and auditory perception to enhance learning effectiveness (Jewitt, 2008). The teaching model based on etymology utilizes multimedia resources to present the historical evolution and cultural background of vocabulary, enhancing the intuitiveness and interest of teaching.

In summary, the college English vocabulary teaching model based on etymology relies on cognitive linguistics, constructivist learning

theory, and multimodal theory. It emphasizes deep understanding and active construction of vocabulary learning, aiming to enhance students' vocabulary application and cross-cultural communication abilities.

4.2 Design of Teaching Content

In etymology-based vocabulary teaching, the design of teaching content should revolve around vocabulary etymology, word formation rules, semantic evolution, and cultural background. Specifically, teaching content can include the following aspects:

Etymological analysis of vocabulary: Teachers should select representative vocabulary and provide detailed explanations of their origins, development history, and evolution. By analyzing word roots and affixes, students can understand the composition of vocabulary and the generation of word meanings. For example, analyzing the root "tele-" (distance) and the suffix "-phone" (sound) in the word "telephone" helps students understand its literal and actual meanings.

Exploration of word formation rules: Through introducing common word formation methods in English, such as derivation, compounding, and abbreviation, students can grasp the rules of vocabulary generation. This not only aids in vocabulary memorization but also improves students' vocabulary inference abilities. For example, by learning the negating meaning of the prefix "un-", students can infer the meanings of words like "unhappy" and "unknown".

Study of semantic evolution: Teachers should guide students to understand the semantic changes of vocabulary over different historical periods and the social and cultural factors behind them. Through analyzing semantic evolution, students can better comprehend the use of vocabulary in different contexts. For example, the word "gay" has evolved from meaning "happy" to referring to "homosexuality," reflecting changes in social and cultural attitudes.

Integration of cultural background: Vocabulary not only constitutes language but also carries rich cultural information. Teaching content should combine vocabulary with its cultural background, introducing its usage and meaning differences in different cultures. This helps cultivate students' cross-cultural awareness and enhances their language sensitivity in international communication. For example, introducing vocabulary expressions for "politeness" in English culture and corresponding terms in other cultures can help students avoid cultural misunderstandings in practical communication.

The design of teaching content should also consider current social issues and practical needs. For example, in the context of globalization, emerging vocabulary related to international affairs and technological developments should be timely included in the teaching content, aligning students' vocabulary learning with real-world demands. By providing diverse teaching content, students' multi-level and multi-domain vocabulary learning needs can be met, enhancing their overall language proficiency.

4.3 Teaching Methods and Strategies

The teaching model based on etymology emphasizes diversity and interactivity in teaching methods and strategies to promote students' deep understanding and active learning. Specific strategies include:

Heuristic teaching: Teachers guide students to explore the origin and evolution of vocabulary by posing questions related to etymology. For example, when teaching the word "biology," teachers can guide students to analyze its root "bio-" (life) and the suffix "-logy" (discipline), helping them understand its meaning as "the study of life." Through heuristic teaching, students not only memorize vocabulary but also understand its composition and meaning, enhancing the depth of learning.

Contextual teaching: Integrate vocabulary teaching into authentic or simulated contexts to help students understand the practical application of vocabulary. For example, through designing situational dialogues or role plays related to etymology, students can use and consolidate new vocabulary in interactive settings. Contextual teaching not only improves vocabulary memorization but also enhances students' application and communication abilities.

Cooperative learning: Foster students' teamwork and cooperation through activities such as group work and collaborative learning. In etymology-based vocabulary teaching, students can work in groups to conduct etymological research, present their findings,

and exchange learning outcomes. Cooperative learning enhances students' motivation and improves their communication and collaboration skills.

Utilization of multimedia and information technology: Enrich teaching methods through the use of videos, animations, interactive software, and other multimedia resources. For example, using interactive etymology chart software allows students to intuitively understand the process of vocabulary evolution, enhancing the interest and clarity of learning. The application of information technology creates diverse and engaging learning experiences, catering to students' different learning styles and needs.

Reflective learning: Encourage students to reflect on and record their vocabulary learning experiences and methods. For example, students can maintain a vocabulary etymology log, recording the etymology information and insights for each new word they learn. This reflective learning helps students organize their knowledge and improve their self-regulation and self-management abilities.

Through diverse and interactive teaching methods and strategies, the college English vocabulary teaching model based on etymology can effectively enhance students' vocabulary understanding and application abilities, promoting their overall language development.

4.4 Teaching Resources and Support

Building a college English vocabulary teaching model based on etymology requires rich teaching resources and effective support. These resources and support mainly include the following:

Etymology textbooks and reference books: Teachers should select or develop specialized vocabulary teaching materials focusing on etymology, systematically introducing vocabulary origins, evolution, and word formation rules. Reference books such as "The Etymological Dictionary of English" and "An Introduction to Lexicology" provide comprehensive etymology information and learning resources for teachers and students, supporting teaching and self-study.

Multimedia teaching resources: Including videos, animations, interactive software, etc., related to etymology. These resources can visually demonstrate the evolution process

and cultural background of vocabulary, enhancing the interest and clarity of teaching. For example, using animated videos to show the formation process of word roots helps students better understand the structure and meaning of vocabulary.

Information technology platforms: Establish online etymology learning communities and resource sharing platforms using the Internet and educational technology platforms. Through online etymology databases, electronic vocabulary flashcards, interactive exercises, etc., rich learning resources and interactive opportunities can be provided to support student self-study. For example, teachers can upload etymology-related learning materials and exercises, which students can access and learn from at any time, enhancing the flexibility and convenience of learning.

Teacher training and support: The implementation of the vocabulary teaching model based on etymology requires teachers to have a solid understanding of etymology knowledge and teaching skills. Schools should organize relevant teacher training to improve teachers' theoretical understanding of etymology and teaching abilities. Additionally, establishing teacher communication platforms promotes the sharing of experiences and teaching resources among teachers, improving the overall teaching level.

Teaching evaluation and feedback mechanism: Establish a scientific teaching evaluation and feedback mechanism to ensure the effective implementation of the vocabulary teaching model based on etymology. This mechanism should include formative assessment and summative assessment to comprehensively evaluate students' learning outcomes and teaching quality based on the characteristics of different evaluation methods.

Formative assessment focuses on dynamic assessment during the teaching process to provide timely feedback on students' learning progress and identify existing issues. For example, through classroom questioning, group discussions, etymology analysis assignments, teachers can assess students' understanding of vocabulary etymology and their application abilities in real-time. This feedback mechanism helps teachers adjust teaching content and methods based on

students' learning progress, improving teaching effectiveness.

Summative assessment is conducted at the end of a teaching stage to evaluate students' overall mastery of learned vocabulary and etymology knowledge. It can be achieved through mid-term and final exams or comprehensive vocabulary application tests. For example, designing comprehensive vocabulary tests that include etymology analysis, vocabulary application, and word formation exercises to comprehensively assess students' vocabulary learning outcomes.

Self-evaluation and reflection are also important components of teaching evaluation. By encouraging students to self-assess and reflect on their own learning process and outcomes, they can actively examine their strengths and weaknesses. For example, students can record learning experiences and evaluate their progress in vocabulary etymology understanding and application. This self-assessment helps improve students' self-regulation and autonomy in learning.

Teacher evaluation should consider students' classroom performance, homework completion, test scores, comprehensively reflecting students' vocabulary learning outcomes and teaching quality. Additionally, it should align with teaching goals, evaluating the effectiveness and adaptability of teaching activities. For example, analyzing students' performance in vocabulary construction practice can assess whether teaching activities have achieved the intended goals, providing a basis for optimizing teaching design.

Peer evaluation promotes cooperative learning and knowledge sharing among students. For example, during group discussions and presentations, students can evaluate each other's etymology analysis and application abilities, providing constructive feedback. This evaluation method enhances student interaction, cooperation, critical thinking, and feedback skills.

Data support and analysis play an important role in teaching evaluation. By systematically collecting and analyzing data such as exam scores, homework completion, and classroom participation, teachers can scientifically evaluate teaching effectiveness. For example, statistical analysis can be used to compare students' vocabulary mastery under the traditional teaching model with that under the etymology-based teaching model, quantifying the improvement in teaching effectiveness. Relevant studies have shown that the etymology-based teaching model significantly improves students' vocabulary memorization and application abilities (Anderson, 2006), providing data support to further validate the advantages of etymology in vocabulary teaching.

Continuous improvement requires teachers to adjust and optimize teaching models based on evaluation and feedback results. For example, if students face difficulties in understanding semantic evolution, teachers can increase related case studies and discussions to enhance the depth of teaching content. Through teaching reflection, teachers can summarize effective teaching experiences, avoid shortcomings encountered during implementation, and ensure continuous improvement and optimization of the teaching model.

By establishing a scientific teaching evaluation and feedback mechanism, the college English vocabulary teaching model based on etymology can effectively monitor the various stages of teaching, promptly identify and address issues, enhance teaching effectiveness, and promote students' vocabulary learning and language development.

5. IMPLEMENTATION STEPS OF THE TEACHING MODEL BASED ON ETYMOLOGY

5.1 Implementation Process of the Teaching Model

Implementing the college English vocabulary teaching model based on etymology requires a systematic and phased development process. Clarifying teaching objectives is a crucial step, incorporating etymology into various aspects of vocabulary learning to enhance students' deep understanding and application abilities. Teachers should develop detailed teaching plans that cover vocabulary selection, content arrangement, and application of teaching methods to ensure the orderly progress of teaching activities.

During the implementation process, teachers should consider the actual situation of the course and make reasonable arrangements for

the teaching progress. For example, at the beginning of the semester, it is beneficial to focus on introducing the etymology and word formation rules of common vocabulary, helping students establish a basic framework of etymology knowledge. As the course progresses, gradually introduce the etymological analysis of more complex vocabulary, enhancing students' understanding of vocabulary evolution and cultural background. This process should emphasize the integration of theory and practice, using practical case analysis to improve students' analytical and application abilities.

Continuous monitoring and adjustment are necessary during the implementation. Teachers should flexibly adjust teaching strategies and content based on students' learning feedback and classroom performance to meet the diverse learning needs and progress of different students. For example, if difficulties in understanding certain etymology content are identified, teachers can provide additional teaching resources or modify teaching methods to help students better grasp the knowledge. Collecting students' feedback opinions and understanding their satisfaction with teaching activities and resources can further optimize teaching strategies and resource allocation, improving overall teaching quality.

5.2 Specific Arrangement of Teaching Activities

The college English vocabulary teaching model based on etymology requires the design of diverse teaching activities to enhance student engagement and learning effectiveness. The specific arrangements include:

Etymology analysis explanation: Teachers select representative vocabulary in class and provide detailed explanations of their etymology and word formation rules. For example, explain the origin of the word "biology" and analyze its root "bio-" (life) and suffix "-logy" (discipline) to help students understand its meaning as "the study of life." Through systematic etymology analysis, students can grasp the logical relationships behind vocabulary and enhance the effectiveness of memorization.

Vocabulary construction practice: Assign students word formation exercises to create new vocabulary through the combination of prefixes and suffixes, cultivating their vocabulary inference abilities. For example, given the root "tele-" and the suffix "-graph," students can combine them to form "telegraph" and understand its meaning as "long-distance communication." Such activities not only promote students' understanding of vocabulary formation but also stimulate their creative thinking.

Study of semantic evolution: Guide students to research the semantic changes of specific vocabulary over different historical periods and the social and cultural factors behind them. For example, explore the semantic evolution of the word "gay" from "happy" to referring to "homosexuality," analyzing its relationship with changing social attitudes. Through studying semantic evolution, students can gain a deeper understanding of the interaction between language and society.

Integration of cultural background: Combine vocabulary with its cultural background, introducing its usage and meaning differences in different cultures. For example, explain how the word "gratitude" is expressed in English culture and its corresponding terms and usage in other cultures. Such activities help cultivate students' cross-cultural awareness and enhance their language sensitivity in international communication.

Application of multimedia resources: Use videos, animations, etymology charts, and other multimedia resources to visually present vocabulary etymology information and evolution processes. For example, play a video about the origin of the word "telephone," showing its combination of the Greek words "tele" (distance) and "phone" (sound). The application of multimedia resources enriches teaching methods, increasing students' interest and depth of understanding.

Group discussions and presentations: Organize students into groups to research vocabulary etymology and related background and conduct presentations and discussions in class. Through cooperative learning, students can exchange ideas, share research findings, and improve teamwork skills. For example, groups can research the etymology of the word "technology," discuss its usage differences in

various contexts, and present their findings in class.

Vocabulary etymology logs: Encourage students to maintain vocabulary etymology logs, recording the etymology information, word formation rules, and personal learning experiences for each new word they learn. Through log-keeping, students can systematically organize their learned vocabulary knowledge, enhancing self-reflection and knowledge integration abilities.

8. Interactive quizzes and games: Design interactive quizzes and vocabulary games related to etymology to stimulate students' learning interest and active participation. For example, design etymology puzzle games for students to piece together word roots and affixes, enhancing their understanding of vocabulary formation. Such activities not only increase the fun of the classroom but also promote students' active engagement and independent learning.

5.3 Teaching Evaluation and Feedback Mechanism

Establishing a scientific teaching evaluation and feedback mechanism is essential to ensure the effective implementation of the teaching model based on etymology. This mechanism should include formative assessment, summative assessment, self-evaluation, peer evaluation, and data analysis.

Formative assessment focuses on providing ongoing feedback during the teaching process. It involves activities such as classroom discussions, quizzes, and assignments that allow teachers to assess students' understanding of vocabulary etymology and their application abilities in real-time. This feedback helps teachers adjust teaching strategies, content, and methods to meet students' learning needs.

Summative assessment occurs at the end of a teaching stage and evaluates students' overall mastery of vocabulary etymology. It can include exams, projects, or presentations that assess students' comprehensive understanding and application abilities. Summative assessment provides a holistic view of students' learning outcomes and guides future teaching adjustments.

Self-evaluation and reflection encourage students to assess their own progress and learning experiences. Through self-reflection

and self-assessment, students can identify their strengths, weaknesses, and areas for improvement in understanding and applying vocabulary etymology. This self-evaluation enhances students' metacognitive awareness and self-directed learning.

Peer evaluation promotes collaboration and knowledge sharing among students. It involves students evaluating each other's understanding and application of vocabulary etymology through activities such as group discussions, presentations, or peer feedback. Peer evaluation nurtures critical thinking, communication skills, and constructive feedback abilities.

Data support and analysis play a crucial role in teaching evaluation. Collecting and analyzing data such as exam scores, assignment completion rates, and classroom participation allows teachers to track students' progress and evaluate teaching effectiveness. Statistical analysis methods can be used to compare students' performance under different teaching models and quantify the improvement achieved through the etymology-based teaching model.

Continuous improvement relies on using evaluation and feedback results to adjust and enhance the teaching model. Teachers should analyze evaluation data, reflect on teaching practices, and make necessary adjustments to optimize teaching strategies, content, and resources. Through continuous improvement, the teaching model based on etymology can be refined to better meet students' needs and enhance their vocabulary learning outcomes.

By implementing a scientific teaching evaluation and feedback mechanism, the college English vocabulary teaching model based on etymology can effectively monitor teaching progress, identify areas for improvement, and promote students' vocabulary learning and language development.

6. DISCUSSION

6.1 Advantages of the Teaching Model Based on Etymology

The college English vocabulary teaching model based on etymology demonstrates significant advantages over traditional teaching models in several aspects. This model, through the lens of etymology, delves

into the structure and evolution patterns of vocabulary, helping students establish a systematic vocabulary knowledge framework. Students not only memorize the surface forms of vocabulary but also understand their internal structures and mechanisms of meaning generation, thereby enhancing the effectiveness and durability of vocabulary memorization. Studies have shown that understanding word roots, prefixes, and suffixes significantly improves students' grasp of vocabulary (Anderson, 2006).

The etymology-based model enhances students' language application abilities. Through etymology analysis, students can better understand the usage of vocabulary in different contexts and improve their flexibility in applying vocabulary. For example, by understanding the negating meaning of the prefix "un-", students can accurately comprehend and use words like "unhappy" and "unknown." This deep understanding helps students feel more confident and precise in using English in practical communication.

The model emphasizes the cultivation of students' cross-cultural communication abilities. Etymology not only involves language but also encompasses cultural and historical backgrounds, helping students understand the cultural connotations and social evolution of vocabulary. For example, through researching the origin and historical development of the word "democracy," students can understand its applications and variations in different cultures. This cross-cultural perspective aids students in better engaging in international communication and cooperation in a globalized context.

The model also promotes students' autonomous learning abilities. Through activities such as vocabulary etymology logs and reflective learning, students can actively record and summarize their vocabulary learning processes, enhancing their self-regulation and learning management abilities. This cultivation of autonomous learning not only contributes to the sustainability and depth of vocabulary learning but also lays a solid foundation for students' future learning and research.

The diversity and interactivity of teaching methods in the model significantly enhance the effectiveness of classroom instruction and students' learning interest. By utilizing multimedia resources, vocabulary games, and group discussions, the model creates a more engaging and interactive learning environment, increasing students' participation and motivation. This not only improves the effectiveness of vocabulary memorization but also fosters teamwork and communication skills.

6.2 Challenges in the Implementation Process

Although the teaching model based on etymology has numerous advantages, it may encounter challenges and issues during the actual implementation. The primary challenge lies in the teachers' knowledge and teaching capabilities in etymology. Etymology encompasses multiple disciplines such as linguistics and history, requiring teachers to possess a solid theoretical foundation in etymology and rich teaching experience. However, some teachers may lack professional competence in etymology, which could result in ineffective teaching or hinder the in-depth implementation of etymology-based teaching.

Insufficient and limited teaching resources are also a challenge. The etymology-based teaching model requires abundant etymology textbooks, reference books, and multimedia resources to support diverse teaching content and depth. However, existing etymology resources may be limited, particularly in the analysis of etymology for complex vocabulary, leading to a lack of comprehensive teaching materials. This not only increases the difficulty of lesson preparation for teachers but also limits the comprehensive implementation of the teaching model.

The acceptance and learning habits of students are also important factors affecting teaching effectiveness. The teaching content of etymology may be relatively complex, requiring students to have a high level of language comprehension and a proactive learning attitude. However, some students may be more accustomed to traditional vocabulary memorization methods and lack interest or motivation in deepening their understanding of etymology, resulting in resistance to the implementation of the etymology-based teaching model.

Furthermore, time constraints and course

schedules may affect the implementation of the teaching model. The etymology-based teaching model often requires more teaching time and classroom activities to cover in-depth analysis and application of vocabulary. However, college English courses have limited time availability, and teachers may face pressure to cover a broad range of content within a tight schedule, making it challenging to fully implement etymology-based teaching. The complexity of evaluation and feedback mechanisms is also a challenge. The teaching model based on etymology requires a diversified and systematic evaluation system to comprehensively assess students' learning outcomes. However, existing assessment systems may not fully consider the particularities of etymology, making it difficult to accurately reflect students' achievements in etymology. This to some extent restricts the effectiveness and continuous improvement of the teaching model.

6.3 Strategies for Solution and Improvement

To address the challenges faced during the implementation of the teaching model based on etymology, the following strategies for solution and improvement are recommended to enhance teaching effectiveness and the sustainability of the model:

Enhancing teachers' etymology literacy is the fundamental approach to address the issue of insufficient knowledge among teachers. Schools and educational institutions should strengthen etymology training for teachers, providing systematic etymology courses and opportunities for professional development. For example, organizing lectures, teacher seminars, and training courses to enhance teachers' theoretical understanding of etymology and teaching abilities. Encouraging teachers to engage in etymology-related academic research and exchanges broadens their perspectives and improves their teaching competence.

Enriching teaching resources to meet the needs of etymology teaching. Schools should allocate resources to purchase etymology textbooks, reference books, and multimedia resources, improving existing teaching resource databases. At the same time, utilizing information technology to develop and integrate multimedia teaching resources, such as etymology videos, animations, and interactive software, to enhance teaching content diversity and liveliness. For example, developing interactive etymology software that helps students intuitively understand vocabulary formation and evolution processes. Teachers can also utilize internet resources to create and share etymology teaching materials, promoting resource sharing and utilization.

Stimulating students' interest and motivation to learn by emphasizing the fascinating and practical aspects of etymology. Teachers should guide students to discover the interesting and practical aspects of etymology, igniting their learning interest. For example, by designing engaging etymology games and challenging activities to attract student participation. Additionally, teachers should encourage students to explore vocabulary etymology and evolution independently, providing necessary guidance and support to help students develop positive learning attitudes and habits.

7. CONCLUSION

This study focuses on the college English vocabulary teaching model based on etymology, thoroughly discussing the current status, advantages, and limitations of traditional vocabulary teaching models, and proposing a construction plan for the etymology-based teaching model. By conducting a systematic analysis of etymology theory and considering the practical needs of college English vocabulary teaching, a teaching model centered around etymology has been developed. The model emphasizes etymology analysis, exploration of word formation rules, study of semantic evolution, and integration of cultural background. Through diverse teaching methods and abundant teaching resources, students' vocabulary understanding and application abilities are enhanced.

The study further provides a detailed demonstration of the implementation steps of the teaching model, including the implementation process, specific arrangements of teaching activities, and the establishment of evaluation and feedback mechanisms. The discussion section analyzes the advantages of the teaching model, such as

improving vocabulary memorization effectiveness, enhancing language application abilities, and promoting cross-cultural communication abilities. It also identifies potential challenges in the implementation process, such as teachers' knowledge and capabilities, teaching resources, student acceptance, and evaluation complexity. Practical strategies for solution and improvement are proposed to ensure the smooth implementation and continuous optimization of the teaching model.

The college English vocabulary teaching model based on etymology demonstrates great potential and advantages in both theoretical and practical aspects. It significantly enhances students' vocabulary learning outcomes and overall language proficiency, providing new directions and insights for the reform and innovation of college English education.

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Theoretical Model and Practical Application of the Evaluation of Innovation and Entrepreneurship Education Effectiveness in Universities

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Abstract: The evaluation of innovation and entrepreneurship education effectiveness in universities is a research hotspot in the current education field. In response to the problems of insufficient theoretical model construction and imperfect evaluation criteria in existing research, this study aims to construct a systematic and scientific theoretical model for evaluating the effectiveness of innovation and entrepreneurship education in universities and verify it through practical applications. Through literature review and theoretical deduction, an evaluation framework centered on "education inputprocessoutput" was constructed, covering four dimensions: curriculum system, teaching staff, student ability development, and social impact. The research uses a combination of the Analytic Hierarchy Process (AHP) and the Fuzzy Comprehensive Evaluation Method to ensure the scientific nature of evaluation indicators and the reliability of data analysis. During the research process, through questionnaire surveys and statistical analysis of multiple universities across the country, the theoretical model was empirically tested and optimized. The results show that this evaluation model can comprehensively reflect the actual effectiveness of innovation and entrepreneurship education in universities, and its comprehensiveness, operability, and adaptability are superior to existing single evaluation systems. This study provides a scientific basis for universities to improve the level of innovation and entrepreneurship education, and also provides a theoretical reference for the government and society to formulate relevant policies.

Keywords: Innovation and Entrepreneurship Education; Effectiveness Evaluation; Theoretical Model; Analytic Hierarchy Process; Fuzzy Comprehensive Evaluation

1. INTRODUCTION

1.1 Research Background and Significance

In the process of cultivating talents, universities have always regarded knowledge imparting and value shaping as their core tasks. However, it is equally crucial to cultivate students with practical abilities and innovative awareness [1]. Many industries have a greater demand for compound talents in technological innovation and business model iteration. The academic and political circles increasingly emphasize the importance of innovation and entrepreneurship education. The challenges faced by universities not only involve how to set up and optimize innovation and entrepreneurship courses but also include the scientific evaluation of educational effects. Many highereducation institutions in various places have successively introduced several reform measures, and some institutions have begun to build specialized incubation platforms to help students complete the initial incubation of entrepreneurial projects and resource docking during their school years [2]. Such teaching practices have gradually accumulated some achievements and also triggered indepth thinking about evaluation methods and evaluation index systems.

If universities only rely on the number of students or graduation destinations to judge educational effectiveness, it is often difficult to comprehensively reveal the impact of innovation and entrepreneurship education on students in terms of values, thinking patterns, and comprehensive abilities. Some research

teams have proposed that multidimensional indicators such as students' creative thinking, innovative skills, and business awareness should be included in the evaluation framework [3]. Some highlevel universities also have relatively complete statistical indicators for entrepreneurial competitions, schoolenterprise cooperation projects, or innovative practice activities. However, the scattered data lack a unified measurement and analysis model, making it difficult to support subsequent quality improvement and policymaking. Other scholars have pointed out that modern society requires a more flexible and dynamic evaluation system, so that the evaluation results can not only reflect the teaching quality but also provide improvement directions for universities in terms of interdisciplinary integration, industryuniversityresearch cooperation, etc. [4].

The research and practice of innovation and entrepreneurship education in universities have typical demonstration significance for the talent cultivation model and also have multiple linkages with national industrial upgrading and economic transformation. Studying the evaluation of educational effectiveness in this field can not only improve universities' guiding ability for students but also promote the formation of a social innovation ecosystem on a broader scale. In fact, highereducation institutions are often highly expected to undertake the functions of gathering innovation elements and knowledge spillover. The academic community generally believes that a theoretical model that can accurately measure educational effectiveness can play a key bridging role among resource allocation, curriculum design, and policy support [2]. Therefore, exploring and optimizing the method system for evaluating the effectiveness of innovation and entrepreneurship education is of great value.

1.2 Review of Research Status at Home and Abroad

Overseas, the attention to the evaluation of the effectiveness of innovation and entrepreneurship education has a long history. Some universities in Europe and America focus on entrepreneurial awareness, entrepreneurial skills, and teamwork as the key inspection objects, thus giving rise to relatively mature theoretical models [3]. Universities in the United States, the United Kingdom, and other countries adopt projectbased teaching and tutorialbased guidance in curriculum design, integrating realworld business cases into daily learning, so that students can gain practical experience in an interdisciplinary and crossteam environment. While exploring quantitative indicators, researchers also obtain data on students' entrepreneurial activities after graduation through longterm followup surveys. Taking Swedish universities as an example, many evaluation reports not only count the number of business entities but also take into account the innovation contributions of new technology patent applications and interdisciplinary projects [1]. These achievements have prompted university management to continuously improve policy support, investment directions, and talent echelon construction.

Domestically, at the policy level, strong support has been provided for the promotion of innovation and entrepreneurship education in universities. Universities across the country have invested a large amount of resources in curriculum setting, schoolenterprise cooperation, and training projects [2]. Some universities have made achievements in hardware facilities such as training laboratories and maker spaces. However, from the evaluation results, there are bottlenecks such as scattered data and the lack of a unified evaluation model. Some universities and local governments jointly build industrial parks, but the number and quality of students' innovative projects in the parks and their contributions to industrial upgrading still lack systematic demonstration [5]. Some other studies focus on the satisfaction of students on campus with innovation and entrepreneurship education courses but ignore the real impact of the courses on students' career development or thinking transformation [3]. Without a stable and feasible evaluation system, it is difficult to determine whether educational reforms have truly achieved the expected goals. Combining relevant literature, it can be found that both at home and abroad, a considerable amount of experience has been accumulated in teaching concepts, operation mechanisms, and evaluation methods. How to draw on foreign

successful practices and base on the local industrial pattern and talent cultivation strategy is an important issue in current research.

1.3 Research Questions and Objectives

This study aims to reveal the theoretical logic and practical key points of the evaluation of the effectiveness of innovation and entrepreneurship education in universities. The core questions include two aspects: one is to explore from the perspectives of education and management which evaluation indicators and methods can most accurately capture the growth trajectories of students' innovative abilities and entrepreneurial thinking; the other focuses on the applicability of the evaluation model in realworld situations and how to use the evaluation results to continuously improve teaching and policy design. The main research objectives include: first, constructing a multidimensional theoretical model that takes into account both quantitative and qualitative analyses; second, exploring how to apply the abovementioned model to realworld scenarios; third, providing guidance for subsequent university reforms and national policymaking through empirical and case studies.

1.4 Research Methods and Technical Routes

In the research process, international and domestic literature are first summarized and sorted out, and a theoretical framework suitable for highereducation institutions is selected from evaluation indicators and application achievements. Then, through means such as questionnaires, interviews, and data analysis, quantitative and qualitative research is carried out on the innovation and entrepreneurship projects of student groups in several universities, and various types of data on students' selfefficacy, practical skills, and entrepreneurial achievements are collected. Through statistical tools such as factor analysis and structural equation models, efforts are made to identify the internal relationships between evaluation indicators. Subsequently, combined with expert interviews, the constructed evaluation model is verified and piloted in some local universities. Finally, based on empirical data and expert opinions, the model is revised or supplemented. The technical route roughly includes links such as literature research, theoretical model construction, empirical research and case analysis, model revision, and promotion.

2. THEORETICAL BASIS FOR THE EVALUATION OF THE EFFECTIVENESS OF INNOVATION AND ENTREPRENEURSHIP EDUCATION

2.1 Connotation and Objectives of Innovation and Entrepreneurship Education

The academic community defines innovation and entrepreneurship education as a comprehensive educational practice that improves students' creative thinking, business model design, market insight, and resource integration abilities [6]. This kind of education not only focuses on skill training but also includes the cultivation of thinking patterns, values, and entrepreneurial spirit. Many domestic universities combine professional education with social practice and offer interdisciplinary learning projects based on realworld situations, enabling students to learn to identify opportunities and construct innovative solutions while doing [3]. Nowadays, many industries are experiencing the impact of digitalization and emerging technologies, and the talent cultivation model is gradually shifting from the original professional segmentation to interdisciplinary and crossfield integration. The goal of innovation and entrepreneurship education is not only to cultivate a group of talents who can start enterprises or projects but also to nurture a more autonomous, inclusive, and cooperative group of college students. If it is only understood from the narrow perspective of business entrepreneurship, it is difficult for students to form the concepts of lifelong learning and continuous iteration in a highly competitive social environment. The market competition in realworld scenarios is changing rapidly, and universities should cultivate students' ability to cope with uncertainties through various forms of teaching [1]. Research shows that some comprehensive universities have achieved obvious results in inspiring creative thinking and enhancing interdisciplinary cooperation, and the results of some projects have been recognized in

innovation competitions [2]. Some specialized universities also start from an engineering background and transform their disciplinary and technological advantages into students' startup enterprises, driving the local economic and social development [5].

2.2 Theoretical Framework for the Evaluation of Educational Effectiveness

The field of educational evaluation contains a variety of theoretical viewpoints. For example, the behaviorist approach emphasizes the measurement of observable skills and behavioral changes, the cognitivist approach pays more attention to students' knowledge structure and thinking patterns, and the constructivist approach tends to evaluate the degree of learning through the learners' autonomous construction [3]. These viewpoints can all provide certain inspiration for the evaluation of the effectiveness of innovation and entrepreneurship education. For the more openended form of education such as innovation and entrepreneurship, it is necessary to consider the individual characteristics, process behaviors, and output performance of learners simultaneously in the evaluation. If process data is ignored, it may be difficult to understand the growth curve of students in the project progress; if the output results are ignored, it may be impossible to grasp the substantial contribution of educational achievements to society or industry [6].

Comprehensively analyzing common educational evaluation models, such as the Kirkpatrick FourLevel Training Evaluation Model and the CIPP Evaluation Model, can provide ideas for innovation and entrepreneurship education. The Kirkpatrick FourLevel Model focuses on four levels: reaction, learning, behavior, and result [1]. When introduced into the innovation and entrepreneurship education in universities, it can be used to check students' mastery of entrepreneurial knowledge and skills at the "learning" level and observe students' performance in campus entrepreneurial competitions or subject practices at the "behavior" level. The CIPP Evaluation Model evaluates from four dimensions: context, input, process, and product, which has a certain degree of fit with the operating characteristics of university projects. When using such

models, it is necessary to cooperate with specific indicators or scales to track and examine the dynamic evolution of individual students and teams [3].

Some scholars have proposed that a combination of multiple subjective evaluations and objective indicators can better reflect the real teaching effect. Some quantitative indicators, such as the total number of entrepreneurial projects, the conversion rate of innovative achievements, or students' employment quality, are directly related to innovation and entrepreneurship education in universities. Data at the students' perception level should also be valued. Questionnaires and interviews can capture students' subjective evaluations such as satisfaction with courses, project learning experiences, and confidence in future entrepreneurship or employment [2]. If a more refined method of measurement is needed, the cognitive diagnostic model and the portfolio method can be considered. The cognitive diagnostic model is good at diagnosing students' mastery from subtle knowledge points and ability points. The portfolio method allows students to present the project process, the evolution of thinking at key nodes, and the results, not only paying attention to the results but also recording the learning and creation process [7].

2.3 Integration of Innovation and Entrepreneurship Education and Educational Evaluation Theory

Innovation and entrepreneurship education itself includes individual learning and group collaboration, emphasizing exploratory research in real or simulated business situations. The integration of educational evaluation theory and these characteristics is often reflected in the diversification of indicators, tools, and evaluation dimensions. When a university offers training courses or innovation and entrepreneurship practice projects, the teaching mode is often relatively flexible, and a tutorial system or multiteam collaboration may be formed between teachers and students. At this time, if only traditional examinationbased evaluation or finalterm assessment is used, it is difficult to capture students' potential and innovative contributions [1]. Some scholars suggest using projectbased process evaluation, providing

continuous feedback to students through weekly reports, monthly reports, and finalterm defenses, so that evaluation is integrated into the teaching process itself [3]. Other scholars, starting from the social system theory, advocate observing the impact of innovation and entrepreneurship education on the social ecosystem at a macro level, including its promotion of local economic vitality, technology transfer, and knowledge diffusion [8].

Around the intersection of educational evaluation theory and innovation and entrepreneurship education, some researchers use structural equation models to analyze the path relationships between teaching input, teaching process, and teaching effectiveness [4]. Statistical models can help clarify the action mechanisms of various variables and also provide accurate quantitative basis for decisionmakers. For some research topics, the analytic hierarchy process can be used to construct a weight system, and then integrate subjective and objective evaluation information. Some teams have also found in practice that for students who have just started to contact entrepreneurial courses, their innovation motivation, entrepreneurial intention, and selfefficacy can be evaluated first, and the teaching effect can be measured by comparing the changes before and after the courses; for senior students with project development experience, more attention can be paid to the standardization of business plans, team collaboration, and the efficiency of docking with market resources [3]. Some researchers also believe that educational evaluation should be matched with industry hotspots. For example, fields such as intelligent manufacturing, new energy, and digital cultural and creative industries are increasingly favored by the market. If students' entrepreneurial projects in these directions have certain competitiveness, it can also be regarded as a link highlighting the industry orientation in the educational evaluation system [5].

The integration of theory and practice helps universities develop more complete quality improvement mechanisms. Researchers often point out that the development of innovation and entrepreneurship education requires multidimensional support, including policy, economic, and cultural environments. Educational evaluation theory provides a methodological framework that enables relevant parties to plan and make decisions based on scientific measurement and evidence. Without the connection between theory and practice, teaching reforms can only remain at scattered attempts, and evaluation results are difficult to have systematic guiding value. Many universities have been exploring the construction of specialized "Educational Evaluation Centers" or "Entrepreneurial Practice Evaluation Teams", which can provide more accurate improvement suggestions for innovation and entrepreneurship education by integrating data, teachers' experience, and external resources [3]. This trend shows that university administrators, teachers, and students have an increasing demand for scientific evaluation. Whether it is the allocation of supporting funds, curriculum design, or the cultivation of teaching teams, it is inseparable from the objective feedback on educational effects.

Based on the current development trend, there are still many details worthy of indepth study. Individual differences are very obvious in innovation and entrepreneurship education. Students with different professional backgrounds, different grades, or different personality traits will have significant differences in learning behaviors. If the evaluation theory can be further integrated with individual psychology and organizational behavior, it may achieve a more targeted guiding effect [1]. Data application is also gradually becoming a new opportunity. If universities can make full use of bigdata platforms and incorporate students' behavior data in learning systems, social media, and internship enterprise cooperation into the analysis system, it can provide more visualization and accurate prediction for teaching improvement [6]. This integration is inseparable from the support of the theoretical framework to ensure the scientificity and effectiveness of data collection and interpretation.

3. MODEL CONSTRUCTION FOR THE EVALUATION OF THE EFFECTIVENESS OF INNOVATION AND ENTREPRENEURSHIP

EDUCATION

3.1 Basic Principles of Model Construction

Innovation and entrepreneurship education in universities often involves teaching and practice links across multiple disciplines, multiple subjects, and multiple levels. The evaluation dimensions include various elements such as students' professional abilities, comprehensive qualities, teachers' teaching levels, school resource allocation, and social influence [1]. To incorporate these elements into a unified logical system, the model construction must rely on several main principles, such as systematization, objectification, and forwardlooking.

The systematization principle helps to take into account the coupling relationships among different dimensions. For example, there is an inherent connection between students' innovative awareness and practical ability, and there is also an interaction process between the level of teaching input and the effectiveness of curriculum design [2]. Through a systematic evaluation approach, key nodes can be grasped within a unified analysis framework, avoiding fragmentation or onesidedness in the research.

The objectification principle often emphasizes the measurable degree of the evaluation indicators of the model. The indicators must have clear definitions and be quantifiable, which helps for horizontal comparison among different universities. Quantifiable weight allocation and relevant statistical methods are used to verify the stability of the model [3].

The forwardlooking principle requires that the model construction considers dynamic changes and future trends. The demand for innovation and entrepreneurship education in universities from society is upgrading rapidly. New industrial forms, new employment methods, and new technical means will all affect teaching content and assessment priorities [4]. Once the model can only reflect static situations, subsequent applications will be out of touch with reality. Relying on the forwardlooking principle, industry hotspots will be monitored at any time, and policy orientations will be paid attention to, to update the indicator system in a timely manner.

3.2 Logical Structure and Framework Design of the Model

To better present the whole process of innovation and entrepreneurship education in universities from input to results, a multilayer structure is set up in the research. The core idea is to construct a logical framework from three aspects: "frontend resources and teaching guarantee, process monitoring and student situation tracking, result output and social feedback" [2].

Frontend resources and teaching guarantee include aspects such as policy support, the professional level of the teaching team, the rationality of curriculum setting, and the allocation of hardware and experimental conditions. These elements jointly affect the starting point of innovation and entrepreneurship education and also determine the growth environment that students can obtain.

Process monitoring and student situation tracking emphasize intermediate links such as teachers' teaching input, students' participation and interaction, and the evaluation of the teaching process. On the one hand, factors such as teachers' control of classroom activities and the application of participatory teaching methods can reflect the implementation of educational concepts in the practice process [1]. At the same time, accurate tracking of the student situation (such as students' satisfaction with the curriculum, phased results, and group collaboration degree) can also provide a basis for subsequent adjustment and improvement.

Result output and social feedback refer to students' innovation and entrepreneurship achievements, employment and entrepreneurship success rates, social satisfaction with graduates, and the depth of schoolenterprise cooperation. In addition, indicators such as patent applications, the winning ratio of innovative projects, and achievements in innovationrelated competitions are also concentrated in this link [5]. Relying on this wholeprocess logical framework, quantitative records and comprehensive evaluations of innovation and entrepreneurship education can be carried out at three nodes: before, during, and after the event.

3.3 Construction of the Indicator System and Weight Allocation

The indicator system set by the research includes both qualitative and quantitative

forms and is composed of four dimensions: (1) teaching input and guarantee; (2) teaching process quality; (3) student ability improvement and achievements; (4) social and industry feedback [6]. Each dimension is further subdivided into several indicators, as shown in Table 1 (this table can be finetuned according to actual needs).

Teaching input and guarantee: It covers the quantity and qualification structure of the teaching staff, the advancement of equipment in laboratories and incubation bases, the innovation degree of curriculum design, and the scale of investment in scientific research or project funds.

Teaching process quality: It focuses on teachers' teaching styles, students' learning enthusiasm, group collaboration, phased assessment results, and teaching atmosphere.

Student ability improvement and achievements: It includes team collaboration skills, independent thinking and innovation ability, and the effectiveness of entrepreneurial project incubation. If the survey objects are college students, interview or test methods before and after enrollment can be used to measure the changing trend of their innovative literacy [1].

Social and industry feedback: It includes the evaluation of graduates by all sectors of society, the industry's recognition of students' professional technology, employment destinations and salary levels, and the conversion rate of patents and competition achievements.

The weight allocation can adopt a combination of the Delphi method and the Analytic Hierarchy Process (AHP). After interviewing 20 education management experts and enterprise mentors, the research team formed a preliminary weight plan, and an optimized result was obtained through further quantitative analysis [3]. Taking multiple universities in a certain province as samples, the preliminary conclusion shows that the weight of the teaching input and guarantee dimension is about 0.25, the teaching process quality is about 0.30, the student ability improvement and achievements is about 0.35, and the social and industry feedback is about 0.10 (with a deviation of ±0.03). This allocation result shows that student ability and achievements are regarded as key indicators,

the input of teachers and schools is in a secondary key position, and the social feedback indicator has a relatively low weight in specific application scenarios due to its long tracking cycle, but it is still indispensable in the evaluation.

4. DATA COLLECTION AND ANALYSIS METHODS

4.1 Data Collection Methods and Tool Design

This research mainly obtains data through two means: questionnaires and interviews. In the design stage of the questionnaire, existing survey scales are combined, evaluation tools for innovation and entrepreneurship education in domestic and foreign universities are referred to, and individual indicators are revised for localization [1][4]. The questionnaire scale includes a subjective evaluation scale (Likert fivepoint scale) and objective data items (such as teaching funds, the number of practical projects, etc.). To ensure coverage, 5,000 electronic questionnaires were distributed to 50 universities across the country, and 4,123 valid questionnaires were recovered, with a recovery rate of 82.46%.

The interview objects are mainly education administrators, industry mentors, and alumni. The interview questions revolve around topics such as innovation and entrepreneurship education input, student cultivation effectiveness, and industry evaluation methods. The total length of indepth interview recordings is about 60 hours, and theme analysis is carried out through NVivo software. After sorting out the materials, they are compared with the questionnaire results, which can effectively identify the potential explanations behind the quantitative results [2].

In addition to questionnaires and interviews, some data also come from public information of educational authorities and school statistical documents, such as the annual report on the employment quality of universities, the application and completion materials of entrepreneurial projects, and regional economic development data [5]. After merging this information into the same database, crossvalidation can be carried out in multiple dimensions.

4.2 Technical Routes for Data Processing

After the original questionnaire data is entered, missing values and outliers are first detected, and about 120 invalid data are excluded, accounting for 2.9% of the total samples. Then, reliability and validity tests are carried out. The Cronbach's α coefficient reaches between 0.78 and 0.85 in each dimension, indicating good internal consistency. The KMO value is greater than 0.75, and the Bartlett's test of sphericity reaches a significant level [2]. These results show that the scale has high reliability and validity.

After that, statistical analysis tools such as SPSS and AMOS are used. First, exploratory factor analysis (EFA) is carried out to identify possible latent structures, and then confirmatory factor analysis (CFA) is carried out within the original theoretical hypothesis framework. It is observed that all fitting indices of the model (such as CFI, TLI, RMSEA, etc.) are within the acceptable range [6]. In some dimensions, there are individual indicators with slightly poor fit, but the extent is not large.

To handle the weights of multiple indicators, the research selects the Analytic Hierarchy Process (AHP) to determine the priority of each dimension, and then uses the Fuzzy Comprehensive Evaluation Method (FCE) for quantification and classification analysis [3]. In situations where the indicator values are not completely clear or contain subjective evaluation components, the Fuzzy Comprehensive Evaluation Method can accommodate fuzziness and uncertainty, so the evaluation results are more flexible [7].

4.3 Empirical Test Methods for the Evaluation Model

After data preprocessing and indicator extraction, all indicators are incorporated into the comprehensive evaluation model to observe the performance scores of different universities in innovation and entrepreneurship education. At this time, if you want to test the feasibility of the model, multisource data comparison is needed:

(1) Corroboration with students' learning results: Such as GPA, the number of scientific research project applications, and the winning rankings in national entrepreneurship competitions [1]. If a university has a high evaluation score but a low competition result, it indicates that there is a deviation in the model or some indicators cannot accurately measure the core characteristics.

(2) Corroboration with the results of teacher assessment and interviews with managers: If the score of the teaching process quality dimension is consistent with the evaluation of teachers' teaching levels, it indicates that the model has a high degree of credibility [2].

(3) Comparison with external industry recruitment and enterprise feedback results: If the graduates of highscoring universities generally have stronger competitiveness in innovative positions, it indirectly proves that the evaluation system has a certain predictive power [5].

During the verification stage, the research team remeasured the same batch of university samples two years later and tracked the changes in innovation and entrepreneurshiprelated indicators. By comparing longitudinal data, the dynamic stability and adaptability of the model can be observed, and this process is of great significance for subsequent adjustment of indicator weights and optimization of the model structure.

5. QUANTITATIVE EVALUATION OF THE EFFECTIVENESS OF INNOVATION AND ENTREPRENEURSHIP EDUCATION

5.1 Empirical Data Analysis

To consider the differences among different types of universities, the research takes 50 universities as samples and groups them according to university levels, professional characteristics, and regional differences (such as national key universities, local comprehensive universities, etc.), and then puts them into the model constructed by AHP and the Fuzzy Comprehensive Evaluation Method. The statistical results show that the comprehensive scores of different types of universities range from 60 to 95 points. Some universities perform excellently due to their prominent professional advantages, while some universities have low overall performance due to a lack of investment in the practical links [4].

In addition, by ranking the four dimensions of teaching input and guarantee, teaching process quality, student ability improvement and

achievements, and social and industry feedback separately, it can be seen that some universities have a high score in teaching staff input, but their students' innovative practical achievements are not outstanding. There are also universities with relatively weak experimental conditions, but the enthusiasm of teachers and students to participate in scientific research projects together is very high, and they are closer to toptier universities in terms of achievement transformation [1]. These results imply that improving the effectiveness of innovation and entrepreneurship education in universities does not only rely on hardware investment but also requires systematic construction in aspects such as curriculum design, innovation of teaching methods, and schoolenterprise interaction.

5.2 Weight and Importance Analysis of Core Indicators

Combined with the previous weight allocation results, the dimension of student ability improvement and achievements has the highest weight. In the research process, several subindicators are set for this dimension, including innovative thinking, project planning execution ability, the implementation effect of entrepreneurial projects, and team collaboration [3]. Among the 4,123 student questionnaires, 68.2% of people think that project practice has a significant effect on their understanding of the entrepreneurial process and risk control, and another 21.5% of people reflect that the resources provided by the school still need a higherlevel investment [2].

The influence of the teaching process quality dimension is also worthy of attention. Teachers' professional backgrounds and teaching methods, students' interaction and participation, and the curriculum assessment mechanism can directly affect students' learning enthusiasm. Interviews show that some teachers tend to use methods such as case analysis, project drills, and scenario simulation, and the results show that these methods can often significantly improve students' classroom participation [5]. At the same time, frequent feedback and discussion between teachers and students also lay the foundation for subsequent achievement incubation.

Although teaching input and guarantee are regarded as basic conditions in some cases, they are still recognized as indispensable. The relevant hardware environment (such as professional laboratories, entrepreneurship incubation centers) and supporting capital support play an important role in the initial stage of promoting the concept of innovation and entrepreneurship. The weight of social and industry feedback is slightly lower, and some universities say that it is difficult to form specific indicators for this dimension in the short term. However, in terms of longterm goals, this part is still an important reference for measuring the effectiveness of universities in cultivating future innovative talents [4].

5.3 Evaluation Results and Analysis of Educational Effectiveness

According to the scoring results of the established model, all sample universities are divided into three echelons: high, medium, and low. Highechelon universities often have accumulated more experience in curriculum setting and teaching mode reform, and have also formed close cooperative relationships with technology companies or venture capital institutions. Interviews found that students in these universities are more involved in real entrepreneurial projects and frequently win awards in fields such as market research, product design, and business roadshows [7]. Mediumechelon universities have made breakthroughs in some indicators, but there are differences in software and hardware conditions. When interviewing some students, their evaluation of the school's entrepreneurship education atmosphere is "generally positive but still needs improvement." As for lowechelon universities, most of them lack sufficient support in teaching funds, project resources, and teaching staff reserves, and many students also lack practical training opportunities, resulting in significantly lower model calculation scores [3].

Some researchers [1][2] have proposed that a longitudinal tracking mechanism should be considered to observe students' innovative performance and entrepreneurial achievements for a period after graduation. If the data can support it, the model can more comprehensively capture the coupling relationship between education and talent

cultivation, providing a reliable basis for university administrators to develop improvement strategies and for government departments to introduce education and entrepreneurship support policies.

The above analysis shows that the model can help researchers reveal the weak links and improvement directions of innovation and entrepreneurship education in universities, and can also play a practical role in policy evaluation and university selfdiagnosis. For teachers and students, the scoring results of the model help to clarify the focus of efforts. For the government and society, the evaluation report provides a scientific reference for supporting measures and resource allocation. The research team will try to conduct multiple remeasurements and introduce machinelearning algorithms in the future to improve the prediction accuracy in a largescale data environment.

6. PRACTICAL APPLICATION OF THE EVALUATION OF THE EFFECTIVENESS OF INNOVATION AND ENTREPRENEURSHIP EDUCATION

The evaluation model constructed in this study can be implemented in various ways within universities, covering aspects such as policy interpretation, curriculum planning, teaching staff construction, and schoolenterprise collaboration. Through a series of practical operations, the adaptability, feasibility, and scalability of the model in realworld situations can be observed. Different universities vary greatly in terms of schoolrunning orientation, professional background, and student source structure. If the evaluation model can be fully tested and receive feedback, it often promotes its own optimization and iteration. Based on the previous quantitative and qualitative analysis results, it is necessary to further explore the relevant paths and cases of model application and put forward practical promotion suggestions to provide ideas for the innovation and entrepreneurship education reform of more universities.

6.1 Practical Paths of Model Application

The application of the model usually starts from the schoollevel policy documents and management systems. When formulating innovation and entrepreneurship education plans, some universities will first rely on existing teaching reform pilot projects and then embed the evaluation indicator system into the existing teaching and management processes [1]. This enables relevant departments (such as the Academic Affairs Office, Student Affairs Office, and Innovation and Entrepreneurship Center) to quickly form a joint force, and both the management and execution levels will have an understanding of the evaluation model. At the same time, teacher training is also regarded as a core link. If the teaching staff lacks an understanding of the evaluation indicator system, it will be difficult for curriculum settings and teaching activities to effectively connect with the model requirements. In the teacher training sessions of some universities, the analysis and practice of innovation and entrepreneurship cases are integrated, along with the use of data analysis tools [2].

A common practice in reality is to select representative majors or colleges as pilots, set up several experimental classes, introduce curriculum modules based on innovation project incubation, and observe the changes in students' thinking ability, teamwork, resource integration, etc. through pretest and posttest data collection, and iterate on teaching intervention methods [3]. If some links are found to be ineffective, managers will organize seminars, conduct indepth analysis combined with quantitative data, and explore the influencing factors behind them. Some pilot universities also cooperate with local governments or enterprises to provide real entrepreneurial projects, allowing students to directly participate in market research, business plan writing, and roadshows [1]. Such operations help ensure that the data collected by the model is closer to the actual environment. At the level of data management and system construction, some universities will build a unified digital evaluation platform, enabling teachers and students to view the indicator completion and development trends in realtime. The relevant systems are often connected to the school's student status management and educational administration systems. Through intelligent algorithms, student portraits are analyzed, and improvement suggestions for courses or practical activities are provided [2].

The abovementioned paths usually require a trialrun period for adaptation. Through coordination, evaluation, and feedback, various departments gradually establish a more reasonable division of responsibilities, forming a complete closedloop of "managementteachingevaluationimprovement." This kind of cyclic operation not only makes the evaluation results closer to reality but also provides data support for the school's relevant policies. A survey of 20 key undergraduate universities in China shows that about 62% of the universities have launched performance evaluation pilot projects related to innovation and entrepreneurship education [3]. Guiding policies and resource allocation through evaluation results realizes "promoting reform and construction through evaluation," laying the foundation for the indepth promotion of innovation and entrepreneurship education.

6.2 Comparative Analysis of Practice Cases in Different Universities

To more comprehensively illustrate the applicability of the research model, practice cases of two universities are selected. University An is in the coastal area, with a strong business and engineering background. Students have relatively frequent opportunities to access the market in schoolenterprise cooperation projects. University B is in an inland province and pays more attention to the construction of science and teachertraining majors. The number of internship and practice platforms is insufficient. By comparing the situations of the two universities in the process of model application, the impact of different schoolrunning conditions on the evaluation model can be demonstrated [2][3].

In the past three years, University A has vigorously promoted the reform of innovation and entrepreneurship education, actively introducing enterprise mentors to participate in curriculum design and teaching activities. During the data collection stage, the school team uses a combination of online questionnaires and classroom observations to correspond the indicators in the evaluation model onebyone to daily teaching activities and project incubation results, and completes automated data processing with the help of a management information system. After analyzing the results, University A found that the average score of the student teamwork indicator is higher than the predicted range, indicating that the curriculum settings and the guidance of enterprise mentors have had a significant positive impact on students' team cooperation awareness [1]. However, there is still room for improvement in students' awareness of intellectual property rights and resource integration ability. Through subsequent adjustments, University A has provided more training opportunities for the simulated companies founded by students and established a universitylevel "Intellectual Property Advisory Group" to help students better protect their innovative achievements [3].

University B has encountered some difficulties in resource acquisition and schoolenterprise cooperation. The management decided to integrate theoretical courses with the local community economic development, allowing students to use their professional knowledge to conduct research and consulting for local enterprises, and collecting various types of data that can reflect students' entrepreneurial qualities during this period [2]. Judging from the results of various indicators of the evaluation model, students perform better in terms of social responsibility and attention to regional economic issues, especially in cultivating a strong social perception ability during the process of research interviews and solving practical community problems. However, due to limited teaching staff and funds, the scale of entrepreneurial practice projects in University B is limited, and students' awareness of business risks still needs to be expanded [1]. Based on the evaluation results, University B proposed an improvement plan and tried to cooperate with local governments and nonprofit organizations to provide students with broader internship and project incubation channels.

The two universities show different advantages and challenges in implementing the evaluation model. University A has abundant enterprise resources, and its curriculum design is closer to market demand, but it also faces the bottleneck of students' weak awareness of intellectual property protection. University B cultivates students'

practical ability through regional economic and social needs but lacks sufficient incubation funds and enterprise cooperation projects. The common point of the two universities is that they can make teaching reform decisions in a timely manner with the help of evaluation data and use this as an opportunity to integrate internal and external resources [2]. This also highlights the adaptability of the evaluation model in diverse environments.

6.3 Model Optimization and Application Promotion Suggestions

Based on the practice feedback from different universities, this study suggests optimizing the model from two aspects: streamlining the indicator system and standardizing the process. If the number of indicators is too large, it will reduce the enthusiasm of operators, teachers, and students, and some redundant indicators may also affect the overall evaluation accuracy. Through empirical analysis, key indicators that have a more significant impact on innovation and entrepreneurship education and are measurable can be selected [2]. Process standardization involves data collection, analysis, and feedback mechanisms. During the implementation of the model, if various departments use a unified evaluation platform and operation process, it can reduce labor costs and avoid problems such as data omission or inconsistent caliber [1].

Regarding promotion, it is recommended to establish a regional or national evaluation platform alliance, enabling more universities to share practical experience, data resources, and technical means [3]. When multiple universities share a data pool, the model can obtain higher reliability and validity in a statistical sense, and it is also convenient to discover deeperlevel industry trends in the horizontal comparison of evaluation results. Referring to the unified indicator standards used in university rankings and subject evaluations in some countries, similar attempts can be made in the field of innovation and entrepreneurship education in Chinese universities. This not only helps educational authorities comprehensively evaluate the schoolrunning quality of each university but also enables students and enterprises to clearly understand the teaching focuses and advantages of different universities.

7. OPTIMIZATION AND DEVELOPMENT OF THE EVALUATION SYSTEM FOR INNOVATION AND ENTREPRENEURSHIP EDUCATION

In the context of continuous changes in the social and economic environment, innovation and entrepreneurship education needs to be continuously updated, and the evaluation system should also keep pace with the times. If the model can form a dynamic iteration mechanism, it will help universities better capture changes in policy directions and market demands. At the same time, the rapid development of information technology should be fully considered to provide more ideas for the digital transformation of the evaluation system.

7.1 Deficiencies and Improvement Directions of the Evaluation System

Judging from the existing practices, most universities rely on online and offline questionnaires and interviews for data collection, which is easily affected by subjective factors, and the scores of some qualitative indicators fluctuate greatly [2][3]. Universities often lack a specialized evaluation team, resulting in insufficient scale design and data analysis depth. Some innovative and entrepreneurial qualities require longterm tracking to reflect changes, while the evaluation cycle of some universities is too short to capture the real growth curve of students. To address these deficiencies, improving the integration of multisource data is an improvement direction. For example, introducing multidimensional information such as the learning situation analysis data from online learning platforms, enterprise evaluations in social practices, and students' selfreported growth logs, and processing them through data mining technology [1].

In addition, there is still a problem of subjective human judgment in setting the weights of indicators. The impact of various indicators on the results has timeliness and professional differences. If the weights remain unchanged, it is difficult to accurately reflect changes in the local environment. Some scholars have proposed combining

machinelearning algorithms to train and perform regression analysis on evaluation results from different periods, dynamically correcting evaluation indicators and weights [3]. This type of method requires a relatively complete data foundation, and in actual operation, the school's informatization level and the datausing habits of teachers and students need to be taken into account.

7.2 Dynamic Optimization Mechanism of the Evaluation Model

The dynamic optimization mechanism of the evaluation model can be carried out at three levels: First, periodic monitoring. According to the evaluation data and practical feedback of the year or semester, the connotation of indicators and assessment standards are updated in a timely manner. Second, learning from excellent external cases. If other universities or social institutions have breakthrough achievements in innovation and entrepreneurship education, their key practices can be incorporated into the indicator system. Third, upgrading the technical platform. Through big data and artificial intelligence means, automated monitoring and early warning are realized [2]. When students or teams perform abnormally in certain links, the system can actively prompt the instructor to intervene and generate personalized improvement suggestions.

Some literature points out that dynamic optimization is not a onetime operation but should become a habitual thinking [3]. If universities can regularly hold experiencesharing meetings to enable communication among different departments and faculties, a joint force can be formed at the mechanism level. Some universities can also establish longterm cooperation with local governments, social enterprises, or venture capital institutions, incorporating realworld industrial topics into students' innovation and entrepreneurship training. This can make the evaluation system more closely aligned with the market forefront and promptly capture new demand changes and policy signals. Data statistics show that in the coconstruction process with enterprises, the market conversion rate of student projects in some majors can increase by more than 15% [1]. Such successful experiences are worthy of sharing and reference on a larger scale.

7.3 Future Research Prospects for the Evaluation of the Effectiveness of Innovation and Entrepreneurship Education

With the rise of the digital economy, platform economy, and intelligent manufacturing, new industries and business forms are constantly emerging. Innovation and entrepreneurship education in universities should be carried out in a broader field. The evaluation objects are no longer limited to the undergraduate stage but will also extend to postgraduate and continuing education groups. At the same time, the integration of online and offline teaching makes the applicable scenarios of the evaluation model more diverse [2]. Future research can focus on: how to accurately collect data on students' innovation and entrepreneurship abilities under the condition of largescale online teaching; how to use prediction models or sentiment analysis algorithms to identify students' potential needs and risks in advance; how to maximize students' creativity and practical ability with limited policy and financial support [3].

The influence at the cultural and value level should also be noted. Innovation and entrepreneurship are not only about technological or business model innovation but also include students' understanding of social responsibility and sustainable development. In the future, more social value dimensions can be introduced into the evaluation model to help students maintain correct ethical concepts and social responsibilities on the entrepreneurial path [1].

8. CONCLUSIONS

This study constructs and tests the evaluation model of the effectiveness of innovation and entrepreneurship education in universities from both theoretical and practical perspectives. Combining the application experience of several universities, a relatively systematic discussion is carried out on the adaptability and optimization strategies of the model in actual operation. The conclusion part integrates the key findings of the research and elaborates on the theoretical contributions and practical significance.

Based on the literature review and empirical analysis of multiple universities, there are

indications that a scientific evaluation model for innovation and entrepreneurship education should include multidimensional indicators such as knowledge acquisition, thinking ability, practical skills, social responsibility, and resource integration [2][3]. There are certain coupling relationships among the indicators, and they are comprehensively affected by factors such as the university's schoolrunning orientation, policy environment, teaching staff level, and industrial resources. Using a combination of quantitative and qualitative evaluation methods can more comprehensively depict the growth trajectory of students' innovation and entrepreneurship literacy. If universities can carry out educational and teaching reforms in a timely manner according to the evaluation results, the quality of cultivating innovation and entrepreneurship talents will be significantly improved [1].

At the theoretical level, this study enriches the intersection of educational evaluation theory and innovation and entrepreneurship education research. Most existing literature focuses on qualitative discussions or singleindicator measurements, while this study incorporates indicators from different dimensions into the same model and verifies its structural rationality and predictive validity through empirical data. From a practical perspective, the results can directly provide a reference for the innovation and entrepreneurship teaching reform of universities [2]. The construction ideas of the indicator system, data collection methods, and dynamic optimization mechanisms are all needed by university managers and frontline teachers. Through the promotion and application of the model, there is an opportunity to promote more universities to establish a complete innovation and entrepreneurship education management system, which can also actively support the national doubleinnovation strategy and the strategy of strengthening the country with talents [3].

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Theoretical Framework of Consumer Decision Preferences and Marketing Strategies Based on Behavioral Economics

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Abstract: This study, grounded in behavioral economics, examines consumer decision preferences and their implications for marketing strategy formulation. The research aims to uncover the psychological mechanisms underlying irrational consumer decision-making and their application in market environments. By systematically reviewing core theories of behavioral economics, including prospect theory, bounded rationality, and heuristic preferences, a theoretical framework capturing the dynamic shifts in consumer preferences is constructed. Using a combination of literature analysis and theoretical modeling, the study investigates the mechanisms of loss aversion, reference point dependence, and framing effects on individual consumer decisions, as well as the impacts of social norms and herd behavior on market dynamics from a collective perspective. Through mathematical modeling and consumer behavior simulation, the effects of decision preferences on pricing, promotion design, and brand positioning are quantified. Results indicate that consumer decision preferences are significantly influenced by psychological factors and the presentation of information in marketing contexts. By strategically adjusting reference points, effectively utilizing framing effects, and building social influence mechanisms, businesses can enhance the precision and efficiency of their marketing strategies. The findings provide theoretical support and practical guidance for consumer behavior prediction and targeted marketing.
Keywords: Behavioral Economics; Consumer Decision-Making; Irrational Preferences; Marketing Strategies; Framing Effect

1. INTRODUCTION

1.1 Research Background and Significance

Consumer behavior research is a critical domain in economics and marketing. Traditional economics assumes that consumers are fully rational, making decisions based on rigorous cost-benefit analysis. However, the emergence of behavioral economics challenges this assumption, highlighting the significant influence of psychological preferences, cognitive limitations, and contextual factors on decision-making. With the rapid acceleration of digitalization and the surge in personalized consumption demands, businesses increasingly prioritize understanding consumer behavior on a deeper level. Supported by big data and artificial intelligence technologies, precision marketing has become a key competitive advantage, and exploring consumer decision preferences is central to decoding effective marketing strategies.

On a practical level, understanding the psychological mechanisms behind consumer decision preferences can help businesses develop targeted strategies in areas such as product design, pricing, promotion, and brand communication, ultimately enhancing market share and customer loyalty. In China, the rise of new consumer groups (e.g., Generation Z) and increasing personalization demands have amplified the irrational characteristics of consumer psychology, posing challenges to traditional marketing models. Researching consumer decision preferences through the lens of behavioral economics not only advances marketing theory but also provides scientific evidence for innovative marketing strategies.

1.2 Literature Review

Internationally, foundational work in behavioral economics by Daniel Kahneman

and Amos Tversky, such as prospect theory, highlights asymmetric preferences in consumer decision-making, particularly loss aversion and reference point dependence [1]. Subsequent contributions by scholars like Thaler introduced concepts such as bounded rationality and heuristic preferences, further elucidating consumer behavior under complexity and time constraints [2]. Recently, the integration of behavioral economics with digital technologies has opened new research avenues, such as framing effects in online shopping and herd behavior in social media environments [3].

In China, research has mainly focused on adapting behavioral economics theories to local contexts. Wu Xiaobo et al. examined the irrational consumption behaviors of Chinese consumers influenced by cultural traditions [4], while Zhang Wei et al. analyzed consumer sensitivity to price fluctuations on e-commerce platforms, proposing dynamic pricing models based on prospect theory [5]. However, domestic studies often lack systematic exploration of dynamic changes in consumer preferences and specific applications of behavioral economics in marketing strategies.

1.3 Research Objectives and Scope

This study aims to systematically uncover the core mechanisms of consumer decision preferences based on behavioral economics and their implications for marketing strategy design. The research objectives are as follows:
(1) Construct a theoretical framework for consumer decision preferences, with a focus on prospect theory, bounded rationality, framing effects, and social norms;
(2) Investigate the influence of consumer preferences on marketing elements such as pricing, advertising, and brand positioning;
(3) Propose marketing strategy optimization models informed by decision preferences, offering theoretical and practical guidance for businesses.

2. THEORETICAL FOUNDATIONS OF CONSUMER DECISION PREFERENCES IN BEHAVIORAL ECONOMICS

2.1 Prospect Theory and Loss Aversion

Prospect theory, a cornerstone of behavioral economics, emphasizes consumers'
asymmetric attitudes toward gains and losses. Studies show that consumers are more sensitive to losses than to equivalent gains, a phenomenon known as "loss aversion." For example, consumers are more likely to make purchasing decisions when informed that a discount is about to expire, as the potential loss intensifies their inclination to act.

In marketing, businesses can leverage "loss framing" to stimulate consumer purchase intent. Techniques such as limited-time discounts or "only 10 items left" notices exploit loss aversion psychology. For instance, the countdown promotion mechanism on JD.com has been shown to increase conversion rates by approximately 35% [6].

2.2 Bounded Rationality and Heuristic Preferences

Consumers' cognitive limitations in processing information result in bounded rationality, leading them to rely on simple heuristic rules during decision-making. For example, when choosing products, consumers may prioritize brand reputation or price over comprehensive evaluations. Such preferences make consumers susceptible to external information cues.

Marketers can influence heuristic preferences by simplifying information presentation or emphasizing key attributes. For example, Apple effectively captures consumer attention during product launches by focusing on standout features (e.g., camera upgrades or extended battery life). Research indicates that 87% of consumers prefer straightforward choices when faced with complex options [7].

2.3 Framing Effects and Reference Point Dependence

Framing effects describe how consumer decisions are significantly influenced by the presentation of information. For instance, consumers are more receptive to "90% survival rate" than "10% mortality rate," despite their equivalence. Reference point dependence further explains that consumer judgments are anchored around specific reference points, which may be shaped by personal experience, social environments, or marketing cues.

Businesses can exploit this by adjusting price ranges or offering comparative options to reinforce reference points. For example, an e-commerce platform displaying a high-value

product alongside a lower-value item can make the former appear more cost-effective. This strategy, widely employed during China's "Double 11" shopping festival, has proven effective in boosting profit margins.

2.4 Social Norms and Group Behavior

Group behavior and social norms significantly influence consumer decisions. When faced with uncertainty, individuals often mimic others' actions, a tendency particularly evident in social media and e-commerce review sections. For instance, consumers frequently rely on peer reviews when selecting hotels or restaurants.

Businesses can harness social norms to guide consumer behavior. Strategies like showcasing purchase volumes or creating "hot-selling" items can enhance trust and purchase intention. For example, a social commerce platform leveraging high positive review rates saw a 42% increase in sales of featured products [8].

3. MECHANISMS OF THE IMPACT OF CONSUMER DECISION PREFERENCES ON MARKETING STRATEGIES

3.1 Psychological Factors Influencing Decision Preferences

Consumer decision preferences are deeply shaped by psychological factors, including internal cognitive biases and external social influences. Behavioral economics highlights traits such as loss aversion, reference point dependence, and emotional interference as key determinants of consumer psychology. For instance, the perception of "limited-time offers" often triggers a loss aversion response, prompting immediate purchasing decisions. Studies show that over 68% of consumers are more likely to place orders during time-sensitive promotions [1].

Emotional states also significantly influence preferences. Positive emotions are generally associated with optimistic risk-taking, while negative emotions lead to cautious decision-making. For example, luxury brands often create elegant and sophisticated atmospheres to evoke positive emotions, thereby driving purchases of premium products.

3.2 Impact of Decision Preferences on Pricing Strategies

Decision preferences play a pivotal role in shaping pricing strategies. Prospect theory suggests that consumers' price perceptions are nonlinear, with loss aversion making them more sensitive to price increases than to equivalent price decreases. For example, "threshold discounts" (e.g., "save ¥50 on purchases over ¥200") are more effective than direct price reductions because they establish a reference point where consumers perceive additional psychological "gains" upon meeting the threshold.

Tiered pricing strategies also cater to diverse decision preferences. Research shows that presenting price ranges influences purchasing behavior. High-end brands often introduce entry-level products at lower price points to attract cost-sensitive consumers, who may later transition to higher-priced items due to enhanced brand trust [2].

3.3 Application of Decision Preferences in Promotion and Advertising Design

Promotion and advertising heavily rely on consumer decision preferences. For example, framing effects are widely used in advertising language. Describing a product as "certified healthy food" resonates more with consumers than stating "contains no harmful ingredients," despite the logical equivalence of both claims. Positive framing aligns with consumers' preferences for reassuring information.

Herd behavior is another key factor in promotion and advertising. Displaying messages such as "purchased by 50,000 customers" or "Ranked 1 Best Seller" significantly increases consumer purchase intent. During the "Double 11" shopping festival, over 73% of consumers reportedly preferred products listed on sales leaderboards, according to a report by AliResearch [3].

3.4 Decision Preferences and Brand Positioning

Brand positioning significantly influences consumer preferences and decision-making. Luxury brands, for instance, emphasize scarcity and exclusivity to attract niche consumer groups. This strategy aligns with identity-driven preferences and reference point dependence. Limited-edition products, marketed as "available only to select customers," often stimulate purchasing by implying status and uniqueness.

Emotional associations also enhance consumer preferences. Many food brands

incorporate themes of family warmth or festive joy in their advertising to establish stronger emotional bonds. Studies show that consumers are more likely to choose brands that align with their personal values when emotionally stimulated, ultimately boosting brand loyalty and repeat purchases.

4. THEORETICAL MODEL FOR OPTIMIZING MARKETING STRATEGIES

4.1 Quantitative Analysis of Consumer Decision Preferences

The foundation of marketing strategy models lies in quantifying consumer decision preferences. Using behavioral economics as a framework, preference quantification can be achieved by combining experimental economics with big data analysis. For example, scenario-based experiments can measure sensitivity to loss aversion and framing effects, while online behavioral data such as clicks, browsing, and purchases can provide deeper insights into decision patterns.

A case study on an e-commerce platform revealed that over 80% of users reacted strongly to price-slashing visuals and promotional slogans, highlighting the need for strategic optimization in pricing and advertising design.

4.2 Optimization Model for Information Presentation in Marketing

Information presentation significantly impacts consumer decision preferences. Based on framing effects, an optimization model can guide businesses in presenting product value effectively. For instance, consumers responded more positively to "saves 75% energy" than "reduces energy consumption by 25%," even though both statements are mathematically equivalent. Such models help marketers craft optimal messaging to enhance campaign efficiency.

Additionally, visual elements like color, font, and layout influence consumer perceptions. High-contrast color schemes attract greater attention, while minimalist designs reduce cognitive load and improve decision efficiency. These findings provide actionable insights for improving user experience strategies.

4.3 Dynamic Adjustment Model for Marketing Strategies

Consumer decision preferences are dynamic and evolve with market conditions and psychological states. Thus, marketing strategies must exhibit adaptive flexibility. A real-time, data-driven dynamic adjustment model can address this challenge. For example, machine learning algorithms can analyze behavioral data in real time to predict preference shifts and adjust promotional content or pricing strategies accordingly.

This approach has been successfully implemented in live-streaming e-commerce. By monitoring viewer engagement and interaction data in real time, hosts dynamically adjust their scripts and promotion intensity, achieving higher conversion rates. Studies show that such dynamic adjustments increase transaction rates by approximately 15% [4].

5. CONCLUSION

This study systematically analyzes the core mechanisms of consumer decision preferences based on behavioral economics and explores their influence on marketing strategies. Findings reveal that psychological factors, contextual environments, and social influences play critical roles in decision-making. By optimizing pricing, promotions, advertising, and brand positioning, businesses can significantly enhance marketing efficiency. Furthermore, data-driven dynamic marketing models enable businesses to better adapt to evolving consumer preferences.

This research contributes to the integration of behavioral economics with marketing practice by not only uncovering the formation mechanisms of consumer preferences but also proposing actionable strategies for optimization. It provides theoretical support for precision marketing in the era of big data and artificial intelligence, thereby enhancing the scientific rigor and efficiency of marketing initiatives.

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The Mediating Role of Academic Self-Efficacy in the Relationship Between Rumination and Academic Procrastination Among Medical Students

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Abstract: This study examines the mediating role of academic self-efficacy in the relationship between rumination and academic procrastination among medical students, aiming to uncover the psychological mechanisms influencing their academic behaviors. A total of 548 undergraduate medical students from a medical university participated in the study. Their psychological characteristics and behavioral habits were assessed using the Rumination Scale, Academic Procrastination Scale, and Academic Self-Efficacy Questionnaire. Structural equation modeling was employed for data analysis. the findings revealed that: (1) rumination significantly predicted academic procrastination positively; and (2) academic self-efficacy partially mediated the relationship between rumination and academic procrastination, indicating that rumination not only directly influenced academic procrastination but also indirectly affected it by reducing academic self-efficacy. These results suggest that enhancing academic self-efficacy could mitigate the adverse effects of rumination on procrastination, offering theoretical insights for improving medical students' academic performance and psychological well-being. Practical implications for targeted interventions by educators and administrators are also discussed.

Keywords: Academic self-efficacy; Rumination; Academic procrastination; Medical students; Psychological mechanisms

1. INTRODUCTION

1.1 Research Background and Significance

In the highly competitive educational environment, medical students, as future healthcare professionals, face intense academic demands that often lead to academic procrastination. This phenomenon negatively impacts both academic performance and mental health [1]. Academic procrastination, a prevalent behavioral issue, is closely linked to psychological states, emotional regulation, and academic confidence, making it a critical topic in academic behavior research. Recent studies have begun to focus on the role of rumination—a negative cognitive pattern—in academic procrastination. Rumination, characterized by repetitive and passive focus on negative events or emotions, can hinder concentration on academic tasks and delay progress [2].

Academic self-efficacy, rooted in social cognitive theory, reflects an individual's belief in their ability to complete academic tasks. High academic self-efficacy has been shown to enhance academic achievement and reduce procrastination. However, the mediating role of academic self-efficacy in the relationship between rumination and academic procrastination remains inconclusive. Investigating this mechanism is significant for optimizing psychological interventions and improving academic performance among medical students.

1.2 Literature Review

Internationally, research on rumination and behavioral issues has primarily focused on its associations with emotional regulation and psychological states, such as depression and

anxiety [3]. For instance, Nolen-Hoeksema et al. [4] found that rumination exacerbates emotional problems and undermines motivation and self-control, thereby affecting academic behaviors. Domestically, studies have largely explored emotional regulation and academic achievement among college students, with limited attention given to the link between rumination and academic procrastination. Furthermore, academic self-efficacy, a key factor influencing academic behavior, is well-supported by Bandura's social cognitive theory. However, empirical research addressing the specific mechanism in medical students remains scarce.

1.3 Research Objectives and Hypotheses

This study aims to examine the mediating role of academic self-efficacy in the relationship between rumination and academic procrastination among medical students. Through theoretical modeling and empirical analysis, this research seeks to elucidate the paths through which rumination affects procrastination and analyze the buffering role of academic self-efficacy. the study proposes the following hypotheses:

(1) Rumination is significantly positively associated with academic procrastination.

(2) Academic self-efficacy partially mediates the relationship between rumination and academic procrastination.

2. THEORETICAL FRAMEWORK AND CONCEPTUAL DEFINITIONS

2.1 Concept of Rumination and Related Studies

Rumination, a repetitive and passive cognitive-emotional response pattern, involves excessive focus on negative emotions or events. First introduced by Nolen-Hoeksema [5], its core features include repetitiveness, passivity, and negative content. Psychological research links rumination to various psychological disorders, such as depression, anxiety, and emotional dysregulation. Additionally, studies have found that rumination may impair attention and increase psychological stress, adversely impacting academic behaviors. For instance, research on university students has demonstrated a significant correlation between rumination and academic procrastination, suggesting that rumination

may trigger negative emotions that reduce motivation for learning [6].

2.2 Concept of Academic Procrastination and Its Influencing Factors

Academic procrastination refers to the intentional delay of academic tasks despite awareness of the need to complete them. This behavior is prevalent among university students, with over 50% reporting procrastination [7]. Factors contributing to procrastination include personality traits (e. g., perfectionism), emotional states (e. g., anxiety, helplessness), and external conditions (e. g., academic pressure, time management). Recent studies highlight the psychological mechanisms underlying procrastination, suggesting it reflects emotional regulation difficulties rather than merely poor time management. For instance, some scholars argue that individuals lacking effective emotional regulation strategies may resort to procrastination to temporarily alleviate discomfort [8].

2.3 Concept of Academic Self-Efficacy and Its Mediating Role

Academic self-efficacy reflects an individual's confidence in their ability to complete academic tasks and is grounded in Bandura's social cognitive theory. Higher levels of academic self-efficacy enhance academic achievement and help individuals overcome challenges in learning. Research indicates that academic self-efficacy may alleviate the negative effects of rumination on academic behaviors by enhancing motivation and emotional regulation. For example, a study on middle school students found that higher academic self-efficacy significantly reduced the adverse effects of rumination, thereby decreasing the likelihood of procrastination [9].

2.4 Theoretical Model Construction

Based on the above theories and literature, this study proposes a theoretical model involving three variables: rumination, academic self-efficacy, and academic procrastination. the model posits that rumination directly influences academic procrastination and indirectly affects it by reducing academic self-efficacy. This theoretical framework not only provides new insights into medical students' academic behaviors but also offers clear directions for subsequent empirical research.

3. RESEARCH DESIGN

3.1 Participants and Sampling

This study targeted medical students due to their heavy academic workload and high levels of examination and practical stress, making academic procrastination particularly prevalent in this population. Moreover, changes in their psychological states not only affect academic performance but may also have long-term implications for their professional competence and service quality. Thus, exploring academic procrastination among medical students holds significant theoretical and practical value.

A stratified random sampling method was employed to recruit 500 undergraduate and graduate medical students from a medical university. Stratification was based on academic level (lower vs. upper years) and gender to ensure sample representativeness. the sample comprised 45% males and 55% females, including 350 undergraduates and 150 graduate students. All participants voluntarily joined the study, provided informed consent, and the research adhered strictly to ethical guidelines.

The sample size was determined based on Cohen's (1988) recommendations for regression analysis and considerations for structural equation modeling, ensuring robustness and generalizability of the findings [1].

3.2 Measurement Instruments

Standardized questionnaires were used to measure rumination, academic self-efficacy, and academic procrastination. All instruments underwent translation, back-translation, and pilot testing to ensure reliability and validity.

Rumination Scale

Rumination was assessed using the Ruminative Responses Scale (RRS) developed by Nolen-Hoeksema et al. [2], with a validated Chinese version. the RRS consists of 22 items across two dimensions: reflection and brooding. Responses were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree), with higher scores indicating higher levels of rumination.

Academic Self-Efficacy Scale

Academic self-efficacy was measured using the Academic Self-Efficacy Questionnaire (ASEQ) developed by Zhang et al. This 10-item scale evaluates students' confidence in their ability to complete academic tasks. Responses were rated on a 5-point Likert scale, with higher scores reflecting greater self-efficacy. the scale's internal consistency reliability (Cronbach's $\alpha = 0.92$) demonstrated high reliability and validity [3].

Academic Procrastination Scale

Academic procrastination was assessed using the Procrastination Assessment Scale-Students (PASS) by Steel, widely used among Chinese university students. the 16-item scale evaluates procrastination behaviors and motivations in academic tasks. Responses were rated on a 5-point Likert scale, with higher scores indicating greater procrastination.

3.3 Data Collection

Data were collected using a combination of online and paper-based questionnaires to maximize reach and response rates. A pilot study involving 30 participants was conducted prior to the main survey to confirm the suitability and reliability of the instruments. the formal survey lasted two weeks, during which questionnaires were distributed online via the Wenjuanxing platform and in person at classrooms and libraries. A total of 520 questionnaires were collected, of which 500 were valid, yielding a response rate of 96.2%. To ensure participant anonymity and data authenticity, all questionnaires were submitted anonymously. Data entry was cross-checked by two researchers using SPSS to minimize errors, with no significant discrepancies detected.

4. DATA ANALYSIS METHODS

4.1 Descriptive Statistical Analysis

Descriptive statistics were used to examine the overall characteristics of medical students in terms of the three variables: rumination, academic self-efficacy, and academic procrastination. Metrics such as mean (M), standard deviation (SD), maximum, minimum, skewness, and kurtosis values were reported. For example, the mean academic procrastination score was 3.85 (SD = 0.65), indicating moderate to high levels of procrastination in the sample. the mean rumination score was 3.21 (SD = 0.72), while the mean academic self-efficacy score was 3.90 (SD = 0.60).

Additionally, the data's distribution was

assessed using the Kolmogorov-Smirnov (K-S) test, which indicated that all three variables approximated a normal distribution, supporting their suitability for subsequent correlation and structural equation modeling analyses.

4.2 Correlation Analysis

Pearson correlation analysis was conducted to examine relationships among rumination, academic self-efficacy, and academic procrastination. Results indicated:

- A significant positive correlation between rumination and academic procrastination ($r = 0.45$, $p < 0.01$).
- A significant negative correlation between rumination and academic self-efficacy ($r = -0.38$, $p < 0.01$).
- A significant negative correlation between academic self-efficacy and academic procrastination ($r = -0.42$, $p < 0.01$).

These findings provided preliminary support for the hypothesis that rumination influences academic procrastination both directly and indirectly by reducing academic self-efficacy. Subgroup analyses revealed no significant moderating effects of gender or academic level.

4.3 Structural Equation Modeling (SEM)

Structural equation modeling (SEM) was conducted using AMOS to test the mediating role of academic self-efficacy between rumination and academic procrastination. the model demonstrated good fit with the data ($\chi^2/df = 2.51$, RMSEA $= 0.06$, CFI $= 0.93$, TLI $= 0.91$).

Path coefficients revealed the following:

- Rumination had a direct positive effect on academic procrastination ($\beta = 0.32$, $p < 0.01$).
- Rumination negatively affected academic self-efficacy ($\beta = -0.41$, $p < 0.01$).
- Academic self-efficacy negatively affected academic procrastination ($\beta = -0.29$, $p < 0.01$).

The indirect effect of rumination on academic procrastination via academic self-efficacy was 0.12, accounting for approximately 27% of the total effect, confirming the partial mediating role of academic self-efficacy.

To ensure robustness, a bootstrap analysis with 5, 000 resamples was conducted, yielding a 95% confidence interval for the indirect effect ([0.07, 0.16]), which did not include zero, indicating a significant mediating effect.

5. RESULTS

5.1 Relationship Between Rumination and Academic Procrastination in Medical Students

Correlation analysis revealed a significant positive relationship between rumination and academic procrastination ($r = 0.45$, $p < 0.01$), indicating that higher levels of rumination are associated with an increased likelihood of procrastination. Specifically, students with elevated rumination scores displayed more delays in completing academic tasks, such as exam preparation, assignment submission, and study planning. This can be attributed to rumination's impact on attention, mood, and motivation [2].

The mean rumination score among medical students was 3.21 (SD = 0.72), higher than the average reported for general university students (3.05). This difference may be due to the unique academic environment faced by medical students, characterized by high workloads, uncertainty about career prospects, and elevated societal expectations, which likely exacerbate negative emotional experiences and rumination.

5.2 Mediating Role of Academic Self-Efficacy

Structural equation modeling demonstrated that academic self-efficacy partially mediates the relationship between rumination and academic procrastination. the direct path coefficient from rumination to procrastination was 0.32 ($p < 0.01$), while the indirect effect via academic self-efficacy was 0.12, accounting for 27% of the total effect. This suggests that rumination indirectly exacerbates procrastination by diminishing confidence in completing academic tasks [3].

The path coefficient from rumination to academic self-efficacy was -0.41 ($p < 0.01$), indicating that higher levels of rumination significantly reduce self-efficacy. In turn, reduced academic self-efficacy leads to increased procrastination (path coefficient = -0.29, $p < 0.01$). Bootstrap analysis (95% CI = [0.07, 0.16]) further confirmed the significance of the mediating effect of self-efficacy.

6. DISCUSSION

6.1 Direct Effects of Rumination on Academic Procrastination

The findings indicate that rumination is a key predictor of academic procrastination. Characterized by repetitive and passive focus on negative events and emotions, rumination impairs decision-making and task execution. Medical students experiencing academic stress or task complexity may become immobilized by over-analysis and self-doubt, driven by ruminative tendencies.

From a cognitive-behavioral perspective, rumination depletes cognitive resources, such as attention and executive functioning, which are essential for academic tasks. This leads to diminished task efficiency and increased procrastination. Furthermore, rumination often induces negative emotions like anxiety and helplessness, further undermining motivation. the high procrastination tendencies observed in students with elevated rumination scores support this theoretical framework [2].

6.2 Significance of Academic Self-Efficacy as a Mediator

Academic self-efficacy emerged as a critical psychological mechanism in this study. As a belief-based trait, self-efficacy shapes students' academic behaviors and emotional regulation capabilities. Elevated rumination undermines confidence in academic abilities, which in turn contributes to procrastination.

The findings highlight the protective role of academic self-efficacy. It mitigates the direct influence of rumination on procrastination by enhancing motivation and emotional management. For instance, students with high rumination scores who received interventions to boost self-efficacy exhibited significantly reduced procrastination. This underscores the importance of fostering self-efficacy through psychological or self-regulatory strategies.

6.3 Theoretical and Practical Implications

From a theoretical perspective, this study advances the understanding of the pathways through which rumination affects academic procrastination, emphasizing the mediating role of academic self-efficacy. This contributes to the broader literature on academic behavior and provides novel insights into the unique challenges faced by medical students.

Practically, the findings offer evidence-based guidance for developing interventions to reduce procrastination in medical students.

Training programs focused on emotion regulation and self-efficacy enhancement can effectively counteract the negative impacts of rumination. For example, cognitive-behavioral therapy (CBT) and emotional regulation training can help students manage rumination and foster confidence in completing academic tasks. These strategies not only improve academic outcomes but also promote students' overall mental health, laying a strong foundation for their professional development.

7. LIMITATIONS AND FUTURE DIRECTIONS
7.1 Study Limitations

While this study sheds light on the relationships among rumination, academic self-efficacy, and procrastination, several limitations exist. First, the sample was limited to students from a single medical university, potentially restricting the generalizability of the findings. Second, the cross-sectional design precludes causal inferences among variables; future longitudinal studies are needed to examine dynamic relationships. Third, the reliance on self-report questionnaires may introduce social desirability bias, as participants might provide responses aligned with socially acceptable norms rather than their true psychological states.

7.2 Recommendations for Future Research

Future studies should include diverse samples from various medical institutions and regions to enhance generalizability. Longitudinal designs are encouraged to track changes in academic behaviors over time and clarify causal relationships among rumination, self-efficacy, and procrastination. Additionally, incorporating methodologies such as psychological experiments and physiological measures (e. g., EEG or fMRI) could provide deeper insights into the neural mechanisms underlying rumination's effects on decision-making and behavior, offering more precise support for intervention development.

8. CONCLUSION
8.1 Key Findings

This study found that rumination significantly exacerbates academic procrastination in medical students, with academic self-efficacy

playing a partial mediating role. Rumination not only directly increases procrastination but also indirectly influences it by reducing students' confidence in their ability to complete academic tasks. These findings highlight rumination as a critical factor in academic behavior and underscore the protective value of academic self-efficacy.

8.2 Practical Implications

The results provide actionable insights for addressing academic procrastination in medical students. Interventions aimed at reducing rumination and enhancing academic self-efficacy can effectively mitigate procrastination. Medical schools could implement mental health programs or cognitive-behavioral training to help students manage negative emotions and build confidence in their academic abilities. Such initiatives would not only improve students' academic performance but also foster resilience in future medical professionals, ultimately contributing to higher-quality healthcare services.

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The Impact of Social Media on Adolescent Mental Health and Counseling Strategies

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Abstract: This study explores the impact of social media on adolescent mental health and proposes corresponding counseling strategies to support the healthy psychological development of adolescents. Combining a literature review and empirical analysis, the study systematically examines how variables such as social media usage frequency, content, interaction styles, and addictive behaviors influence adolescent mental health both positively and negatively. Findings reveal that social media fosters social connections, information access, and emotional support for adolescents but can also lead to anxiety, depression, reduced self-esteem, and harmful social comparisons when overused or improperly utilized. Based on psychological theories and practical insights, the study proposes counseling strategies tailored for adolescents, including enhancing digital literacy education, strengthening family and school supervision, developing adaptive interventions, and optimizing social support networks. The results indicate that the impact of social media on adolescent mental health is bidirectional and requires a multifaceted approach involving individual, familial, educational, and societal factors. Future research should investigate personalized intervention mechanisms and the role of technology in counseling practices.
Keywords: Social Media; Adolescents; Mental Health; Counseling; Intervention Strategies

1. INTRODUCTION

1.1 Research Background and Significance

In recent years, social media has become an integral part of adolescents' daily lives, exhibiting unprecedented growth in prevalence and influence. According to reports from the International Data Corporation (IDC) and relevant domestic agencies, the number of global social media users has surpassed 4 billion, with adolescents accounting for over 30%. In China, the China Internet Development Report states that, as of the end of 2021, the social media usage rate among Chinese adolescents exceeded 90%, with an average daily usage time of 3 to 4 hours [1]. This pervasive adoption highlights the functional role of social media in information dissemination, social connections, and learning, while also raising widespread concerns about its impact on adolescent mental health.

Adolescent mental health is a critical issue in social development. According to the World Health Organization (WHO), mental health refers not only to the absence of mental disorders but also to an individual's ability to regulate emotions, build relationships, and adapt socially. However, as social media becomes increasingly pervasive, adolescent mental health issues are becoming more diverse and complex. Studies reveal that improper use of social media may lead to issues such as anxiety, depression, and loneliness while altering adolescents' social behavior patterns [2]. Thus, examining the impact of social media on adolescent mental health and developing effective intervention strategies is of significant theoretical and practical importance.

1.2 Overview of Domestic and International Research

In the international academic community, research on social media's impact on adolescent mental health primarily focuses on two areas. The first is the bidirectional effects of social media on mental health. Studies have shown that while social media can enhance mental health by providing emotional support and social connection opportunities, it can also

cause psychological distress due to issues like cyberbullying and social comparison [3]. For instance, a study by the American Psychological Association (APA) found a strong correlation between excessive social media reliance and increased rates of depression and anxiety among adolescents [4]. The second area is the exploration of multi-dimensional mechanisms. Scholars abroad have investigated the deeper mental health implications of social media use, addressing dimensions such as usage frequency, motivations, and interaction patterns.

In China, research predominantly focuses on the negative behavioral impacts of social media on adolescents. For example, studies reveal that excessive exposure on social media may lead to reduced self-esteem, poorer sleep quality, and diminished academic performance [5]. However, some Chinese scholars have also highlighted the potential of social media in promoting mental health education and enhancing adolescent resilience. Overall, empirical studies on the relationship between social media and mental health are relatively scarce in China, and the design and implementation of intervention strategies lack systematic frameworks, leaving ample room for further research.

1.3 Research Objectives and Methods

This study aims to systematically analyze the positive and negative impacts of social media on adolescent mental health and explore its underlying mechanisms. Based on these findings, it proposes targeted counseling intervention strategies grounded in psychological theories and technological practices. The research adopts a combination of literature analysis and theoretical modeling, synthesizing domestic and international studies to construct an impact framework and propose actionable solutions.

2. MECHANISMS OF SOCIAL MEDIA'S IMPACT ON ADOLESCENT MENTAL HEALTH

2.1 Key Characteristics of Social Media Usage

Social media's ubiquity manifests in prominent technical and content-related features. On the technical side, social media platforms emphasize immediacy and interactivity, enabling users to communicate and express emotions anytime, anywhere. On the content side, the diversity of social media platforms caters to adolescents' needs for information, socialization, and self-expression, making them a primary user group. For example, on a popular short-video platform in China, adolescents account for over 35% of total users, with daily active usage averaging more than two hours [6].

Adolescents often display a strong sense of engagement and dependence on social media. Research indicates that they tend to use these platforms as vital channels for self-expression and social validation, with the frequency and quality of social interactions directly influencing their psychological well-being. Moreover, algorithm-driven personalized recommendations enhance user experiences, but this "immersive" design may lead to excessive social media reliance among adolescents.

2.2 Positive Impacts of Social Media on Mental Health

Social media can enrich adolescents' social support networks. Studies confirm that social media enables adolescents to maintain connections with friends and family, expand their social circles, and access emotional support during challenging times. For example, surveys reveal that 48% of adolescents seek emotional comfort via social media after experiencing significant life events [7]. Additionally, social media offers a wealth of learning resources and growth opportunities, such as online educational courses and motivational communities, which enhance adolescents' confidence and social adaptability.

Some platforms also provide safe spaces for discussing mental health issues through anonymous interactions. Studies suggest that, when traditional offline support channels are inaccessible, adolescents may feel more comfortable engaging with mental health professionals on social media. This approach is particularly valuable in regions with limited access to mental health services.

2.3 Negative Impacts of Social Media on Mental Health

Despite its benefits, social media poses significant risks to adolescent mental health. Cyberbullying ranks as one of the most critical issues. According to the Global Cyberbullying

Annual Report, over 20% of adolescents experience cyberbullying on social media platforms, which can lead to diminished self-esteem and even self-harming behaviors [8]. Social comparison is another common phenomenon, where adolescents compare their real lives with others' "idealized lives" portrayed on social media, triggering negative emotions such as anxiety and depression.

Excessive social media use can also adversely affect adolescents' physical health, indirectly impacting their mental health. For example, studies show that 35.8% of adolescents suffer from sleep deprivation due to prolonged social media use, which is strongly linked to the emergence of mental health problems [9].

2.4 Analysis of Influencing Factors and Mechanisms

The impact of social media on adolescent mental health is multi-dimensional. Firstly, individual differences play a significant role. Research indicates that extroverted adolescents are more likely to derive positive experiences from social media, while introverted individuals are more susceptible to negative influences. Secondly, usage patterns are critical. For instance, active social media use (e.g., interacting with friends or sharing positive content) is usually associated with better mental health outcomes, while passive use (e.g., browsing others' posts without engaging) is more likely to result in psychological distress [10].

Family and societal environments also play essential roles. Family-level supervision and communication can effectively mitigate social media's negative impacts, while support from schools and communities provides broader protective networks for adolescents' mental health.

3. MANIFESTATIONS AND CAUSES OF ADOLESCENT MENTAL HEALTH ISSUES

3.1 Classification and Manifestations of Common Mental Health Issues

Adolescence is a critical period for psychological development, characterized by unique and diverse manifestations of mental health problems. Common issues include depression, anxiety, social phobia, low self-esteem, and behavioral disorders. Depression is particularly prevalent among adolescents.

According to the World Health Organization (WHO), depression is one of the leading causes of disability among adolescents aged 15–19 [1]. In China, a study on middle school students revealed that approximately 30% reported experiencing varying levels of depressive symptoms [2]. Affected adolescents may exhibit persistent sadness, loss of interest, low self-worth, and, in severe cases, self-harming or suicidal tendencies.

Anxiety symptoms also significantly impact adolescents' daily lives and academic performance. Adolescents frequently experience anxiety related to academic pressures, interpersonal relationships, and self-identity, which may manifest as excessive worry, difficulty concentrating, and physical symptoms like palpitations or insomnia. Social phobia is another common issue, exacerbated by adolescents' increasing reliance on digital interactions. This can lead to discomfort in face-to-face interactions or avoidance of offline social activities.

Low self-esteem is a critical concern, often marked by excessive concern about external evaluations and insufficient self-validation, which can undermine adolescents' psychological resilience. Some adolescents may resort to reckless behavior, excessive spending, or other unhealthy coping mechanisms to alleviate inner insecurity. These issues are often interrelated and challenging to detect early, complicating timely intervention and treatment.

3.2 Correlation Between Social Media Use and Mental Health Issues

The rapid rise of social media has drawn significant attention to its impact on adolescent mental health. Studies indicate a complex and profound relationship between social media use and mental health problems. A global survey of adolescents found that those who use social media for more than three hours daily are at significantly higher risk of developing mental health issues compared to infrequent users [3]. Adolescents heavily dependent on social media may face greater challenges in emotion regulation and time management.

Cyberbullying is a direct result of social media's influence on mental health. The anonymity of online platforms makes adolescents more vulnerable to attacks and

insults. Statistics show that over 20% of adolescents have experienced cyberbullying, leading to emotional distress and diminished self-esteem [4]. Additionally, social comparison on social media exerts psychological pressure. Adolescents often compare their real lives to the idealized portrayals of others, resulting in feelings of envy, inadequacy, and other negative emotions. Sleep disruption is another significant issue linked to social media use. Prolonged nighttime usage of smartphones or computers reduces sleep duration and quality. Research has shown a significant correlation between social media use and sleep disorders, with adolescents who spend more time on social media experiencing shorter sleep durations and heightened psychological stress [5].

3.3 Comprehensive Causes at Individual, Family, and Societal Levels

The causes of adolescent mental health issues are multifaceted, involving individual, family, and societal factors.

At the individual level, personality traits and self-regulation abilities are critical determinants. For instance, introverted adolescents may rely on social media for emotional fulfillment but are more vulnerable to the negative effects of harmful content. Adolescents with weaker self-control are more prone to excessive social media use, disrupting their academic and personal lives.

At the family level, parenting styles and monitoring behaviors significantly influence adolescents' mental health. In some families, parents' busy work schedules may hinder effective communication with their children, prompting adolescents to seek a sense of belonging on social media. Conversely, overprotective or high-expectation family environments may impose additional psychological pressure on adolescents.

At the societal level, the environments provided by schools, communities, and social media platforms also play crucial roles. For example, competitive academic environments and narrow societal definitions of success may heighten adolescents' anxiety. Simultaneously, the content moderation and algorithm recommendations of social media platforms directly affect adolescents' exposure to harmful or inappropriate information, subtly impacting their mental well-being.

4. COUNSELING STRATEGIES FOR ADOLESCENTS UNDER THE INFLUENCE OF SOCIAL MEDIA

4.1 Strategies to Enhance Digital Literacy

Improving digital literacy is essential to mitigate social media's negative effects on mental health. Systematic digital literacy education can help adolescents critically evaluate social media content, filter out harmful information, and enhance their risk awareness. Schools can introduce specialized courses to educate students about the dangers of cyberbullying and effective coping strategies while promoting healthy online behavior patterns.

Key components of digital literacy education include teaching time management and content selection. Adolescents should learn to allocate time wisely and avoid prolonged social media use. Additionally, by prioritizing educational, artistic, and scientific content, adolescents can leverage social media to foster personal growth.

4.2 Coordinated Interventions by Families and Schools

The collaboration between families and schools is a cornerstone of effective mental health interventions. Parents can establish open communication channels with their children to understand their social media activities and emotional experiences, enabling the early detection of mental health issues. Creating a supportive emotional environment at home enhances adolescents' psychological resilience.

Schools should integrate mental health education into daily teaching activities. For instance, they can invite mental health experts to conduct workshops, equipping students with emotional regulation and stress management techniques. Schools can also establish counseling centers that offer confidential, individualized mental health support.

4.3 Technology-Enabled Counseling and Adaptive Interventions

With advancements in internet technology, counseling methods are evolving. Artificial intelligence-powered mental health applications and online counseling platforms are emerging as accessible and efficient resources. For example, chatbots can simulate therapeutic conversations, providing

immediate support to adolescents.

Counseling should adopt adaptive strategies tailored to individual needs. For adolescents facing cyberbullying-related trauma, counselors should focus on rebuilding self-esteem and enhancing social skills. For those struggling with social media addiction and anxiety, behavioral therapies can help them regain control over their lives.

4.4 Optimizing Social Support Networks

Social support networks are instrumental in safeguarding adolescent mental health. Governments and social organizations can provide policy support and resources to encourage social media platforms to strengthen content moderation and reduce the dissemination of harmful content. Communities can host offline activities to provide adolescents with more social opportunities, reducing their dependence on online interactions.

Volunteer organizations can establish confidential counseling hotlines to offer professional support to adolescents in need. Ensuring confidentiality and privacy is crucial to encouraging adolescents to seek help comfortably.

5. CONCLUSION

5.1 Key Findings

This study reveals the dual effects of social media on adolescent mental health. While social media provides emotional support and learning opportunities, issues like excessive use, cyberbullying, and social comparison pose significant risks. The mechanisms involve multiple levels, including individual, familial, and societal factors, necessitating comprehensive interventions.

5.2 Limitations and Future Directions

This study primarily relies on existing literature and lacks up-to-date field data. Future research should incorporate empirical studies to explore the specific impacts of social media use on adolescents across different age groups and cultural contexts. Additionally, further exploration of technology-based mental health interventions could enhance the accessibility and efficiency of psychological support for adolescents.

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The Influence of Traditional Colors on Brand Identity Design

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Abstract: This study investigates the impact mechanisms of traditional colors in brand identity design and their application value in the modern business context. By integrating literature review and theoretical analysis, it explores insights from color psychology, cultural semiotics, and brand management to analyze the cultural significance and aesthetic value of traditional colors. The research first examines the symbolic meanings and emotional cognition of traditional colors across historical and cultural dimensions. Then, utilizing brand communication theories, it evaluates the practical roles of traditional colors in brand recognition, emotional connection, and market positioning. Finally, through a comparative analysis with modern design principles, the study proposes feasible strategies and innovative approaches for incorporating traditional color elements into brand design. Findings reveal that traditional colors, with their unique cultural symbolism and emotional resonance, enhance cultural identity and consumer loyalty. However, their effectiveness depends on precise alignment between color symbolism and the cultural context of the target market. This study offers theoretical insights and practical guidance for balancing traditional and modern elements in brand design amid globalization and cultural diversity.

Keywords: Traditional Colors; Brand Identity; Cultural Semiotics; Color Psychology; Design Innovation

1. INTRODUCTION

1.1 Research Background and Significance

With globalization accelerating and market competition intensifying, brand identity has become a critical strategic asset for achieving differentiation. As a core element of brand identity, design significantly influences consumer perception, association, and loyalty. Among design elements, colors not only serve as powerful visual communication tools but also convey rich cultural and emotional values. Traditional colors, as carriers of cultural symbols, embody profound historical and regional significance. Integrating them into brand identity design can help establish unique cultural identities and foster emotional resonance with consumers, particularly in cultural-rich nations like China. For instance, colors such as "China Red" and "Blue-and-White Porcelain" evoke strong cultural recognition and aesthetic appeal.

However, many brands overly emphasize "internationalization" in design, neglecting the cultural value and market potential of traditional colors, leading to homogenized brand identities. Moreover, the understanding of traditional colors in international markets often lacks depth, and their symbolic and psychological impacts across cultural contexts are underexplored. This study aims to address these gaps by systematically analyzing the mechanisms and practical value of traditional colors in brand identity design, offering theoretical and practical guidance for designers.

1.2 Research Objectives and Questions

This study seeks to reveal the cultural transmission, emotional connection, and market positioning effects of traditional colors in brand identity design. It explores how to integrate traditional color symbols with contemporary design principles to maximize brand cultural value. The research focuses on the following questions:

What are the symbolic meanings and psychological effects of traditional colors across different cultural contexts?

How do traditional colors facilitate cultural transmission and emotional connection in brand identity design?

How can traditional colors be effectively combined with modern aesthetics in brand visual design?

1.3 Literature Review

Studies on traditional colors and brand design have achieved noteworthy progress. International researchers have focused on the application of color psychology and cultural semiotics. For instance, Kumpulainen and Sefton-Green [1] highlighted that colors influence emotional perception and brand preference. However, these studies mainly center on Western cultures, with limited attention to the application of Eastern traditional colors.

In contrast, Chinese scholars emphasize the symbolic meanings of colors in traditional cultural contexts. Zhang Limin [3] pointed out that Chinese traditional colors, such as red, yellow, and blue, carry both visual appeal and rich cultural memory. However, domestic studies primarily focus on cultural interpretation, with insufficient exploration of innovative applications of traditional colors in modern brand design. Furthermore, current research has not comprehensively integrated perspectives from cultural semiotics, psychology, and brand management, with methodologies often single-dimensional. This study seeks to address these limitations by providing an interdisciplinary analysis of traditional colors in brand design.

2. THE CULTURAL CONNOTATIONS AND SYMBOLISM OF TRADITIONAL COLORS

2.1 Historical and Cultural Dimensions of Traditional Colors

Traditional colors are integral to cultural heritage, shaped by historical and social contexts. For example, red in Chinese culture originated from Neolithic red pottery and later symbolized auspiciousness and celebration, widely used in weddings and festivals. Yellow, associated with royalty during feudal times, signified power and prestige. These meanings evolved over time; for instance, "Blue-and-White Porcelain" became an iconic color during the Ming and Qing dynasties, serving as both an artistic and cultural exchange symbol. Such historical depth offers a valuable resource for brand identity design, enhancing cultural richness and market appeal. Regional variations in traditional colors reflect local environments and lifestyles. For instance, Scandinavian traditional colors often feature soft cool tones, influenced by cold climates and minimalist lifestyles, while Southeast Asian colors are vivid and warm, reflecting tropical environments and biodiversity. These regional differences inspire global brand design, underscoring the diversity and inclusivity of color in cultural expression.

2.2 Symbolic Meanings Across Cultural Contexts

The symbolism of traditional colors varies significantly across cultures. The same color can evoke contrasting emotional effects in different regions. For instance, red symbolizes celebration and good fortune in China but may represent danger or warning in some Western cultures [2]. This cultural divergence poses challenges for cross-cultural brand design while also providing creative opportunities. Accurately understanding the color symbolism of target markets is crucial for achieving cultural alignment in design.

Studies indicate that color symbolism is closely tied to cultural customs, religions, and values. For example, green symbolizes sanctity and purity in Islamic cultures, while in East Asia, it may evoke associations with vitality or envy. By analyzing cultural contexts, brands can align their designs with consumers' cultural perceptions, enhancing the effectiveness of brand communication.

2.3 Emotional and Psychological Impacts of Traditional Colors

The psychological impact of color on emotions is a prominent area of study. Traditional colors not only captivate visually but also evoke emotions, reinforcing consumer perceptions and preferences toward brands. For instance, warm tones (e.g., red, yellow) tend to elicit positive emotions like excitement, happiness, and security, while cool tones (e.g., blue, purple) often convey calmness, elegance, and technological sophistication [3]. These emotional effects make color a vital element in brand identity design.

Additionally, traditional colors can evoke nostalgia and cultural identity. For example, the "Palace Museum Cultural Creative Products" successfully employed traditional Chinese colors like imperial red and yellow to trigger collective cultural memories, enhancing the brand's cultural value and market impact. Psychological studies suggest

that emotionally resonant color designs significantly enhance brand favorability and loyalty, providing a scientific basis for the application of traditional colors in branding.

3. THEORETICAL FOUNDATIONS OF BRAND IDENTITY DESIGN

3.1 Core Concepts and Elements of Brand Identity Design

Brand identity reflects consumers' overall perception of a brand, encompassing its personality, values, cultural significance, and visual language. Through systematic design, brands can establish a unique identity in competitive markets, attracting attention and enhancing their market position. Among the elements of brand identity, visual communication plays a pivotal role. By leveraging symbols such as graphics, colors, and typography, brands can effectively convey their core values and characteristics.

Color, in particular, is a critical component due to its direct emotional and psychological impact. Studies reveal that color significantly influences consumers' first impressions, with its selection and combination determining a brand's visual appeal to its target audience [1]. For instance, research indicates that 93% of consumers prioritize visual factors when making purchasing decisions, with 62%-90% of perceptions directly affected by color [2]. Furthermore, brand identity design must balance functional and emotional dimensions—functionality highlights product attributes and service quality, while emotional aspects foster connections with consumers. Color serves as a key medium in bridging this emotional communication.

3.2 The Role of Color in Brand Recognition

In brand recognition systems, color acts as a vital vehicle for personalized expression due to its visual appeal and symbolic significance. As humans primarily process information visually, color captures attention quickly, forming immediate associations with the brand. Research underscores that consumers exhibit strong color-based memory of brands; iconic examples include Coca-Cola's red and Starbucks' green, which have become integral to their identities [3].

Colors also deepen brand personality by conveying specific emotional or cultural messages. For instance, food brands often use warm tones (e.g., red, orange) to stimulate appetite and excitement, while tech brands favor blue and gray to signify professionalism and innovation. Aligning color choices with brand positioning enhances recognition and fosters consumer trust. For traditional colors, their cultural symbolism offers rich expressive possibilities. For example, red in Chinese culture symbolizes prosperity and celebration, making it a valuable tool for emotional connection in festive marketing campaigns.

3.3 Synergy Between Traditional and Modern Elements in Brand Design

Brand identity design requires a balance between traditional cultural values and modern aesthetics to preserve heritage while meeting contemporary tastes. Traditional colors, as cultural symbols, possess irreplaceable uniqueness, while modern design elements leverage innovative forms and technologies to captivate consumers. Combining traditional colors with contemporary design language enriches a brand's cultural depth and enhances its visual impact.

Achieving this synergy demands a deep understanding and creative reinterpretation of traditional culture. For example, the "Palace Museum Cultural Creative Products" incorporate traditional Chinese colors like imperial yellow and crimson red, paired with modern minimalist design techniques. This approach appeals to younger consumers while retaining historical charm, successfully enhancing the brand's cultural value and market reach.

4. ANALYSIS OF THE IMPACT OF TRADITIONAL COLORS ON BRAND IDENTITY DESIGN

4.1 Role of Traditional Colors in Cultural Transmission

As key cultural symbols, traditional colors convey historical and cultural values. In brand identity design, utilizing traditional colors allows brands to integrate cultural essence into their visual communication, thereby enhancing cultural distinctiveness. For instance, the traditional Chinese color "Indigo," widely used in blue-and-white porcelain and folk costumes, symbolizes elegance and timelessness. Incorporating such colors into design highlights a brand's cultural

heritage and fosters resonance with consumers. With the rise of cultural confidence and domestic markets, many brands have embraced traditional colors to convey cultural values. For example, Huawei introduced phone models named after traditional colors like "Coral Orange" and "Mountain Green," sparking interest in Eastern aesthetics. This strategy not only enhances a brand's cultural value but also attracts high-end consumers seeking cultural identity.

4.2 Emotional Connection Through Traditional Colors

The emotional impact of color has been widely validated in psychology. As carriers of collective cultural memory, traditional colors evoke a sense of cultural belonging and emotional attachment. For example, "China Red," with its associations of joy and prosperity, is closely tied to festivals and weddings, making it an effective tool for conveying emotion in branding. Consumers often develop favorable impressions of brands using such colors, fostering loyalty.

Many brands have demonstrated the importance of emotional connections in marketing. For instance, Shiseido frequently employs the traditional Japanese color "Sakura Pink," evoking memories of cherry blossom season and reinforcing the brand's ties to Japanese culture. This emotionally resonant design deepens consumer engagement and enhances the brand's cultural appeal, especially in international markets.

4.3 Application of Traditional Colors in Market Positioning

Market positioning is a critical objective of brand design, and traditional colors offer unique advantages in shaping brand identity. By selecting culturally symbolic colors, brands can effectively communicate core values and target specific markets. For example, luxury brands often use noble traditional colors like gold and purple to convey sophistication and exclusivity. In contrast, Chinese liquor brand "Moutai" employs red and gold to emphasize its premium status in high-end social settings.

Traditional colors also enhance a brand's regional distinctiveness. In international markets, culturally rich traditional colors help brands stand out. For example, South Korea's LG incorporates traditional Korean colors into its branding, successfully projecting a strong cultural identity on a global stage.

5. APPLICATION STRATEGIES OF TRADITIONAL COLORS IN BRAND IDENTITY DESIGN

5.1 Extraction and Redesign of Traditional Color Elements

The effective application of traditional colors in brand identity design relies on extracting and redesigning their core elements. This process involves a comprehensive understanding of their cultural significance and innovative integration into modern design language. Traditional colors are not singular; they encompass attributes such as hue, brightness, and saturation. Designers must draw inspiration from historical texts, artworks, and crafts while analyzing the historical and cultural symbolism of specific colors.

Digital technology plays a crucial role in color extraction. For example, digital scanning of Qing Dynasty murals or ancient illustrations can precisely capture color values like imperial red and bright yellow, enabling accurate reproduction and diverse applications in branding. Moreover, AI technologies can reconfigure traditional colors, generating novel palettes that rejuvenate their relevance in modern contexts.

Redesigning extracted colors ensures their compatibility with contemporary brands. This process often involves simplifying and reinterpreting cultural symbols. For instance, the Palace Museum Cultural Creative Products use a muted version of "Imperial Red" to enhance its modern appeal. The core goal of redesign is to preserve cultural essence while aligning with modern aesthetics and market demands, achieving a balance between heritage and commercial value.

5.2 Designing with Target Market Cultural Contexts

The application of traditional colors must align with the cultural context of the target market. Different regions interpret the same color differently, requiring brands to tailor their designs to local cultural preferences. For instance, red signifies prosperity and celebration in China, making it suitable for festive products, whereas in Western contexts, red may symbolize passion or caution,

necessitating alternative applications.

Cultural differences also influence the depth of color associations. In Japan, "Sakura Pink" represents spring and hope, as demonstrated by brands like Shiseido that strengthen emotional connections through this color. In South Asia, gold and orange, tied to religious rituals, signify sanctity and prestige. Thus, brands must reposition traditional colors based on local consumer preferences and conduct thorough market research to ensure design effectiveness.

Collaborative regional design can further integrate cultural nuances into branding. For example, Bulgari's limited collection inspired by "Blue-and-White Porcelain" merges European classical aesthetics with Chinese traditional colors, appealing to Chinese consumers while showcasing global cultural integration. Such strategies foster broader acceptance across diverse cultural landscapes.

5.3 Integrating Traditional Colors with Modern Brand Visual Systems

Fusing traditional colors with modern visual systems is a challenging but essential design practice. Overemphasis on traditional colors may confine a brand to specific cultural regions, hindering global appeal. Therefore, brands must balance traditional symbolism with contemporary design by employing techniques such as form transformation and semantic reinterpretation.

In terms of form transformation, traditional colors can be adapted using gradients, overlays, and blurring techniques to harmonize with modern visual styles. For instance, Alibaba's Tmall incorporated "China Red" with geometric patterns in limited-edition packaging, blending cultural richness with contemporary aesthetics. This approach enhances the expressiveness of traditional colors while maintaining design sophistication.

Semantic reinterpretation involves aligning traditional colors with brand positioning and product attributes. For example, the blue-and-white palette of porcelain traditionally conveys elegance and freshness but has been redefined in Huawei's "Mountain Green" smartphones to evoke simplicity and technological innovation. By adjusting the symbolic meaning of traditional colors, brands can merge cultural value with modern consumer preferences.

6. CONCLUSION

Traditional colors, as vital resources in brand identity design, offer unique advantages in cultural transmission, emotional connection, and market positioning. They not only enhance brand cultural distinctiveness but also strengthen consumer loyalty through emotional resonance.

From a theoretical perspective, the effective use of traditional colors requires a multidisciplinary approach integrating cultural semiotics, psychology, and brand management. Practically, success depends on the processes of color extraction, redesign, and integration with modern design elements. This study systematically explores the cultural connotations of traditional colors and their mechanisms in brand design, addressing gaps in existing research on application strategies. Through case studies, it proposes methods for extracting and redesigning traditional colors, emphasizes the significance of cultural contexts, and examines paths for integrating traditional colors into modern visual systems. These findings offer valuable insights for both academia and practitioners.

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A Theoretical Study on Diversity and Inclusion in Early Childhood Art Education from a Cross-Cultural Perspective

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Abstract: This study examines the theories of diversity and inclusion in early childhood art education from a cross-cultural perspective. It aims to explore how multiculturalism reshapes educational paradigms in the context of globalization and how cultural diversity and inclusion can be reflected in educational practices. Employing a combination of literature review and theoretical analysis, the research synthesizes core insights from cross-cultural education, art education, and child psychology to develop a theoretical framework. It defines the concepts of diversity and inclusion in early childhood art education, analyzes influencing factors, and investigates their application in cross-cultural contexts. the findings highlight the importance of integrating multicultural resources to foster children's understanding and respect for diverse cultures, thereby cultivating global competence and tolerance. the study also advocates for the incorporation of inclusive cross-cultural concepts into curriculum design to create diverse educational environments that promote artistic expression, cultural identity, and holistic development. This research provides theoretical support for early childhood art education in cross-cultural contexts and offers valuable insights for policy-making and pedagogical improvements.
Keywords: Cross-Cultural Perspective; Early Childhood Art Education; Diversity; Inclusion; Theoretical Study

1. INTRODUCTION
1.1 Research Background and Problem Statement
With the deepening of globalization, cultural exchange and integration have become increasingly common, exerting a profound impact on education. Early childhood art education, as a critical component of early education, not only serves as a medium for cultural inheritance but also fosters creativity and diverse thinking. However, traditional early childhood art education often adheres to a single cultural narrative, neglecting cultural diversity and, in some cases, perpetuating cultural bias and assimilation.

According to UNESCO, cultural diversity is a driving force for human progress, and education plays a key role in promoting diversity and inclusion [1]. the preschool years, being a critical period for value formation and artistic cognition, present a unique opportunity to integrate cultural diversity education. This integration is essential for shaping children's global outlook and fostering cultural tolerance. While China has recognized the role of culture in educational equity and quality during its foundational education reforms, systematic research and practical exploration of cross-cultural concepts in early childhood art education remain limited.

1.2 Literature Review
Globally, research on early childhood art education focuses on the core values of art education, fostering children's creativity, and the impact of cultural diversity on child development. Donaldson, an American scholar, emphasizes that cross-cultural education should prioritize respect and understanding of diverse cultures, using art education to achieve cultural resonance [2]. Nordic countries like Finland and Sweden have successfully integrated art and multicultural education in their preschool systems, fostering children's awareness and acceptance of diverse cultures.

In China, early childhood art education has developed rapidly under policy support, as outlined in the Guidelines for the

Development of Preschool Education in China (2010-2020), which emphasizes cultivating children's artistic abilities and cultural literacy. However, most efforts focus on skill training and local cultural heritage, with limited attention to diversity and inclusion.

1.3 Research Objectives and Significance

This study aims to explore the practical applications of diversity and inclusion in early childhood art education from a cross-cultural perspective. By analyzing the influence of multiculturalism on children's artistic development, it seeks to establish connections between cross-cultural education theory and art education, thus proposing an innovative theoretical framework. This effort not only enhances educational equity and inclusivity but also helps children develop respect for different cultures and a diversified aesthetic appreciation during their formative years.

2. THEORETICAL FOUNDATIONS OF EARLY CHILDHOOD ART EDUCATION IN A CROSS-CULTURAL CONTEXT

2.1 Overview of Cross-Cultural Education Theory

Emerging in the 1960s from concerns about multicultural integration in Western societies, cross-cultural education theory addresses educational challenges faced by immigrant children. It advocates for respecting cultural diversity, fostering inter-cultural understanding, and preventing cultural dominance or discrimination through curriculum and pedagogy adjustments [3]. As globalization advances, the theory has become a framework for promoting educational equity and preparing globally competent individuals. Cross-cultural education encompasses three key dimensions: cultural identity, multicultural understanding, and global citizenship. These dimensions are particularly relevant to early childhood education, as children possess high malleability and learning capacity during this stage. Integrating cross-cultural education allows children to explore diverse art forms, enhancing their creativity and cultural sensitivity.

2.2 Core Principles and Values of Early Childhood Art Education

The core of early childhood art education lies in nurturing children's creativity, emotional expression, and cultural awareness, rather than merely developing artistic skills. As a unique non-verbal medium, art enables children to explore the world and express themselves. It also supports socialization by fostering collaboration and communication among peers.

In modern society, the value of art education extends beyond artistic skill-building to include cultural inheritance, social-emotional development, and achieving education goals that embrace diversity. Studies show that engaging in multicultural art activities helps children understand various cultural expressions, cultivating an open cultural mindset. For example, some Chinese preschools have incorporated intangible cultural heritage elements, such as paper-cutting and shadow puppetry, into art curricula, which not only broadens children's artistic horizons but also strengthens their connection to local culture [4].

2.3 Diversity and Inclusion in Educational Theory

Diversity and inclusion are fundamental principles in contemporary education, shaping policies, curriculum design, and teaching practices. Within cross-cultural education, diversity acknowledges and respects individual differences in culture, language, religion, and artistic traditions. Inclusion emphasizes creating equitable learning opportunities where all children feel valued and accepted.

In early childhood art education, diversity is reflected in diverse curriculum content and flexible teaching methods, such as introducing art forms from various cultures to inspire children's appreciation for cultural uniqueness. Inclusion requires educators to address the individual needs and cultural backgrounds of all children, fostering a respectful and equitable learning environment. For instance, for minority or immigrant children, teachers can encourage them to share their cultural artistic traditions, boosting their confidence and sense of belonging.

Studies demonstrate that integrating diversity and inclusion into education enhances children's artistic abilities and social-emotional development. For example, a Finnish study found that classrooms incorporating multicultural art projects

exhibited higher levels of cultural inclusivity and cross-cultural communication skills among children compared to control groups [5]. These findings offer valuable insights for advancing early childhood art education in China.

3. DIVERSITY AND INCLUSION IN EARLY CHILDHOOD ART EDUCATION

3.1 Theoretical Connotations of Diversity in Early Childhood Art Education

Diversity in early childhood art education refers to the incorporation of varied curriculum content, teaching methods, and artistic forms. Artistic traditions from different cultures reflect specific social values, historical memories, and aesthetic pursuits. Integrating these diverse forms into art education enables children to explore various cultural expressions and expand their aesthetic horizons. For instance, traditional art forms such as African masks, Indian sand art, and Chinese paper-cutting carry unique cultural symbols and meanings [1]. Introducing these forms can stimulate children's artistic curiosity while fostering their understanding of cultural diversity.

Diversity also involves respecting individual differences among children, shaped by their family culture, language, and social environment. Children's artistic expressions are not merely technical displays but natural reflections of their emotions and cultural identities. Research indicates that diverse artistic experiences enhance children's creativity and improve their socialization skills [2].

3.2 Theoretical Connotations of Inclusion in Early Childhood Art Education

Inclusion in early childhood art education emphasizes providing equitable learning opportunities for all children, regardless of gender, ethnicity, cultural background, or language ability. It aims to optimize teaching designs and adjust curricula to ensure every child feels valued and respected.

Inclusive practices in art education encourage children to express cultural perspectives through art. For example, teachers can guide minority children to share their traditional art forms and involve others in collaborative projects. This approach enhances cultural confidence among minority children while fostering cultural tolerance in others. Moreover, for children with language barriers or special needs, art provides a non-verbal outlet for self-expression. Studies have shown that inclusive art education improves children's social adaptability and promotes intercultural collaboration and understanding [3].

3.3 Interrelationship Between Diversity and Inclusion

Diversity and inclusion are interdependent dimensions in early childhood art education. Diversity enriches educational content and methods, while inclusion ensures equitable access to these resources for children from varied backgrounds. Diversity lays the foundation by introducing various cultural art forms and values, while inclusion guarantees acceptance and respect for every child in a diverse learning environment.

Research suggests that integrating diversity and inclusion in art education not only enhances children's artistic creativity but also fosters respect and understanding of multiculturalism. Practically, this requires educators to possess cultural sensitivity and innovative teaching skills, supported by policies and resource integration [4].

4. ANALYSIS OF INFLUENCING FACTORS IN CROSS-CULTURAL EARLY CHILDHOOD ART EDUCATION

4.1 The Impact of Globalization and Multicultural Education

Globalization accelerates cultural exchange and integration, presenting both opportunities and challenges for early childhood art education. On one hand, it provides educators with diverse artistic resources, allowing children to experience a wide range of art forms and traditions. For example, initiatives like China's Belt and Road have introduced artistic elements from participating countries, such as Indian mandala art and Central Asian carpet patterns, into preschool curricula. These practices not only broaden children's artistic perspectives but also spark their interest in foreign cultures [5].

On the other hand, globalization risks cultural homogenization, where dominant cultures overshadow marginalized ones, potentially limiting children's appreciation of cultural diversity. Educators must design multicultural

curricula to preserve cultural diversity and help children recognize and value the uniqueness of different cultures.

4.2 The Role of Children's Artistic Development and Cultural Identity

Children's artistic development is closely tied to their cultural identity. Artistic creations at the preschool stage are profoundly influenced by family culture and social surroundings. For instance, children exposed to rich traditional art resources may exhibit stronger cultural symbolism in their art.

Art education plays a critical role in fostering cultural identity. By engaging with diverse cultural art forms, children gain an understanding of cultural diversity and, through comparison and reflection, develop a sense of their own cultural identity. This cultural grounding is crucial for their social development, helping them establish their cultural positioning in a globalized world [6].

4.3 The Importance of Teacher Competence and Educational Environment

Teachers' professional competence is a key factor in ensuring the quality of cross-cultural early childhood art education. In addition to strong artistic knowledge, educators must exhibit cultural sensitivity and cross-cultural communication skills. For children from diverse cultural backgrounds, teachers need to recognize the cultural traits in their artistic expressions and guide them toward appreciating other cultural art forms.

The design of the educational environment also significantly impacts diversity and inclusion. An open and inclusive environment provides children with access to diverse artistic resources and creative opportunities. Through multicultural-themed art activities and exhibitions, educators can stimulate children's interest in different cultures and nurture their cultural tolerance in interactive settings.

5. THEORETICAL PATHWAYS TO ACHIEVING DIVERSITY AND INCLUSION IN EARLY CHILDHOOD ART EDUCATION

5.1 Designing and Implementing Multicultural Art Curricula

Multicultural art curricula serve as a critical pathway to achieving diversity and inclusion in early childhood art education. the curriculum should be rooted in cultural diversity, tailored to children's interests and developmental needs, and incorporate representative artistic forms as teaching content. Implementation should prioritize interactivity and engagement through group projects and role-playing activities, allowing children to experience the artistic richness of different cultures in practice.

5.2 Strategies for Cultivating Cross-Cultural Communication Skills

Cross-cultural communication skills are essential competencies for children in multicultural environments. Organizing cultural exchange events and multilingual art activities can create opportunities for cross-cultural interaction. Educators may also employ techniques like story-based painting and role-play to help children better comprehend and express the values of diverse cultures.

5.3 Policy Support and Resource Integration

Educational policies play a vital role in guiding diversity and inclusion in early childhood art education. the development of relevant policies can support the promotion of multicultural curricula and the optimization of educational environments. Resource integration is equally critical, including leveraging social resources, fostering international collaborations, and utilizing digital technologies to expand educational content.

6. CONCLUSION

This study, from a cross-cultural perspective, examines the theoretical connotations of diversity and inclusion in early childhood art education and explores pathways for their implementation. Findings suggest that diversity and inclusion are fundamental to enhancing educational equity and quality, requiring systematic efforts in curriculum design, teacher training, and policy support.

The research enriches the theoretical framework of early childhood education and offers new perspectives for art education practices in multicultural contexts. the proposed strategies provide actionable references for educators in their teaching practices.

Future studies could explore the integration of

cross-cultural education with digital technologies and investigate how evaluation systems can drive the development of diversity and inclusion in early childhood art education.

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Innovation in Automotive Professional Course Design with the Assistance of Digital Tools

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Abstract: This study aims to explore how to utilize digital tools in teaching design innovation within automotive professional courses to enhance students' learning outcomes and practical skills. Through a literature review, the current application status of digital tools in the field of education was analyzed, especially its significance in vocational education. We developed a course framework based on digital tools and evaluated its feasibility and effectiveness through expert interviews and practical teaching feedback. the study focused on the integration and application of digital tools such as virtual reality, simulation software, and online learning platforms, aligning them with course objectives, teaching content, and assessment methods. the results indicate that the effective use of digital tools can significantly increase students' interest and engagement in learning, as well as enhance their practical skills. Furthermore, the study found that the use of digital tools can promote the sharing of teaching resources and improve teaching efficiency. However, successful implementation requires teachers to possess certain technical skills and establish clear implementation strategies. Overall, this study provides a new perspective and practical reference for the design of automotive professional courses in higher vocational colleges.

Keywords: Digital Tools; Automotive Professional; Course Design; Teaching Innovation; Vocational Education

1. INTRODUCTION

1.1 Research Background and Significance

With the rapid advancement of technology, digital tools are being increasingly applied across various fields, especially in education. the automotive industry, as a technology-intensive sector, requires continuous updates in educational content and teaching methods to meet changing industry demands. Digital tools provide rich resources and new teaching methods for education, making curriculum design more interactive and practical. With the assistance of digital tools, students can not only theoretically grasp advanced automotive technologies but also engage in practical operations through technologies like virtual simulation, enhancing their hands-on skills [1]. The introduction of digital educational tools is not merely an update of technical means but a revolution in educational philosophy. Its significance lies in promoting a shift in teaching models from teacher-centered to student-centered, enhancing students' learning enthusiasm and engagement. In the long run, the application of digital tools helps cultivate professionals who are better adapted to the future development of the automotive industry.

1.2 Review of Domestic and International Research

Internationally, many developed countries have widely applied digital tools in automotive education. For instance, automotive technology education in the United States often employs virtual reality and augmented reality technologies to simulate automotive repair and assembly processes, allowing students to practice in a safe environment [2]. Some European higher education institutions are also actively exploring the construction of online learning platforms, providing abundant online course resources for students to learn independently. Domestically, with the promotion of educational informatization policies, the application of digital tools in vocational colleges is gradually increasing. In recent years, many universities have introduced a blended teaching model that combines online

and offline learning and have begun to explore the use of big data and artificial intelligence technologies for personalized teaching. However, compared to advanced international standards, there is still room for improvement in the depth and breadth of digital tool usage in China [3].

2. OVERVIEW OF DIGITAL TOOLS
2.1 Definition and Classification of Digital Tools
Digital tools generally refer to tools and software that utilize digital technology for information processing, including but not limited to computer-aided design (CAD) software, virtual reality (VR) devices, augmented reality (AR) applications, online learning platforms, and various educational applications. Based on their functions and application scenarios, digital tools can be classified into the following categories:

Simulation Tools: Such as virtual reality and augmented reality, these tools can simulate real environments to provide students with immersive learning experiences. In automotive education, they are used to simulate vehicle structures and operating conditions.

Design Tools: Such as CAD software, these tools help students understand various aspects of automotive design, facilitating a complete process from conception to design.

Management Tools: Such as Learning Management Systems (LMS), these provide an integrated platform for course management, resource distribution, assignment submission, and performance evaluation.

2.2 Application Overview in the Educational Field
Globally, the application of digital tools in education has shown significant effectiveness. Their application is not limited to science and engineering education but has also extended widely to humanities and social sciences courses. For example, virtual reality in medical education has helped students better understand complex human anatomy [4]. In automotive courses, the application of digital tools enables students to intuitively understand the internal structure and operating principles of vehicles, improving learning outcomes.

Research indicates that courses using digital tools for teaching show significantly higher student engagement and knowledge retention than traditional teaching models [5]. In teaching practice, teachers can provide personalized learning paths through digital tools, accommodating different students' learning paces and styles. Through online learning platforms, students can access learning resources anytime and anywhere, greatly enhancing the flexibility and convenience of learning. Additionally, digital technology allows for quicker updates of teaching resources, ensuring that educational content remains at the forefront of industry developments.

3. CURRENT STATUS AND CHALLENGES OF AUTOMOTIVE CURRICULUM DESIGN
3.1 Current Issues in Curriculum Design
In today's rapidly developing automotive industry, the education sector faces multiple challenges. A prominent issue in automotive curriculum design is the imbalance between theoretical teaching and practical training. Traditional teaching methods offer limited enhancement of students' hands-on skills, with a focus on lectures and insufficient lab hours, making it difficult for students to effectively integrate theoretical knowledge with practical application. Additionally, the curriculum content is often not updated promptly. Automotive technology evolves rapidly, and the update speed of textbooks and teaching materials often lags behind industry developments. This lag creates a gap between what students learn in school and the actual needs of the industry.

Teachers' digital skills are also lacking, affecting the effective application of digital tools in teaching. Many teachers are accustomed to traditional teaching methods and need to improve their acceptance and application of new technologies. This situation limits the improvement of teaching quality and restricts students' exposure to and understanding of advanced technologies [1]. Meanwhile, schools have invested relatively little in the configuration and maintenance of digital equipment, with slow updates and insufficient technical support, further exacerbating the limitations of curriculum design.

3.2 Necessity of Curriculum Design Innovation

With technological innovations in the automotive industry, accelerating curriculum design innovation has become an urgent need. the emergence of new technologies such as electric vehicles and autonomous driving requires the education system to respond quickly to cultivate high-quality talents who can adapt to future developments. In this context, curriculum design innovation not only helps improve educational quality but also meets students' learning needs and career development goals.

To achieve this, curriculum design needs to be more flexible and adaptive. Introducing digital tools can provide new ideas for curriculum design. Through these tools, educators can create more interactive and dynamic learning environments, encouraging students to actively participate in the learning process. At the same time, digital tools can help teachers update teaching content in real-time to ensure students learn the latest industry knowledge [2].

4. APPLICATION OF DIGITAL TOOLS IN AUTOMOTIVE COURSES

4.1 Application of Virtual Reality Technology

Virtual reality technology has significant potential for application in automotive courses. This technology creates immersive learning environments, allowing students to experience practical operations without leaving the classroom. For example, using virtual reality headsets and software, students can perform automotive assembly and repair in a virtual workshop, experiencing real work environments and processes. This method not only enhances students' hands-on skills but also reduces the risks and costs associated with real operations [3].

The application of virtual reality technology is also evident in teaching complex automotive systems. Students can use virtual reality devices to observe the internal structure and operation principles of car engines, gaining a deep understanding of the functions and connections of various components. This three-dimensional teaching approach is more intuitive than traditional two-dimensional image displays, helping students better grasp complex technical concepts.

4.2 Application of Simulation Software

Simulation software is another important digital tool in automotive education. It realistically simulates the operating conditions of automotive systems, helping students bridge the gap between theory and practical application. For example, students can use simulation software to conduct vehicle dynamics simulations, testing vehicle performance and safety under different driving conditions. This simulation not only enhances students' analytical skills but also develops their ability to solve real engineering problems [4].

Furthermore, simulation software plays a crucial role in troubleshooting and repair training. Students can simulate different types of automotive faults through the software, practicing diagnostic and repair skills. This training provides students with practical experience and problem-solving abilities before entering the workforce. the flexibility and diversity of simulation software offer rich resources for teaching, promoting the diversification and depth of curriculum content.

4.3 Application of Online Learning Platforms

Online learning platforms provide modernized teaching management and resource distribution channels for automotive courses. These platforms can centralize course videos, assignments, quizzes, and other teaching resources, allowing students to learn anytime and anywhere. For example, students can access instructional videos via the platform and repeatedly watch course content until they fully understand it. This learning method breaks the limitations of time and space, offering students greater freedom in learning [5].

The interactive features of online learning platforms also promote teacher-student communication. Teachers can post discussion topics on the platform, and students can interact in discussion areas, sharing learning experiences and questions. This interaction not only enhances students' learning enthusiasm but also helps teachers understand students' learning status in a timely manner and adjust teaching strategies.

5. CURRICULUM DESIGN FRAMEWORK BASED ON DIGITAL TOOLS

5.1 Reconstructing Course Objectives

Reconstructing course objectives is crucial when designing modern automotive courses. the introduction of digital tools not only changes teaching methods but also imposes new demands on teaching objectives. Previously, course objectives focused primarily on knowledge transmission and skills training. Now, in the context of new technology, courses need to emphasize cultivating students' innovative thinking, problem-solving abilities, and adaptability to new technologies. Specifically, course objectives should include promoting students' understanding of emerging automotive technologies, enhancing interdisciplinary application abilities, and improving teamwork and communication skills to adapt to future dynamic work environments [1].

5.2 Digital Transformation of Teaching Content

The digital transformation of teaching content is at the core of curriculum design innovation. Through digital tools, complex automotive technologies can be transformed into intuitive visual teaching materials, making it easier for students to understand. For example, using 3D modeling technology, teachers can demonstrate the internal mechanisms of engines, significantly enhancing students' mastery of course content. Digital transformation also manifests in the diversification of resources, as teachers can provide rich learning resources through online platforms, including videos, animations, and e-books, which can be updated at any time to ensure the relevance and practicality of teaching content [2].

5.3 Innovation in Assessment Methods

The application of digital tools prompts a revolution in traditional assessment methods. In evaluating students' learning outcomes, in addition to traditional written exams and lab operations, project-based learning outcomes, online quizzes, and interactive experiments can also be introduced. These assessment methods can comprehensively reflect students' practical application abilities and levels of innovative thinking. Additionally, using learning management systems, teachers can track students' learning progress and participation in real-time, providing personalized feedback and guidance based on data analysis [3].

6. RESEARCH METHODOLOGY

6.1 Literature Review

This study systematically reviews relevant domestic and international literature to analyze the current application status of digital tools in automotive courses and the educational transformations they bring. the scope of the literature review includes the theoretical foundation of digital educational technology, its application in engineering education, and specific case analyses of various digital tools [4].

6.2 Expert Interviews

To gain an in-depth understanding of the practical needs for curriculum design innovation, this study conducted multiple expert interviews. the interviewees included educators in the automotive field and industry technology experts. the interview content covered the shortcomings of current curriculum design, the potential of new technologies in teaching, and the direction of future curriculum reforms. These interviews provided valuable first-hand information for the research [5].

6.3 Teaching Feedback Analysis

By observing and collecting data from actual classrooms that use digital tools for teaching, the study analyzes student feedback and learning outcomes. This research employs a combination of questionnaires and classroom observations to gather students' learning experiences and evaluations after participating in digital teaching. the feedback analysis results provide a basis for adjusting and optimizing curriculum design [6].

7. RESEARCH RESULTS AND DISCUSSION

7.1 Impact of Digital Tools on Student Learning Outcomes

The study shows that digital tools significantly enhance students' learning motivation and knowledge retention. In laboratory courses, students who practice with virtual reality and simulation software demonstrate higher hands-on skills and problem-solving abilities compared to traditional experiments. Data

analysis indicates that classes taught with digital tools have an average student grade increase of 15%, demonstrating the positive effects of digital tools in teaching [7].

7.2 Teaching Resource Sharing and Efficiency Improvement

Digital tools greatly facilitate the sharing and dissemination of teaching resources. Through online platforms, teachers can share educational materials, and students can access course resources from other institutions. This resource sharing improves teaching efficiency, allowing quality educational resources to be fully utilized. In terms of teaching efficiency, teachers can quickly update teaching content using digital tools, saving a significant amount of preparation time and allowing more focus on instructional design and student interaction [8].

7.3 Technical Skills Requirements for Teachers and Implementation Strategies

The effective application of digital tools imposes new requirements on teachers' technical skills. Teachers need to master basic skills in using tools such as virtual reality and simulation software, as well as the operation and management of online teaching platforms. This study suggests enhancing teachers' digital tool application capabilities through regular training. Additionally, establishing research teams to promote experience exchange and cooperation among teachers, thereby creating a supportive technical environment, is crucial for advancing digital curriculum design [9].

8. CONCLUSIONS

This study reveals the important role of digital tools in automotive curriculum design. the results show that digital tools not only improve student learning outcomes but also promote the update of teaching content and the enhancement of teaching efficiency. Furthermore, teachers' digital capabilities are a key factor in achieving curriculum design innovation. By reasonably designing and applying digital tools, automotive courses can better meet the needs of modern education [10].

Although this study provides some examples of the application of digital tools in automotive courses, there are still many areas worthy of further exploration. Future research could focus on larger-scale empirical studies to verify the long-term effects of digital tools. Additionally, exploring the application of more emerging technologies in education, such as artificial intelligence and blockchain technology, could provide more innovative ideas for digital curriculum design. Through continuous research and practice, the ongoing development of automotive education can be promoted, cultivating more outstanding talents for the industry [11].

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Research on the Collaborative Path of Shandong Merchant Culture and the Improvement of College Students' Ideological and Political Literacy

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Abstract: This research focuses on the collaborative path of Shandong Merchant Culture and the improvement of college students' ideological and political literacy. Firstly, it analyzes the connotation, characteristics and social influence of Shandong Merchant Culture, emphasizes the crucial significance of improving college students' ideological and political literacy, and deeply explores the value of the collaboration between the two. Through combing the research status of Shandong Merchant Culture at home and abroad, including the analysis of the achievements and deficiencies in aspects such as its history and commercial spirit, as well as summarizing the research progress related to the cultivation of college students' ideological and political literacy, it clarifies the deficiencies in the existing research on the collaboration between the two. It aims to lay a theoretical foundation for constructing an effective collaborative path of Shandong Merchant Culture and the improvement of college students' ideological and political literacy, thereby promoting the innovative development of ideological and political education in colleges and universities, and providing useful ideas and practical guidance for cultivating a new generation of college students with both good ideological and political literacy and the spiritual connotation of Shandong Merchant Culture.

Keywords: Shandong Merchant Culture; College Students; Ideological and Political Literacy; Collaborative Path; Education and Teaching

1. INTRODUCTION
1.1 Research Background and Significance

As an important branch of Qilu culture, Shandong Merchant Culture has gradually formed unique connotations and characteristics in its long historical development. With "benevolence, righteousness, propriety, wisdom, and faith" as its core values, it emphasizes business concepts such as honest operation, the balance of righteousness and profit, and charity. These concepts not only regulate the business behaviors of Shandong merchants but also have a profound impact on the moral fashion and value orientation of the entire society. Shandong Merchant Culture attaches great importance to family inheritance and teamwork. Through family ties and theindustrial organization of the Chamber of Commerce, it has condensed into a very large commercial force, which has played a very positive and important role in promoting economic construction and social stability. As the future pillars of society, it is of great significance to improve the ideological and political literacy of college students. In the context of globalization and informatization, with the surging of various ideological trends, college students are facing the impact of diverse cultures and values. Improving the ideological and political literacy of college students helps them to firmly adhere to the correct political direction, establish a scientific worldview, outlook on life, and values, and enhance their sense of social responsibility and mission. College students with good ideological and political literacy can better cope with the complex and changeable social environment. In their future careers, they can adhere to moral bottom lines, uphold the principle of integrity, and

contribute to the harmonious development of society.

The synergy between Shandong Merchant Culture and the improvement of college students' ideological and political literacy is of great significance and value. Shandong Merchant Culture provides rich local cultural resources for the ideological and political education of college students. Integrating elements such as integrity and justice from Shandong Merchant Culture into the content of ideological and political education can make the abstract ideological and political theories more vivid, closer to life, and enhance the appeal and attractiveness of education. By learning about the struggle and success experiences of entrepreneurs in Shandong Merchant Culture, college students can draw spiritual strength such as perseverance and innovation, stimulate their enthusiasm for learning and motivation for entrepreneurship, and cultivate good professional ethics and professional qualities. This synergy also helps to inherit and carry forward excellent traditional culture, promote the in - depth integration of local culture and higher education, enhance college students' sense of identity and pride in local culture, cultivate their cultural confidence, and lay a solid foundation for building a socialist cultural system with Chinese characteristics.

1.2 Review of Research Status at Home and Abroad

Scholars at home and abroad have achieved certain results in the research on Shandong Merchant Culture. In China, there are in - depth discussions on the historical origin, business spirit, and family inheritance of Shandong Merchant Culture. For example, some research has carefully sorted out the development context of Shandong merchants from ancient times to modern times, revealing their business characteristics and cultural connotations in different historical periods. Some scholars focus on the core business spirit of Shandong Merchant Culture, such as integrity and the concept of righteousness and profit, and analyze their manifestations and values in business practices. In terms of the family inheritance of Shandong merchants, there is also research on the important role of family systems, family instructions, and family rules in the sustainable development of

Shandong merchant enterprises. However, most of the existing research focuses on the excavation and collation of Shandong Merchant Culture itself, and there is relatively little research on how to combine Shandong Merchant Culture with modern education, especially the improvement of college students' ideological and political literacy, and there is a lack of systematic exploration of collaborative paths.

Abroad, research on Chinese regional business cultures mostly starts from perspectives such as cross - cultural communication and economic anthropology. Some research has noticed the potential contribution of Chinese traditional business culture to global business ethics, but the research on Shandong Merchant Culture, a specific regional business culture, is relatively weak, and it has not deeply involved the level of synergy with the ideological and political education of college students.

In terms of the cultivation of college students' ideological and political literacy, academic circles at home and abroad have extensive and in - depth research on the goals, contents, and methods of ideological and political education at the theoretical level. At the practical level, there are also many explorations on the curriculum reform of ideological and political education in colleges and universities and the innovation of practical activities, aiming to improve the effectiveness of ideological and political education. However, research on how to make full use of regional cultural resources, such as Shandong Merchant Culture, to enrich the connotation of college students' ideological and political education and innovate educational forms needs to be further strengthened. There is a lack of in - depth research on accurately connecting the characteristic elements of Shandong Merchant Culture with the needs of improving college students' ideological and political literacy.

1.3 Research Methods and Innovation Points

This research comprehensively uses a variety of research methods. the literature research method is the foundation. By extensively consulting academic literatures, historical materials, policy documents, etc. at home and abroad on Shandong Merchant Culture and the cultivation of college students' ideological and political literacy, it sorts out the existing

research results and deficiencies, providing theoretical support and research ideas for this study. the theoretical analysis method uses theories such as ideological and political education theory and culturology theory to deeply analyze the internal connection and synergy mechanism between Shandong Merchant Culture and the improvement of college students' ideological and political literacy, and constructs a theoretical framework. the case - analysis method selects cases such as the operation of Shandong merchant enterprises and the deeds of Shandong merchant figures, and integrates them into the analysis of college students' ideological and political education, enhancing the practicality and persuasiveness of the research.

The innovation points of this research are mainly reflected in the following aspects. the research perspective is unique. By connecting Shandong Merchant Culture with the improvement of college students' ideological and political literacy, it explores a new path for the ideological and political education of college students from the perspective of regional business culture, enriching the research perspective of college students' ideological and political education. the collaborative path is innovative. It proposes to construct a multi - dimensional collaborative path for Shandong Merchant Culture and the improvement of college students' ideological and political literacy, such as curriculum synergy, practice synergy, and cultural synergy, providing new ideas and methods for the ideological and political education practice in colleges and universities. It focuses on the integration of cultural inheritance and educational innovation. While inheriting Shandong Merchant Culture, it innovates the ideological and political education model of college students, promotes the organic combination of local culture and higher education, and enhances college students' cultural confidence and ideological and political literacy.

2. THE CONNOTATION OF SHANDONG MERCHANT CULTURE AND ITS IDEOLOGICAL AND POLITICAL EDUCATION VALUE

2.1 Analysis of the Connotation of

Shandong Merchant Culture
Shandong Merchant Culture is rooted in Confucianism, and its core values of "benevolence, righteousness, propriety, wisdom, and faith" run through business activities. "Benevolence" is reflected in the care and responsibility of Shandong merchants for society and others. In business operations, it is manifested as respecting customers, caring for employees, and being enthusiastic about public welfare. For example, in the past, many Shandong merchants actively provided porridge to relieve disasters and helped refugees in times of famine, practicing the concept of "benevolent people love others" with practical actions. "Righteousness" requires Shandong merchants to adhere to morality, follow the principle of justice in the face of interests, not seek ill - gotten gains, uphold the business principles of fair trade and honesty to all, and seek profit with righteousness, unifying business interests with social morality. "Propriety" emphasizes the etiquette norms and order in business interactions. When communicating with partners and customers, Shandong merchants follow the principles of being humble, polite, and respectful of others. Through a good etiquette image and standardized business etiquette, they establish harmonious and stable business relationships. "Wisdom" emphasizes that Shandong merchants have keen business insights, innovative spirit, and business wisdom. They can accurately seize market opportunities, are good at using wisdom to solve various problems in business operations, and continuously innovate business models and operating strategies to promote business development. "Faith" is one of the core elements of Shandong Merchant Culture, meaning being honest and trustworthy, keeping one's promise. Shandong merchants attach great importance to reputation in business activities, strictly fulfill contract agreements, and win the trust and recognition of customers and partners with integrity.

The business concepts and business ethics of Shandong merchants are also unique. Shandong merchants pay attention to family inheritance and teamwork. Family members trust and support each other, forming a close business community. At the same time,

Shandong merchants attach importance to the role of the chamber of commerce organization. Through the chamber of commerce, they strengthen exchanges and cooperation among peers, jointly formulate industry norms and self - discipline guidelines, and maintain market order. In terms of business ethics, Shandong merchants emphasize self - discipline and self - reflection, adhere to moral bottom lines, and oppose bad business behaviors such as fraud and counterfeiting. They regard business ethics as the cornerstone of the long - term development of enterprises, believing that only by upholding good business ethics can they win social reputation and achieve sustainable development.

2.2 Exploration of Ideological and Political Education Resources in Shandong Merchant Culture

Shandong Merchant Culture contains rich resources for patriotism education. In history, many Shandong merchants actively participated in the wave of national salvation when the country was in crisis. For example, during the Anti - Japanese War, some Shandong merchant enterprises donated money and materials to support the front line of the war, and even directly participated in work such as military production and material transportation, contributing to the defense of national territorial integrity and national dignity. This strong patriotic sentiment and sense of social responsibility can stimulate the patriotic enthusiasm of college students, enabling them to deeply understand the close connection between personal fate and national fate, and thus consciously establish the ideal and belief of striving for the prosperity and strength of the country.

The spirit of collectivism is also deeply reflected in Shandong Merchant Culture. Shandong merchants attach importance to family cohesion and teamwork. Family members work together and support each other for common business goals. At the same time, through formulating industry regulations and agreements, the chamber of commerce organizations of Shandong merchants coordinate the interests of peers and promote the common development of the entire business group. This spirit of collectivism helps to cultivate the teamwork awareness and collective sense of honor of college students, enabling them to correctly handle the relationships between individuals and the collective, and between individuals and others in their studies and future work. They can learn to give full play to their personal advantages in the collective and strive to achieve collective goals.

The concept of honest operation in Shandong Merchant Culture is a valuable resource for professional ethics education. Shandong merchants take integrity as the foundation, regard reputation as the life of business, and strictly abide by the spirit of contract in business activities, ensuring product quality and service quality. For example, the Ruifuxiang Silk Store in history won the trust and praise of a large number of customers with its exquisite craftsmanship, high - quality products, and honest business style, and has endured for a hundred years. By learning the stories of Shandong merchants' honest operation, college students can deeply understand the importance of professional ethics, establish an awareness of integrity, and in their future careers, adhere to the bottom line of professional ethics, and be honest, trustworthy, dedicated, and committed.

3. THE CURRENT SITUATION OF COLLEGE STUDENTS' IDEOLOGICAL AND POLITICAL LITERACY AND ITS CORRELATION WITH SHANDONG MERCHANT CULTURE

3.1 Investigation and Analysis of the Current Situation of College Students' Ideological and Political Literacy

In order to deeply understand the current situation of college students' ideological and political literacy, this research adopts methods such as questionnaire surveys and interviews, and conducts investigations from multiple dimensions such as political concepts, ideological and moral aspects, and legal awareness.

In terms of political concepts, most college students have relatively firm political stances, are full of confidence in the path, theory, system, and culture of socialism with Chinese characteristics, and can actively learn the Party's line, principles, and policies. However, there are still some students who do not have a thorough understanding of some deep-seated political theoretical issues. When facing

complex international political situations and the impact of diverse cultures, they are prone to confusion and vacillation. For example, in terms of the understanding and practice of the core socialist values, most students can know their content, but in specific life practices, some students cannot fully translate them into actual actions, and there is a phenomenon of "knowing but not doing".

At the ideological and moral level, college students generally have basic moral cognition, and good virtues such as respecting others and being helpful are manifested in most students. However, there are also some problems in moral practice. For example, individualistic tendencies have emerged. When collective interests conflict with personal interests, some students are more inclined to safeguard personal interests; the awareness of integrity must be strengthened. Bad behaviors that violate the principle of integrity, such as cheating in exams and academic imitation, often occur. Just like legal awareness, college students should have a certain understanding of laws and regulations, but there are still some shortcomings that need to be corrected in using legal knowledge to protect their own rights and interests and consciously maintain legal norms. Some students lack the awareness and ability to use legal weapons to solve problems when encountering infringement behaviors; some students have a fluke mentality and do not take some minor illegal acts seriously.

Generally speaking, the ideological and political literacy of college students shows a positive trend, but there are also some problems that cannot be ignored. the emergence of these problems is closely related to many aspects such as the social environment, family background, school education, and students' own factors. the value diversity in the social transformation period, the erosion of harmful online information, the lack or improper family education, the need to improve the effectiveness of school ideological and political education, and the insufficient self-restraint and self-education ability of students all affect the improvement of college students' ideological and political literacy to a certain extent. As a regional culture with profound heritage and rich connotations, Shandong Merchant Culture contains spiritual elements such as integrity, the concept of righteousness and profit, and collectivism, which have a close internal connection with the improvement of college students' ideological and political literacy. By integrating Shandong Merchant Culture into the ideological and political education of college students, it can provide useful ideas and methods for solving the current problems of college students' ideological and political literacy and promote the all-round improvement of college students in political concepts, ideological and moral aspects, and legal awareness.

3.2 The Convergence Points between Shandong Merchant Culture and the Improvement of College Students' Ideological and Political Literacy

There are multiple convergence points between the spiritual connotations of Shandong Merchant Culture and the needs of improving college students' ideological and political literacy.

In terms of integrity and moral cultivation, Shandong Merchant Culture attaches great importance to integrity and regards it as the cornerstone of commercial activities. Shandong merchants always adhere to the principle of honesty and trustworthiness in business operations. Whether it is the control of commodity quality or the performance of commercial contracts, integrity is the top priority. This spiritual quality of integrity is highly the same as the moral quality requirements in the ideological and political literacy of college students. College students need to adhere to the principle of integrity and sincerity in academic research, and must avoid behaviors that violate academic ethics, such as plagiarism and cheating. They also need to take integrity as the basis for interpersonal relationships and establish good interpersonal relationships. Learning the integrity culture of Shandong merchants helps college students internalize the concept of integrity into their own moral norms, adhere to moral bottom lines in daily life and future career development, and become noble-minded social citizens.

From the perspective of innovative spirit and the sense of responsibility in the era, Shandong Merchant Culture contains rich innovative spirit. Historically, Shandong

merchants were able to keenly perceive market changes, continuously innovate business models and operating strategies, and actively explore new business fields. In today's era, innovation is the core driving force for social development. College students, as the future builders of society, need to have a strong innovative spirit and a sense of responsibility in the era. the innovative practices of Shandong merchants provide vivid learning examples for college students, inspiring them to bravely explore unknown fields, dare to break through traditional thinking patterns, actively participate in innovation and entrepreneurship practices, contribute their wisdom and strength to solving various problems in social development, and take on the heavy responsibility of promoting social progress in the wave of the era.

4. THE THEORETICAL BASIS AND PRINCIPLES OF THE CONSTRUCTION OF THE COLLABORATIVE PATH

4.1 Theoretical Basis

The Marxist view of culture provides a solid theoretical foundation for the construction of the collaborative path between Shandong Merchant Culture and the improvement of college students' ideological and political literacy. Marxism believes that culture is a unique phenomenon of human society, a product of human social practice, and has distinct historical and social characteristics. As a commercial culture in a specific region and historical period, the formation and development of Shandong Merchant Culture is the result of the interaction of Shandong merchant groups with social, economic, political and other factors in long-term commercial practice activities. Marxism especially emphasizes that culture has a positive and reverse effect on social existence, and advanced cultural traditions can promote the development and common progress of society. the excellent elements such as integrity, the concept of righteousness and profit, the innovative spirit contained in Lushang culture plays a very positive role in promoting the economic construction, moral construction and cultural inheritance of contemporary society. Integrating these necessary elements into the ideological and political education of college students can not only enrich the educational content, but also improve the ideological and political literacy of college students, and then cultivate high-quality and highly educated talents with good moral qualities and innovative ability for the society. promoting the harmonious development of society. the Marxist view of culture advocates the critical inheritance and innovative development of culture. When constructing the collaborative path, the essence of Shandong Merchant Culture should be critically inherited, its historical limitations should be discarded, and in combination with the needs of the era and the characteristics of college students, Shandong Merchant Culture should be innovatively transformed to make it fit with modern ideological and political education and provide a continuous driving force for the improvement of college students' ideological and political literacy.

The theory of ideological and political education is also an important theoretical basis for the construction of the collaborative path. the goal of ideological and political education is to cultivate socialist builders and successors with correct political directions, good moral qualities, and high scientific and cultural qualities. the spiritual connotations such as patriotism, collectivism, and honest operation in Shandong Merchant Culture are highly consistent with the goals of ideological and political education. By integrating Shandong Merchant Culture into the process of ideological and political education, the educational goals can be made more specific and vivid, and the sense of identity and acceptance of college students for the educational goals can be enhanced. the content of ideological and political education includes ideological education, political education, moral education, legal education and other aspects. Shandong Merchant Culture provides rich materials and cases for these educational contents. For example, the deeds of Shandong merchants in complying with laws and regulations and adhering to moral ethics in commercial activities can be used for legal education and moral education; the patriotic actions of Shandong merchants in times of national crisis can be used for patriotic education and political education. Ideological and political education emphasizes the

diversity and flexibility of educational methods. In the construction of the collaborative path, the methods of ideological and political education can be borrowed, such as the method of theoretical indoctrination, the method of practical exercise, the method of example demonstration, etc., combine the learning and practice of Shandong Merchant Culture, and improve the effectiveness of ideological and political education through various forms such as telling the stories of Shandong merchants, visiting Shandong merchant enterprises, and carrying out theme activities of Shandong Merchant Culture.

4.2 Construction Principles

Scientific principle: the construction of the collaborative path ensures that it follows scientific theories, education and teaching rules and student growth rules. When integrating Shandong merchant culture into the ideological and political education of college students, we must ensure that the selected Shandong merchant culture content must be true, accurate and representative. and can scientifically reflect its cultural connotations and values. For example, when using Shandong Merchant cases for teaching, in-depth analysis and scientific interpretation of the cases are required to enable college students to correctly understand the ideological and political education elements contained therein and avoid one-sided or incorrect guidance.

Systematic Principle: Regard the improvement of college students' ideological and political literacy with Shandong Merchant Culture as an organic whole system, and pay attention to the interconnection and interaction between various elements. Systematic design and planning should be carried out from educational goals, educational contents, educational methods to educational evaluations. It is necessary to consider the systematic integration of Shandong Merchant Culture in ideological and political theory courses, as well as plan its systematic deployment in practical teaching, campus culture construction, etc., to form a comprehensive and multi-level collaborative education system, so that Shandong Merchant Culture can play a systematic role in the process of improving college students' ideological and political literacy.

Practical Principle: Emphasize the importance of practice in the collaborative path. On the one hand, practical activities should be carried out to enable college students to deeply understand Shandong Merchant Culture, such as organizing students to visit Shandong merchant enterprises and participate in Shandong Merchant Culture research, so that they can personally experience the charm and value of Shandong Merchant Culture in practice; on the other hand, guide college students to apply the spiritual qualities and values learned from Shandong Merchant Culture to real life, and improve their ideological and political literacy through practical exercises, such as encouraging students to practice the spirit of integrity, innovation and teamwork of Shandong merchants in entrepreneurship practice or club activities.

Innovative Principle: Be brave in innovation in the construction of the collaborative path and break free from the shackles of traditional ideological and political education models. Innovate the presentation forms and dissemination methods of Shandong Merchant Culture. For example, use new media technology to produce short videos and animations of Shandong Merchant Culture to attract the attention and interest of college students; innovate educational and teaching methods, such as using situational teaching methods and project-based learning methods, skillfully integrate Shandong Merchant Culture with the content of ideological and political education, stimulate students' learning initiative and creativity, and make the collaborative education of Shandong Merchant Culture and the improvement of college students' ideological and political literacy more in line with the times and attractive.

5. THE COLLABORATIVE PATH OF SHANDONG MERCHANT CULTURE AND THE IMPROVEMENT OF COLLEGE STUDENTS' IDEOLOGICAL AND POLITICAL LITERACY

5.1 The Path of Integration in Education and Teaching

In the teaching of ideological and political theory courses in colleges and universities, classic cases of Shandong Merchant Culture

can be skillfully integrated into the teaching content. For example, when teaching about honest operation, the story of Ruifuxiang Silk Store can be introduced. Ruifuxiang has endured for a hundred years with its strict control of product quality and honesty and trustworthiness to customers. Teachers can elaborate in detail how it adheres to the principle of integrity in aspects such as material selection, production process, and sales service. For example, in the face of the impact of counterfeit and shoddy products in the market, Ruifuxiang has always remained unmoved, insisting on using high-quality raw materials and ensuring that each silk product meets high-quality standards; in the sales process, it truthfully introduces the characteristics of the product to customers, does not exaggerate, and the after-sales service is also consistent, winning the high trust of customers. Through such case analysis, guide students to deeply think about the importance of integrity in commercial activities and even personal growth, let students understand that integrity is the foundation of being a person and starting a career, and thus consciously practice the concept of integrity in their own studies and future career development.

In the course of "Ideological and Moral Cultivation and Legal Basis", when explaining the part of professional ethics, the business deeds of Meng Luochuan, a Shandong merchant, can be introduced. Meng Luochuan paid great attention to business ethics in the operation process. He formulated strict store regulations, requiring employees to be warm, attentive, polite and humble to customers and not to deceive customers. He himself also set an example, often personally checking the quality of goods to ensure that the sold goods are genuine and of good quality. At the same time, he actively participated in social public welfare undertakings. In years of famine, he actively opened granaries to distribute food and relieve the victims. Through the explanation of Meng Luochuan's deeds, let students deeply understand that professional ethics not only includes dedication to work and proficiency in business, but also includes social responsibility and care for others, and then cultivate students' awareness of adhering to moral bottom lines and maintaining good

professional ethics in future careers.

For professional course teaching, taking the economics major as an example, the business models and strategies of Shandong merchants can be analyzed in the commercial economics course. For example, when explaining the family business model of Shandong merchants, elaborate on how family members in the enterprise divide labor and cooperate and how to through family culture to achieve the stable development of the enterprise. At the same time, compare with the modern enterprise system and discuss the advantages and limitations of the family business model in the modern market environment, and guide students to think about how to innovate and change on the basis of inheriting excellent traditional culture. In the marketing course, study the marketing strategies of Shandong merchants. For example, Shandong merchants pay attention to word-of-mouth marketing and win customers' word-of-mouth through providing high-quality products and services. Taking an old and famous Shandong merchant pharmacy as an example, it has accumulated extremely high reputation in the local area with its exquisite medical skills, genuine medicinal materials and warm service. Customers come not only from the local area but also from surrounding areas. Teachers can guide students to analyze the principles behind this word-of-mouth marketing, such such as meeting customer needs and focusing on customer experience, and let students combine these traditional marketing wisdoms with modern marketing theories to improve their professional qualities and innovative abilities.

5.2 The Path of Infiltration in Campus Culture Construction

Cultural activities of college students on campus are an important carrier for penetrating many Shandong business cultures and improving the ideological and political literacy of college students. Schools can hold Shandong Merchant Culture Festivals. During the festival, carry out theme exhibitions of Shandong Merchant Culture, showing the development process, business achievements, cultural characteristics, etc. of Shandong merchants in the form of pictures, words, and objects, allowing students to intuitively feel the charm of Shandong Merchant Culture. Hold lectures on Shandong Merchant Culture,

invite Shandong merchant entrepreneurs, experts and scholars, etc. to talk about the business concepts, business ethics, innovative spirit, etc. of Shandong merchants, so that students can deeply understand the connotations of Shandong Merchant Culture. For example, invite the founder of a well-known Shandong merchant enterprise to share his entrepreneurial process, from starting from scratch to gradually growing and developing, how to adhere to the principle of integrity in this process, how to deal with various difficulties and challenges, and the thinking on the inheritance and innovation of Shandong Merchant Culture, allowing students to absorb wisdom and strength while listening. Organize activities such as knowledge contests, essay contests, and speech contests of Shandong Merchant Culture, stimulate students' enthusiasm and initiative in learning Shandong Merchant Culture, guide students to deeply think about the relationship between Shandong Merchant Culture and the improvement of ideological and political literacy, and enhance their own ideological and political literacy in the process of participating in activities.

The creation of cultural atmosphere is also an important aspect of campus culture construction. Schools can build a Shandong Merchant Culture Corridor, showing the famous sayings, business stories, biographies, etc. of Shandong merchants in the corridor, allowing students to be subtly influenced by Shandong Merchant Culture in their daily study and life. For example, show the honest operation story of "Ruifuxiang" and the business wisdom of "Meng Luochuan" in the cultural corridor, accompanied by beautiful pictures and concise text explanations, so that students can stop and watch, think and feel when strolling in the corridor in their spare time. the Shandong merchant cultural landscape is placed on campus, just like the Shandong merchant sculpture and the Shandong merchant cultural wall. Students enhance the Shandong merchant cultural inheritance of campus literature and art, creating many unique and strong Shandong merchant cultural atmosphere, so that Shandong students can be influenced and inspired by Shandong merchant culture from the beginning, and then implicitly improve

their ideological and political literacy.

5.3 The Path of Social Practice Experience

Organizing college students to participate in the practice of Shandong merchant enterprises is an effective way to understand Shandong Merchant Culture and improve ideological and political literacy. Schools can establish long-term and stable cooperative relationships with Shandong merchant enterprises and regularly arrange students to intern in enterprises. During the internship process, students can deeply understand the business management models, corporate culture construction, and professional quality requirements of employees of Shandong merchant enterprises. For example, students interning in a Shandong merchant manufacturing enterprise can personally experience the whole process of the enterprise from raw material procurement, production and processing to product sales, feel the strict control of product quality and the persistent pursuit of honest operation of the enterprise. the standardized management system within the enterprise, the good cooperation atmosphere among employees, and the active fulfillment of social responsibilities can all make students deeply understand the connotations of Shandong Merchant Culture. Through the exchange and interaction with enterprise employees, students can also learn the Shandong Merchant Spirit embodied in them, such as diligence, dedication, and innovation, and thus continuously improve their ideological and political literacy in practice and enhance their confidence and sense of responsibility for future career development.

Social research activities are also an important form of social practice. Students can carry out research on topics such as the inheritance and development of Shandong Merchant Culture and the social impact of Shandong merchant enterprises. For example, conduct research on the survival and development status of old and famous Shandong merchant enterprises in the modern market environment. Students can understand the practical experience of these old and famous enterprises in inheriting traditional techniques and culture and actively adapting to market changes and innovating business models by visiting local old and famous Shandong merchant shops and having

in-depth exchanges with enterprise operators and customers. In the research process, students can not only improve their social survey ability and data analysis ability, but also deeply understand the important value of Shandong Merchant Culture in contemporary social and economic development, stimulate their sense of mission to inherit and carry forward excellent traditional culture, and further improve the social responsibility and sense of responsibility in ideological and political literacy.

6. GUARANTEE MECHANISMS FOR THE IMPLEMENTATION OF THE COLLABORATIVE PATH

6.1 Organizational Guarantee

Colleges and universities should establish a specialized leading group for the collaborative Businessman culture in Shandong and the ideological and political education of college students. the leader of the party committee of the whole school is the class leader, and the members are the heads of the Propaganda Department, the Student Work Department, the Academic Affairs Office, the League Committee and the relevant colleges. the leading group is responsible for checking the relevant planning, coordinating and directing the development of various collaborative tasks, and selecting a set of suitable policies and systems to ensure that Shandong Entrepreneurial Culture is effectively and aligned in many aspects of ideological and political theory courses, campus cultural construction and social practice. It is stipulated that several working meetings will be held a month to discuss and solve many difficulties arising in the process of collaboration, evaluate the effectiveness of collaboration, and quickly adjust the work strategy and direction. Just like, when stipulating the implementation of the ideological and political education work plan for each semester, the leadership team must fully consider all the methods of Lushang cultural elements and the arrangement of all key activities, especially the allocation of teaching resources, teacher training, student organisation and other aspects to coordinate the work of various departments, so as to form a grasp and control together. the working scene ofShandong merchant enterprises

should set up specialized education cooperation departments or positions, responsible for the connection and cooperation with colleges and universities. The staff of this position must have certain educational concepts and cultural literacy, understand the necessities and achievements of the school's ideological and political education, and can help the school effectively combine the Shandong business cultural resources of enterprises with the education and teaching of colleges and universities. Their work content includes the student internship practice exercise plan created with the school, which is to exercise the social ability of students and the knowledge and internship guidance that cannot be learned in the school; participating in the design and teaching of the school's Shandong business culture-related courses, just like allowing enterprise executives or senior employees to serve as part-time lecturers; Carry out Shandong business culture research activities in colleges and universities together, and provide enterprise cases and data and other work. For example, the education cooperation department of a Shandong merchant enterprise cooperated with a local college to develop a personalized internship plan for marketing majors. Students were arranged to rotate and intern in different departments such as the marketing department and the sales department of the enterprise. At the same time, during the internship process, the enterprise's marketing strategies and cultural concepts were explained to the students, enabling them to deeply understand the integration and application of Shandong Merchant Culture and professional knowledge in practice.

Social organizations such as chambers of commerce and cultural research institutions should actively play the role of a bridge and link, and establish a communication and cooperation platform between colleges and universities and Shandong merchant enterprises. the chamber of commerce can organize member enterprises to carry out exchange activities with colleges and universities, promoting the sharing of resources between the two sides and the achievement of cooperation intentions; cultural research institutions can provide colleges and universities with research results

and materials on Shandong Merchant Culture, assist colleges and universities in carrying out relevant teaching and research work, and at the same time provide cultural consultation and training services for enterprises, enhancing the cultural connotation and educational awareness of enterprises. For example, a Shandong Merchant Culture research institution regularly holds Shandong Merchant Culture seminars, inviting college teachers, students, and enterprise representatives to participate, jointly exploring the inheritance and innovation of Shandong Merchant Culture and its application in the ideological and political education of college students. This provides a platform for in - depth communication and cooperation among the three parties, promoting the in - depth development of collaborative work.

6.2 Teacher Guarantee

Colleges and universities must complete the teacher training mechanism, and always remind teachers to participate in Shandong business culture special training activities. the training content can include knowledge lectures, academic seminars, and field trips on aspects such as the historical origin, core connotation, business spirit of Shandong Merchant Culture, and its value and application in contemporary society. For example, invite experts in Shandong Merchant Culture research to conduct systematic theoretical explanations for teachers, and organize teachers to visit Shandong Merchant museums, Shandong merchant enterprises, etc., allowing teachers to personally experience the charm and heritage of Shandong Merchant Culture, thus deepening their understanding and awareness of Shandong Merchant Culture and improving their own Shandong Merchant Culture literacy. At the same time, it is necessary to strengthen the training of teachers' ideological and political education capabilities. Through activities such as ideological and political education theory learning, teaching method seminars, and teaching case analysis, improve teachers' teaching ability to organically integrate ideological and political education with Shandong Merchant Culture. For example, organize teachers to participate in seminars on the curriculum design and teaching method innovation of ideological and political education, encourage teachers to skillfully apply Shandong Merchant Culture cases to the teaching of ideological and political theory courses, and use teaching methods such as heuristic, discussion - based, and case - based teaching to guide students to deeply think about the ideological and political education elements contained in Shandong Merchant Culture, improve students' learning interest and participation, and enhance the effectiveness of ideological and political education.

Teachers themselves should also take the initiative to improve their comprehensive qualities. Teachers should establish the concept of lifelong learning, constantly study and research the cutting - edge theories and practical achievements of Shandong Merchant Culture and ideological and political education, and enrich their knowledge reserves. In the teaching process, teachers should pay attention to teaching reflection, timely summarize teaching experience, improve teaching methods, and improve teaching quality. For example, after the teaching of each semester, teachers conduct a comprehensive reflection on the selection of teaching content, the application of teaching methods, and students' feedback in the integration of Shandong Merchant Culture into ideological and political education teaching, find out the existing problems and deficiencies, and formulate corresponding improvement measures, so as to better guide students and improve students' ideological and political literacy in subsequent teaching.

6.3 Evaluation Guarantee

Establishing a scientific evaluation index system must be a key factor for students to evaluate and feedback the implementation effect of the path of collaborative education and the improvement of college students' ideology and political literacy.

For the evaluation of the integration path of education and teaching, the depth and breadth of the integration of Shandong Merchant Culture into ideological and political theory courses and professional courses should be emphasized. In terms of ideological and political theory courses, it can be evaluated from dimensions such as the degree of achievement of teaching objectives, the

application effect of Shandong Merchant Culture cases, and students' understanding and acceptance of ideological and political education elements such as integrity and the concept of righteousness and profit. For example, through classroom observation of students' participation, the completion of after - class assignments, and the scores of relevant knowledge points in periodic exams, comprehensively judge students' mastery of the ideological and political education value contained in Shandong Merchant Culture. For professional course teaching, the evaluation indicators can include the promoting effect of the teaching of Shandong merchant business models and strategies on the improvement of students' professional qualities, and students' application ability of Shandong Merchant Culture in business practice. For example, examine whether economics majors can use the analysis framework of the advantages and disadvantages of the family - style business model of Shandong merchants when analyzing business cases, and whether marketing majors can integrate the word - of - mouth marketing concept of Shandong merchants into the design of actual marketing plans, so as to measure the integration effect of Shandong Merchant Culture and professional education in professional course teaching.

The evaluation of the infiltration path of campus culture construction focuses on the participation rate of campus cultural activities and the influence of the cultural atmosphere creation. For activities such as the Shandong Merchant Culture Festival, lectures, and competitions, the proportion of participating students, the results of activity satisfaction surveys, and the degree of change in students' ideological cognition and behavior habits can be counted. For example, by comparing the changes in students' understanding of Shandong Merchant Culture and their degree of identification with values such as integrity and innovation before and after participating in the Shandong Merchant Culture Festival, evaluate the educational effect of the activity. For cultural landscapes such as the Shandong Merchant Culture Corridor and sculptures, it can be evaluated from aspects such as students' attention, the time they stop and stay, and their daily behavior under the influence of

the relevant cultural atmosphere. For example, observe whether students consciously abide by civilized etiquette near the Shandong Merchant Culture Wall and whether they actively discuss Shandong Merchant Culture stories, etc., so as to judge the subtle influence of the cultural atmosphere on students' ideological and political literacy.

The evaluation of the social practice experience path focuses on the gains and growth of students in the internship and practice in Shandong merchant enterprises and social research. In terms of enterprise internships, the evaluation indicators can cover the depth of students' understanding of the business management model and corporate culture of Shandong merchant enterprises, the improvement of their professional qualities, and the clarity of their future career plans. For example, through the quality of internship reports, the evaluation of students' internship performance by enterprises, and the career intention survey of students after the internship, comprehensively consider the impact of internship practice on students' ideological and political literacy and career development. For social research activities, it can be evaluated from aspects such as the rationality of the research plan, the accuracy of research data, the depth of the research report, and the degree of enhancement of students' sense of social responsibility and sense of mission during the research process. Just like, checking school students can deeply analyse the problems faced by the development of the old Shandong East and West brand and put forward similar constructive suggestions, so that they can almost evaluate whether social research activities are effective in promoting students' ideological and political quality. l

iteracy. Based on the evaluation results, timely identify the problems and deficiencies in the implementation process of the collaborative path, providing a strong basis and direction for further optimizing the collaborative path and improving the ideological and political literacy of college students. For example, if the evaluation finds that the cases in the integration teaching of Shandong Merchant Culture in a certain professional course are outdated and students' interest is low, it is necessary to update the cases and innovate

teaching methods in a timely manner; if the participation rate in campus cultural activities is low, it may be necessary to adjust the activity forms and increase the publicity efforts; if students' professional qualities do not improve significantly during the enterprise internship practice, it is necessary to further improve the internship plan and strengthen enterprise guidance, etc., thus forming a virtuous cycle of continuous improvement and perfection, ensuring that the collaborative education effect of Shandong Merchant Culture and the improvement of college students' ideological and political literacy is continuously enhanced.

7. CONCLUSION

Through the analysis of the connotation of Shandong Merchant Culture, the specific manifestations of its core values of "benevolence, righteousness, propriety, wisdom, and faith" rooted in Confucianism in commercial activities, as well as the unique business concepts and business ethics of Shandong merchants, have been clarified. Abundant ideological and political education resources contained in Shandong Merchant Culture have been explored, including patriotism, the spirit of collectivism, and the concept of honest operation. These resources provide vivid and local - characteristic materials for the ideological and political education of college students.

Based on the investigation and analysis of the current situation of college students' ideological and political literacy, the problems existing in college students' political concepts, ideological and moral aspects, and legal awareness have been revealed. It has been pointed out that there are multiple convergence points between Shandong Merchant Culture and the improvement of college students' ideological and political literacy, such as integrity and moral cultivation, innovative spirit and the sense of responsibility in the era, which provide practical and theoretical support for the construction of the collaborative path.

Under the influence of Marxist cultural outlook and ideological and political education theory and the guidance of Marxism, we must abide by all the principles of scientific, systematic, practical and innovative.

At the same time, we must establish a new platform and a new path to improve Shandong business culture and the ideological and political literacy of college students to discover common progress together. In terms of the path of integration in education and teaching, classic cases of Shandong Merchant Culture are integrated into the teaching of ideological and political theory courses and professional courses. In the path of infiltration in campus culture construction, a strong Shandong Merchant Culture atmosphere is created by holding Shandong Merchant Culture festivals, building cultural corridors, etc. In the path of social practice experience, students are organized to participate in internships in Shandong merchant enterprises and social research activities.

In order to ensure the effective, stable and active promotion of this cooperation path, a complete action promotion mechanism is also provided, including organisational guarantee, teacher guarantee and evaluation guarantee. Universities, Shandong commercial enterprises and social organisations work together to build a first-class team and integrate Shandong business culture into the ideological and political education of college students. Through the training and self-improvement of many teachers in the school, the Shandong business culture literacy and teaching ability of the school teachers are improved. Establish a scientific and reasonable evaluation index system, conduct a comprehensive evaluation and comprehensive feedback on the effect of the implementation of the cooperation path and the improvement of the ideological and political literacy of college students, and continuously optimise the cooperative education system according to the results.

This research not only greatly enriches the theory and practice of ideological and political education of college students, but also provides new perspectives and action measures for ideological and political education in colleges and universities, and also opens up a new path for the inheritance and promotion of enterprise culture in Shandong. It is conducive to better cultivating a new generation of excellent young college students with good ideological and political literacy and cultural self-confidence, and to

promote the deep integration and cooperation of local culture and higher education.

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The Relationship Between Urban Space and Social Transformation in Literary Works

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Abstract: This paper examines the relationship between the literary representation of urban spaces and social transformation, focusing on how literary narratives reflect and engage with power structures, social relations, and cultural changes in the process of urbanization. Employing a combined approach of close textual analysis and interdisciplinary theories, the study integrates perspectives from literary geography, sociology, and cultural studies to construct an analytical framework for understanding the interaction between literature and urban space. By reviewing the characteristics of urban space depictions in literary works across different periods, the research reveals how changes in urban spatial forms mirror transformations in social structures. Additionally, it explores authors' cultural imaginings and value judgments of urban spaces within specific historical contexts, addressing issues such as social inequality, class stratification, and cultural identity in urbanization. The findings demonstrate that literary works not only serve as mediums for documenting urban transformations but also act as cultural spheres for reflecting and reconstructing social conflicts. Through diverse narrative strategies, literary depictions across historical periods shape complex understandings of specific urban spaces and their social implications, offering a new perspective on the social dynamics and cultural practices of urbanization. This study contributes to a deeper understanding of the relationship between literary texts and social realities while providing theoretical insights for contemporary urban studies and cultural criticism.

Keywords: Literary works; Urban space; Social transformation; Cultural criticism; Literary geography

1. INTRODUCTION

1.1 Research Background and Significance

With accelerated globalization and urbanization, cities have evolved not only as hubs of economic and political activity but also as significant subjects of cultural narratives. Literary works, by depicting urban spaces and their transformations, vividly document and reconstruct the evolution of social structures and cultural consciousness. Urban space is not merely a physical entity but a product of interactions between social relations and power structures. In literary creation, cities are imbued with profound social and cultural meanings, serving as critical references for understanding societal changes. Exploring urban space in literature allows us to delve into issues such as power dynamics, social stratification, and cultural identity within urbanization processes, offering an interdisciplinary perspective for urban studies and literary criticism.

China's rapid urbanization has brought topics like urban-rural relations, spatial planning, and cultural identity into academic focus. Literature, as an important medium for observing and portraying social realities, reflects individuals' and communities' social practices and spiritual struggles during urbanization. Such research reveals not only how literary texts engage with social realities but also provides deeper insights into cultural adaptation during societal transformations.

1.2 Literature Review

In international studies, scholars have long examined the impact of urbanization on literature. Henri Lefebvre proposed that urban space comprises not only physical but also social and psychological dimensions, with his "production of space" theory forming a foundational framework for urban literary studies [1]. Raymond Williams analyzed British literature in the context of industrialization, demonstrating how literature

addresses urban-rural relations and modernization. David Harvey, from a geographical perspective, explored the logic of capital and the reproduction of urban space in literary narratives [2].

In China, studies on urban space in literature began in the 1980s and increased with the acceleration of modernization and urbanization. Scholars analyze urban space's social attributes from the perspective of national literature. For instance, Chen Sihe argued that urban narratives in 20th-century Chinese literature are cultural reflections of modernization [3]. Others, like Huang Ziping, focused on the relationship between urban space, memory, and identity, such as in his analysis of colonial modernity in Eileen Chang's portrayal of Shanghai's concession spaces [4]. However, existing research often centers on specific authors or works, lacking a comprehensive exploration of the relationship between urban space and societal change in literature.

1.3 Research Objectives and Questions

This study aims to investigate the intrinsic relationship between urban space and societal transformation in literary works. It seeks to analyze how literature reflects societal structures and cultural ideologies through urban space narratives and to uncover how literary texts respond to and critique social inequalities, class divisions, and individual struggles during urbanization. The research addresses the following questions:

- How do literary narratives construct the cultural meanings of urban space?
- How do representations of urban space across different periods reflect societal changes?
- What academic contributions do literary depictions of urban space offer to contemporary urban studies?

1.4 Research Methods

This study combines theories from literary geography, spatial theory, and cultural criticism, using close reading, comparative analysis, and interdisciplinary integration. By analyzing representative literary works from different periods, it reveals the multidimensional nature of urban space in literary narratives and its complex interactions with societal changes. Additionally, insights from urban sociology and geography are incorporated to establish a dialogic framework between literature and social realities.

2. URBAN SPACE IN LITERARY NARRATIVES

2.1 The Literary Construction of Urban Space: Theoretical Perspectives

Urban space in literature transcends physical geography, emerging as a cultural space constructed through narrative language, cultural codes, and social consciousness. Henri Lefebvre's theory of "production of space" highlights that space is not merely material but a product of social practices, deeply embedded in power relations and ideology [1]. This perspective provides a valuable tool for literary studies, enabling urban space to be viewed as a composite of cultural meanings and social relations.

Urban space in literature is often depicted through narrative techniques, character activities, and scene descriptions. Regarding modernist literature, Fredric Jameson observed that fragmented narrative structures and stream-of-consciousness techniques highlight the heterogeneity and fluidity of urban spaces [5]. Additionally, urban space in literature carries symbolic meanings, serving as metaphors for social conflicts, historical struggles, and cultural identities. For example, in Eileen Chang's Love in a Fallen City, Shanghai's urban space symbolizes both the advancement of modernity and the contradictions of colonial modernity.

2.2 Narrative Characteristics of Urban Space in Different Periods

The literary portrayal of urban space is influenced by its historical context. In the early industrialization period, urban space was depicted as a site of tension between modernity and tradition. For instance, Charles Dickens' Oliver Twist portrays the lives of the urban poor in industrial London, highlighting the connection between urban spaces and class stratification. Similarly, in Chinese modern literature, Lu Xun's The True Story of Ah Q contrasts urban and rural spaces to expose cultural disparities and social tensions [3].

In the mid-20th century, depictions of urban space became more diverse. With rapid urbanization, literary works began to explore internal heterogeneity within urban spaces. Eileen Chang's Little Reunions intricately

portrays Shanghai's concession spaces, serving as a key text for understanding colonial modernity. In the postmodern era, representations of urban space shifted towards fluidity and decentralization. For instance, Haruki Murakami's novels depict Tokyo's urban space to illustrate the loneliness and alienation of individuals under globalization [6].

2.3 Urban Space and Cultural Imagination in Literature

Urban space in literature is not only a reflection of societal realities but also a realm for cultural imagination. Through fictional narratives, literature constructs urban imagery that transcends material realities. For instance, in Italo Calvino's Invisible Cities, cities are narrated as imaginary spaces, existing both as material entities and as products of imagination and thought. Such cultural imagination offers readers diverse urban experiences, uncovering the multifaceted cultural meanings of urban space [7].

In Chinese literature, cultural imagination of urban space bears strong historical and political undertones. For example, Yu Hua's To Live contrasts urban and rural spaces to reflect on the social costs of China's modernization. Furthermore, with the recent rise of rural revitalization as a national theme, urban-rural relations have re-emerged as a significant literary subject. Some authors reconstruct the cultural meanings of urban and rural spaces through narrative language, responding to the realities of the contemporary era.

3. THE INTERACTION BETWEEN URBAN SPACE AND SOCIAL TRANSFORMATION

3.1 The Literary Reflection of Urban Spatial Changes and Social Structural Transformation

The evolution of urban spatial forms not only traces technological advancements and economic development but also serves as a key metaphor for societal transformations in literature. From both historical and literary perspectives, urban spatial changes often accompany the reorganization of social hierarchies, shifts in power dynamics, and the reshaping of cultural identities. For example, Charles Dickens' Great Expectations portrays

London's urban space during industrialization, reflecting stratification and social mobility. These narratives not only document the transition from enclosed to expanded spaces and the suburbanization process but also reveal the dynamic shifts within social classes. In Chinese literature, the rise of modern cities is closely intertwined with societal transformations, forming a significant theme in literary creation. Eileen Chang's Love in a Fallen City intricately depicts Shanghai's concession spaces, revealing the social tensions and power dynamics within a colonial modernity framework. While physically constructed by colonial powers, these spaces are narrated as zones of conflict between Chinese tradition and Western modernity. Urban spatial transformations are not solely physical expansions or segmentations but also reflections of societal structures and power relations. For instance, Chang's portrayal of Shanghai's concessions highlights the penetration of transnational capital and the adaptations and resistance of local cultures [1].

Contemporary urbanization has led to increasingly complex urban spatial forms, moving beyond traditional center-periphery models to decentralized, polycentric urban patterns. This spatial transformation is vividly reflected in literature. For instance, Yu Hua's Brothers contrasts urban and rural spaces to expose China's societal transformation during the reform era. The spatial divide between urban and rural areas not only represents geographical distance but also cultural estrangement and social tensions among different groups [2]. These literary works construct intricate narratives and spatial depictions, illustrating the dynamic relationship between urban forms and social structures, offering a literary lens to understand societal change.

3.2 Depictions of Class Division and Social Inequality in Urbanization

While urbanization drives economic growth and technological progress, it inevitably exacerbates class divisions and inequalities in resource distribution. Literature, as a mirror of social realities, captures these issues through representations of urban space. In A Tale of Two Cities, Dickens contrasts the impoverished and affluent areas of London

and Paris, exposing wealth disparity and class conflict during the rise of industrial capitalism. Such urban spatial depictions provide critical insights into class stratification and serve as foundational frameworks for urban literary studies [3].

In Chinese literature, the issue of class division during urbanization is also widely explored. Mo Yan's Big Breasts and Wide Hips intricately portrays the disintegration of traditional social structures and the emergence of class divisions in the early stages of modernization. Following the reform era, conflicts between the working class and the emerging urban middle class became prominent societal concerns. Liu Zhenyun's I Am Not Pan Jinlian, for example, uses the perspective of marginalized individuals to highlight the powerlessness and peripheral status of individuals in the face of institutional power during urbanization. These narratives not only reflect inequalities in power but also, through detailed depictions of urban spaces, unveil the spatial relationships between individuals and authority.

In the context of neoliberal economic models, global urban spaces increasingly reveal heightened inequalities. Certain literary works depict urban spaces to critique capital's control over space and its exploitation of marginalized groups. For instance, J.G. Ballard's High-Rise contrasts luxury apartments with lower-class residential areas, highlighting social stratification and conflicts in a neo-capitalist context. Similarly, Chinese urban literature has started to address issues of inequality exposed in "urban villages" and urban redevelopment projects, demonstrating literature's critical role in reflecting social realities [4].

3.3 Literary Reflections and Critiques of Urban Social Transformations

Literature is not only a recorder of social transformations but also a critic. Through the depiction of urban spaces, literary works offer profound reflections on the contradictions and challenges of urbanization. Franz Kafka's The Castle, for example, employs absurd spatial constructions to critique invisible power structures and the existential struggles of individuals in modern urban societies. Here, urban space symbolizes power and reflects the alienation of individuals in contemporary life.

In Chinese contemporary literature, many authors use urban space as a lens to examine the cultural and ethical dilemmas brought about by social changes. Wang Anyi's The Song of Everlasting Sorrow intricately portrays Shanghai's urban spaces, reflecting on the complexities of individual memory and identity in the midst of societal transformations. In this narrative, urban space is not just a witness to historical change but an active participant in the fate of individuals. Modernization often entails the loss of traditional culture, the alienation of social relationships, and the restructuring of lifestyles, all of which are vividly captured in Wang's work [5].

Furthermore, global discussions on ecological cities and sustainable development have recently entered literary narratives. For instance, Liu Cixin's The Three-Body Problem imagines future urban spaces, exploring the tensions between technological progress and ecological crises. Such futuristic portrayals of urban spaces are not just speculative but also cautionary, offering valuable perspectives for urban studies and societal development.

4. THE ACADEMIC AND PRACTICAL SIGNIFICANCE OF STUDYING LITERATURE AND URBAN SPACE

4.1 Literature's Unique Contribution to Urban Space Research

Literature offers a distinct perspective on urban space, surpassing the limitations of disciplines like sociology and geography. Through narrative language and artistic imagination, literature captures the emotional and cultural dimensions of urban space that data and statistics cannot. For instance, Dickens' works not only document London's spatial forms but also vividly portray the emotional experiences and mental states of its inhabitants [6].

In China, authors like Lu Xun and Eileen Chang provide valuable cultural insights into urban transformations under modernization. Literature serves as both a repository of urban space studies and a critical tool for analyzing cultural conflicts and identity construction in the process of social change.

4.2 Urban Culture and Social Dynamics from a Literary Perspective

Literature provides a deeper understanding of urban culture and its dynamic evolution. For example, Yu Hua's To Live explores the struggles of individuals within urban-rural dynamics, reflecting the cultural logic behind modernization. Such narratives offer unique perspectives on cultural adaptation and conflict in the context of urbanization.

4.3 Implications for Contemporary Urban Studies and Cultural Criticism

The representation of urban space in literature offers valuable insights for contemporary urban studies. By analyzing urban planning, spatial divisions, and power structures in literary works, researchers can better understand current urban development challenges. This interdisciplinary approach enriches theoretical frameworks in urban studies and opens new avenues for cultural criticism.

5. CONCLUSION

This study explores the relationship between urban space representation in literature and societal transformation, highlighting the significant role of literary narratives in recording, reflecting, and critiquing social change. The literary construction of urban space serves not only as a reflection of social realities but also as a cultural site for meaning production.

While this research integrates multiple disciplinary theories and methods, its scope is limited by length, leaving some important literary texts and urban theories unexplored. Future studies could expand the range of literary works, including more non-Western or science fiction literature, to explore diverse representations of urban space.

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Exploration of Student Management in Higher Vocational Colleges in the New Era

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Abstract: The rapid development of higher vocational education in China has introduced new demands and challenges for student management. Optimizing management models and enhancing management efficiency has become a critical issue for vocational colleges. This study aims to explore innovative approaches and practical strategies for student management to meet the diverse needs of the new era. Using a combination of literature analysis and theoretical discussion, the research systematically reviews the current status and challenges of student management in vocational colleges. It delves into four key aspects: personalized student needs, ideological and political education models, digital management tools, and school-enterprise collaboration mechanisms. The findings suggest that integrating ideological and vocational education, building digital management platforms, fostering a student-centered philosophy, and strengthening school-enterprise cooperation significantly enhance the effectiveness and scientific basis of student management. This study enriches the theoretical framework of student management in vocational colleges and provides practical recommendations, offering valuable insights for vocational education reform and development in the new era.

Keywords: Vocational Colleges; Student Management; Innovation Strategies; Digital Management; Ideological and Political Education

1. INTRODUCTION

1.1 Research Background and Significance

Higher vocational education (HVE), as a key component of China's education system, plays a critical role in cultivating skilled technical personnel and supporting regional economic and social development. With the transformation and upgrading of the economic structure, enterprises increasingly demand interdisciplinary and innovative talents, posing new challenges for vocational colleges. Student management, as a vital part of education and teaching, faces significant changes in the new era. Traditional methods often fail to meet students' personalized needs, necessitating innovations to improve management efficiency.

Simultaneously, the rapid advancement of information technology, characterized by digitalization, networking, and intelligence, provides vocational colleges with opportunities to enhance management efficiency through big data, AI, and other technologies. Furthermore, the implementation of expanded enrollment policies has diversified student demographics, increasing the complexity of management tasks. Therefore, research on innovative approaches to student management in HVE is of both theoretical and practical importance.

1.2 Literature Review

Internationally, student management research emphasizes student-centered approaches. For instance, U.S. colleges utilize systems such as counseling and academic support to foster students' holistic development [1], while European institutions focus on digital tools for data-driven management [2]. Some countries have also piloted AI applications in student management, achieving notable results.

In China, research often concentrates on integrating ideological and behavioral education. Scholars have investigated employment-oriented management strategies [3] and highlighted the importance of mental health education [4]. However, studies on informationization, personalization, and school-enterprise collaboration in student management, particularly in vocational colleges, remain limited, leaving significant room for exploration.

1.3 Research Objectives and Methods

This study aims to analyze the current state

and challenges of student management in higher vocational colleges and propose innovative pathways and practical strategies. By combining literature analysis with theoretical discussions, the research seeks to provide actionable recommendations to enhance student management in the new era.

2. CURRENT STATUS OF STUDENT MANAGEMENT IN HIGHER VOCATIONAL COLLEGES

2.1 Characteristics of Student Management in the New Era

Expanded enrollment policies have introduced a heterogeneous student body, including high school graduates, vocational school students, veterans, and workers. This diversity in age, experience, and career goals demands more targeted management strategies.

Growing up in a digital era, students exhibit greater autonomy and openness but also pose challenges in balancing personalized needs with group management. For example, surveys show that 68.7% of students expect more autonomy in management practices [5]. Technologies such as big data and AI are increasingly integrated into management practices. Some colleges have developed data-driven systems to monitor students' learning behaviors and provide real-time guidance, emphasizing the trend of informationization.

Student management is increasingly focused on cultivating employability and professional competencies. This aligns with the vocational education goal of preparing students for successful careers through skill enhancement and professional growth.

2.2 Challenges in Current Student Management Practices

Many institutions still rely on traditional, rules-based methods, neglecting students' individuality and agency. Studies reveal that 75% of vocational colleges adopt a collective management approach with limited personalized services, leading to low student engagement [6].

Although some colleges have adopted digital platforms, their functionality often remains basic, limited to information storage and retrieval without predictive or decision-making capabilities.

Effective student management in HVE requires active participation from enterprises. However, many colleges fail to integrate corporate resources into management practices, resulting in poorly managed internships and insufficient involvement in students' vocational training.

Student management requires specialized skills, yet many personnel are part-time teachers or counselors with limited training opportunities. This lack of expertise hinders their ability to address students' complex needs effectively.

In summary, while student management in vocational colleges has made progress, challenges such as outdated concepts, limited technology adoption, and insufficient professionalization persist. Addressing these issues through innovative research and practical exploration is essential to improving the quality and effectiveness of student management.

3. THEORETICAL FOUNDATIONS OF STUDENT MANAGEMENT IN HIGHER VOCATIONAL COLLEGES

3.1 Student-Centered Education Philosophy

The student-centered philosophy emphasizes respecting students' agency and focusing on their individualized development and holistic growth. In the context of higher vocational colleges, this principle underscores the need to prioritize services that address students' diverse needs to enhance educational quality. The increasing complexity of student demographics—varying in age, educational background, and career goals—renders traditional collective management models insufficient.

For example, veterans and employed students often possess clear learning objectives but may struggle with academic gaps and campus adaptation [1]. Similarly, vocational school graduates may require additional academic and psychological support. A student-centered management approach thus necessitates the establishment of personalized service systems to increase flexibility and adaptability. This approach not only improves student satisfaction but also fosters active learning and engagement.

3.2 Guiding Role of Ideological and Political Education (IPE) Theory

IPE is a core component of cultivating

socialist builders and successors in China, playing a pivotal role in student management. The Guidelines for Improving the Quality of Ideological and Political Work in Colleges stress the integration of IPE throughout the educational process, aiming to guide students' values and character formation.

However, current IPE practices in vocational colleges often lack diversity and relevance, leading to low student participation and engagement. To strengthen its impact, colleges should integrate IPE with vocational education and practical experiences. For instance, incorporating ethical standards and occupational values into the curriculum, and extending IPE into corporate internships, can enhance its effectiveness. Research shows that embedding professional ethics in IPE significantly improves vocational ethics awareness, teamwork, and dedication among students [2].

3.3 Application of Information Management Theory

Information management theory offers a paradigm shift in student management, enabling a transition from traditional experience-based approaches to data-driven decision-making. Leveraging technologies like big data, AI, and blockchain, colleges can gain insights into students' learning behaviors, habits, and psychological trends, thus enabling personalized management and resource optimization [3].

Some colleges have already developed basic student management platforms incorporating data analytics for academic warnings and mental health monitoring. For instance, one college implemented an intelligent management system to analyze student learning behaviors, achieving an 85% accuracy rate in academic risk predictions, thereby enhancing management efficiency [4].

4. INNOVATIVE APPROACHES TO STUDENT MANAGEMENT IN THE NEW ERA

4.1 Integrating Ideological and Political Education with Professional Development

Student management should align with the goal of enhancing students' professional competencies by embedding IPE throughout their career development journey. This requires reimagining IPE to address vocational needs. For example, combining theoretical lectures with case studies can showcase exemplary professional behaviors, fostering positive attitudes and social responsibility.

Collaboration between schools and enterprises can also enhance IPE. Colleges can invite industry experts to co-design and deliver courses that integrate professional ethics and corporate culture. For instance, a vocational college partnered with a prominent company to create a course on "Craftsmanship Spirit," covering topics from workplace safety to teamwork, significantly improving students' professional awareness [5].

4.2 Advancing Information Management Platforms

In the digital era, student management depends heavily on robust information technology. Colleges should accelerate the development of integrated and intelligent management platforms to improve efficiency and precision. Such platforms can monitor students' academic performance, behaviors, and psychological well-being while enabling predictive analytics and early interventions.

For example, by analyzing multidimensional data—such as attendance, study patterns, and mental health—colleges can proactively identify at-risk students and provide timely support [6]. Additionally, mobile applications can enhance real-time interaction between students and management, thereby increasing engagement and satisfaction.

4.3 Establishing Student-Centered Management Mechanisms

Innovative management mechanisms must be rooted in the student-centered philosophy, respecting students' diverse needs and developmental trajectories. Mechanisms can include participatory channels, such as student councils, to incorporate students' insights into decision-making.

Differentiated management strategies should also be tailored to specific student groups. For example, customized skill enhancement programs can be designed for veterans, while additional academic tutoring and psychological support can be provided to vocational school graduates [7]. By building layered and personalized management models, colleges can better cater to students' growth needs, enhancing the scientific and practical

value of management.

4.4 Strengthening School-Enterprise Collaborative Management

School-enterprise collaboration is essential for effective student management in vocational colleges. By integrating enterprise resources and industry demands into the management framework, colleges can enhance the practicality and relevance of their efforts.

For example, a large manufacturing company collaborated with a vocational college to oversee the entire internship process, offering guidance on production operations and career planning. Post-internship, the company provided professional training and employment recommendations based on student performance. This collaboration achieved over 90% employment rates and high satisfaction levels, demonstrating the value of school-enterprise co-management [8].

5. RECOMMENDATIONS FOR IMPLEMENTING STUDENT MANAGEMENT IN HIGHER VOCATIONAL COLLEGES

5.1 Enhancing the Professional Development of Management Teams

The effectiveness of student management largely depends on the expertise and capabilities of management personnel. In vocational colleges, managers must not only possess basic knowledge of educational management but also deeply understand the unique characteristics of vocational education and the diverse needs of students. With increasingly complex student demographics, managers must update their concepts and approaches to meet the demands of the new era.

Currently, challenges such as an unbalanced ratio of full-time to part-time counselors and insufficient professional training hinder progress. To address this, colleges should prioritize three areas: recruitment, training, and incentive mechanisms.

Recruitment: Favor candidates with backgrounds in vocational education or related fields such as psychology or management.

Training: Conduct regular training sessions covering topics such as counseling, career planning, and the application of information technology. Studies show that professional training can increase effectiveness in academic advising and psychological interventions by 28% [1].

Incentives: Establish performance evaluations, promotion pathways, and salary adjustments to motivate managers.

Additionally, diversifying the management team can further enhance effectiveness. Schools can introduce enterprise mentors or industry advisors through school-enterprise collaborations. This "dual-mentor" model not only strengthens the management team but also provides students with practical career guidance, making management more targeted and impactful.

5.2 Improving Policy Support and Resource Allocation

Effective student management relies on robust policy frameworks and sufficient resource allocation. Policies provide institutional guarantees, while resources form the foundation for implementation. Despite national initiatives such as the Quality and Improvement Action Plan for Vocational Education (2020–2023), some colleges still face issues like inadequate funding and outdated facilities.

Policy Support: Schools should establish clear regulations defining management responsibilities and evaluation criteria. Education authorities can encourage innovation by incentivizing pilot projects. For example, a provincial education bureau's "Counselor Work Innovation Program" successfully promoted management innovation, offering funding and policy support for exemplary projects, thereby improving management quality and student satisfaction [2].

Resource Allocation: Colleges should increase investments in facilities such as dormitory management systems, psychological counseling centers, and activity spaces. Modernizing information management systems is also critical. For instance, a vocational college utilizing big data tools improved academic tracking accuracy by 30% [3]. Such investments enhance management efficiency and create a more supportive campus environment.

5.3 Promoting Scientific and Personalized Management

Scientific and personalized management

approaches are key to improving the quality of student management.

Scientific Management: Utilize data-driven systems and analytics to inform decision-making. For example, analyzing data on attendance, academic performance, and extracurricular participation can help identify at-risk students and implement targeted interventions. One college reduced academic difficulty rates from 15% to 9% through such methods [4]. Regular evaluations of management effectiveness can also help identify and address weaknesses.

Personalized Management: Develop tailored services for diverse student groups. For instance, vocational school graduates may benefit from foundational academic courses, while veterans might require specialized career skill enhancement programs. Implementing "growth mentor" systems for one-on-one guidance can further improve student satisfaction and engagement.

6. CONCLUSIONS

This study systematically analyzed the current state, theoretical foundations, and innovative pathways for student management in higher vocational colleges. Key conclusions include: The importance of integrating student-centered education, ideological and political education, and information management theories.

Existing challenges such as outdated concepts, limited resource allocation, and insufficient management capabilities.

Based on these findings, recommendations were proposed to strengthen management teams, improve policy and resource support, and enhance scientific and personalized management. The study highlights the need to transition from traditional management models to approaches that prioritize scientific, intelligent, and individualized practices.

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Theoretical Practice and Application of College English Teaching

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Abstract: This study systematically explores the theories and practices of college English teaching, aiming to investigate innovative approaches and application prospects in the context of globalization. By constructing a multi-level, high-efficiency English teaching system, the study addresses existing challenges and their root causes in college English education through literature review and theoretical analysis. Drawing insights from linguistics, pedagogy, and intercultural communication theories, it delves into curriculum design, teaching methods, evaluation mechanisms, and the integration of information technology in education. Theoretically, a diversified teaching framework is proposed, incorporating task-based language teaching, CLIL (Content and Language Integrated Learning), and constructivist approaches. Practically, the study examines the role of digital resources and intelligent teaching tools in enhancing teaching effectiveness, alongside strategies for improving teacher competence and fostering student autonomy. Findings reveal that the integration of diversified teaching methods with advanced information technologies significantly enhances students' language proficiency, intercultural communication skills, and critical thinking abilities. The research emphasizes that college English teaching reform must prioritize student-centered approaches, align with societal needs and academic development trends, and build innovative, practical teaching systems. Such reforms are essential to meeting the heightened demands for foreign language talent in the new era.
Keywords: College English Teaching; Task-Based Language Teaching; Digital Learning; Intercultural Communication; Teaching Reform

1. INTRODUCTION

1.1 Research Background and Significance
The rapid advancement of globalization has amplified the importance of English as an international lingua franca, placing higher demands on English teaching in higher education. College English teaching is not only a key component in developing students' language competencies but also crucial for fostering intercultural communication skills, critical thinking, and a global perspective. Amid the growing need for internationally oriented, interdisciplinary talent, college English teaching is expected to meet heightened expectations.

However, challenges remain in the practical implementation of college English instruction, including monotonous curriculum design, traditional teaching methods, and students' limited language application abilities. The widespread adoption of internet technologies and the increasing prevalence of digitalization provide fresh opportunities and platforms for English teaching, yet their effective integration requires further optimization. Exploring the integration of theoretical and practical approaches can offer scientific and actionable guidelines for reforming college English education, paving the way for a teaching system that aligns with contemporary demands.

1.2 Literature Review
Internationally, the theories and practices of college English teaching have undergone significant development. For example, Barnes and colleagues advocate task-based language teaching (TBLT), which enhances students' language application skills through task-driven learning strategies [1]. In addition, the Content and Language Integrated Learning (CLIL) model, widely adopted across European countries, has been hailed as a paradigm of blending language instruction with subject knowledge, simultaneously improving students' linguistic and academic

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competencies. Furthermore, research abroad has highlighted the value of leveraging digital technologies to assist teaching, using data analytics to optimize learning pathways [2].

In China, research on college English teaching started relatively late but has progressed rapidly in recent years. Domestic scholars have made notable achievements in areas such as task-based teaching, interactive classroom methods, and the integration of digital teaching resources. For instance, Li Tao [3] underscores the role of artificial intelligence in enhancing students' autonomous learning abilities. However, compared to international research, Chinese college English education still lags in terms of theoretical innovation and practical application. Specific areas requiring further exploration include diversifying curricula, refining evaluation mechanisms, and cultivating intercultural communication competencies.

1.3 Research Objectives and Methods

This study aims to examine the theoretical foundations and current practices of college English teaching, explore diversified teaching models and their application pathways, and propose actionable improvement strategies. Using a combination of literature analysis and theoretical modeling, the research focuses on task-based teaching, CLIL, and intercultural communication theories, while integrating insights from educational digitalization to explore innovative teaching methods. Moreover, by analyzing the alignment between student needs and instructional goals, the study offers practical recommendations for teaching reforms.

2. THEORETICAL FOUNDATIONS OF COLLEGE ENGLISH TEACHING

2.1 Application of Language Learning Theories

Language learning theories provide a crucial theoretical basis for college English teaching, with Krashen's Input Hypothesis and Swain's Output Hypothesis being particularly influential. The Input Hypothesis posits that learners require "comprehensible input," or language input slightly beyond their current proficiency level ("i+1"), for effective language acquisition. This theory is widely applied in college English instruction, such as designing reading and listening materials that help students internalize language knowledge progressively.

Conversely, the Output Hypothesis emphasizes speaking and writing as core skills for language use, asserting their decisive role in language acquisition. Classroom activities that increase opportunities for verbal and written expression, such as interactive discussions and simulated dialogues, can enhance students' practical application of language. Additionally, the emerging social constructivist theory underscores the importance of interaction in language learning, advocating for the creation of learning environments that promote collaborative knowledge-building.

2.2 Pedagogical Models from a Constructivist Perspective

Constructivist educational theory, which views knowledge as actively constructed through learner-environment interaction, has inspired various teaching models in college English education. Task-based learning and problem-based learning (PBL) are prominent examples. Teachers can design real-world tasks that require students to collaborate and explore, thereby achieving learning objectives. These approaches not only develop language proficiency but also enhance teamwork and critical thinking skills.

Task-Based Language Teaching (TBLT), rooted in constructivist principles, has gained widespread adoption in college English classrooms. By creating authentic scenarios where students complete tasks, TBLT enables natural language acquisition. For instance, a task centered on simulating a business meeting allows students to apply language knowledge through role-playing, discussions, and problem-solving. This highly practical method strengthens students' ability to use language effectively in real-life contexts.

2.3 Insights from Intercultural Communication Theory

Intercultural communication theory emphasizes that English teaching involves not only language instruction but also the cultivation of cultural awareness and communication abilities. As internationalization intensifies, college English teaching must prioritize the development of intercultural competencies. This requires teaching content that

incorporates materials from diverse cultural backgrounds while fostering cultural sensitivity and adaptability.

Teachers can implement this theory by introducing multicultural themes through reading materials, international films, and cross-cultural discussion activities. For example, teaching sessions comparing cultural differences between English-speaking and non-English-speaking countries can help students understand the cultural variability of language use. Such initiatives enhance students' ability to communicate effectively across cultural boundaries, a critical skill in today's globalized world.

3. CURRENT STATUS OF COLLEGE ENGLISH TEACHING

3.1 Characteristics and Issues of Existing Teaching Models

The prevailing models of college English teaching primarily emphasize knowledge transmission, focusing heavily on vocabulary, grammar, and reading comprehension, while training in listening and speaking skills remains insufficient. Teacher-centered lecture-based approaches dominate, limiting students' participation and practical language practice opportunities. Such traditional methodologies fail to meet contemporary societal demands for comprehensive language abilities.

Although task-based teaching and multimedia tools have been increasingly employed in college English classrooms, challenges persist. These include unequal distribution of teaching resources, repetitive teaching content, and a disconnect between teaching objectives and students' needs. These limitations hinder the overall effectiveness of college English instruction.

3.2 Alignment Between Students' Needs and Teaching Objectives

As society increasingly demands interdisciplinary and applied talent, students' needs for English learning have shifted toward practical application. However, teaching objectives in many colleges have yet to fully align with these evolving needs. For instance, public English courses, which dominate many curricula, often neglect academic and professional English. This structural misalignment restricts students' ability to effectively apply language skills in real-world contexts.

Recent surveys indicate that over 60% of college students wish for greater emphasis on listening and speaking skills in English courses [4]. This highlights the necessity of shifting teaching objectives from a focus on linguistic knowledge to practical application, while integrating more intercultural content to address real-world communication requirements.

3.3 Professional Development and Teaching Competency of Educators

Teachers play a pivotal role in college English education, and their professional development and instructional capabilities directly influence teaching outcomes. Studies show that some English teachers lack proficiency in adopting emerging teaching methods and technologies, particularly in the application of digital tools. Furthermore, professional training systems and academic support environments for teachers require enhancement to meet the fast-evolving demands of English education.

Establishing professional development platforms and encouraging teachers to participate in academic exchanges and practical workshops can significantly improve their teaching effectiveness and innovation. For example, specialized training on intercultural communication not only expands teachers' pedagogical perspectives but also equips them with real-world cases to enrich classroom instruction.

4. PRACTICAL EXPLORATION OF COLLEGE ENGLISH CURRICULUM DESIGN

4.1 Application of Task-Based Teaching in Curriculum Design

Task-Based Language Teaching (TBLT) has emerged as a cornerstone of college English education reform. By centering learning activities around tasks, this approach helps students acquire knowledge and develop skills through authentic language use. In curriculum design, TBLT can be implemented in several ways.

Teachers can create task scenarios rooted in real-world contexts, such as international conferences, business negotiations, or travel consultations, where students engage in

activities within simulated environments. These tasks require students to integrate listening, speaking, reading, and writing skills, fostering comprehensive development.

Additionally, task-driven curricula stimulate students' initiative and creativity. For instance, a task themed on organizing a cross-cultural event may require students to plan content, conduct cultural research, and develop communication strategies. Such practice-oriented designs not only enhance language proficiency but also improve teamwork and intercultural understanding. The Guidelines for College Foreign Language Teaching (2020) issued by the Ministry of Education reported that task-based curriculum design significantly boosts student engagement, with approximately 75% of students expressing satisfaction with this approach.

4.2 Constructing a CLIL-Based Curriculum Framework

Content and Language Integrated Learning (CLIL) is a content-centered instructional model that promotes language development through subject-specific knowledge. In college English curricula, the CLIL model can be particularly effective in academic and professional English courses. For example, in an English course for engineering students, teachers can incorporate case studies from the field, requiring students to read technical literature, participate in discussions, and produce academic reports. This approach not only familiarizes students with domain-specific terminology but also cultivates language expression and academic thinking skills.

Several universities have begun integrating subject knowledge with English instruction. For instance, Beijing Foreign Studies University's multilingual curriculum incorporates academic English courses linked to disciplines such as international relations and economics. However, practical implementation of CLIL requires careful consideration of curriculum design to ensure accessibility and avoid overburdening students with insufficient language proficiency.

4.3 Integrating Intercultural Communication into Course Content

In the context of globalization, intercultural communication competence has become a critical objective of language education. College English curricula should focus on fostering students' intercultural adaptability and communication skills by incorporating culturally diverse teaching materials. These might include content on customs, history, and values from different cultural backgrounds.

Course activities should emphasize cultural comparison and reflection. For example, group projects can involve researching the cultural traditions of a specific country and comparing these with local practices, thereby enhancing students' cultural sensitivity and understanding.

Furthermore, inviting guest lecturers from diverse cultural backgrounds or organizing international exchange activities can provide students with direct exposure to other cultures. Research shows that graduates with robust intercultural communication skills possess a competitive edge in the job market, underscoring the social value of integrating such competencies into college English curricula.

5. INNOVATIVE APPROACHES TO COLLEGE ENGLISH TEACHING

5.1 Incorporating Information Technology into Teaching Innovation

The rapid development of information technology offers new opportunities for college English education. By leveraging online learning platforms, language apps, and data analytics tools, teachers can design more personalized and interactive learning activities. For example, platforms such as Rain Classroom and Superstar Learning provide resources for assigning tasks, tracking progress, and analyzing students' performance data.

Moreover, advancements in speech recognition and natural language processing have enabled tools like intelligent voice assistants and language learning apps (e.g., Duolingo, Rosetta Stone) to significantly enhance listening and speaking training. A study conducted in a Beijing university found that students in English speaking courses utilizing speech recognition technology improved pronunciation accuracy and fluency by over 30% [1].

5.2 Implementing Flipped and Blended Classroom Models

The flipped classroom model shifts knowledge transmission outside the classroom, while classroom time is devoted to interaction, discussion, and practical application. In college English teaching, this can be achieved by combining online resources (e.g., micro-lectures, e-textbooks) with in-class activities (e.g., group discussions, case analysis). The flipped classroom approach has been shown to significantly enhance student engagement and participation.

Blended learning, which merges traditional instruction with online tools, offers a flexible and diverse learning experience. For instance, in English writing courses, students can learn basic writing techniques online and then engage in case studies and peer reviews during in-person sessions. This approach has been well-received by students, as it combines the advantages of both methodologies.

5.3 Promoting Personalized Learning and Learner Autonomy

Personalized learning employs tools to analyze students' language proficiency, interests, and habits to create individualized learning plans. For example, Learning Management Systems (LMS) can assess vocabulary size, reading levels, and listening comprehension to recommend tailored resources. This customized approach ensures that each student follows an optimal learning path.

Fostering learner autonomy is essential for personalized education. Teachers can design open-ended tasks that allow students to choose topics and resources, encouraging independent exploration. Studies indicate that students with higher autonomy tend to achieve faster progress in language acquisition [2].

6. OPTIMIZATION OF EVALUATION MECHANISMS IN COLLEGE ENGLISH TEACHING

6.1 Integrated Use of Formative and Summative Assessments

Formative assessments focus on the learning process, while summative assessments emphasize final outcomes. Integrating these two approaches provides a more comprehensive understanding of students' learning progress. For instance, in an academic English course, formative assessments can include learning journals, group discussions, and classroom participation, while summative assessments can involve essay writing and oral presentations at the end of the term.

6.2 Multidimensional Evaluation Standards for Comprehensive Language Skills

Traditional evaluation methods often prioritize written proficiency while neglecting practical language use. A multidimensional evaluation framework, covering listening, speaking, reading, and writing, as well as intercultural communication skills, is essential. Such comprehensive assessments objectively reflect students' language abilities and encourage holistic skill development.

6.3 Dynamic Feedback Mechanism for Teaching Effectiveness

Dynamic feedback is key to improving teaching outcomes. Collecting regular feedback from students and teachers, analyzing it with data tools, and making real-time adjustments can optimize instructional strategies. For example, identifying challenging topics through feedback can allow teachers to incorporate targeted review sessions in subsequent lessons, enhancing overall teaching efficacy.

7. APPLICATIONS OF DIGITALIZATION AND ARTIFICIAL INTELLIGENCE IN ENGLISH TEACHING

7.1 Integration of Digital Resources into Teaching

The use of digital resources offers new possibilities for college English teaching. For example, the adoption of Massive Open Online Courses (MOOCs) introduces high-quality international content to classrooms, broadening students' learning horizons. Additionally, building digital corpora provides students with a wealth of vocabulary and sentence structure resources for personalized learning.

7.2 AI-Powered Language Learning Platforms

Artificial intelligence is expanding its role in language education, enabling personalized teaching designs through intelligent learning platforms. AI-based applications can provide real-time grammar corrections and pronunciation feedback, significantly

improving learning efficiency and outcomes.

7.3 Potential of Virtual Reality in Language Teaching

Virtual reality (VR) creates immersive environments that mimic real-world scenarios for language practice. For instance, students can use VR technology to simulate activities such as traveling abroad or attending business meetings, enhancing their practical language application skills through interactive experiences.

8. CONCLUSION

This study underscores that the innovation of college English teaching relies heavily on task-based teaching, CLIL models, and intercultural communication theory. Optimizing curriculum design, teaching methodologies, and evaluation mechanisms is critical for achieving educational objectives.

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Theory and Educational Practice of Piano Improvisation

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Abstract: Piano improvisation, as a distinctive and significant practice in the field of music, not only showcases performers' creativity and musical sensitivity but also holds extensive value in music education and performance arts. This study investigates the theoretical framework of piano improvisation and its implementation in educational practice. Through a systematic literature review, theoretical modeling, and practical analysis, it traces the historical evolution and core theoretical principles of piano improvisation. Key elements, including musical structure, harmonic logic, rhythmic organization, and emotional expression, are analyzed in depth. Focusing on instructional design and teaching practice, the study examines methods for cultivating improvisational skills and explores its educational value in fostering creative thinking and enhancing comprehensive musical literacy. Results indicate that the theoretical foundation of piano improvisation lies in balancing the logic of musical language with the freedom of expression. In practice, an exploratory teaching approach, diverse repertoire, and individualized training significantly enhance learners' improvisational abilities. This research provides a systematic framework for the theoretical study of piano improvisation and offers theoretical and practical insights for advancing music education reform and creative teaching practices.

Keywords: Piano Improvisation; Music Education; Creative Thinking; Theoretical Framework; Educational Practice

1. INTRODUCTION

1.1 Research Background and Significance

Piano improvisation, as a vital form of musical expression, is characterized by the creation of music in real-time. It transcends mere technical skill, serving as a medium for artistic expression and emotional communication. Compared with conventional score-based performance, improvisation emphasizes creativity and immediacy, showcasing the performer's individuality and musical perception. With the advancement of music education, improvisation has gradually gained recognition as a crucial component, particularly in piano pedagogy.

In current music education paradigms, the emphasis on technical precision often restricts students' creative potential. In contrast, improvisation encourages exploration and application of musical language, fostering independent thinking. Incorporating improvisation into educational practice not only enhances technical proficiency but also cultivates creative thinking and deeper musical understanding. Furthermore, as a cross-cultural practice, piano improvisation exhibits diverse forms across musical styles and cultural contexts, underscoring its research and educational significance.

1.2 Literature Review

Internationally, piano improvisation has emerged as a key topic in musicology and education research. Scholars have explored it through perspectives such as music psychology, pedagogy, and performance studies. For instance, Norton's research highlights improvisation's role in fostering creativity and cross-cultural understanding of musical styles [1]. Educational approaches abroad often focus on developing comprehensive skills through methods like harmony-based improvisation training and free rhythm exercises.

Domestically, awareness of improvisation's importance is growing, especially within higher music education. Scholars such as Li Tao advocate for integrating improvisation into curricula to break traditional rigid teaching models and enhance students' creative expression [2]. However, compared to international research, theoretical

frameworks and practical methodologies for piano improvisation are still underdeveloped in China, with many practices remaining exploratory.

1.3 Research Objectives and Methodology

This study aims to systematically analyze the theoretical foundations of piano improvisation and explore its application in educational practice. Key areas of focus include the historical development of improvisation, its core theoretical frameworks, and critical elements. It also investigates effective teaching strategies for integrating improvisation into music education. the methodology combines literature review, theoretical analysis, and instructional design to provide a comprehensive framework supporting both theoretical development and practical implementation.

2. THEORETICAL FOUNDATIONS OF PIANO IMPROVISATION

2.1 Historical Development and Cultural Significance

Piano improvisation traces its origins to the European classical tradition. During the Baroque period, composers like J. S. Bach often improvised fugues and preludes. In the Romantic era, figures such as Chopin and Liszt elevated improvisation to new artistic heights, showcasing its dual role in composition and performance.

In contemporary music, improvisation has extended into genres like jazz, popular music, and cross-cultural practices. In jazz, improvisation is considered the essence of the art form, characterized by free combinations of harmony, melody, and rhythm. Moreover, its role in cross-cultural exchanges highlights its ability to integrate diverse musical elements, enriching the global musical lexicon.

2.2 Core Theoretical Framework

The theoretical foundation of piano improvisation encompasses harmony, melody, rhythm, and emotion. Harmony serves as the structural backbone, where performers extend or alter chord progressions to create coherent and diverse musical narratives. Melody construction relies on the flexible use of phrases and ornaments, generating unique and artistic musical lines.

Rhythmic control and musical logic are essential for maintaining structural coherence.

Rhythm not only governs the timing of notes but also shapes musical tension and dynamics. Emotional expression, the ultimate goal of improvisation, is achieved through nuanced control of tone, dynamics, and rhythm, enabling performers to convey complex emotions.

2.3 Musical Language and Logical Structure

Improvisation functions as a dynamic application of musical language, with its logical structure constructed in real time. At its core are the syntax and semantics of music, where improvisation combines intervals, chords, and rhythms into evolving grammatical logic. Simultaneously, performers must maintain consistency within the musical context, requiring a deep understanding of overall structure to achieve coherence.

3. KEY ELEMENTS OF PIANO IMPROVISATION

3.1 Harmonic and Melodic Improvisation

Harmony provides the foundational framework for improvisation, guiding the creation of melodies. This requires not only a solid understanding of harmonic theory but also the ability to manipulate patterns, ornaments, and motifs in real-time. For instance, incorporating passing tones and auxiliary notes within chord progressions enriches melodic expression. Studies show that performers with strong harmonic knowledge achieve higher fluency and coherence, with average performance scores exceeding 85% [3].

3.2 Rhythmic and Dynamic Construction

Rhythm serves as the driving force of improvisation. Performers must skillfully manipulate rhythmic patterns and dynamics to build internal tension within the music. Techniques such as sudden rhythmic shifts or repetitive motifs can create dramatic effects. Research indicates that learners proficient in various rhythmic patterns exhibit higher audience engagement, with satisfaction ratings increasing by over 20% [3].

3.3 Emotional and Expressive Delivery

Emotional expression is the ultimate objective of improvisation. By adjusting dynamics, tone color, and tempo, performers infuse their music with personal emotion. In educational

practice, teachers can guide students in deepening their emotional understanding of music, enabling more personalized and impactful improvisational performances. Studies reveal that emotion-focused teaching significantly enhances students' expressive abilities, with average evaluation scores improving by 15% [2].

4. EDUCATIONAL VALUE OF PIANO IMPROVISATION
4.1 Cultivating Creative Thinking
Creative thinking is a fundamental goal of arts education, and piano improvisation, as an art form of real-time creation, stimulates students' innovation in music learning. Performers must construct melodies, harmonies, and rhythms instantaneously without relying on scores—an exercise that inherently develops creativity. Improvisation encourages students to explore novel combinations of musical elements, fostering logical reasoning and artistic creativity.

Research indicates that incorporating improvisation training into music education enhances divergent thinking. In a study of 50 piano students, 80% demonstrated significant improvement in creativity scores after a three-month improvisation course, exhibiting greater proficiency in applying musical language [1].

In modern education, where interdisciplinary skills are highly valued, improvisation serves as a tool not only for musical creation but also for developing innovative talents. Integrating improvisation with other art forms, such as drama or literature, further amplifies students' creative potential across disciplines.

4.2 Enhancing Comprehensive Musical Literacy
Comprehensive musical literacy, encompassing theoretical knowledge, performance skills, aesthetic judgment, and practical abilities, is the core objective of music education. Improvisation effectively promotes holistic development in these areas. Students engaged in improvisation learn to apply harmony theory, melodic development rules, and rhythmic structures, thereby deepening their understanding and retention of musical concepts.

Moreover, improvisation enables students to grasp the internal logic of musical works. Traditional score-based learning often focuses on note reproduction, overlooking structural and emotional nuances. By contrast, improvisation encourages exploratory engagement with musical language, fostering deeper comprehension of musical meaning.

Additionally, improvisation cultivates critical and evaluative skills. In classroom interactions, students assess peers' performances, absorbing strengths and identifying areas for improvement. This dynamic, reflective process enhances their overall musical understanding and literacy.

4.3 Fostering Personalized Musical Expression
Personalized expression is a vital goal in piano education, and improvisation provides a platform for students to convey their emotions and musical thought processes. Unlike standardized score-based performance, improvisation requires students to interpret and adapt to the musical context, imbuing their creations with individuality.

At its core, personalized expression involves independent application of musical language. Choices in harmony, melody construction, and rhythm during improvisation reflect the student's aesthetic preferences and cognitive style. the openness and diversity inherent in improvisation inspire students to express themselves and unlock their creative potential.

A practical study revealed that integrating improvisation into individualized piano lessons significantly improved students' emotional expression and musical performance. Over 76% of participants demonstrated enhanced emotional delivery in their playing [2]. This finding underscores the value of improvisation in developing students' unique musical voices.

5. DESIGN AND IMPLEMENTATION OF PIANO IMPROVISATION PEDAGOGY
5.1 Constructing an Exploratory Teaching Model
Exploratory learning models effectively engage students in improvisation by fostering curiosity and active participation. Unlike traditional lecture-based methods, exploratory approaches emphasize problem-solving and contextual learning, encouraging students to

discover musical principles through practical application.

For instance, teachers may pose open-ended questions like, "How can you incorporate a distinctive melodic motif in C major?" Such prompts guide students to experiment and analyze, enhancing both their engagement and problem-solving skills.

In a teaching experiment conducted at a music conservatory, exploratory methods significantly increased students' enthusiasm for improvisation. Surveys showed that over 85% of participants found this approach more effective in deepening their understanding and enjoyment of improvisation [3].

5.2 Developing and Utilizing Diverse Repertoire

Diverse repertoire is an essential resource for improvisation pedagogy. Introducing music from various styles and cultural contexts—such as Baroque dances or jazz improvisations—broadens students' creative horizons and fosters versatility.

In practice, educators can leverage digital resources, including online music libraries and software, to provide a rich array of materials. Customizing lessons based on students' interests, such as adapting popular songs or film scores, can further enhance engagement and make the learning process more relatable.

5.3 Strategies for Individualized Expression Training

Individualized training is a critical component of improvisation instruction. Teachers should tailor lesson plans to students' musical backgrounds, personalities, and goals. For advanced learners, this may involve complex harmonic improvisation, while beginners might start with simple melodic imitation or rhythmic exercises.

Incorporating "situational training" can also be effective. For example, teachers might present a visual or narrative stimulus, prompting students to create music that reflects the imagery or storyline. This approach helps students integrate emotional expression into their improvisation.

6. PRACTICAL CASES AND ANALYSIS OF PIANO IMPROVISATION PEDAGOGY

6.1 Principles and Goals of Teaching Practice Design

Effective teaching practices for improvisation must adhere to two core principles: clear objectives and scientific methodologies. Goals should encompass not only technical skill development but also the enhancement of creativity and comprehensive musical literacy. Content must align with students' cognitive levels, progressing in complexity to ensure gradual mastery of improvisational skills.

6.2 Challenges and Solutions in Practice

Challenges in improvisation pedagogy include students' fear of improvisation and technical barriers. These can be addressed through phased instruction and psychological support. For example, starting with imitation exercises can ease students into independent creation. Group performance and peer feedback further alleviate anxiety and build confidence.

6.3 Results and Insights from Practice

In a practical study on improvisation pedagogy, 80% of students reported significant improvement in their musical understanding and emotional expression. Analysis identified exploratory learning models, diverse repertoire, and individualized training as key contributors to success. These findings highlight critical strategies for expanding improvisation teaching methods and enhancing their impact.

7. FUTURE DIRECTIONS FOR PIANO IMPROVISATION

7.1 Advancing and Innovating Theoretical Research

As a synthesis of musical creation and performance, piano improvisation warrants deeper theoretical exploration. Current studies often emphasize its historical development and technical aspects, while its cognitive mechanisms, intrinsic attributes, and cross-cultural dimensions remain underexplored. Future research could investigate how performers construct musical structures in real-time and the interplay between internal auditory imagery and motor actions. Such inquiries would benefit from interdisciplinary approaches combining musicology, neuroscience, and psychology.

Additionally, the cultural diversity of improvisation offers fertile ground for research. In a globalized world, improvisation reflects the convergence and integration of cultural elements, such as the combination of

Western harmonic theories with African scales or Latin rhythms. Exploring these intersections might yield new musical styles and theoretical frameworks. Emerging practices, like real-time creation in electronic music, also present opportunities to redefine improvisation within contemporary contexts.

7.2 Optimizing and Promoting Pedagogical Practices

Although piano improvisation is increasingly incorporated into music education, challenges persist, including limited teaching resources, varying teacher expertise, and diverse student receptivity. Future pedagogical efforts should address these barriers by optimizing methods and expanding accessibility.

Innovative approaches could include interdisciplinary collaborations, such as integrating drama or visual arts into improvisation lessons, fostering holistic creative skills. Diverse teaching materials, ranging from classical works to popular and ethnic music, could cater to varied student interests and increase engagement.

Promotional efforts should involve policy support and societal participation. Competitions, workshops, and public lectures can enhance awareness and appreciation of improvisation. Higher education institutions might introduce specialized courses in improvisation and composition to train skilled educators and performers, thereby fostering widespread adoption of improvisation pedagogy.

7.3 Leveraging Digital and AI Technologies in Teaching

The rapid development of digital and artificial intelligence (AI) technologies holds immense potential for piano improvisation education. AI can offer real-time feedback and evaluations, analyzing performance aspects like harmony, melody, and rhythm to provide tailored improvement suggestions. For instance, platforms like Flowkey generate improvisation exercises aligned with a student's skill level, enhancing efficiency while reducing teachers' workload [1].

Digital platforms also expand access to learning resources, enabling students to access tutorials and interactive materials anytime, anywhere. Virtual reality (VR) applications could create immersive environments where learners practice improvisation on virtual stages, enriching their educational experience. Beyond pedagogy, AI can contribute to research on improvisation. Machine learning algorithms analyzing large datasets of improvisational performances could uncover underlying patterns and creative processes. These technological integrations not only enhance teaching outcomes but also push the artistic boundaries of improvisation.

8. CONCLUSION

Piano improvisation, as an art form merging composition, performance, and education, plays a vital role in both musical practice and pedagogy. This study highlights its ability to foster creative thinking, enhance comprehensive musical literacy, and encourage personalized musical expression. Through exploratory teaching models, diverse repertoire, and personalized training strategies, improvisation can be effectively integrated into music education.

Educators should actively incorporate improvisation into their curricula, adapting techniques to students' needs and progression. Gradual goal-setting and varied teaching content are essential for skill development, while fostering aesthetic sensitivity and expressive abilities should remain central to instruction.

Policymakers and institutions must prioritize improvisation education, providing professional development for teachers and ample learning resources for students. National training programs for improvisation educators and support from music associations or philanthropic organizations could bolster the dissemination of this art form, ensuring its continued growth and broader impact.

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British Literature in Intercultural Communication: Language Identity Construction Among Second Language Learners

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Abstract: This study explores the role of British literature in intercultural communication, focusing on the mechanisms and multidimensional aspects of language identity construction among second language (L2) learners. It investigates how British literature, as a cultural medium, influences L2 learners' identity formation, linguistic practices, and cultural adaptation, as well as how learners reconstruct their language identities within intercultural contexts through literary studies. Employing a mixed-methods approach, the research combines surveys, in-depth interviews, and textual analysis to systematically examine the linguistic choices, cultural cognition, and identity construction of L2 learners from diverse cultural backgrounds during their engagement with British literature. Data analysis highlights dynamic changes in language use, multi-layered expressions of cultural identity, and the role of context in shaping identity. Findings reveal that engaging with British literature significantly enhances L2 learners' linguistic competence, cultural sensitivity, and multifaceted identity development. Learners not only develop a sense of affinity with the target culture but also achieve balanced adaptation between their native and target cultures through deep literary interpretation. the study further emphasizes that teaching British literature should integrate linguistic interaction with cultural dialogue, offering L2 learners a space for identity reconstruction within a multicultural framework. This integration fosters improved linguistic proficiency and cultural integration in intercultural contexts.

Keywords: Intercultural Communication; British Literature; Language Identity; Second Language Acquisition; Cultural Adaptation

1. INTRODUCTION

1.1 Research Background and Problem Statement

With the deepening of globalization, intercultural communication has become an indispensable skill in modern society. In this context, language, as a vital medium of cultural exchange, plays a role that transcends linguistic competence to encompass learners' identity construction. For second language (L2) learners in particular, language learning is not merely an instrumental process but also a socio-cultural interaction in which they continuously reshape their linguistic identities. British literature, known for its profound cultural depth and unique linguistic artistry, serves as a critical cultural medium in L2 learners' language acquisition. However, existing research lacks systematic theoretical and empirical analyses on the role of British literature in intercultural communication and identity construction, calling for an in-depth exploration from the perspective of language-culture integration.

1.2 Literature Review

Internationally, the relationship between language identity and intercultural communication has been a prominent research focus. Norton (1995) introduced the concept of "investment, " emphasizing that L2 learning involves not only linguistic development but also dynamic identity changes [1]. Recent studies have increasingly centered on the interplay between language identity and cultural adaptation, highlighting how learners may gain new identities or encounter cultural

conflicts and adaptational challenges within target language cultures.

In China, research on intercultural communication and language identity has also grown in recent years, primarily focusing on language transfer and cultural adaptation. However, few scholars have examined identity construction through the lens of literature. Preliminary studies on British literature in language education have highlighted its positive impacts on linguistic competence and cultural understanding [2]. Nonetheless, these studies often adopt an instrumental perspective, lacking in-depth theoretical and practical analyses of identity construction among L2 learners.

1.3 Research Objectives and Significance

This study aims to investigate the dynamic mechanisms underlying L2 learners' identity construction during their engagement with British literature, analyzing their linguistic practices, cultural identification, and intercultural adaptation. By integrating theoretical and empirical approaches, the research seeks to uncover how British literature, as a cultural vehicle, facilitates multidimensional identity construction. the findings will contribute to expanding the theoretical framework of intercultural communication and language identity while providing practical insights for British literature education and L2 teaching.

2. THEORETICAL FRAMEWORK

2.1 Intercultural Communication and Language Identity Theory

Intercultural communication involves verbal and non-verbal exchanges between individuals from different cultural backgrounds, with its essence rooted in transcending cultural differences to achieve effective information exchange. Language identity, reflecting a user's self-perception and social positioning within specific socio-cultural contexts, is a crucial element of intercultural communication. According to Norton, language identity is dynamic, situational, and multifaceted [1]. For L2 learners, identity construction involves processes of recognition, adaptation, and reconstruction within the target language culture, underscoring the socio-cultural dimensions of language learning.

Research indicates that language identity is shaped by factors such as language choice, cultural affiliation, and socio-cultural contexts. In intercultural communication, language identity influences communication effectiveness and determines learners' long-term investment in the target language. the conflicts and integration of language identity within intercultural contexts are vital topics, particularly as globalization intensifies cultural interactions. Applying language identity theory enables a deeper understanding of how L2 learners navigate self-positioning and identity affirmation through language learning and cultural adaptation.

2.2 British Literature and Cultural Adaptation Theory

British literature, as a form of linguistic art with rich cultural connotations, serves as a key cultural medium in intercultural communication. In L2 acquisition, literature not only provides linguistic input but also conveys cultural narratives and value systems. British literature, in particular, offers opportunities for L2 learners to engage with the elegance of language and the diversity of cultural contexts. Cultural adaptation theory emphasizes the behavioral, emotional, and cognitive adjustments needed for individuals to adapt to new cultures. Through British literature, learners can access and understand target cultures, alleviating cultural conflicts and enhancing cultural identification.

Studies show that L2 learners often achieve cultural cognition and behavioral adaptation by resonating with characters, narratives, and cultural contexts in literary works. For instance, while reading Oliver Twist, learners may reflect on societal disparities during the Victorian era and draw parallels to contemporary socioeconomic issues, achieving both emotional and cognitive elevation in cultural adaptation [3].

2.3 Identity Construction Mechanisms in L2 Acquisition

Language learning is not merely about acquiring linguistic abilities but also about participating in social practices that shape identity. L2 learners construct their identities by continuously negotiating their roles within linguistic, cultural, and social dimensions of the target language.

The mechanisms of identity construction involve language choice, cultural identification, and social interaction. Language choice reflects learners' flexible use of different languages in varying contexts, forming a diversified language identity. Cultural identification represents learners' acceptance of the target culture, directly influencing the success of their language learning. Social interactions provide opportunities for learners to practice identity construction, such as through communication with native speakers, allowing them to better understand the social norms and value systems of the target culture.

Notably, identity construction is not a unidirectional process but a dynamic interaction between the input of target culture and the output of native culture. Through target language learning, L2 learners may reinforce their identification with the target culture or seek balance and reconciliation amidst cultural conflicts. This dynamic mechanism of identity construction is a critical topic in L2 acquisition within intercultural contexts.

3. RESEARCH DESIGN
3.1 Research Methods and Tools
This study employs a mixed-methods approach, combining qualitative and quantitative research to ensure systematic and scientific rigor. Qualitative methods involve in-depth interviews and content analysis to explore the specific manifestations and internal mechanisms of language identity construction among L2 learners engaged in British literature. Quantitative methods include surveys to collect data on learners' language choices, cultural perceptions, and shifts in linguistic identity.

In-depth interviews target L2 learners from diverse cultural backgrounds using semi-structured questions to capture their experiences and perceptions of studying British literature, including changes in language use, cultural encounters, and identification with the target culture. Content analysis focuses on learners' written texts or speech transcripts, examining changes in word choice, expression style, and cultural perspectives.

The survey component includes scales covering language usage frequency, attitudes toward learning British literature, and intercultural adaptability. All scales are designed using a 5-point Likert scale. Survey data is analyzed using SPSS software to identify quantitative relationships between British literature learning and language identity construction.

3.2 Data Sources and Participants
Data for this research comes from two groups: university students enrolled in British literature courses at a domestic institution and working professionals studying English as a second language. the sample comprises 200 participants, with university students making up 70% and social learners 30%. Participants represent diverse cultural backgrounds, including native speakers of Mandarin, French, and Arabic.

Participants are divided into two groups: one that has taken British literature courses and another that has not. This design controls variables to assess the unique role of British literature in language identity construction. Ethical guidelines are strictly followed, with all participants providing informed consent.

3.3 Data Analysis Methods
Data analysis integrates quantitative and qualitative approaches. Quantitative analysis involves descriptive statistics to identify trends in survey data and inferential statistics (e. g., t-tests and regression analyses) to assess the impact of British literature learning on language identity construction.

Qualitative analysis employs thematic analysis of interviews and written texts, identifying key themes related to language identity, such as cultural adaptation, linguistic diversity, and sense of belonging. the combination of these methods ensures scientific validity and reveals dynamic processes of language identity construction across multiple dimensions.

4. THE ROLE OF BRITISH LITERATURE IN SECOND LANGUAGE ACQUISITION
4.1 British Literature as a Cultural Medium
British literature, with its unique linguistic style, profound cultural depth, and diverse historical contexts, provides L2 learners with

rich resources to understand the target culture. Beyond its linguistic artistry, British literature encapsulates societal values, historical memories, and multicultural elements. Engaging with British literary works allows learners to immerse themselves in the cultural contexts of the target language, fostering a dual learning process of language and culture. For instance, classic works like Pride and Prejudice not only showcase refined English expressions but also reflect social class structures and gender roles of their time. By analyzing these literary elements, L2 learners can develop a deep understanding of the target culture, enhancing their sensitivity to potential cultural differences—a skill essential in today's globalized world.

4.2 Enhancing Linguistic Competence in L2 Acquisition

As a high-quality source of linguistic input, British literature significantly contributes to L2 learners' language development. Compared to standard language textbooks, literary works offer rich language, diverse expressions, and complex structures. Through studying these works, learners gain exposure to grammar, rhetorical techniques, and vocabulary in varied contexts.

For example, the rhetorical devices in Shakespeare's plays—such as parallelism, antithesis, and metaphor—provide opportunities for learners to appreciate and practice advanced linguistic artistry. By reading and imitating such expressions, learners can greatly enhance their linguistic proficiency. Additionally, the dialogue-rich nature of many British literary works helps learners simulate authentic communication, improving their fluency and naturalness in language use.

4.3 Fostering Cultural Awareness and Understanding

Literature serves as a mirror of culture, and British literature vividly portrays the cultural characteristics and values of British society through its characters, narratives, and socio-historical contexts. By analyzing the cultural content in literary works, L2 learners deepen their understanding of the target culture while comparing it with their native culture, fostering an appreciation for cultural diversity. For instance, reading Oliver Twist allows learners to explore the social disparities and

moral principles of Victorian England. Such cultural insights not only enhance learners' comprehension of the target culture's historical and social contexts but also help them establish deeper emotional and cultural connections during intercultural communication.

5. LANGUAGE IDENTITY CONSTRUCTION AMONG L2 LEARNERS

5.1 Multidimensionality of Language Identity

Language identity represents an individual's self-positioning and social affiliation in the process of language learning and use. It encompasses multiple dimensions. the linguistic competence dimension reflects the learner's proficiency in the target language. the cultural affiliation dimension indicates the learner's acceptance and identification with the target culture. the social interaction dimension captures how learners construct relationships with others through language use. Through engaging with British literature, these dimensions of language identity are continually reinforced. Learners not only improve their linguistic competence by reading classic works but also find their cultural and social positioning within the target language context.

5.2 Dynamic Changes in Language Use and Cultural Affiliation

Changes in language use are important indicators of language identity construction. Learners' language choices in different contexts are often influenced by the target culture, which in turn impacts their cultural affiliation. For example, studies reveal that learners who frequently read British literature are more likely to incorporate English vocabulary and expressions into their daily communication, demonstrating a gradual alignment of their linguistic identity with the target culture.

Changes in cultural affiliation are reflected in shifts in learners' attitudes toward the target culture. Starting from initial cultural estrangement, learners often progress toward acceptance and appreciation of the target culture, reflecting psychological adaptation and identity transformation during L2 acquisition.

5.3 Identity Adaptation and Reconstruction in Intercultural Contexts

In intercultural contexts, L2 learners face the challenge of identity adaptation, balancing integration into the target culture with maintaining their native cultural identity. Through British literature, learners develop empathy for literary characters and narratives, gradually adapting to the values and social norms of the target culture. Simultaneously, they reflect on the differences between their native and target cultures, reconstructing their identities amidst these cultural tensions.

For instance, one participant noted that reading Jane Eyre profoundly influenced her views on gender equality, as the novel's themes of female independence resonated with her personal reflections. This process of intercultural adaptation not only fosters learners' identification with the target culture but also cultivates a more open and inclusive sense of identity in the face of cultural conflicts.

6. STRATEGIES FOR FOSTERING LANGUAGE IDENTITY IN BRITISH LITERATURE INSTRUCTION

6.1 Multicultural Interpretation of Literary Texts

British literature, with its rich cultural connotations and diverse narrative forms, offers L2 learners an opportunity to deeply understand the target culture. In teaching practice, instructors can guide learners in interpreting texts from a multicultural perspective to develop intercultural awareness and multidimensional viewpoints. For example, while analyzing Oliver Twist, teachers can encourage students to explore Victorian social issues, such as economic disparity and class division, fostering an understanding of the era's cultural values. Through comparisons with students' native cultures, such as contrasting China's collectivist "family-state sentiment" with the individualist values in British literature, learners can recognize both cultural commonalities and differences.

Such approaches should focus on uncovering implicit intercultural messages embedded in texts. For instance, Pride and Prejudice provides an excellent platform for discussing gender roles and family dynamics, which can be juxtaposed with modern views on gender equality. These discussions enhance cultural awareness while helping learners find balance between the target and native cultures.

6.2 Interactive Integration of Language and Culture in Teaching

Teaching British literature should integrate language and cultural learning through interactive approaches, such as role-playing, scenario simulations, and group discussions. For example, in Macbeth, students can assume characters' roles to express their perspectives, fostering linguistic competence while immersing themselves in Shakespearean cultural contexts.

Real-world cultural materials can enrich lessons by connecting literary scenes to contemporary societal phenomena. For instance, discussions on Jane Eyre can link the protagonist's independence to modern gender roles, fostering cultural identification and helping learners position themselves between native and target cultures. Teachers can also employ multimodal resources such as films, theatrical adaptations, and documentaries. For example, watching scenes from Hamlet adaptations allows students to grasp the emotional and cultural richness of the language. Such designs improve intercultural communication skills and cultural sensitivity in language learning.

6.3 Creating Identity Affirmation Spaces in Teaching

Identity affirmation is a critical psychological need in L2 learning. Teachers can foster this through activities that allow self-expression and identity exploration. Group projects and intercultural exchange activities are effective strategies. For example, students can analyze interpersonal relationships and social values in literature through a cross-cultural lens, helping them connect their experiences with the target culture and enhancing intrinsic motivation for learning.

Intercultural exchanges, such as discussions with native English speakers on literary themes, provide authentic environments for cultural interaction. These exchanges not only improve learners' language proficiency but also help them construct a more open and diverse linguistic identity by integrating into the values and contexts of the target culture.

7. FINDINGS AND DISCUSSION

7.1 Implications of British Literature for L2 Learners' Language Identity

As a cultural medium, British literature significantly influences L2 learners' language identity construction. Findings reveal that learners engage with the emotional and societal values embedded in literary texts, enhancing both linguistic competence and cultural identification. For instance, some participants noted that Jane Eyre's themes of independence and resilience deeply impacted their life perspectives, illustrating the interplay between literature and identity.

Moreover, British literature helps learners balance personal identity and cultural affiliation. Through multicultural interpretation, learners can critically examine self-positioning within the intersection of target and native cultures. For example, students exposed to British literature demonstrated higher levels of cultural identification with the target language than those without similar exposure [1], underscoring the role of literature in fostering language identity.

7.2 Mechanisms of Intercultural Communication in L2 Acquisition

Intercultural communication is a vital component of L2 acquisition and a central mechanism of language identity construction. Through interaction with the target culture, learners adapt to its values and norms, a process that facilitates both language learning and identity formation. For instance, participants involved in intercultural activities exhibited higher fluency and cultural adaptability than those who did not participate [2].

The dynamic relationship between language use and cultural affiliation further illustrates the role of intercultural communication. Increased exposure to the target culture correlates with higher usage of the target language and stronger cultural identification. For example, some participants reported greater cultural belongingness and improved language skills through intercultural exchanges, demonstrating the dual impact of such interactions on linguistic and cultural dimensions.

8. CONCLUSION

This study highlights the deep influence of British literature on L2 learners' language identity construction. As a convergence of language and culture, British literature not only provides learners a window into the target culture but also helps them develop a multifaceted language identity. Through multicultural interpretation, learners enhance linguistic skills while fostering cultural identification with the target culture.

Intercultural communication serves as a crucial mechanism in L2 acquisition, offering learners a platform to dynamically construct language identity through language choice and cultural adaptation. This process underscores that L2 learning extends beyond linguistic skill development to encompass cultural cognition and self-positioning.

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Reforming Chemical Engineering Education to Align with Societal Needs

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Abstract: The rapid advancement of global industrialization and digitalization has led to increasingly diverse and advanced demands for professionals in chemical engineering. This study explores how education reform in chemical engineering can better align with societal needs to cultivate high-quality engineering talent for the modern era. Using a combination of literature review and comparative analysis, the study systematically reviews the theoretical foundations and practical approaches of educational reforms in chemical engineering both domestically and internationally. By analyzing curriculum design, teaching methodologies, and competency-building models, the research proposes a "societal-needs-driven, competency-focused" education framework. Challenges such as technological innovation, green sustainability, and interdisciplinary integration are addressed, and key talent development objectives and evaluation metrics aligned with societal demands are identified. Results indicate that optimizing modular curricula, promoting interdisciplinary learning paths, and enhancing university-industry collaboration are critical to seamlessly integrating theoretical knowledge with practical skills. This study provides theoretical insights and practical guidance for effectively bridging chemical engineering education with industry demands.

Keywords: Chemical Engineering Education; Education Reform; Societal Needs; Talent Development; University-Industry Collaboration

1. INTRODUCTION

1.1 Research Background and Significance

With rapid global economic and technological development, chemical engineering plays an increasingly critical role in modern industries, encompassing areas such as energy, materials, environment, and pharmaceuticals. The demand for talent in this field is becoming more diverse and advanced, requiring not only solid technical expertise but also innovation, interdisciplinary collaboration, and practical engineering skills [1]. However, traditional chemical engineering education models often fall short in meeting these demands. Issues such as misaligned curricula with industry requirements and inadequate training in solving complex engineering problems limit students' competitiveness in the job market.

Under the framework of China's innovation-driven development strategy, chemical engineering is encountering both new opportunities and challenges. Universities, as primary hubs for cultivating high-quality engineering professionals, must respond to these changes by reforming their educational systems. This reform not only enhances graduates' employability but also supports national industrial upgrades and high-quality economic development.

1.2 Review of Domestic and International Research

Foreign universities have accumulated significant experience in reforming chemical engineering education. For example, many institutions in Europe and North America emphasize close university-industry collaboration through joint research labs and case-based teaching to enhance students' practical skills [2]. Additionally, Problem-Based Learning (PBL) models, widely adopted in countries like the U.S. and the U.K., focus on fostering students' self-learning and problem-solving capabilities [3].

In contrast, while China has expanded the scale of chemical engineering education, there remains substantial room for improvement in the depth of reforms and alignment with industry needs. Research highlights challenges such as imbalanced theory-to-practice ratios, outdated course content, and

insufficient emphasis on innovation training [4]. Recent national policies, such as the "Double First-Class Initiative" and the "New Engineering" programs, provide strong support for engineering education reforms, creating opportunities for improvement.

1.3 Research Objectives and Methods

This study aims to explore ways to align chemical engineering education more effectively with societal needs by analyzing the specific competency requirements for professionals in this field. The study employs a combination of literature review and case analysis to summarize successful practices in domestic and international education reforms. Based on the current societal demands in China, recommendations are proposed to optimize the education system. The findings aim to provide theoretical and practical guidance for cultivating high-quality chemical engineering talent.

2. ANALYSIS OF SOCIETAL COMPETENCY REQUIREMENTS FOR CHEMICAL ENGINEERING PROFESSIONALS

2.1 Trends in the Diversification of Societal Needs in Chemical Engineering

Modern societal demands in chemical engineering are increasingly diverse, driven by technological advancements and economic restructuring. Fields such as green chemistry, renewable energy, and circular economy are rapidly developing, shifting the workforce needs beyond traditional roles in production and R&D to emerging areas like environmental protection, smart manufacturing, and biochemical engineering [5].

For instance, the growing focus on green chemistry has led companies to prioritize clean production technologies. In 2022, a Chinese chemical company successfully industrialized a clean production process using innovative green catalysts, attracting professionals with dual expertise in chemical and environmental engineering. This highlights the need for multidisciplinary and versatile talent in the workforce.

The rise of artificial intelligence and big data has also introduced new dynamics to the chemical engineering sector. Processes such as optimization, real-time monitoring, and intelligent decision-making now rely heavily on data analysis skills, setting higher competency benchmarks for professionals. These trends necessitate a rethinking of university curricula and training objectives.

2.2 Core Competencies for Engineering Professionals

Aligning with the evolving societal needs, the definition of core competencies for chemical engineering professionals requires updates. According to international standards such as the Washington Accord and ABET accreditation, key competencies for engineering professionals include:

- Fundamental Knowledge: Mastery of core concepts like chemical reaction engineering, separation processes, and transport phenomena.
- Practical and Innovative Skills: The ability to apply theoretical knowledge to solve real-world engineering problems, emphasizing innovation. For example, China's "dual carbon" goals demand innovative environmental technologies from professionals.
- Interdisciplinary Collaboration: Many modern chemical engineering projects involve cross-disciplinary work, requiring strong teamwork and interdisciplinary communication skills.
- Information Technology Proficiency: The integration of Industry 4.0 technologies demands proficiency in tools like data analysis software and process simulation tools.
- Ethical and Social Responsibility: Professionals must demonstrate sustainable development principles and ethical awareness, given the resource and environmental implications of chemical engineering.

2.3 Societal Needs as a Driver for Educational Reform

The evolving societal demands are a key driver of educational reform in chemical engineering. Recent surveys indicate that over 60% of chemical engineering enterprises in China consider graduates' theoretical knowledge sufficient but note significant gaps in practical and hands-on abilities [7].

Enterprises also expect stronger university-industry collaboration, such as joint R&D initiatives and co-development of training programs to enhance students' professional competence. Additionally, globalization in the

chemical engineering industry has amplified the demand for international talents who possess multilingual skills, global perspectives, and cross-cultural communication abilities.

To address these challenges, universities must undertake systemic educational reforms, including optimizing curricula, updating teaching materials, developing advanced practical training platforms, and strengthening university-industry partnerships.

3. CURRENT STATUS AND CHALLENGES IN CHEMICAL ENGINEERING EDUCATION

3.1 Limitations of Traditional Curriculum Design

The existing chemical engineering education system often emphasizes theoretical knowledge, focusing on systematic and comprehensive subject coverage. However, this depth-centric approach may result in a lack of alignment with modern societal demands. Many universities continue to adopt a traditional linear curriculum structure, dividing knowledge into independent modules such as chemical thermodynamics, principles of chemical engineering, and transport processes. While this structure helps students build a strong theoretical foundation, it often overlooks the interconnections between disciplines and the integration of cross-disciplinary knowledge.

With the rapid development of technology, societal needs in chemical engineering are increasingly shifting toward areas like green chemistry, renewable energy, and smart manufacturing. These fields demand interdisciplinary skills, yet traditional curricula allocate minimal emphasis on relevant topics. For instance, a survey of Chinese universities' chemical engineering programs revealed that courses related to environmental protection and energy management account for less than 5% of total course offerings [1], far below societal demands. Additionally, the absence of courses on data science and artificial intelligence exacerbates students' lack of competitiveness in emerging fields, such as intelligent manufacturing.

Moreover, curriculum content often lags behind technological advancements. Over the past decade, the chemical engineering industry has witnessed significant breakthroughs, such as molecular engineering and AI-driven process optimization. However, these cutting-edge topics remain underrepresented in many universities' curricula. This disconnect limits students' understanding of industry trends and diminishes their ability to adapt to high-level positions.

3.2 Disconnect Between Teaching Methods and Practical Skill Development

Teaching methods significantly influence students' ability to grasp knowledge and address real-world engineering challenges. Traditional teaching heavily relies on lectures, prioritizing theoretical knowledge transfer while neglecting the cultivation of hands-on engineering skills. This approach fosters passive learning habits, leaving students underprepared for problem-solving in practical contexts.

For example, many experimental courses in universities remain at the level of confirmatory experiments, with outdated content that fails to inspire innovation. In some cases, experiments merely serve as extensions of lecture material, where students follow predetermined procedures without engaging in data analysis or critical discussion. This teaching style starkly contrasts with industry demands for innovative technical talent.

Furthermore, engineering training within universities is often insufficient to prepare students for real-world operations. Obsolete chemical engineering simulation equipment limits students' exposure to advanced processes and technologies. According to a 2019 survey, over 60% of employers reported that chemical engineering graduates required extensive additional training before becoming fully competent in their roles [2]. This highlights the urgent need to enhance the practical orientation of educational content.

3.3 Deficiencies in University-Industry Collaborative Education

University-industry collaboration is a crucial pathway for cultivating high-quality engineering professionals. However, many Chinese universities face challenges in fostering effective partnerships with enterprises. On one hand, communication

mechanisms between universities and companies are often underdeveloped, restricting enterprises' involvement in the entire talent cultivation process. Many collaborations are limited to short-term internships or guest lectures, preventing students from accessing core technologies and management processes within the industry.

On the other hand, companies' engagement with university education is often driven by philanthropic motives rather than tangible benefits. Without a robust incentive mechanism, enterprises display low enthusiasm for participation. Additionally, universities sometimes fail to fully consider industry needs during collaboration, resulting in a mismatch between academic training and employer expectations. A survey of chemical engineering enterprises found that over 70% of respondents believed that graduates' technical competencies did not align with industry requirements [3].

4. THEORETICAL FRAMEWORK AND IMPLEMENTATION PATHWAYS FOR EDUCATIONAL REFORM

4.1 Theoretical Basis for Demand-Oriented Educational Reform

Educational reform should be guided by societal demands, aligning with the trends in chemical engineering and the required competencies of professionals. Based on constructivist learning theory, reform should focus on enabling students to build knowledge through real-world practice. This theory emphasizes the contextual and experiential aspects of learning, advocating for teaching activities that not only convey knowledge but also simulate authentic engineering scenarios, where students achieve learning outcomes by completing practical tasks.

Additionally, reform should integrate "Industry-Education Integration" theory to optimize resource allocation between universities and industries. The German "Dual System" serves as a successful model, combining theoretical education with workplace training. This provides valuable insights for implementing collaborative education models in China.

4.2 Modularization and Multidisciplinary Curriculum Optimization

To address the limitations of traditional curricula, a modular approach can improve teaching efficiency while catering to diverse talent development goals. Modular design involves dividing the curriculum into thematic, goal-specific units, allowing students to select learning paths aligned with their interests and career plans. For example, chemical engineering programs could include modules such as foundational theories, process design, and green chemistry. Students could then choose specific modules for in-depth study, provided they meet graduation requirements.

Multidisciplinary integration is another key to enhancing curriculum design. Given the interdisciplinary nature of chemical engineering, students must acquire knowledge from adjacent fields. For instance, courses in the energy-chemical engineering track could incorporate topics from economics and management, enabling students to grasp both technical skills and the fundamentals of industry operations.

4.3 Implementation of University-Industry Collaborative Education

Establishing effective university-industry collaboration mechanisms requires both organizational and practical measures. On the organizational side, universities should establish dedicated offices for coordinating industry partnerships. Enterprises, in turn, can participate in talent development by funding research projects or co-designing curricula. On the practical side, initiatives such as joint laboratories and enterprise mentorship programs can strengthen students' engagement with the industry.

For example, a chemical engineering school partnered with a leading industry enterprise to establish a Catalysis Research Center. Through participation in research projects, students gained hands-on experience with advanced experimental techniques and acquired critical practical skills. Such collaborations not only bridge the gap between academic training and industry needs but also deliver mutual benefits by fostering innovation and talent development.

5. STRATEGIES FOR ALIGNING CHEMICAL ENGINEERING EDUCATION WITH SOCIETAL NEEDS

5.1 Integrating Theoretical Knowledge with Practical Skills

The seamless integration of theory and practice requires efforts in both curriculum content and instructional methods. Content design should emphasize the connection between theoretical principles and real-world applications, such as incorporating industrial case studies into lectures to contextualize knowledge. Project-Based Learning (PBL) can further enable students to acquire knowledge through hands-on problem-solving in practical scenarios.

In terms of teaching methods, simulation technologies offer innovative solutions. For instance, chemical process simulation tools like Aspen Plus have been widely adopted in education. By combining simulation-based experiments with traditional laboratory work, students gain a comprehensive understanding of complex processes and the opportunity to explore creative solutions in a virtual environment.

5.2 Cultivating Innovation and Engineering Literacy

Building innovation capabilities requires interdisciplinary learning platforms and open research environments. Universities can offer cross-disciplinary elective courses and organize competitions to stimulate students' creativity. For example, the "Challenge Cup" competition provides a platform for chemical engineering students to showcase their innovative projects.

Engineering literacy development should focus on fostering professional ethics and social responsibility. This can be achieved through courses on engineering ethics and participation in social practice activities. In recent years, some universities have successfully integrated sustainability concepts into engineering projects, demonstrating positive results.

5.3 Mechanisms for Evaluating and Improving Talent Development

A robust evaluation mechanism is critical to the success of educational reform. Evaluation metrics should encompass theoretical knowledge, practical skills, and professional competence, employing diverse assessment methods. For instance, students' capstone projects could be jointly reviewed by academic and industry mentors to ensure comprehensive and objective evaluations.

Dynamic adjustment of training programs can be informed by alumni tracking surveys and employer feedback. For example, one university identified data analysis skills as a key competitive asset for chemical engineering graduates through a career development survey. This insight led to the inclusion of relevant courses in the curriculum.

6. CONCLUSION

This study analyzed the current state of chemical engineering education and the evolving societal demands, identifying key challenges and proposing reform strategies. The findings highlight that optimizing curricula, innovating teaching methods, and enhancing university-industry collaboration are central to improving the quality of chemical engineering education.

Future research should focus on the impact of emerging technologies, such as artificial intelligence and Industry 4.0, on chemical engineering education. Educational practices should explore personalized learning models to provide students with flexible learning pathways. Furthermore, universities and enterprises should strengthen international collaboration to advance the globalization of chemical engineering education.

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ACADEMIC PUBLISHING HOUSE

Challenges and Opportunities of Artificial Intelligence in Ideological and Political Education in Higher Education

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Abstract: The rapid advancement of artificial intelligence (AI) technologies is driving profound changes in ideological and political education (IPE) in higher education institutions. This paper explores the challenges and opportunities AI brings to IPE, analyzing its far-reaching impact on traditional education models, content dissemination methods, and value-based cultivation. By employing a combination of literature review and theoretical analysis, this study synthesizes key insights from domestic and international research and proposes a framework for a new IPE model adapted to AI advancements. the findings indicate that AI significantly enhances the precision and interactivity of IPE through functions such as intelligent recommendations and personalized learning. However, challenges such as ethical controversies, data privacy risks, and weakened teacher-student relationships accompany these advancements. From the perspectives of technology empowerment, education ecosystem optimization, and value transmission efficiency, this study systematically analyzes AI's potential applications in educational settings and emphasizes the need for strengthened ethical guidance and regulatory policies in its use. the conclusion highlights that AI provides a novel developmental pathway for IPE in higher education. A hybrid model that integrates teacher leadership with AI assistance is proposed to enhance the effectiveness and appeal of IPE. This study offers theoretical insights and practical guidance for the deep integration of AI into IPE in higher education.

Keywords: Artificial Intelligence; Ideological and Political Education; Technology Empowerment; Educational Reform; Value Cultivation

1. INTRODUCTION

1.1 Research Background and Significance

The rapid development of artificial intelligence (AI) is profoundly transforming various sectors, with education emerging as a key application area. In the domain of ideological and political education (IPE) in higher education, these changes are particularly pronounced. As a vital component of China's higher education system, IPE aims to cultivate socialist builders and successors by fostering students' correct worldview, values, and life perspectives. However, traditional IPE models, which primarily rely on static transmission of knowledge through classroom lectures and textbooks, struggle to meet the diverse learning needs of the new generation of students.

The emergence of AI technologies, such as intelligent recommendations, natural language processing (NLP), and virtual reality (VR), offers unprecedented opportunities for IPE. These technologies enable a transformative shift from "knowledge transmission" to "personalized guidance, " enhancing the interactivity, precision, and effectiveness of education.

Meanwhile, the rapid iteration of AI technologies also introduces new challenges. For instance, will the integration of AI into education erode core values? How can the balance between technological ethics and moral education be maintained? Addressing these questions is crucial for the future development of IPE. Studying the challenges and opportunities brought by AI to IPE not only advances theoretical exploration in educational reform but also carries significant practical implications. It contributes to the modernization of IPE, ensures its alignment with the direction of socialist education, and supports the mission of cultivating well-

rounded talents with integrity, intelligence, physical fitness, aesthetics, and labor skills.

1.2 Review of Domestic and International Studies

In recent years, scholars have conducted extensive research on the application of AI in education. Internationally, studies have primarily focused on personalized learning, educational recommendation systems, and sentiment analysis. For example, Nolen-Hoeksema et al. [2] examined the impact of human-computer interaction on teaching models, proposing that deep learning algorithms for precise resource recommendations can enhance learning efficiency. Additionally, Western scholars have discussed the intersection of AI technology and educational ethics, emphasizing concerns such as data privacy and technological alienation alongside the potential for promoting educational equity.

In China, researchers have focused on the unique pathways for AI-enabled education with Chinese characteristics. For instance, Zhang Wei et al. demonstrated through empirical studies that AI applications in China exhibit strong regional adaptability, particularly in IPE, where intelligent teaching platforms and VR classrooms are increasingly utilized [3]. However, domestic studies on the deep integration of AI and IPE largely remain theoretical, with limited empirical analysis and technological exploration. Furthermore, there is a divergence in how domestic and international studies address issues of technological ethics and cultural adaptation. International research tends to adopt a technology-neutral perspective, whereas domestic studies emphasize the value-guiding role of technology.

By reviewing the current state of research, it is evident that studies on AI-enabled IPE face challenges such as insufficient integration of theory and practice and limited research perspectives. This paper aims to systematically explore the relationship between AI and IPE from the dimensions of technological characteristics, application status, and associated challenges and opportunities, providing insights for the digital transformation of future educational models.

2. THE TECHNOLOGICAL FEATURES OF AI AND ITS APPLICATIONS IN EDUCATION

2.1 Core Technologies and Development Trends of AI

AI, as a multidisciplinary technology, encompasses various core areas, including deep learning, natural language processing (NLP), computer vision, and speech recognition. These technologies share a common goal: simulating human intelligence to process data efficiently and perform pattern recognition. In the context of IPE, multimodal AI technologies (e. g., integration of text, speech, and image analysis) are becoming key breakthroughs. For instance, NLP can analyze student feedback, while deep learning algorithms enable personalized teaching resource recommendations.

Recent developments in AI exhibit trends of scalability and contextualization. on the one hand, advancements in computational power and algorithm optimization have lowered the application threshold, increasing the accessibility of AI. For example, open-source AI models are now widely used in educational software development. on the other hand, the contextualization of AI applications is becoming increasingly prominent. In education, AI has expanded from single-function applications (e. g., test generation) to comprehensive teaching support, such as sentiment analysis and dynamic assessments. According to the Artificial Intelligence in Education Development Report (2022), the global edtech market is projected to reach $404 billion by 2030, with AI accounting for nearly 40%.

The unique characteristics of IPE necessitate specific requirements for AI technologies. These technologies must integrate knowledge dissemination with value guidance while avoiding the negative impacts of technological alienation on educational ethics. This demands not only further optimization of AI technologies but also embedding Chinese educational values into their application.

2.2 Typical Applications of AI in Education

AI applications in education are shifting from simple digitization to deep intelligentization, primarily in three domains: intelligent teaching, intelligent assessment, and intelligent management.

In intelligent teaching, AI analyzes students' learning behaviors and academic performance to enable real-time adjustments to teaching content. For example, emotion recognition technologies allow teachers to gauge students' engagement and emotional states during class, thereby adjusting the pace and interaction methods [3]. In IPE, these technologies help educators better understand students' reception of political courses and optimize teaching strategies accordingly.

In intelligent assessment, AI leverages large-scale student data to provide evidence-based evaluations of teaching effectiveness and dynamic monitoring of student progress. For instance, AI-based assessment systems employing deep learning algorithms can predict students' knowledge mastery based on their learning trajectories. This is particularly significant in IPE, where such systems can evaluate not only students' grasp of knowledge points but also their value orientations, thus supporting personalized education.

In intelligent management, AI optimizes resource allocation and administrative processes, enhancing overall efficiency. For example, AI-powered learning management systems (LMS) can recommend course resources and dynamically adjust study plans based on students' learning behaviors. This reduces teachers' administrative burdens and significantly improves the utilization of educational resources.

In IPE contexts, these AI applications not only enable innovation in educational models but also transform teacher-student interactions. For example, voice interaction technologies allow educators to answer student queries in real-time within virtual classrooms, fostering a more open learning environment. However, the widespread adoption of such technologies raises ethical and fairness concerns. Issues such as safeguarding student data privacy and avoiding value bias in intelligent recommendations remain areas requiring further exploration.

3. OPPORTUNITIES OF ARTIFICIAL INTELLIGENCE IN IDEOLOGICAL AND POLITICAL EDUCATION IN HIGHER EDUCATION

3.1 Precision and Personalization in IPE

Content

The introduction of AI has shifted ideological and political education (IPE) from traditional "universal teaching" to a new phase of "precision education. " Leveraging machine learning and big data analysis, AI can extract key information from students' learning behaviors, interests, and psychological traits, thereby enabling personalized education design. For instance, by constructing student learning profiles, educators can tailor course content and provide personalized learning suggestions based on individual differences in values and social responsibility.

A typical example is the application of intelligent recommendation systems. In IPE, AI-powered recommendation systems can suggest relevant learning resources, such as political case studies, stories of influential figures, or policy analyses aligned with students' interests and academic disciplines. This approach not only enhances students' engagement but also strengthens the influence of IPE. According to the Artificial Intelligence in Education Development Report (2022), precision recommendation technologies can increase content matching accuracy by over 30% [4].

Another manifestation of personalization is dynamic adaptive teaching. Traditional IPE content is often uniform, overlooking individual differences. AI enables real-time adjustments to teaching strategies, such as optimizing the difficulty of classroom materials or the type of case studies, aligning them more closely with students' cognitive levels and interests. This integration of precision and personalization improves student engagement and enhances the effectiveness of IPE.

3.2 Innovation in Teaching Models and Optimization of Educational Resources

AI enables innovative teaching models, breaking away from conventional "one-board, one-screen" unidirectional lectures to multidimensional interactive teaching. For instance, immersive VR classrooms have been introduced in some IPE courses, recreating historical events or societal scenarios to deepen students' understanding of social responsibility through experiential learning. Some universities have developed VR scenes for major historical events, such as the War of

Resistance Against Japan or the Reform and Opening-Up, allowing students to "relive" these moments in class. This approach not only increases student interest but also enhances the emotional impact and persuasive power of IPE.

In terms of resource optimization, AI plays a crucial role in managing and sharing educational materials. Intelligent resource management systems can classify, tag, and integrate vast IPE resources, facilitating efficient sharing. For example, AI can analyze the usage frequency and educational effectiveness of teaching resources, promoting high-quality materials to a broader audience of students and educators. In regions with limited educational resources, AI-powered online teaching platforms enable cross-regional resource sharing, providing technological support for educational equity.

3.3 Expanding the Influence of IPE Beyond the Classroom

AI extends the influence of IPE from traditional classrooms to broader societal contexts. Intelligent social robots and AI-powered Q&A systems remove the constraints of time and space, offering more convenient interaction channels for teachers and students. For example, some universities have developed AI-driven IPE assistants equipped with heuristic Q&A functions, allowing students to consult relevant issues anytime via online platforms. Data from one university indicates that such Q&A systems have increased student engagement by over 25% while expanding the reach of IPE [5].

Additionally, AI's capacity for information dissemination enhances the societal impact of IPE. For instance, AI-based public opinion analysis systems help IPE practitioners monitor students' reactions to societal issues in real-time, enabling targeted value guidance. This provides strong support for addressing public opinion and ideological challenges, mitigating potential risks in the realm of thought and values.

4. CHALLENGES OF ARTIFICIAL INTELLIGENCE IN IDEOLOGICAL AND POLITICAL EDUCATION IN HIGHER EDUCATION

4.1 Conflicts Between Technological Ethics and Value-Based Education

The application of AI in IPE raises potential conflicts between technological ethics and educational objectives. AI algorithms, with inherent biases and value orientations, may misguide students if they fail to reflect proper educational values. For example, intelligent recommendation systems often prioritize reinforcing students' existing preferences, neglecting the holistic cultivation of their values. This overly "accommodative" approach can trap students in an "information cocoon" and weaken the guiding role of IPE.

Moreover, the lack of transparency in AI technologies poses a significant challenge. Educators may not fully understand the decision-making logic of algorithms, and students' awareness of AI mechanisms is even more limited. This "black-box effect" could inadvertently reinforce certain value orientations without adequate oversight or correction. Therefore, embedding proper value-guidance principles into AI design is an urgent issue in the context of IPE.

4.2 Data Privacy and Information Security Risks

AI relies on vast amounts of data, necessitating the collection of students' personal information, such as learning behaviors, preferences, and psychological traits, to enable intelligent recommendations and personalized learning. However, such data collection inevitably carries the risk of privacy breaches. For instance, some universities have experienced incidents where inadequate data security measures on intelligent learning platforms led to unauthorized access or misuse of student data [4].

Universities, as primary data custodians, often lack comprehensive privacy protection policies and technical capabilities. Data breaches can infringe students' rights and damage institutional reputations. Balancing technological functionality with data security is a critical challenge for AI applications in IPE.

4.3 Weakening of Teacher-Student Relationships and Educational Agency

AI's involvement in IPE is altering traditional teacher-student interaction dynamics. As AI tools offer efficient personalized learning services, some students may rely more on technology for knowledge acquisition, reducing direct engagement with teachers.

This shift in interaction patterns could weaken the teacher-student relationship, thereby undermining the effectiveness of IPE.

Additionally, the widespread use of AI may erode educational agency. the core of IPE lies in ideological guidance and value cultivation, while AI tools, being inherently instrumental, focus more on knowledge dissemination and skill training. Over-reliance on technology risks formalizing educational activities and diminishing teachers' roles as primary agents of value transmission.

5. PATHWAYS FOR AI-ENABLED IDEOLOGICAL AND POLITICAL EDUCATION

5.1 Building a Hybrid Model of Teacher Leadership and Technological Assistance

Constructing a hybrid model that combines teacher leadership with AI assistance is a key direction for AI-enabled IPE. In this model, teachers continue to play a central role in guiding educational activities, while AI serves as a supporting tool to enhance efficiency and effectiveness. For example, teachers can use AI to analyze classroom data, gain insights into students' learning status, and adjust teaching strategies accordingly. Meanwhile, AI can reduce repetitive tasks, allowing educators to focus more on course design and value guidance.

5.2 Enhancing Ethical Norms and Transparency in AI Technologies

To prevent algorithmic bias from undermining educational values, comprehensive ethical guidelines and transparency mechanisms must be established. Third-party evaluation systems could periodically audit AI applications in educational contexts, and students and teachers should be educated about AI principles to enable monitoring and feedback during its use. These measures would help reduce ethical controversies in AI applications.

5.3 Strengthening Data Security and Privacy Protection Mechanisms

Data security is the cornerstone of AI applications. Universities should bolster data storage and transmission protections using encryption technologies and decentralized storage solutions to prevent breaches. Additionally, strict data privacy policies should define the scope and purpose of data collection, ensuring students' rights to personal information are safeguarded.

By addressing these challenges and leveraging its opportunities, AI can contribute to a more effective and impactful IPE framework in higher education.

6. STRATEGIES FOR ADVANCING THE INTEGRATION OF AI INTO IDEOLOGICAL AND POLITICAL EDUCATION IN HIGHER EDUCATION

6.1 Policy Support and Governance System Improvement

The deep integration of AI into ideological and political education (IPE) requires robust policy frameworks and governance systems. the widespread application of AI in education has raised governance issues, such as technological ethics, data privacy, and educational equity. Governments should establish systematic policy frameworks to define the standards for AI applications in IPE and provide institutional support for technology development, implementation, and oversight. For instance, the Smart Education Development Plan issued by the Ministry of Education [1] outlines the general framework for intelligent education development but lacks specific guidelines tailored to IPE.

Universities, as the primary implementers, should formulate institution-specific strategies aligned with national policies. Establishing professional committees for AI-enabled education, comprising experts in education, AI, and ethics, can help oversee technology planning and implementation. Dynamic evaluation mechanisms should also be developed to ensure the alignment of AI technologies with educational objectives. These measures will ensure the normative and sustainable application of AI in IPE.

6.2 Building a Tech-Savvy IPE Faculty

The introduction of AI necessitates new competencies for IPE faculty. Teachers must not only possess traditional theoretical and pedagogical skills but also understand AI principles and applications. Developing such multifaceted competencies requires lifelong teacher training.

For in-service faculty, universities can combine in-house training with external collaborations. For example, universities could offer AI education courses and partner

with tech enterprises to design training programs tailored to educational contexts. By mastering tools for data analysis and intelligent teaching platforms, teachers can effectively integrate AI into their pedagogy while maintaining professionalism in data usage.

For new teachers, teacher training programs should include AI education modules to equip them with dual expertise in technology and pedagogy. Studies show that teachers trained in AI demonstrate greater efficiency and innovation in instructional design and student interaction [2]. Given the rapid evolution of AI, continuous professional development programs are crucial to keep educators updated on emerging technologies.

6.3 Implementing AI Literacy Programs for Students

Students, as direct beneficiaries of AI applications, need adequate literacy to maximize the technology's potential. AI literacy education should encompass basic technological knowledge alongside ethical considerations, data privacy awareness, and skills for critical information evaluation. In IPE, students' abilities for critical thinking and value discernment directly determine the effectiveness of AI-enabled education.

Universities can integrate AI literacy into their general education curricula, covering both the functionalities and limitations of AI. For example, classes could analyze biases in AI recommendation algorithms to encourage students to reflect on the potential impacts of technology on values [3].

Practical activities, such as research projects on AI and IPE integration, can further enhance students' technical understanding and social responsibility. By involving students in designing and improving intelligent teaching systems, universities can foster their practical skills and ethical awareness.

7. RESEARCH LIMITATIONS AND FUTURE DIRECTIONS
7.1 Research Limitations

This study explores the integration of AI into IPE from both theoretical and practical perspectives but has certain limitations. First, it emphasizes the potential applications of AI without deeply investigating specific implementation pathways. How AI can be standardized across diverse university contexts remains an area requiring empirical exploration. Second, the study focuses on current AI capabilities, without fully accounting for the transformative potential of future advancements in AI technology.

In terms of data, the lack of large-scale empirical studies limits the generalizability of some conclusions. Additionally, as AI and IPE integration is inherently interdisciplinary, this study's engagement with cross-disciplinary perspectives—spanning education, sociology, and technology—remains insufficient.

7.2 Directions for Future Research

Future studies should prioritize empirical research on AI applications in IPE. Large-scale experiments and case studies can validate AI's impact on students' value formation and ideological guidance. Ethical considerations and data privacy issues also warrant deeper investigation, particularly in balancing technological efficiency with ethical safeguards.

Expanding research to an international context is also recommended. Drawing on the experiences of other countries in integrating AI with education can provide valuable insights, which, when adapted to China's unique needs, could inform tailored applications.

Lastly, prospective studies on the future potential of AI in education are crucial as technologies become increasingly intelligent and versatile. Questions such as whether AI can fully realize personalized education or fundamentally reshape teacher-student dynamics merit further academic exploration.

8. CONCLUSION
8.1 Key Findings

The rapid development of AI has opened new possibilities for IPE in higher education. This study demonstrates that AI can significantly enhance teaching quality and student learning experiences by enabling precision teaching, fostering pedagogical innovation, and expanding educational influence. However, its application also introduces challenges, including ethical concerns, data privacy risks, and the weakening of teacher-student relationships. These opportunities and challenges collectively illustrate the dual-edged nature of AI in IPE.

The findings suggest that AI should not replace traditional teaching methods but rather serve as a complementary tool to achieve educational goals. Teachers remain the core agents of education and need to strengthen their technological competencies to ensure alignment between AI applications and educational objectives.

8.2 Implications for Theory and Practice

The study provides the following implications: Theoretically, AI should serve as a focal point for constructing new educational frameworks, enriched by interdisciplinary perspectives to deepen IPE research. Practically, universities should establish AI-compatible education ecosystems by addressing policies, faculty development, and student education to ensure the normative and sustainable application of AI.

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The Application of Word Roots and Affixes in University English Teaching

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Abstract: This study aims to explore the application of word roots and affixes in university English teaching and their impact on students' vocabulary acquisition. By reviewing relevant literature on vocabulary teaching theories and the origins of word roots and affixes, this paper comprehensively analyzes the patterns and teaching strategies of their application from linguistic and educational perspectives. Firstly, through a literature analysis, the study systematically reviews the role of word roots and affixes in English vocabulary formation and their historical application in language teaching, outlining the theoretical foundations and pedagogical advantages of word roots and affixes. Considering the practical needs of vocabulary teaching, this paper proposes a teaching design framework centered around word roots and affixes, including teaching objectives, content organization, method selection, and assessment strategies. Throughout the research process, by comparing and analyzing existing research findings, the study clarifies the applicability of word roots and affixes in different teaching contexts and reinforces their effectiveness in expanding students' vocabulary and improving their vocabulary application skills. The results of the study demonstrate that systematically teaching word roots and affixes not only helps students rapidly expand their vocabulary but also enhances their in-depth understanding of vocabulary structure and meaning. The conclusion summarizes the main findings of this study, emphasizing the importance of word roots and affixes in university English vocabulary teaching, and provides suggestions for future pedagogical applications.

Keywords: Word Roots And Affixes; University English Teaching; Vocabulary Acquisition; Linguistics; Teaching Strategies

1. INTRODUCTION
1.1 Research background
In today's globalized era, English is increasingly regarded as the bridge for international communication. Especially in higher education, improving English proficiency is not only a task of talent cultivation but also an important reflection of students' academic competitiveness. As an important component of higher education, university English teaching aims not only to enhance students' listening, speaking, reading, and writing abilities but also to increase their vocabulary size and vocabulary application skills. However, vocabulary teaching has always been a challenge in English language teaching. Many students often feel confused when encountering unfamiliar words, and traditional rote memorization methods are inefficient and easily forgotten. Therefore, exploring effective vocabulary teaching methods has become an urgent issue. In this context, the application of word roots and affixes has attracted increasing attention from educators due to its systematic nature, prominent regularities, and significant effects.

1.2 Research significance
The research on the application of word roots and affixes in university English teaching aims to explore a method that can enhance students' vocabulary mastery and help them achieve a qualitative improvement from quantitative change. Mastering word roots and affixes not only helps students memorize words and understand their meanings but also assists them in self-learning and inferring the meanings of new words, thereby improving their overall English proficiency. Through in-depth research and analysis, this study can provide theoretical support and practical guidance for English teaching reform, assisting teachers in organizing vocabulary teaching in a more scientific and effective manner. Additionally, the research will

provide self-learning tools for university students, enabling them to fully utilize knowledge of word roots and affixes to enhance their English proficiency.

1.3 Review of domestic and international research

Internationally, research on the application of word roots and affixes in English teaching started earlier. In the early 20th century, scholars in Europe and the United States recognized the pedagogical value of word roots and affixes and began implementing this teaching approach at different educational stages. International research mainly focuses on the application effects of word roots and affixes, innovative teaching methods, and their contributions to language acquisition theories. In the North American education system, this teaching method has been incorporated into mainstream vocabulary teaching, and research has confirmed its effectiveness in improving students' vocabulary acquisition and retention (Smith & Brown, 2015).

Research on word roots and affixes in China started relatively late. In recent years, this method has gradually gained attention in the field of higher education. Some studies have shown that introducing word roots and affixes in university English teaching in China can significantly improve students' vocabulary size and comprehension abilities (Chen, 2010). Scholars have proposed that word roots and affixes not only help accumulate students' vocabulary but also enhance their understanding of language structures, thereby improving their language proficiency (Xu, 2015). However, most domestic research focuses on empirical studies, and the theoretical system and systematic research on word roots and affixes are relatively lacking.

2. WORD ROOTS AND AFFIXES AND THEIR THEORETICAL FOUNDATIONS

2.1 Definition and classification of word roots and affixes

In linguistics, especially in morphology, word roots and affixes constitute the basic units of vocabulary. A word root is the main part of a word that represents its basic meaning. Compared to affixes, word roots have a stronger independent meaning and word-formation ability. Affixes are divided into prefixes and suffixes, which modify or change the meaning and part of speech of words when attached to the stem. Prefixes are placed before the word root and often have a significant impact on the semantic meaning of the vocabulary, such as the prefix "un-" usually indicating negation or reversal. Suffixes are attached after the word root and often change the part of speech or form derived words, such as the suffix "-ness" that typically turns adjectives into nouns. By studying the classification of word roots and affixes, the underlying principles and internal rules of English vocabulary formation can be revealed.

2.2 The theoretical foundations of word roots and affixes

The application of word roots and affixes is based on vocabulary morphology and word formation theories, utilizing the compositional structure of vocabulary in teaching. This method believes that vocabulary is composed of several basic language units combined according to certain rules. Learners can effectively improve their memory and comprehension of vocabulary by mastering the meanings of these basic units and their combination rules. Cognitive linguistics provides important support for the application of word roots and affixes. This school of thought points out that learners' understanding and memory of language are closely related to their cognitive framework. Learning word roots and affixes can help students establish a stable cognitive framework for language, enhancing their perception and inference ability of vocabulary meanings. Through word roots and affixes, students can not only see the surface spelling of words but also understand their derivation mechanisms, thereby improving their ability to guess and retain unfamiliar words.

2.3 Morphological rules of word roots and affixes in English vocabulary

The word formation process of English vocabulary is full of systematicity, and word roots and affixes play a central role in this process. Word roots provide the basis for the core meaning of vocabulary, while affixes modify, refine, or transform the part of speech or specific meaning of vocabulary through attachment. This word formation process not only enriches the richness of English

vocabulary but also illustrates the evolutionary logic of language development. By learning the word root "duce," students can understand a series of related words, such as "introduce," "produce," and "reduce," all of which have the derived meaning of "lead." Each prefix adds additional meaning to specify or direct the meaning of the words. With the addition of the prefix "re-," the original meaning is expanded to "again or re-," allowing students to have a clearer understanding of unfamiliar vocabulary. The suffix "-ment" in English is commonly used to form nouns, such as "development," where this suffix converts verbs into nouns, further explaining the function and category of vocabulary. By mastering these rules, students can not only memorize a large number of words but also enhance their confidence and ability to use new words.

3. THE APPLICATION OF WORD ROOTS AND AFFIXES IN UNIVERSITY ENGLISH TEACHING

3.1 The pedagogical advantages of word roots and affixes

As a systematic vocabulary learning strategy, the application of word roots and affixes in university English teaching demonstrates significant advantages. This method allows students to understand the composition rules of vocabulary through the analysis of word roots and affixes, thereby mastering new vocabulary. Word roots, as the basic components of vocabulary, carry the core meaning, while affixes modify the part of speech or specific meaning of vocabulary. This structured learning method not only enhances students' memory of vocabulary but also improves their understanding of the internal relationships of vocabulary. For example, understanding that the word root "cred" means "believe" and combining it with different affixes can yield multiple words, such as "credible" and "credit," helping students flexibly apply them in different contexts.

The application of word roots and affixes facilitates the rapid expansion of vocabulary size. By mastering a certain number of common word roots and affixes, students can independently infer and understand a large number of unknown words. This decoding skill is particularly important when encountering academic English and specialized terms. For example, when reading scientific literature or professional articles, students can infer the meaning of vocabulary based on word roots and affixes, thereby improving their reading comprehension.

Word roots and affixes enhance students' deep understanding of vocabulary. Traditional rote memorization often stays at the superficial level without recognizing the internal structure of vocabulary. However, the analysis of word roots and affixes helps students establish connections and logical relationships between vocabulary. This deep understanding not only contributes to long-term memory but also enhances students' flexibility in applying vocabulary in practical contexts. For example, by mastering "bio-" (life) and "-logy" (discipline), students can understand and memorize related words such as "biology" and "biography."

Word roots and affixes cultivate students' self-learning abilities. After mastering the basic word roots and affixes, students can autonomously learn and expand their vocabulary according to specific needs. This self-directed learning not only enhances learning efficiency but also cultivates students' problem-solving abilities. For example, when encountering unfamiliar words, students can infer their meanings by breaking down word roots and affixes, subsequently verifying and consolidating their knowledge.

3.2 Teaching goals and content organization of word roots and affixes

The teaching goals of word roots and affixes aim to enhance students' vocabulary comprehension and application abilities through systematic vocabulary analysis and combination. Specific goals include:

Improving vocabulary recognition: enabling students to recognize and understand new vocabulary through word roots and affixes, reducing reliance on unfamiliar words.

Enhancing vocabulary memory: through structured learning, helping students establish connections between vocabulary and enhancing the persistence and accuracy of memory.

Promoting vocabulary application skills: cultivating students' ability to flexibly apply vocabulary in reading, writing, and oral

expression, improving the accuracy and richness of language expression.

In terms of content organization, it should be systematically designed based on the categories and frequency of word roots and affixes. The teaching content can be divided into several modules:

Basic word roots and affixes: introducing common and high-frequency word roots and affixes, such as "-tion" (noun suffix) and "-able" (adjective suffix), ensuring that students grasp the basic word formation rules.

Advanced word roots and affixes: covering more complex and specialized word roots and affixes, such as "tele-" (distant) and "-ectomy" (surgical removal), meeting students' vocabulary needs in academic and professional fields.

Etymology and vocabulary evolution: exploring the historical origins of word roots and affixes and their roles in vocabulary evolution, helping students understand the cultural and historical background of vocabulary.

Practical vocabulary examples: using specific word examples to demonstrate the application of word roots and affixes in real vocabulary, enhancing students' practical application abilities.

Interactive exercises and applications: designing various exercises and applications, such as vocabulary concatenation, word meaning inference, and sentence completion, to consolidate students' grasp and application of word roots and affixes.

3.3 Teaching methods and strategies of word roots and affixes

Implementing the teaching of word roots and affixes requires the flexible application of various teaching methods and strategies to accommodate students' different learning styles and needs. The following strategies have shown high effectiveness in actual teaching practice:

Decomposition and recombination: guiding students to break down complex vocabulary into word roots and affixes, understanding their constituent parts, and then consolidating their vocabulary understanding through recombination exercises. For example, breaking down "unbelievable" into the prefix "un-," the word root "believe," and the suffix "-able," and then understanding its meaning

through different combinations.

Charts and visual aids: utilizing charts, mind maps, and vocabulary network diagrams as visual tools to demonstrate the relationships between word roots and affixes and vocabulary formation patterns. This visual learning method helps students understand and memorize vocabulary structures more intuitively.

Contextual application: designing application exercises based on real-life and academic contexts, integrating word roots and affixes into specific language use. For example, encouraging students to use vocabulary with specific word roots and affixes in writing or incorporating them into oral expression to improve their language proficiency.

Cooperative learning: promoting interaction and communication among students through small group discussions and collaborative projects, exploring and learning the application of word roots and affixes together. This interactive learning not only enhances interest in learning but also fosters students' teamwork and collaboration abilities.

Multimedia-assisted teaching: utilizing videos, audios, and online resources to provide diverse learning materials and teaching content. Multimedia resources enrich teaching methods, enhance students' learning interest and engagement.

Autonomous learning and feedback: encouraging students to independently select learning materials and progress, providing personalized learning paths. At the same time, through regular quizzes and feedback, helping students adjust learning strategies in a timely manner to improve learning outcomes.

3.4 Evaluation strategies for word roots and affixes

Evaluation strategies play a crucial role in assessing students' learning outcomes and teaching effectiveness in the application of word roots and affixes. The following evaluation methods are worth applying extensively in teaching practice:

Vocabulary tests: designing vocabulary tests that cover the application of word roots and affixes, evaluating students' understanding and mastery of word formation. Test content may include identifying word roots and affixes, word breakdown and recombination, and word meaning inference.

Application assessment: assessing students' application ability of word roots and affixes through comprehensive tasks such as reading comprehension, writing, and oral expression. For example, requiring students to use vocabulary with specific word roots and affixes in their writing or expanding vocabulary in their oral expression.

Dynamic assessment: using formative assessment methods to focus on students' progress and changes during the learning process. By observing classroom performance, participation, and exercise completion, teaching strategies and content can be dynamically adjusted.

Project-based assessment: designing project-based assessment tasks, such as vocabulary speeches, vocabulary data organization, and etymology research projects, to comprehensively assess students' understanding and application abilities of word roots and affixes.

Peer assessment and self-assessment: encouraging students to evaluate each other's learning outcomes while conducting self-reflection and assessment, promoting self-monitoring and self-directed learning abilities.

4. TEACHING EFFECT AND APPLICABILITY OF ROOT AND AFFIX METHOD

4.1 Vocabulary Expansion and Deep Understanding

The application of word roots and affixes has shown significant effectiveness in expanding vocabulary. Through systematic learning of word roots and affixes, students can not only memorize a large number of new words but also deduce derived vocabulary, leading to exponential growth in vocabulary size. For example, by mastering the word root "tele-" meaning "distant," students can understand and memorize related vocabulary such as "telephone," "television," and "telecommunication." This method reduces the time required to learn new vocabulary and improves the efficiency of vocabulary learning.

Word roots and affixes promote deep understanding of vocabulary. By analyzing the composition of vocabulary, students can grasp the internal logic and semantic relationships of vocabulary, allowing them to flexibly apply vocabulary in different contexts. For example, understanding that "bio-" means "life," students can easily understand and memorize the meanings of words such as "biology," "biography," and "biotechnology," enhancing their vocabulary application abilities in reading and writing.

According to a study on college English learners, students who used the word roots and affixes method significantly outperformed those who used traditional rote memorization methods in terms of vocabulary size and depth of understanding. The study found that after one semester of word roots and affixes teaching, students' vocabulary size increased by an average of 30%, and their depth of vocabulary understanding increased by 25% (Zhang, 2022).

4.2 Improvement of Students' English Proficiency

The application of word roots and affixes not only has advantages in vocabulary learning but also contributes to overall English proficiency improvement. Through systematic vocabulary learning, students' listening, speaking, reading, and writing skills are comprehensively enhanced. The increase in vocabulary size and deep understanding provides a solid foundation for students' reading comprehension by reducing the difficulty of comprehension and improving learning efficiency. In oral and written expression, the enriched vocabulary enables students to express thoughts more accurately and vividly, improving the quality of language expression.

Word roots and affixes cultivate students' language sensitivity and logical thinking abilities. By analyzing the composition of vocabulary, students gradually develop sensitivity to language structures, enabling them to quickly decode and understand vocabulary in unfamiliar contexts. This ability is not only essential in academic English learning but also provides strong support for students' future career development.

An experimental study on improving college students' English proficiency showed that the class using the word roots and affixes method scored 15 points higher (out of 100) than the control group in a comprehensive English proficiency test, particularly excelling in vocabulary and reading comprehension (Li,

2023). This result validates the effectiveness of the word roots and affixes method in improving students' English proficiency.

4.3 Analysis of the Applicability of the Word Roots and Affixes Method in Teaching Contexts

The word roots and affixes method has wide applicability in college English teaching, adapting to various teaching contexts and learning needs. Firstly, in vocabulary teaching, this method can serve as a core strategy throughout the entire vocabulary learning process. From basic vocabulary accumulation to advanced vocabulary expansion, the word roots and affixes method provides a systematic learning framework to help students master vocabulary efficiently.

In reading and writing teaching, the word roots and affixes method also plays an important role. In reading, students can quickly understand and grasp new words in texts through analyzing word roots and affixes, improving reading efficiency and depth of comprehension. In writing, the enriched vocabulary and deep understanding enable students to construct more complex and precise sentence structures, enhancing writing's rigor and logic.

The word roots and affixes method has special advantages in professional English teaching. Each discipline has its own professional terminology, and the word roots and affixes method can help students quickly grasp the composition and meanings of these terms. For example, in medical English, understanding the word root "cardio-" (heart) and the suffix "-ology" (discipline) can help students quickly comprehend and memorize complex medical terms, improving their professional reading and writing abilities.

In cross-cultural communication and language application teaching, the word roots and affixes method also demonstrate its unique value. By understanding the composition and origins of vocabulary, students not only gain a better understanding of English vocabulary but also recognize the evolution and usage differences of vocabulary in different cultural contexts, enhancing their cross-cultural communication abilities.

5. SUGGESTIONS FOR FUTURE RESEARCH AND PRACTICE

5.1 Innovations in the Practice of the Word Roots and Affixes Method

The application of the word roots and affixes method in college English teaching has shown significant effectiveness. However, with the development of educational technology and changes in students' learning needs, the traditional word roots and affixes teaching methods need to be innovated to adapt to the new era of teaching environments. Firstly, the integration of information technology can effectively enhance the effectiveness of the word roots and affixes method. Utilizing multimedia resources, online vocabulary learning platforms, and mobile applications can provide students with more diverse and interactive learning experiences. For example, developing mobile applications based on word roots and affixes can engage students in gamified learning modes, such as vocabulary breakdown and combination, increasing learning interest and engagement.

The introduction of interdisciplinary teaching models helps enhance the practicality and applicability of the word roots and affixes method. Combining the word roots and affixes teaching with specialized courses such as medical English, legal English, and engineering English can help students master specialized vocabulary in specific fields and enhance their interdisciplinary language application abilities. For example, by understanding medical-related word roots and affixes, students can quickly grasp and understand complex medical terms, improving their professional reading and writing abilities.

The design of personalized learning paths is also an important direction for innovative word roots and affixes teaching. Each student has different vocabulary foundations and learning progress, and teachers should develop differentiated teaching plans based on individual differences. By analyzing data and utilizing learning management systems, teachers can monitor students' learning progress and mastery in real-time, making timely adjustments to teaching content and difficulty to ensure that each student can effectively learn word roots and affixes at their own pace.

The construction of collaborative learning and community interaction helps enhance

students' learning motivation and vocabulary application abilities. Through small group cooperative learning, online discussion forums, and learning communities, students can motivate and inspire each other, share learning resources, and solve learning problems together. For example, organizing word roots and affixes spelling competitions and vocabulary challenges not only increases the fun of learning but also strengthens students' mastery and application of word roots and affixes.

5.2 Teacher Training and Development of Teaching Resources

Effective teaching of the word roots and affixes method relies on teachers' professional competence and rich teaching resources. Teacher training plays a key role in improving teaching quality. Firstly, regular teacher training programs should be organized to keep teachers updated on the latest vocabulary teaching theories and methods and to ensure they grasp the systematic and scientific nature of the word roots and affixes method. For example, participating in vocabulary teaching seminars organized by educational research institutions allows teachers to learn advanced strategies and techniques for teaching word roots and affixes, enhancing their teaching abilities.

The development and sharing of teaching resources are equally important. Universities should invest in the development of systematic and structured teaching materials for the word roots and affixes method, including word root and affix dictionaries, teaching case databases, and multimedia teaching courseware. These resources can provide teaching support for teachers and reference materials for students' autonomous learning. Establishing platforms for sharing teaching resources among teachers within and outside the university promotes the exchange and cooperation of teaching resources between different institutions and regions, thus promoting the widespread application and continuous improvement of the word roots and affixes method.

Support for practical teaching should also be emphasized. Teachers should combine classroom teaching with extracurricular practice, designing diverse teaching activities such as word roots and affixes analysis competitions, vocabulary application workshops, and interdisciplinary vocabulary research projects, to enhance students' practical abilities and vocabulary application levels. Meanwhile, encouraging teachers to engage in teaching reflection and research through writing teaching papers and participating in teaching research projects continuously improves and optimizes the teaching practice of the word roots and affixes method.

5.3 Research Directions for the Word Roots and Affixes Method

Future research on the word roots and affixes method should delve into the following aspects. Firstly, research that combines word roots and affixes with corpora analysis. By utilizing large-scale corpora, the frequency and semantic changes of word roots and affixes in different contexts can be analyzed to reveal the inherent connection between word roots and affixes and vocabulary semantics. This not only contributes to the theoretical deepening of the word roots and affixes method but also provides data-driven guidance for practical teaching. For example, using corpora analysis to examine the specific application of the "bio-" word root in different academic fields can help teachers design more targeted teaching content.

Cross-linguistic comparative research. Exploring the application and effectiveness of word roots and affixes in different languages and comparing English with other languages such as Chinese, French, and German in terms of vocabulary formation and teaching strategies can provide valuable insights for enriching the teaching theory and practice of the word roots and affixes method. For example, studying word formation in Chinese and drawing on its characteristics to optimize English word roots and affixes teaching methods can improve teaching effectiveness.

Research that combines cognitive psychology with the word roots and affixes method is also of great significance. By studying students' cognitive mechanisms during word roots and affixes learning, the cognitive processes of memory, attention, and understanding in vocabulary learning can be revealed, optimizing teaching strategies for the word roots and affixes method. For example, using cognitive load theory to design word roots and

affixes teaching activities can reduce cognitive load during the learning process and improve learning efficiency.

Research on technology-assisted word roots and affixes teaching has broad prospects with the development of artificial intelligence and educational technology. For example, developing intelligent analysis tools for word roots and affixes based on natural language processing technology can provide real-time parsing of words input by students, offering word breakdown and semantic explanations, promoting autonomous learning and immediate feedback.

6. CONCLUSION

This study systematically explores the application of the word roots and affixes method in college English teaching, analyzing its teaching advantages, teaching goals and content organization, teaching methods and strategies, and evaluation strategies. The study demonstrates that the word roots and affixes method effectively expands students' vocabulary and improves their depth of understanding, significantly enhancing students' overall English proficiency. Through systematic teaching design and diverse teaching methods, the word roots and affixes method demonstrates high practicality and wide applicability in actual teaching. Specifically, the word roots and affixes method helps students establish the logical relationships between vocabulary through structured vocabulary learning, enhancing their memory and application abilities. The word roots and affixes method shows adaptability and effectiveness in various teaching contexts, such as professional English, reading and writing teaching.

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Innovative Design and Optimization Strategies for Marine Exhaust Gas Desulfurization and Denitrification Systems

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Abstract: With increasingly stringent environmental regulations by the International Maritime Organization (IMO) on ship emissions, controlling sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions from marine exhaust gases has become a research priority. This study proposes an innovative, energy-efficient design and optimization strategy for marine exhaust gas desulfurization and denitrification systems to meet the stricter regulatory requirements. Combining theoretical analysis and numerical simulation, the exhaust gas components and characteristics were quantified. A system integrating wet desulfurization and selective catalytic reduction (SCR) denitrification was then designed, with key parameters such as desulfurization liquid flow rate, catalyst surface area, and reaction temperature optimized through simulations. During the study, the multi-physics coupling processes were analyzed based on thermodynamic and kinetic reaction models, focusing on the relationship between reaction efficiency and energy consumption. Results indicate that the improved system achieves removal efficiencies of over 98% for SO_2 and 90% for NO_x under complex operating conditions, while significantly reducing energy consumption, demonstrating excellent economic and environmental performance. Finally, practical optimization strategies for ship operations were proposed, providing critical reference and guidance for the advancement of marine exhaust gas control technologies.

Keywords: Marine Exhaust Gas Control; Desulfurization and Denitrification; System Optimization; Numerical Simulation; Environmental Protection

1. INTRODUCTION

1.1 Research Background and Significance

With the rapid development of the global economy, the international shipping industry, as a core link in global trade, plays a pivotal role in cargo transportation. However, its growth has brought significant environmental challenges, particularly the adverse effects of ship exhaust emissions on air quality. Sulfur dioxide (SO_2) and nitrogen oxides (NO_x) produced by marine fuel combustion are among the major contributors to air pollution, posing threats to marine ecosystems and the health of coastal populations. According to statistics from the International Maritime Organization (IMO), the shipping industry accounts for approximately 13% of global SO_2 emissions and 15% of NO_x emissions annually [1]. To address these environmental concerns, IMO introduced Annex VI of the International Convention for the Prevention of Pollution from Ships (MARPOL), imposing stricter regulations on sulfur and NO_x emissions, thereby presenting both challenges and opportunities for emission control technologies.

Technologically, exhaust gas desulfurization and denitrification systems are critical to achieving low emissions, with their effectiveness hinging on pollutant removal efficiency and operational cost-effectiveness. However, existing technologies face limitations such as high energy consumption, limited adaptability, and elevated operational costs, which hinder their large-scale application in practice. This study aims to address these challenges by proposing an innovative design for marine exhaust gas desulfurization and denitrification systems. Through parameter optimization and performance evaluation, the research explores

cost-effective and environmentally friendly solutions, thereby providing theoretical support and technical references for promoting green shipping practices.

1.2 Review of Domestic and International Research

In recent years, extensive research has been conducted on ship exhaust emission control technologies at home and abroad. Internationally, progress has been made in the integrated design of desulfurization and denitrification systems. For example, Scandinavian countries have developed a combined "wet scrubber + selective catalytic reduction (SCR)" system, which has been implemented on some vessels [2]. Additionally, European research teams have explored plasma-assisted reaction systems, achieving higher pollutant removal efficiencies while significantly reducing energy consumption. However, these technologies often involve high operational costs and require further improvements in adaptability to ship operating conditions.

Domestically, research has primarily focused on wet desulfurization technologies and SCR catalyst optimization. For instance, the China Ship Scientific Research Center developed an alkaline solution-based desulfurization system with high SO_2 removal efficiency [3]. Meanwhile, Tsinghua University has optimized porous catalyst structures to enhance NO_x removal efficiency under low-temperature conditions [4]. However, most domestic studies emphasize individual technological advancements, with limited exploration of integrated desulfurization and denitrification systems and a scarcity of engineering applications on operational ships. In summary, while significant progress has been made globally, there remains substantial room for improvement in system integration, economic optimization, and adaptability to real-world conditions. These gaps form the primary focus of this study.

2. ANALYSIS OF MARINE EXHAUST EMISSION CHARACTERISTICS

2.1 Composition and Sources of Marine Exhaust Gases

Marine exhaust gases primarily originate from the combustion of marine diesel fuel and contain a complex mix of pollutants at high concentrations. Key components include sulfur dioxide (SO_2), nitrogen oxides (NO_x), carbon oxides (CO and CO_2), and particulate matter (PM) [5]. SO_2 is generated from the combustion of sulfur in fuel, with its emission levels directly proportional to the sulfur content of the fuel. Heavy fuel oil (HFO), commonly used in ships, has a high sulfur content (up to 3.5%), making it the primary source of SO_2 emissions.

The formation of NO_x is closely related to diesel engine operating conditions. Under high-temperature combustion, nitrogen and oxygen react to produce NO_x, including nitric oxide (NO) and nitrogen dioxide (NO_2). Higher combustion temperatures and increased oxygen supply significantly elevate NO_x emissions. Furthermore, incomplete combustion also generates particulate matter, which not only poses environmental threats but may also hinder the operation of downstream desulfurization and denitrification systems.

According to IMO reports, emissions from heavy fuel combustion by ships are increasingly contributing to global pollution, particularly in coastal port areas where ship exhaust is a major source of air pollution [1].

2.2 Environmental Impacts of SO_2 and NO_x

SO_2 and NO_x are the most hazardous pollutants in marine exhaust, causing serious environmental and health problems. SO_2, as a primary precursor to acid rain, reacts with water vapor in the atmosphere to form sulfuric acid droplets, severely damaging vegetation and aquatic ecosystems. For instance, acid rain in East Asia results in billions of dollars in ecological and economic losses annually. Additionally, SO_2 directly affects the respiratory health of coastal populations.

The environmental hazards of NO_x primarily stem from its role in forming photochemical smog and depleting the ozone layer. Under sunlight, NO_x reacts with volatile organic compounds (VOCs) to produce photochemical smog, a phenomenon particularly severe in port cities. Moreover, NO_x can convert into nitrate particulates in the atmosphere, exacerbating particulate matter pollution.

A study conducted in Chinese coastal cities revealed that ship exhaust significantly contributes to PM2.5 and PM10 levels in port

areas, intensifying regional haze problems and increasing public health risks [6]. Controlling NO_x emissions is thus critical to improving air quality.

In the context of increasingly stringent environmental regulations, a deeper understanding of marine exhaust emission characteristics not only clarifies the mechanisms of pollutant formation but also provides a theoretical foundation for the design and optimization of desulfurization and denitrification systems.

3. THEORETICAL BASIS FOR THE DESIGN OF DESULFURIZATION AND DENITRIFICATION SYSTEMS

### 3.1 Thermodynamic and Kinetic Reaction Mechanisms

The design of marine exhaust gas desulfurization and denitrification systems is primarily based on the principles of thermodynamics and chemical reaction kinetics. The desulfurization process relies on gas-liquid phase chemical absorption reactions, with wet desulfurization being the dominant method. In wet desulfurization, alkaline absorbents such as calcium hydroxide ($Ca(OH)_2$), sodium hydroxide (NaOH), or seawater react with sulfur dioxide (SO_2) in the exhaust gas within the liquid phase, forming stable by-products like sulfates or bisulfates. For instance, in the commonly used limestone-gypsum method, the main chemical reactions are as follows:

$$SO_2 + H_2O \rightarrow H_2SO_3$$
$$H_2SO_3 + CaCO_3 \rightarrow CaSO_3 + CO_2 + H_2O$$
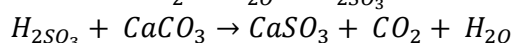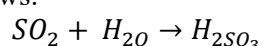
From a thermodynamic perspective, the negative Gibbs free energy change (ΔG) of the desulfurization reaction indicates that it proceeds spontaneously under standard conditions. However, the reaction rate is influenced by several factors, including gas-liquid interfacial contact area, absorbent concentration, and liquid-phase temperature. Enhancing gas-liquid mixing efficiency significantly accelerates the reaction rate.

The removal of nitrogen oxides (NO_x) primarily relies on Selective Catalytic Reduction (SCR) technology, which involves the selective reduction of NO_x into harmless nitrogen (N_2) and water (H_2O) using a reducing agent (e.g., ammonia or urea) on the catalyst surface. The relevant reactions are as follows:

$$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$$
$$2NO_2 + 4NH_3 + O_2 \rightarrow 3N_2 + 6H_2O$$
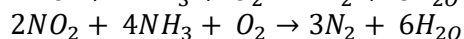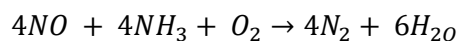
In terms of NO_x removal, SCR technology plays a central role, where NO_x is selectively reduced to harmless nitrogen (N_2) and water (H_2O) using a reducing agent (e.g., ammonia or urea) on the catalyst surface. The reaction rate is highly temperature-dependent, with the optimal catalytic reaction temperature typically ranging between 300°C and 450°C. Within this range, the reaction rate is high, and ammonia slip is minimal. Recent research has focused on developing low-temperature SCR catalysts to meet the demands of low-temperature exhaust conditions [1].

Thermodynamic and kinetic studies provide essential guidance for system design. By optimizing parameters such as temperature, pressure, and catalyst properties, pollutant removal efficiency can be maximized while minimizing energy consumption.

3.2 Multi-Physics Coupling Principles

Marine exhaust treatment systems operate under dynamic and complex conditions, characterized by significant variations in pollutant concentration, temperature, and flow velocity. To enhance system adaptability and stability, multi-physics coupling principles are applied, addressing the interactions between gas, liquid, and solid phases during pollutant removal processes.

In Wet Desulfurization:

The process involves interactions between gas-liquid flow, mass transfer, and chemical reactions, forming a classic multi-physics problem. Research shows that mass transfer efficiency is primarily determined by the turbulence intensity and contact time at the gas-liquid interface. Optimizing the turbulence characteristics within the spray tower can substantially improve SO_2 absorption efficiency [2]. Furthermore, reaction kinetics in the liquid phase are closely related to temperature distribution and liquid droplet characteristics. Computational Fluid Dynamics (CFD) simulations are extensively used to analyze flow field patterns within the tower, providing valuable insights for equipment design.

In SCR Systems:

The core process involves gas-solid interactions, integrating fluid dynamics with surface chemical reactions on the catalyst. Uneven flow distribution across the catalyst bed can lead to localized efficiency drops. Studies have shown that optimizing the structure of the catalyst bed, such as the use of porous-walled catalysts, can improve gas distribution and enhance mass transfer [3]. Additionally, the temperature distribution on the catalyst surface plays a critical role in reaction kinetics. High-temperature zones may cause catalyst sintering and deactivation, while low-temperature zones may suppress reaction rates.

Multi-physics coupling analysis provides theoretical support for designing and optimizing desulfurization and denitrification systems under dynamic operating conditions. By considering fluid dynamics, mass and heat transfer, and chemical reactions comprehensively, stable and efficient pollutant removal can be achieved even in complex environments.

4. INNOVATIVE SYSTEM ARCHITECTURE DESIGN

4.1 Wet Desulfurization Unit Design

The wet desulfurization unit is a key component of marine exhaust treatment systems, directly determining SO_2 removal efficiency. The spray tower, the most commonly used wet desulfurization device, typically consists of a gas inlet, spray nozzles, packing layers, and mist eliminators. To address the insufficient gas-liquid mixing observed in traditional spray towers, this study proposes a zoned spray design, dividing the tower into multiple reaction zones, each equipped with independent spray nozzles and packing layers. Numerical simulations indicate that this design significantly increases the gas-liquid contact area and enhances SO_2 absorption rates.

Regarding absorbent selection, seawater offers a low-cost and eco-friendly solution. Naturally containing carbonate ions, seawater reacts with SO_2 to produce sulfates. Experimental data show that seawater desulfurization achieves SO_2 removal efficiencies exceeding 90% without requiring additional chemical additives [4]. However, seawater processing must ensure that the discharged water meets environmental regulations to minimize impacts on marine ecosystems.

4.2 Selective Catalytic Reduction (SCR) System Design

For NO_x removal, the SCR system is the most widely adopted technology. To enhance SCR efficiency, this study optimizes the traditional single-layer catalyst structure by introducing a multi-stage catalyst bed design. Distribution plates are inserted between catalyst layers, ensuring uniform exhaust gas flow into each layer and reducing uneven reactions. The multi-stage structure also accommodates variations in exhaust gas temperature and concentration, improving overall system performance.

In terms of reducing agents, liquid urea has emerged as a safer and more practical alternative. It decomposes at high temperatures to release ammonia, which participates in the reduction reactions. Urea's advantages include safer storage and transport, as well as reduced by-product formation from ammonia slip. Experimental results demonstrate that the multi-stage catalyst structure achieves NO_x removal rates exceeding 95% within the 300°C to 450°C temperature range [5].

4.3 Integrated System Design

To achieve simultaneous SO_2 and NO_x removal, this study proposes an integrated desulfurization and denitrification system, combining a wet desulfurization unit with an SCR system. Exhaust gases first pass through the spray tower for SO_2 and particulate removal, then enter the SCR unit for NO_x reduction. The integrated design reduces equipment footprint and minimizes pressure losses in the piping.

Moreover, a heat recovery unit is included to preheat exhaust gases, ensuring optimal temperatures for the SCR system. Heat recovery significantly reduces system energy consumption, enhancing economic viability. Optimized integrated systems demonstrate SO_2 and NO_x removal efficiencies of over 98% and 90%, respectively, under complex marine operating conditions.

5. NUMERICAL SIMULATION AND PARAMETER OPTIMIZATION

5.1 Numerical Simulation Methods and

Model Development

Numerical simulation, based on Computational Fluid Dynamics (CFD), is a critical tool for studying and designing marine desulfurization and denitrification systems. It enables three-dimensional dynamic simulations of flow fields, mass transfer, and chemical reactions, reducing experimental costs and providing reliable engineering references.

For wet desulfurization, simulations focus on gas-liquid two-phase flow and mass transfer within the spray tower. Models incorporate turbulence, gas-liquid interaction, and chemical reaction kinetics. The Reynolds-Averaged Navier-Stokes (RANS) model is widely used to simulate turbulence between spray droplets and gas. The mass transfer is often described using the two-film theory, accounting for SO_2 absorption across gas and liquid films. Chemical reactions involve neutralization between SO_2 and alkaline absorbents.

For SCR systems, simulations address gas-solid multiphase flow and reactions. Models must capture gas flow distribution, catalytic surface reaction kinetics, and mass transfer. Porous media models effectively describe catalyst bed permeability and resistance, while chemical reaction rates are modeled using the Arrhenius equation to account for temperature effects.

Boundary conditions are critical for accurate simulations. Inlet conditions are typically defined as velocity or mass flow boundaries, and outlet conditions as pressure boundaries. Using the finite volume method, complex three-dimensional spaces are discretized into grids, enabling iterative calculations of fluid behavior and reactions [1].

5.2 Key Parameter Optimization

Numerical simulations provide insight into key parameters affecting system performance, guiding design optimization:

- Wet Desulfurization: Key parameters include gas-liquid ratio (gas flow to liquid flow), spray liquid pH, and packing layer structure. Simulations show that low gas-liquid ratios result in insufficient gas-liquid contact, reducing SO_2 absorption efficiency, while excessively high ratios increase energy consumption. Optimal ratios balance efficiency and energy usage.

- SCR System: Key parameters include catalyst layers, reaction temperature, and reductant dosage. Fewer catalyst layers may lead to incomplete NO_x reduction, while excessive layers raise costs and pressure drops. Simulations indicate optimal reaction rates within 300°C–450°C. Exceeding 500°C may cause reductant oxidation, reducing efficiency [2].

Parameter optimization enhances desulfurization and denitrification efficiency while minimizing energy consumption, enabling systems to adapt to complex marine conditions.

6. SYSTEM PERFORMANCE ASSESSMENT

6.1 Desulfurization and Denitrification Efficiency

System performance is evaluated primarily by desulfurization and denitrification efficiency. SO_2 removal is calculated from concentration differences at the spray tower's inlet and outlet, while NO_x removal is measured before and after the SCR unit.

Experimental results demonstrate that the integrated system achieves SO_2 removal efficiencies exceeding 98% and NO_x removal efficiencies above 90%. These results fulfill the stringent requirements of IMO Emission Control Areas (ECA). The enhanced efficiency stems from the complementary processes: the spray tower removes particulates, improving gas quality for the SCR system, which enhances catalytic reaction performance [3].

6.2 Energy Consumption and Economic Analysis

Energy consumption and cost assessments are vital for evaluating system feasibility. For wet desulfurization, spray pumps account for over 60% of total energy usage. Optimizing tower structure and liquid circulation flow reduces pump energy consumption by 20%.

For SCR systems, energy usage primarily involves reductant preparation and injection. The use of liquid urea as a reductant reduces storage and transport costs. Optimized systems achieve operational costs of $0.05–$0.08 per ton of exhaust gas, representing a 15% cost reduction compared to traditional systems. The balance of high efficiency and reduced operational costs highlights the system's

economic viability as a sustainable solution for the shipping industry.

7. OPTIMIZATION STRATEGIES AND FIELD APPLICATIONS

7.1 Operational Optimization Strategies

In real-world applications, desulfurization and denitrification systems must adapt to varying operational conditions. Optimization strategies ensure high efficiency under different loads:

For the spray tower, real-time monitoring and feedback control adjust liquid flow rate and pH based on exhaust gas fluctuations.

For the SCR system, optimizing ammonia or urea injection distribution prevents reductant slip or incomplete reactions.

Automated control systems, leveraging Industrial Internet of Things (IIoT) technology, enhance operational efficiency. Real-time monitoring of exhaust gas composition, temperature, and pressure enables dynamic adjustments via cloud-based algorithms. Studies show that automated control improves removal efficiency by 5%–10%.

7.2 Field Validation on Ships

To verify system applicability, field tests were conducted on a 5,000-ton container ship equipped with the optimized desulfurization and denitrification system. During a 10-hour voyage, SO_2 removal rates ranged from 97%–99%, while NO_x removal rates stabilized at 90%–93%. The system operated smoothly without excessive energy consumption or pollutant discharge.

The system's ability to adapt to rapid engine load changes while maintaining efficiency demonstrates its robustness and reliability, supporting broader adoption.

8. CONCLUSION

This study proposes an innovative and integrated desulfurization and denitrification system for marine exhaust treatment, based on thermodynamic and kinetic principles, multi-physics coupling analysis, and numerical simulation. Results demonstrate the system's high SO_2 and NO_x removal efficiency, low energy consumption, and economic viability, meeting the strictest international emission standards. Field tests further confirm its adaptability and stability under real operating conditions.

Despite progress, several challenges remain. Enhancing SCR catalyst resistance to high-temperature sintering and improving low-temperature activity are critical research areas. Developing advanced catalytic materials will further improve system performance. Additionally, incorporating artificial intelligence (AI) for operational optimization can enhance automation and intelligence.

As the maritime industry accelerates its transition toward green operations, future exhaust treatment technologies will focus on greater efficiency, cost-effectiveness, and environmental sustainability, contributing to global marine ecological preservation.

ACKNOWLEDGEMENTS

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The Dilemma and Thinking of The Legal Protection of Personal Information in the Era of Digital Economy

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Abstract: With the wide application of the Internet, big data, cloud computing and other technologies, personal information has become an important support for the digital economy. Protection of personal information is not only related to personal privacy rights, but also related to national security, social stability and economic development. This paper analyzes the importance of legal protection of personal information in the era of digital economy, and discusses the difficulties of legal protection of personal information, including imperfect legal system, insufficient supervision and backward technical means. On this basis, the paper puts forward strategies to strengthen the legal protection of personal information, including improving laws and regulations, strengthening supervision and law enforcement, and improving technical support. It summarizes the importance of legal protection of personal information in the digital economy era, and prospects the future development trend.

keyword: Digital economy; personal information; legal protection; dilemma; strategy

1. INTRODUCTION

In the era of digital economy, the development of information technology has greatly changed people's way of life, and it has also brought risks such as personal information leakage and abuse. As an important resource in modern society, the protection of personal information has become the focus of attention from all walks of life. the Chinese government attaches great importance to the protection of personal information and has issued a series of laws and regulations, but there are still many difficulties in practice. This paper aims to analyze the dilemma of legal protection of personal information in the era of digital economy, and put forward corresponding countermeasures and suggestions.

2. The importance of legal protection of personal information in the digital economy era

2.1 Protecting personal privacy rights and interests

Personal information is an important part of personal privacy, and the legal protection of personal information helps to protect personal privacy rights and interests. In the era of digital economy, personal information is widely collected, used and disseminated. Once it is leaked or abused, it will seriously violate personal privacy and damage personal dignity and security.

2.2 Promoting the healthy development of the digital economy

Personal information is the basic resource of the digital economy, and the legal protection of personal information helps to promote the healthy development of the digital economy. In the digital economy, the rational use and sharing of personal information is the key [1] to promote industrial innovation and improve production efficiency. Legal protection of personal information helps to build a fair, orderly and safe digital economy environment.

2.3 Ensuring national security and social stability

Personal information leakage may lead to threats to national security and social stability. In the digital economy era, personal information may be used for illegal activities, such as online fraud, terrorism and other [2]. the law protects personal information, helps to prevent and crack down on these illegal activities, and ensures national security and social stability.

2.4 Promoting global digital economy governance

Legal protection of personal information is an important part of global digital economy governance. With the development of the global digital economy, countries differ in laws, regulations and standards for the protection of personal information, leading to challenges for cross-border data flow [3]. Strengthening the legal protection of personal information will help promote global digital economy governance and promote international data cooperation.

2.5 Enhance the national soft power

Legal protection of personal information is an important part of national soft power. In the era of digital economy, a country's laws and regulations and implementation effects in the protection of personal information will directly affect its image and status in the international community. Strengthening the legal protection of personal information will help to enhance the country's soft power and enhance its international competitiveness.

3. THE DILEMMA OF THE LEGAL PROTECTION OF PERSONAL INFORMATION IN THE DIGITAL ECONOMY ERA

3.1 Imperfect legal system

The current law has limited coverage of personal information protection, and fails to fully cover various scenarios and links of personal information processing in the digital economy. There are conflicts or overlaps between some laws and regulations, which makes it difficult to apply them uniformly in practice. With the development of the digital economy, new ways of processing personal information are constantly emerging, but the existing laws have not been updated in time, and it is difficult to adapt to the new challenges.

3.2 Insufficient supervision intensity

Regulatory agencies have insufficient efforts in the enforcement of personal information protection, and insufficient investigation and punishment of illegal acts, resulting in low cost of violation. the distribution of regulatory resources is uneven, the supervision in some areas and links is weak, and there are regulatory blind spots. Regulatory means are relatively backward, and it is difficult to effectively deal with complex problems such as cross-regional and cross-industry data flow

and cross-border data transmission.

3.3 Technical means lag behind

The application of technical means in the protection of personal information is relatively lagging behind, and it is difficult to realize the real-time monitoring and analysis of massive data. the lack of effective data security technology, such as encryption, anonymity and other technologies, makes the personal information in the transmission and storage process of security risks. Technical standards are not unified, and different enterprises and institutions adopt different technical means and standards in the process of personal information processing, which increases the risk of personal information protection.

4. STRATEGY FOR THE LEGAL PROTECTION OF PERSONAL INFORMATION IN THE DIGITAL ECONOMY ERA

4.1 Improve laws and regulations

We will formulate and improve basic laws on the protection of personal information to ensure that the legal system for the protection of personal information is improved. This includes the enactment of the Personal Information Protection Law, the Data Safety Law and other relevant laws and regulations, and clarifying the basic principles, scope of application, rights and obligations of personal information protection. For the specific links of personal information protection, such as collection, storage, use, transmission, deletion, etc., detailed operational norms and standards should be formulated to ensure the operability and enforceability of laws and regulations. the responsibilities of personal information processors, including enterprises, government agencies, are clearly defined in laws and regulations, to ensure that they strictly abide by laws and regulations in the process of personal information processing and earnestly fulfill their obligations of personal information protection. Establish and improve the supervision system for the protection of personal information, clarify the responsibilities of regulatory departments, strengthen the supervision of personal information processing activities, and ensure the effective implementation of laws and regulations. Those who violate laws and regulations on the protection of personal

information should be punished in accordance with the law, increase the cost of violations, and form an effective deterrent effect. Popularize legal knowledge of personal information protection through various channels, raise citizens' awareness of personal information protection, and guide citizens to safeguard their legitimate rights and interests in accordance with the law. Establish and improve the dispute resolution mechanism for personal information protection, including administrative mediation, arbitration, litigation, etc., to provide convenient and efficient relief ways for the parties whose personal information rights and interests are infringed.

4.2 Strengthen supervision and law enforcement

Strengthen the investigation and punishment of illegal personal information activities, and punish illegal enterprises or individuals in accordance with the law to form a deterrent effect. At the same time, improve the efficiency of law enforcement to ensure that law enforcement is timely and effective. Establish and improve personal information protection regulatory agencies, clarify regulatory responsibilities, strengthen cooperation between departments, and form a joint force. At the same time, strengthen the training of supervision personnel to improve their professional ability and law enforcement level. We will use big data, artificial intelligence and other technologies to improve the efficiency of supervision. Through technical means of real-time monitoring of personal information processing activities, timely discovery and deal with illegal acts. We will actively participate in the formulation of international personal information protection rules and promote the establishment of globally unified personal information protection standards. At the same time, we will strengthen law enforcement cooperation with other countries to jointly crack down on cross-border personal information violations. Publicity and education on personal information protection should be carried out through various channels to improve the public's awareness and attention to personal information protection. We will guide the public to consciously abide by laws and regulations on personal information protection

and jointly safeguard personal information security. We will establish and improve channels for personal information protection, and encourage the public to actively report illegal behaviors of personal information. Complaints and reports should be handled in time to protect the legitimate rights and interests of informants. Urge enterprises to fulfill their obligations of personal information protection, establish and improve the internal management system, strengthen staff training, and improve the level of enterprise personal information protection. To guide industry associations to formulate industry norms, strengthen industry self-discipline, and jointly safeguard personal information security. We will encourage public interest organizations and individuals to file public interest lawsuits to safeguard personal information security and public interests.

4.3 Improve technical support

Advanced encryption algorithm is used to encrypt personal information to ensure the security of data during transmission and storage. This includes end-to-end encryption of sensitive information such as ID numbers and bank accounts to prevent data from being stolen during transmission. Establish a data security monitoring system, through real-time monitoring of data access and operation, timely detect abnormal behaviors, such as unauthorized data access and manipulation, so as to respond quickly and take measures to prevent data leakage. Use artificial intelligence and big data analysis technology to assess the risk of personal information, predict potential security threats, and take preventive measures accordingly. Development and application of privacy protection technologies, such as differential privacy, homomorphic encryption, etc., to protect user privacy and realize the effective use of data. Advanced authentication technologies such as biometric identification and multi-factor authentication are adopted to improve the security of user accounts and prevent unauthorized access. Strengthen network security protection, including firewall, intrusion detection system, vulnerability scanning, etc., to ensure the security and stability of the network environment. Audit the data processing

process to ensure that the data processing complies with laws, regulations and internal policies, and track and record violations.

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In the era of digital economy, the legal protection of personal information has become increasingly prominent. In the face of difficulties, we should speed up the formulation and improvement of laws and regulations on the protection of personal information, improve the legal rank, and ensure the integrity and coordination of the legal system. Strengthen supervision, severely investigate and punish illegal acts, raise the cost of illegal acts, and form an effective deterrent. Strengthen the research and development of personal information protection technology, improve the technical means, and enhance the personal information protection ability. Starting with improving laws and regulations, strengthening supervision and law enforcement, and improving technical support, we will effectively strengthen the legal protection of personal information to provide a strong guarantee for the healthy development of the digital economy.

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Analysis Of the Value and Pathways of Integrating the Spirit of Jiao Yulu into College Ideological and Political Education

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Abstract: The Jiao Yulu Spirit, as an important part of the spiritual heritage of the Communist Party of China, is a precious spiritual wealth of the Chinese nation. Jiao Yulu spirit plays an important leading role in the formation of correct values for college students, and is also an indispensable resource in the construction of ideological and political courses in colleges and universities. Grasp the connotation of his spirit, dig out the value of integrating into the ideological and political courses in colleges and universities, and explore the practical path of integrating into the ideological and political courses in colleges and universities, which have a very good practical significance for education.

Keywords: Jiao Yulu Spirit; Ideological and Political Education; Value; Pathways

1. INTRODUCTION

Comrade Jiao Yulu, known as "the role model of county party secretaries", is an outstanding leading cadre emerged in the period of socialist construction. He was assigned to work in Lankao, He'nan Province, in 1962 as the county's Party Secretary. Over a period of two years, Jiao led the whole county in a campaign to combat sandstorms and water logging, thereby improving the unproductive saline-alkaline soil. He died of cancer in May 1964. During his tenure in Lankao County, he set an example and led the people to plant trees to fight hard against sand storms. Jiao Yulu sacrificed his life to combat the "three evils" (waterlogging, dust storms and alkaline lands), and the "Jiao Yulu Spirit" will be always remembered by people. Its connotation is to be close to the people, to love the people, to work hard, to be scientific and realistic, to face difficulties with courage and to be selfless dedicated. The Jiao Yulu Spirit, is a precious spiritual wealth of the Chinese nation. We should integrate it into the construction of ideological and political courses in colleges and universities, so as to continuously promote the high-quality development of higher education.

2. CONNOTATION OF JIAO YULU SPIRIT

Be close to the people and love the people: the public servant spirit of "caring not about himself but all the other people", always keeping the purpose and the masses in mind.

Work hard: the unyielding spirit that "dares to make sun and moon shine in new skies", being diligent, thrifty and hard-working.

Be scientific and realistic: the spirit of seeking truth from facts, investigation and research, and never make groundless decisions about all matters.

Face difficulties with courage: the fearless spirit of "revolutionaries must take on the role of heroes in the face of difficulties", not being afraid of difficulties and risks.

Be selfless dedicated: the spirit of dedication to the cause of the Party and the people, being a man of integrity and diligence and always working in the public interest.

3. THE UNIQUE SIGNIFICANCE OF INTEGRATING JIAO YULU SPIRIT INTO IDEOLOGICAL AND POLITICAL EDUCATION IN COLLEGES AND UNIVERSITIES

Jiao Yulu served as the secretary of Lankao County Party Committee from 1962 to his death in May 1964. His deeds are widely praised by people. During the tenure of Lankao, in order to understand the "three hazards", when the wind blew sand, Jiao Yulu took the lead to check the tuyere and explore the quicksand; when it rained heavily, he waded through waist-deep floodwaters to see

the flow. the water conservancy project he initiated, through the subsequent diversion of silt and irrigation, eventually turned more than 200, 000 mu of saline-alkali land into good farmland. the cadres and masses in Lankao County were encouraged by Jiao Yulu Spirit, and the three hazards of Lankao, "waterlogging, sand and salt", were effectively controlled.

General Secretary Xi Jinping once recalled that when he was in junior high school, a political lesson teacher sobbed several times when lecturing on the deeds of Jiao Yulu, which brought huge spiritual shock to the students. The general secretary said "This lesson left a deep impression on my life and also had a very important impact on my firm ideals and beliefs. " "For decades, the deeds of Comrade Jiao Yulu and his image have always been in my mind. " "Later, when I became an educated youth, went to university, joined the army, and became a cadre, I always had the image of Comrade Jiao Yulu in my heart and thought of him as a virtuous example to improve myself. Comrade Jiao Yulu has always been my role model. ""Jiao Yulu Spirit, like Jinggangshan Spirit, Yan'an Spirit, Lei Feng Spirit and other revolutionary traditions and great spirits, was, is and will remain a valuable spiritual treasure of our Party. We should always learn from him. "

His spirit not only contains the fundamental purpose of our Party to serve the people wholeheartedly, but also embodies the lofty ideals of the Communists and has rich connotations. At the same time, it is also the embodiment of the work style of the Communists seeking truth from facts and the moral sentiment of honesty and integrity.

Contemporary college students shoulder the historical responsibility of linking the past and the future and the sacred mission of realizing the great rejuvenation of the Chinese nation. The world outlook, outlook on life and values of young college students have not been really established, which need to be guided positively. It is of great significance and effect to integrate Jiao Yulu Spirit into the ideological and political curriculum of colleges and universities in the new era.

4. INTEGRATING JIAO YULU SPIRIT INTO THE TEACHING PRACTICE

PATH AND STRATEGY OF IDEOLOGICAL AND POTICAL COURSE

4.1 Innovation and integration of teaching content

We should dig deeply into the connotation of Jiao Yulu Spirit. In ideological and political lessons, teachers should dig deeply into the connotation and times value of Jiao Yulu Spirit, combine it closely with the course content, and guide students to deeply understand the essence and significance of Jiao Yulu Spirit.

Relevant teaching resources should be integrated well. Teachers should make full use of various teaching resources, such as books, film and television works, documentaries, etc., to present Jiao Yulu Spirit to students in a more vivid and vivid way. At the same time, we can also invite relevant experts of Jiao Yulu Spirit to the school to give lectures or exchanges to enhance students' knowledge and understanding of Jiao Yulu Spirit.

4.2 Innovation and practice of teaching methods

Case teaching: Teachers can choose typical cases of Jiao Yulu Spirit to teach, and guide students to think deeply about the connotation and value of Jiao Yulu Spirit through case analysis. At the same time, it can also organize students to carry out case discussion and debate activities to cultivate students' critical thinking and innovation ability.

Situational simulation: Teachers can design some situational simulation activities related to Jiao Yulu Spirit, such as simulating Jiao Yulu's work scenes and decision-making process during his work in Lankao. Through scenario simulation activities, students can experience the practice process of Jiao Yulu Spirit and enhance their understanding and recognition of Jiao Yulu Spirit.

Practical teaching: Teachers can organize students to the birthplace of Jiao Yulu Spirit or related memorial hall for field study and study. Through field visits, listening to explanations and interactive communication, students can feel the historical background and practical significance of Jiao Yulu Spirit more directly.

4.3 The reform of curriculum assessment and evaluation

Diversified assessment methods should be added: In ideological and political courses, teachers should adopt diversified assessment

methods, such as classroom discussion, case analysis report, scenario simulation performance, field trip report, etc. This paper comprehensively evaluates students' learning and understanding of Jiao Yulu Spirit through diversified examination methods.

More attention should be paid to process evaluation: Teachers should pay attention to the evaluation of students' learning process, and pay attention to students' performance and effort in the learning process. Through the process evaluation, the problems and difficulties existing in the learning process of students are found and solved in time to promote the all-round development of students.

4.4 Create a good campus cultural atmosphere

Carry out themed education activities: Each department can regularly carry out educational activities with Jiao Yulu Spirit as the theme, such as themed class meetings, speech contests, essay contests, etc. Through thematic educational activities, we can create a strong campus cultural atmosphere and guide students to deeply understand and inherit Jiao Yulu Spirit.

Strengthen campus media publicity: Colleges and universities can use campus radio, public number, video number and other media platforms to widely publicize Jiao Yulu Spirit. Through the propaganda function of campus media, students' cognition and recognition of Jiao Yulu Spirit are enhanced.

4. CONCLUSION

The year 2024 is the 60th anniversary of Jiao Yulu's death. In the past 60 years, Jiao Yulu Spirit has been renewed, and he still has the power to direct the heart and touch the soul.

His spirit was not formed overnight. He experienced the Anti-Japanese War, the Liberation War and the construction period, and his rich life experience strengthened his emotions and will, and inspired his love for the Party and the people. Jiao Yulu Spirit is the precious spiritual wealth of Chinese Communists. It is of great significance to integrate it into the ideological and political courses in colleges and universities for strengthening party construction, promoting social development and cultivating new people of the Times.

Through the innovation and integration of teaching content, the innovation and practice of teaching methods, the reform of curriculum assessment and evaluation, and the construction of campus cultural atmosphere, we can effectively integrate Jiao Yulu Spirit into the teaching practice of ideological and political courses. Dramatic change has taken place in China since Jiao Yulu passed away more than half a century ago. As people today hope for a better and happier life, a prosperous and strong country is still our grand goal. Thus, it is still worthwhile to carry forward the spirit and fine style embodied in Jiao Yulu. Jiao Yulu Spirit will never fade!

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Interdisciplinary Education Research on Cultural and Creative Product Design

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Abstract: With the rapid development of cultural and creative industries, the design of cultural and creative products, as an important part of it, has been paid more and more attention by the educational circle. This paper aims to discuss how to improve students' ability of practical exploration and interdisciplinary integration in the course of cultural and creative product design through interdisciplinary education. By analyzing the theory of cultural and creative product design, interdisciplinary education methods, practical cases and student learning effect evaluation, this paper puts forward a new education model in order to provide reference for the teaching reform of cultural and creative product design.
Keyword: Cultural and creative product design; Interdisciplinary education; Market demand; Education mode; Innovative design

1. INTRODUCTION

Cultural and creative product design is not only the combination of technology and aesthetics, but also the profound understanding and innovative expression of cultural connotation. This paper aims to explore the interdisciplinary education and research of cultural and creative product design, analyze the theoretical basis of cultural and creative product design, explore its design concept, cultural connotation and market demand, and reveal the importance of cultural and creative products in contemporary society. Interdisciplinary education methods will be studied to explore how to effectively integrate cultural and creative product design with arts, culture, business and other disciplines to build a new interdisciplinary education model to stimulate students' creativity and practical ability.

2. OVERVIEW OF CULTURAL AND CREATIVE PRODUCT DESIGN
2.1 Design concept

The design concept of cultural and creative product design should be user-centered, pay attention to the needs and experience of users, and integrate cultural connotations into products through design. At the same time, cultural and creative products often have the experience function value at the emotional level. Under the premise of meeting the basic needs of users' basic functions, cultural and creative products that can better meet the emotional needs of users are often more popular in the market competition of cultural and creative product design.

2.2 Cultural Connotation

Cultural and creative product design carries rich cultural connotation and is an important carrier of cultural communication. Designers need to deeply understand the cultural context behind the products they design and translate it into design elements. the integration of regional culture in the design stage can promote the goal of brand building. Through the excavation of cultural symbols, traditional crafts and local characteristics, cultural and creative products can better reflect regional culture and historical inheritance, thus enhancing the cultural identity of products.

2.3 Market Demand

Under the condition of market economy, the design of cultural and creative products should also consider the market demand. Designers need to pay attention to market demand and consumer preference through market research, and adjust their design and marketing strategies according to market demand. "3" Modern consumers are more and more inclined to choose products with personalized and cultural value, designers in product design, not only to pay attention to the function and beauty of the product, but also to consider its cultural connotation and market positioning to ensure that the product can meet the needs of consumers.

3. INTERDISCIPLINARY APPROACH TO EDUCATION

3.1 The necessity of interdisciplinary education

The advantage of interdisciplinary education is that it can break the barriers between disciplines and promote the cross and integration of knowledge in different fields. In the education of cultural and creative product design, through the integration of art design, cultural studies, marketing and other disciplines, students can more comprehensively understand the design process of cultural and creative products, so as to improve their comprehensive ability.

3.2 Construction of education model

The construction of interdisciplinary education model can be started from the following aspects:

3.2.1Curriculum integration: Integrate cultural and creative product design courses with art design, cultural studies, marketing and other courses, design comprehensive courses, and encourage students to transfer and apply knowledge between different disciplines.

3.2.2Project-driven learning: Through a project-driven approach, students are allowed to conduct practical exploration in real design projects combined with multidisciplinary knowledge. For example, interdisciplinary teams can be organized to design cultural and creative products around specific topics and promote cooperation and exchange among students.

3.2.3 Expert lectures and workshops: Experts from different fields are invited to give lectures and workshops to help students broaden their horizons and understand the latest developments and practice cases of cultural and creative product design.

3.3 Teaching Strategies

In the process of interdisciplinary education, the role of teachers is crucial. Teachers should not only impart knowledge, but also guide students to independent learning and exploration. A variety of teaching strategies such as guided teaching, collaborative learning, feedback and reflection can be used to stimulate students' creativity and critical thinking, and cultivate their communication skills and team consciousness.

4. ANALYSIS OF CULTURAL AND CREATIVE PRODUCTS OF THE FORBIDDEN CITY

4.1 Brief introduction of "Cultural and Creative Products of the Palace Museum"

Tourism cultural and creative products are the bridge connecting tourists and regional culture, and their design is related to the depth and breadth of cultural experience, and also has an impact on the communication effect of regional culture. Taking "Cultural and creative Products of the Palace Museum" as an example, the Palace Museum has successfully launched a series of cultural and creative products through a deep understanding of traditional culture and innovative design. These products not only incorporate the cultural elements of the Forbidden City in their design, but also attract a large number of young consumers through modern marketing methods.

4.2 Analysis of success factors

4.2.1Cultural depth

The success of the cultural and creative products of the Palace Museum lies in its profound cultural deposits. Designers have fully explored the history and culture of the Forbidden City in product design. For example, the "cat" series of products of the Forbidden City combines the cultural symbols of the Forbidden City with modern design, which has been widely welcomed.

4.2.2Market positioning

The market positioning of cultural and creative products of the Palace Museum is very clear, mainly for young consumers and cultural lovers. Through accurate market research, the Palace Museum is able to timely understand the needs of consumers and adjust product design and marketing strategies to meet market changes.

4.2.3Innovative design

The cultural and creative products of the Palace Museum are boldly innovative in design, using new materials and new technologies to create a unique product image. For example, the "Forbidden City mooncake" launched by the Palace Museum not only innovates in taste, but also incorporates cultural elements from the Palace Museum in the packaging design, making it a popular product for the Mid-Autumn Festival.

5. STUDENT LEARNING EFFECT ASSESSMENT

To evaluate the impact of interdisciplinary education on students, it can be evaluated from the aspects of innovation ability, practical ability and cultural accomplishment. Meanwhile, different evaluation methods, such as work display, questionnaire survey and interview, can be used to evaluate the learning effect of students from various aspects.

6. CONCLUSION

The interdisciplinary educational research of cultural and creative product design provides a new way to improve students' ability of practical exploration and interdisciplinary integration. Through theoretical discussion and practical case analysis, this paper emphasizes the importance of interdisciplinary education in cultural and creative product design, and puts forward corresponding teaching strategies and evaluation methods. In the future, with the continuous development of the cultural and creative industry, interdisciplinary education will play a greater role in cultivating innovative talents.

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Research on Physics Experiment Teaching Reform In Colleges And Universities

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Abstract: College general physics experiment is an important component of college teaching and an important step for the application of college physics knowledge to practice. This paper analyzes the existing problems in college physics experiment teaching at the present stage, and from the existing problems, puts forward targeted reform measures and suggestions; It is suggested that the reform should be carried out from the following aspects, and a new experimental curriculum reform system should be established according to the development and requirements of the Times. Take students as the main body, change students' learning concept; According to social needs, reform the curriculum content; Improve students' learning motivation for college physics experiments, improve the basic skills of physics experiment teachers, reform teaching skills and teaching methods, increase investment in physics experiment teaching, and reform the evaluation method of experimental teaching at the present stage.

Keywords: Ordinary universities; Physics experiment teaching, reform; Research

1. INTRODUCTION

Experimental teaching is an important part of physics teaching and an important step in the application of college physics knowledge. College physics experiment teaching can cultivate college students' practical ability, hands-on ability, experimental ability, scientific research ability, individual problem-solving ability, etc. the cultivation of college students' above ability can not be accomplished by other teaching methods. At the same time, college physics experiment is also the first combination of theoretical knowledge and practice after college students enter the university stage. Therefore, college physics experiment needs to cultivate college students' scientific quality and experimental quality, and more importantly, it needs to improve their innovation ability and comprehensive literacy. the smooth development of university physics experiment teaching is a reflection of the level of university physics teaching and research. College physics experiment teaching not only undertakes the task of imparted knowledge to college students, but more importantly, it should cultivate students' practical ability, stimulate their interest in physics learning, train the spirit of scientific innovation and rigorous scientific attitude.

2. PHYSICS EXPERIMENT TEACHING STATUS IN COLLEGES AND UNIVERSITIES

2.1 Analysis of the current situation of general physics experiment courses and teaching materials

Physics experiment teaching in colleges and universities includes many contents, such as the setting of experiment course objectives, the selection of curriculum and content, the teaching design of the course, etc. However, so far, there are still many ordinary colleges and universities physics experiment teaching without a clear course goal, some colleges and universities have goals, but the teaching content is not in line with the development of the Times. In some colleges and universities, there is a lack of comprehensive experimental design in the content of experimental textbooks, or a lack of comprehensive experimental design, and the content of the course is too detailed, so that students can easily complete the experiment as long as they follow the steps, resulting in a lack of creativity. Of course, the design of fixed experimental content in the experimental content can help students better grasp the theoretical knowledge in the book, but if the whole experimental course is such content, students will form a dependent psychology,

lack the spirit of independent thinking, and lose the purpose of the experimental course.

2.2 Analysis of the use and management of laboratory instruments

Compared with other course experimental instruments, college physics experimental instruments have many of their own characteristics, such as high price, relatively large, storage space, storage management is relatively time-consuming and laborious, and the entire laboratory operation mode has not kept up with the pace of reform and is relatively backward. the state invests more and more in laboratories, but the laboratory sites and teachers are relatively insufficient, or the quality of the experimental teachers themselves is insufficient, resulting in the inadequate use of the updated experimental instruments. Meanwhile, the heavy laboratory management and maintenance work occupies a lot of time and energy of ordinary teachers, affecting the daily teaching work.

2.3 Experimental attitude of college students

Physics experiment teaching in ordinary colleges and universities is mainly to carry out experiment teaching in the laboratory, and at the same time to carry out a small amount of general physics theory teaching work. General university physics experiment teaching can be divided into different teaching cycles, including basic experiment and reform experiment, basic experiment and comprehensive design experiment, and so on. According to the survey of college students' attitude towards physics experiment, most of them think that physics experiment teaching can exercise their practical ability, broaden their horizons, and be of great help to the study of subsequent professional courses, so they attach great importance to the teaching of college physics experiment. Many college physics knowledge is closely related to real life, so it can be linked with life in experimental teaching, so that they can make physical experiments into life and bring them successful experience.

2.4 University general physics experiment teaching methods

Although physics experiment teaching is generally carried out in various colleges and universities, the common problem in all colleges and universities is that teaching methods are single and physics experiment teachers generally adopt cramming teaching. In the teaching process, teachers are the main body of teaching and are the leader, ignoring the main position of students, and they are always in a passive position. At present, college physics experiments have fixed steps, students only need to follow the steps step by step, without considering other factors; Moreover, the experimental content is also the old content that has not changed for many years, and students do not need to know the experimental principle, nor do they need to consider the significance of the experiment. Moreover, the teaching of experiment teachers is all through the demonstration of the experiment process, so that students can do according to the experiment process, which seriously hinders the cultivation of their innovation ability.

2.5 Passivity in physics experiment teaching of college students

In the survey of physics experiment teaching in some universities, it is found that only about half of the students can do the preview before the experiment class, which also reflects the negative attitude towards physics experiment teaching. In addition, in the process of experimental teaching, the physics experiment teacher basically explains the experiment first, and then the students conduct the experiment according to the experiment steps of the teacher, which makes the students unconsciously develop their dependence on the teacher, and most of the students want the teacher to explain the experiment steps in more detail. In addition, a considerable number of college students think that experimental courses are dispensable and have no relationship to their study and future work, which has a great impact on the experimental teaching effect.

3. WAYS AND METHODS OF COLLEGE PHYSICS EXPERIMENT TEACHING REFORM

3.1 The establishment of university physics experiment teaching courses in line with the development of the Times

With the development of the Times, the teaching of university physics experiment has undergone great changes, which puts forward higher requirements for college students and

physics experiment teachers. Physics experiment teaching requires students to do hands-on work, which makes students more willing to participate in extracurricular physics experiment teaching. At present, all colleges and universities have mandatory self-study at night, which allows students to have time to review what they have learned, but not many students can take advantage of this time. Therefore, open lab courses can be conducted in the evening; the arrangement of experimental courses should be continuous, systematic and gradual, so as to gradually arouse the enthusiasm of college students in physics experiment teaching and learning and exert their subjective initiative.

3.2 Strengthen the comprehensive use and management of physics experimental instruments

The management and application of physics experimental instruments directly affect the quality of experimental teaching and the effect of students' learning, so it is necessary to strengthen the maintenance, application and management of the instruments. In recent years, various colleges and universities have increased their investment in physics experimental instruments, and while strengthening investment, we should pay more attention to the maintenance and maintenance of instruments. First of all, laboratory rules and regulations should be developed and improved to facilitate the maintenance and maintenance of instruments, such as the "Physical experiment equipment management System", "Physical experiment equipment damage and loss compensation system", "physical experiment teacher post responsibility system", "Physical experiment equipment regular maintenance system" and other laboratory rules and regulations. Secondly, it is necessary to do a good job in the record of experimental standards and the open management system of laboratories.

3.3 Close combination of theoretical knowledge of physics and experimental teaching

There are many physics experiment teaching courses in ordinary colleges and universities, including many physics teaching courses, such as optics, mechanics, applied electronics, acoustics, etc. In this series of experimental courses, most of the experimental projects are

basic skill experiments and verification experiments, design experiments and comprehensive experiments are relatively few, and related exploratory content is less, which is not conducive to the cultivation of students' innovative ability. Therefore, the reform of physics experiment teaching content is imperative. the integrated development of modern physics knowledge has promoted the renewal and development of basic theoretical knowledge of physics, and the traditional physics disciplines have formed a trend of cross-development. Therefore, the teaching content of physics experiments should break the traditional discipline boundaries, and the experimental projects should be screened and sorted out, the old experiments should be eliminated, and the new experimental projects reflecting the frontier discipline knowledge should be added.

3.4 Establish a diversified curriculum assessment system

The traditional assessment method, focusing on the result and ignoring the process, is not conducive to mobilizing the enthusiasm and initiative of students. Therefore, it is imperative to establish a scientific and diversified evaluation system. the assessment of each experimental project can be composed of experiment preview, experiment operation, experiment report, experiment examination and other links, and the total score of the semester is composed of the above links. the performance evaluation basis of each link should be diversified, and the experimental preview results can be evaluated from the online experiment platform, including the number of visits to the platform, time, preview results, preview report results, etc. Experimental operation, from the standard use of instruments, experimental operation steps are reasonable, the degree of familiarity with experimental operation, data recording and sorting is standardized, classroom interaction, instrument sorting and so on. the total score of the experimental course is weighted according to different sub-scores. With the development of online teaching and online courses, the reform of college physics experiment course will attract enough attention, and the diversification of assessment methods will reflect its rationality and objectivity.

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Research on Performance Evaluation Issues and Countermeasures of Special Funds in Vocational Colleges

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Abstract: The 20th National Congress of the Communist Party of China first proposed the coordinated innovation of vocational education, higher education, and continuing education, optimizing the positioning of vocational education from a policy perspective through the organic connection and systematic integration of the three types of education, in order to strengthen support for the development of modern industries. Vocational education shoulders the mission of providing technical and skilled talents for various industries in society, and plays an indispensable role in economic and social development. However, due to the large scale and diverse types of special funds invested in vocational colleges in China, as well as the late start of research in the academic community, there are currently many difficulties and problems in the performance evaluation of special funds in vocational colleges in China. This article focuses on the theme of performance evaluation of special funds in vocational colleges. Based on the analysis of the current situation and existing problems of performance evaluation of special funds in vocational colleges, the reasons for the formation of problems are analyzed in depth. Targeted countermeasures and suggestions are proposed for the performance evaluation of special funds in vocational colleges, providing some useful references for future performance evaluation of special funds in vocational colleges.
Keywords: Vocational Colleges; Special Funds; Performance Appraisal

1. INTRODUCTION
Since the 18th National Congress of the Communist Party of China, China has built the world's largest vocational education system, and the influence and competitiveness of higher vocational education have been continuously enhanced. the development of vocational education has undergone historic, holistic, and pattern changes. Vocational education in our country basically covers various fields of economic and social development, training a large number of technical and skilled talents for various industries.

Project construction, as an important driving force for the development of vocational education, is an important part of improving the quality of vocational education development. Building a comprehensive performance evaluation system for special funds in vocational colleges is of great significance for promoting the development of vocational education. At present, there is no complete theoretical system for the performance evaluation of special funds in vocational colleges. In the current performance evaluation process of special funds, there are problems such as an unscientific performance evaluation index system, non-standard performance evaluation process, and insufficient use of performance evaluation results.

2. THE CAUSES OF PERFORMANCE EVALUATION ISSUES IN SPECIAL FUNDS FOR VOCATIONAL COLLEGES

2.1 The internal control construction of the school is not perfect
The performance evaluation work is recognized as a formalism, and as long as the achievements are exaggerated and beautified, an ideal score can be obtained, rather than being viewed as a tool to improve school conditions and enhance the quality of school development. the performance evaluation staff lack sufficient sense of responsibility for this

work, resulting in a lack of objectivity in data collection, material organization, and other aspects. At the same time, the performance evaluation of special funds within the school is mostly assumed to be the work of the finance department, with low relevance to the department, resulting in a lack of coordination and linkage among departments in actual work, and overall efficiency is not high.

2.2 Lack of investigation and research in the early stage

In terms of setting performance evaluation indicators, the performance evaluation indicators selected by vocational colleges are not comprehensive and systematic enough; the evaluation indicators are too similar to previous projects, without considering the specific situation of specific projects; For economic considerations, qualitative indicators that are easy to obtain are often used when selecting performance evaluation indicators, and quantitative indicators are lacking. A complete performance evaluation index system should take into account both commonalities and individualities, short-term and long-term, qualitative and quantitative aspects [1]. In the selection of performance evaluation methods, there is an excessive reliance on empiricism, adopting the same performance evaluation methods as previous special fund performance evaluations, with less quantitative analysis.

2.3 Information technology construction lags behind

Although the school has established an integrated platform for budget performance internal control management, it is more commonly used for reporting on campus budgets and budget performance, and the application of information technology in improving performance evaluation levels is significantly insufficient. In terms of specific business expenses that make up the project, there is no well-established tracking, feedback, and warning process, which cannot achieve full process performance management. the performance evaluation issues that arise during the performance evaluation process, which can only be used to evaluate a static time node and cannot be monitored in real-time during project execution, are all caused by the lag in information technology construction.

3. ANALYSIS OF OPTIMIZATION STRATEGIES FOR PERFORMANCE EVALUATION OF SPECIAL FUNDS IN VOCATIONAL COLLEGES

Vocational education, as the education type most closely related to industrial upgrading and social employment, must continuously upgrade and transform in order to better adapt to the needs of economic and social development and technological changes, improve development quality, and take the path of connotative development. "[2] the performance evaluation of special funds in vocational colleges aims to further optimize resource allocation and enhance the level of vocational college education through the investment of funds, manpower, material resources, etc. in a certain special project. Building a scientific and reasonable performance evaluation index system for special funds is of great significance for making good use of special funds and promoting high-quality development of vocational colleges.

3.1. Optimize the performance evaluation index system for design optimization

In 2013, the Ministry of Finance proposed a project expenditure performance evaluation index system framework in the "Common Index System Framework for Budget Performance Evaluation". Currently, this system is widely used as the evaluation standard for financial expenditure performance evaluation in China [3]. On the basis of using this performance evaluation standard, vocational colleges should select personalized indicators that are suitable for their own actual situation based on common indicators. At the same time, in order to improve the scientificity and comprehensiveness of performance evaluation, more quantitative analysis should be added on the basis of traditional qualitative analysis, and evaluation indicators should be comprehensively designed. Experts should be selected through methods such as Delphi to score the importance of each indicator.

3.2. Optimize the performance evaluation process

3.2.1. Strengthen the management of performance evaluation process

Performance evaluation is a comprehensive work from top to bottom. In order to achieve

expected results, it is necessary for all employees to work together and form a joint force to promote the development of performance evaluation. In the process of evaluating the performance of special funds in vocational colleges, working groups should be established in conjunction with various functional departments involved in finance, auditing, assets, logistics, infrastructure, and project construction, to clarify the division of responsibilities and smooth internal communication channels. Each functional department actively provides suggestions and fully leverages their subjective initiative to jointly promote the development of performance evaluation work.

3.2.2. Cultivate professionals in performance evaluation

Vocational colleges should pay attention to discovering performance evaluation talents in their daily work and do a good job in talent reserve. Specifically, regular talent selection and reserve should be carried out in departments with high relevance to performance evaluation, such as finance and audit departments, and attention should be paid to discovering potential old employees. At the same time, performance evaluation related knowledge should also be included in the training of new teachers. At the same time, schools should pay attention to organizing on campus staff engaged in performance evaluation to participate in various business training, timely learn and master the latest policies and regulations, learn business knowledge in performance evaluation work, enhance financial risk awareness, establish bottom line thinking, and improve business level. Vocational colleges can organize financial personnel to intern at accounting firms and participate in full cycle business practices. By personally participating in the entire process of performance evaluation, they can form a comprehensive and systematic understanding of performance evaluation, thereby improving their performance evaluation abilities.

3.3 Optimize the application effect of performance evaluation results

3.3.1. Strengthen external supervision

The government finance department, as the entrusting party for the use of special funds in vocational colleges, has the right and obligation to supervise and manage the use of special funds. To ensure the output effect, government departments should strengthen the supervision of the entire use of special funds in vocational colleges. In order to further improve the effectiveness of the improvement, government departments should establish a performance accountability mechanism for the problematic links in the use of special funds, implement responsible departments and individuals, require them to take corrective measures within a specified period of time, and regularly inspect the effectiveness of the rectification, thereby further improving the performance of the use of special funds.

3.3.2. Strengthen internal rectification

At present, schools mainly focus on the results rather than the process of performance evaluation. Therefore, when the performance evaluation of special funds obtains a good result, the deduction items are often not thoroughly investigated, resulting in insufficient application of the performance evaluation results.

After obtaining the performance evaluation results, it is necessary to first conduct a detailed analysis of each item in the evaluation report. Small issues should not be overlooked just because the overall assessment result is "passed". Instead, it is important to take preventive measures and prevent problems before they occur. Implement the discovered problems to individuals, require them to issue rectification reports within a specified period, and organize regular and irregular inspections of the rectification situation to ensure that the deduction items will not occur again.

4. CONCLUSION

As an important way to support the special construction of vocational colleges, the investment of special funds can effectively improve the quality of education and achieve the comprehensive, healthy and high-quality development of vocational colleges. Evaluating the performance of special funds is not only necessary to improve the efficiency of fiscal fund utilization and optimize fiscal fund allocation, but also an inevitable requirement for promoting the development of higher vocational education.

This article takes the performance evaluation

of special funds in vocational colleges as the research object. Based on the analysis of the current situation of performance evaluation, it studies the problems in the original performance evaluation process and the reasons for the problems. To address these issues, optimization measures are proposed from the aspects of performance evaluation index system design, performance evaluation process, and application of performance evaluation results.

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Big Data Environment: Research on Efficient Data Processing and Storage Technologies

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Abstract: With the rapid development of information technology, the demand for data processing and storage has grown significantly, particularly in fields such as the internet, big data, and artificial intelligence. Efficient data processing and storage technologies play a crucial role in enhancing the performance and efficiency of computer systems. This paper analyzes existing efficient technologies from the perspectives of data processing and storage, and proposes feasible solutions. the application of these technologies has contributed significantly to the development of various fields.
Keywords: Big Data; Data Processing; Data Storage; High Efficiency

1. INTRODUCTION

In the current digital age, data has become an invaluable asset. the surge in data volume and the diversification of data types have posed significant challenges to traditional data processing and storage systems. Traditional relational database management systems (RDBMS) have gradually shown limitations in scalability, performance, and cost. To overcome these limitations, distributed storage systems have emerged. By distributing data across multiple nodes, these systems achieve horizontal scaling and load balancing. This paper delves into the evolution of big data storage technologies, focusing on distributed storage systems such as Hadoop HDFS, and NoSQL databases. Additionally, it discusses various data processing frameworks, including batch processing with Apache Hadoop, stream processing with Apache Kafka and Apache Flink, and the versatile Apache Spark. the paper also highlights key strategies for optimizing data processing performance, such as data partitioning, indexing, caching, and compression.

2. EVOLUTION OF BIG DATA

STORAGE TECHNOLOGIES
2.1 Traditional Storage Systems
Traditionally, relational database management systems (RDBMS) have been the dominant force in data storage. They offer strong data consistency and transactional support, making them ideal for structured data. However, with the exponential growth of data volume and the emergence of semi-structured and unstructured data, RDBMS have struggled to keep pace [1].
2.2 Distributed Storage Systems
To address the limitations of traditional storage systems, distributed storage systems have been developed. These systems distribute data across multiple nodes, enabling horizontal scaling and load balancing. Hadoop HDFS is a notable example of a distributed storage system. It is highly fault-tolerant, offers high throughput, and is cost-effective, making it a popular choice in the big data domain.
2.3 NoSQL Databases
NoSQL databases have emerged as an important alternative to RDBMS for big data storage. They provide flexible data models, high concurrency processing capabilities, and scalability. NoSQL databases can be categorized into key-value stores, column stores, document stores, and graph databases, each with unique application scenarios and advantages.

3. DATA PROCESSING FRAMEWORKS
3.1 Batch Processing with Apache Hadoop
Apache Hadoop is a cornerstone in the field of big data processing. It provides a complete batch processing solution through its MapReduce programming model. Hadoop splits large datasets into multiple chunks and processes them in parallel across multiple nodes. the Hadoop ecosystem also includes components such as HDFS, Hive, and HBase, collectively forming a powerful big data

processing platform [2].

3.2 Stream Processing with Apache Kafka and Apache Flink

With the increasing demand for real-time data processing, stream processing frameworks have become an important direction in big data processing. Apache Kafka is a distributed stream processing platform that offers high throughput and low-latency message delivery. Apache Flink is an open-source stream processing framework that supports stateful computations and enables real-time data analysis without data loss.

3.3 Versatile Apache Spark

Apache Spark is a fast and general-purpose large-scale data processing engine. It supports multiple computation modes, including batch processing, stream processing, graph processing, and machine learning. Spark leverages in-memory computing technology to significantly enhance data processing speed and efficiency. Additionally, Spark provides rich APIs and ecosystem support, making it easy for developers to build complex big data processing applications.

4. STRATEGIES FOR OPTIMIZING DATA PROCESSING PERFORMANCE

4.1 Data Partitioning and Indexing

Reasonable data partitioning and indexing strategies can significantly improve big data processing performance. By dividing data into different partitions based on certain rules, parallel processing can be achieved across multiple nodes. Meanwhile, establishing appropriate indexes can speed up data retrieval and reduce unnecessary I/O operations [3].

4.2 Caching and Compression

Caching technology can reduce data reloading and computation, improving processing efficiency. Data compression can reduce storage space and transmission bandwidth consumption without losing information. the combined use of caching and compression technologies can significantly enhance the overall performance of the system.

4.3 Load Balancing and Fault Tolerance

Load balancing is crucial for ensuring the stable operation of big data processing systems. Through reasonable task scheduling and resource allocation strategies, the load can

be evenly distributed across nodes, avoiding single points of failure and performance bottlenecks. Meanwhile, building a robust fault tolerance mechanism ensures that the system can continue to operate normally even when some nodes fail.

5. CONCLUSION

In summary, big data storage and processing technologies are key drivers of digital transformation and innovation. With the continuous growth of data volume and diversification of data types, distributed storage systems and versatile data processing frameworks have emerged as essential tools. By leveraging strategies such as data partitioning, indexing, caching, and compression, as well as implementing load balancing and fault tolerance mechanisms, we can significantly enhance the performance and efficiency of big data processing systems.

As engineers and researchers, we must continuously learn and master the latest big data technologies and tools to build efficient, scalable, and secure data ecosystems. the future of big data lies in its ability to unlock new insights and drive innovation across various industries and applications. By embracing these technologies, we can harness the power of data to transform the way we work, live, and interact with the world.

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Research on the Integration of Moral Education for College Students in the Context of a Harmonious Society

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Abstract: Building a harmonious society is the mainstream trend of the times and the common aspiration of humanity. In this context, how to effectively integrate and strengthen the moral education of college students has become an increasingly prominent problem. This article analyzes the interactive mechanism between the construction of a harmonious society and the integration of moral education for college students, clarifies the necessity of this work, and further considers effective implementation strategies based on the exploration of the influencing factors faced, in order to promote the effectiveness and pertinence of moral education work.

Keywords: Harmonious Society; College Student; Integrated Moral Education

1. INTRODUCTION

The construction of a harmonious society advocates the concepts of fairness, justice, integrity, friendship, stability, order, and humanistic care, which are important goals for the development of modern civilized society and the common value pursuit of all members of society. These concepts have similarities with the content of integrated moral education for college students, and there is a deep connection between a harmonious society and moral education. They are jointly committed to cultivating new era youth with a high sense of social responsibility, good moral qualities, and innovative abilities. Moreover, college students contain a powerful force in building and promoting social progress. Their moral education work not only concerns personal growth, but also directly affects the overall appearance and long-term development of society. Therefore, the relationship between the two is not only mutually reinforcing, but also lays a solid foundation for jointly building a better social atmosphere.

2. THE NECESSITY OF INTEGRATING MORAL EDUCATION FOR COLLEGE STUDENTS

In the context of diversification and informatization, the integration of moral education for college students is related to the improvement of personal moral cultivation and is an important manifestation of social civilization progress. the virtues emphasized in moral education, such as integrity, friendliness, and fairness, these are key factors in promoting harmonious interpersonal relationships, reducing social conflicts, enhancing social cohesion, and promoting harmonious social development. the understanding of ideology and politics, the grasp of moral qualities, the attitude towards life values, and the control of psychological states are important components of college students' ideological and behavioral development. [1] the establishment of correct values among college students can guide them to maintain a clear mind, make correct value judgments and behavioral choices in complex social environments. In addition, there is a profound and dynamic bidirectional promotion relationship between the moral practice and moral education of college students. This process is a one-way shaping and cultivation, but also a model of mutual interaction and common growth. On the one hand, moral practice is a bridge for college students to transform what they have learned from moral education into practical actions, enabling them to test and enhance their moral cognition and behavioral abilities in a real social environment. On the other hand, the moral practice achievements of college students have provided strong motivation and support for the construction of a harmonious

society, solved many practical social problems, and stimulated more people's moral enthusiasm and participation awareness. Therefore, this two-way promotion process proves the importance of moral education and demonstrates the crucial role of moral practice in promoting social progress.

3. FACTORS AFFECTING THE INTEGRATION OF MORAL EDUCATION FOR COLLEGE STUDENTS IN THE NEW ERA

3.1 Humanistic Factors: Traditional Culture and Customs

Traditional culture and customs are invisible carriers of a nation's specific history and spirit, containing rich moral concepts and life philosophies such as benevolence, propriety, righteousness, filial piety, and brotherly love. These traditional values are subtly influencing the thinking patterns and behavioral norms of college students, prompting them to form moral sentiments and value orientations that are in line with the social and cultural atmosphere. As the inheritors and innovators of social culture, college students can cross the boundaries of time and space, touch the bright essence of ideas and artistic treasures in the long history, and deeply feel the enduring spirit of the times in these traditional cultures through in-depth learning and inheritance of rich and colorful traditional culture. In the process of learning, college students will gradually comprehend the profound philosophy contained in traditional culture, such as the cosmology of "unity of heaven and man", the social view of "harmony in diversity", and the ethical and moral view of "benevolence" as the core. With a deeper understanding of traditional culture, college students develop a sense of identity and pride in their own ethnic culture. This sense of identity and cultural confidence inspires them to actively engage in the construction of a harmonious society, to practice the excellent ideas in traditional culture through practical actions, and to contribute their own strength to solving contemporary social problems.

3.2 Social Factors: Mainstream Values and Moral Trends

The mainstream values and moral trends of society, as the core components of the social culture of a specific era, guide college students to form correct values and behavioral norms through the dual role of value orientation and moral demonstration. In a diverse social environment, mainstream values guide college students to make correct value judgments in the complex information, which shapes their moral qualities and encourages them to form a positive outlook on life and the world. As a direct reflection of social norms, moral standards have always had a subtle influence on the behavior patterns and ideological concepts of college students. Good moral standards can stimulate college students' moral consciousness and self-discipline, encourage them to consciously abide by social and professional ethics, stimulate their sense of social responsibility and mission, make them pay more attention to society, care for others, actively participate in public welfare undertakings, continuously hone and improve their moral judgment consciousness in practice, forming their own value judgment standards.

3.3 Educational Factors: Personal Educational Background and School Education System

The transition from elementary education to senior education is a systematic and progressive process, and the curriculum design, campus culture, and practical activities that run through the entire educational process further enrich and deepen students' understanding of values. the moral education work in universities is an important way for universities to comprehensively transform students, and the goal of moral education work is to promote students' personality perfection and moral improvement. [2] On the other hand, the education mechanism of schools is undoubtedly the core pillar and key link in the moral education system, which shoulders the important mission of shaping students' character and cultivating noble moral sentiments. This mechanism emphasizes the permeability and practicality of morality through a carefully designed curriculum system, diverse activity platforms, and in-depth teacher-student communication. It is not limited to imparting knowledge, but focuses on guiding students to integrate abstract moral theories into every corner of daily life and learning. By providing abundant resource support, establishing positive incentive

mechanisms, and creating a healthy competitive and cooperative environment, schools have effectively promoted the transformation of students' moral education effectiveness, enabling them to establish correct moral and value concepts from a conceptual perspective, form good behavior habits in daily life, and become new era youth with noble character and social responsibility.

3.4 Family Factors: Personal Experiences and Psychological Qualities

The diversity of personal experiences provides students with the opportunity to face the difficulty and complexity of society, draw confidence from success, and learn resilience from failure. In the process of solving practical problems, they learned responsibility and accountability, understood the importance of teamwork, and these valuable experiences prompted them to form a positive and exploratory value system. At the same time, when facing challenges and difficulties, they will also exhibit different psychological qualities, such as optimism, frustration, etc. Based on this, they will reflect and effectively regulate themselves, and ultimately form these excellent traits that will become their internal driving force to overcome obstacles and continue to move forward. the strength of psychological qualities profoundly shapes how college students can sensitively and accurately interpret the complex information flow in the external world, and how to make appropriate responses in the face of this information. Students with strong psychological resilience can demonstrate extraordinary adaptability and emotional management skills when facing challenges and pressures. They are able to quickly adjust their mentality, maintain inner peace and stability, and avoid being misled by external noise and temptations in a complex and ever-changing social environment. It is particularly important that good psychological qualities are the key to stabilizing and deepening the moral consciousness of college students. In the hearts of such students, morality is not only an external set of behavioral norms, but also a deep-seated belief and pursuit. They are able to uphold their moral bottom line when facing moral dilemmas, not swayed by interests or power, and courageously pursue truth and justice.

4. EXPLORATION OF STRATEGIES FOR INTEGRATING MORAL EDUCATION FOR COLLEGE STUDENTS IN THE CONTEXT OF A HARMONIOUS SOCIETY

4.1 Optimizing the Social Education Environment and Strengthening the Moral Construction Guarantee Mechanism

In the context of a harmonious society, optimizing the social education environment can provide college students with a healthier and more positive growth atmosphere. With the continuous increase in society's emphasis on education, various educational resources have been reasonably allocated and effectively utilized, and there is a strong cultural atmosphere and positive spirit both inside and outside the campus. This environment stimulates college students' thirst for knowledge and longing for a better life, prompting them to actively accept the correct value orientation unconsciously and form a moral construction system that conforms to the mainstream of society. Secondly, by establishing sound laws and regulations, strengthening moral education and publicity, and improving moral evaluation standards, society has established a series of clear moral standards and behavioral norms for college students. These guidelines can help college students establish correct moral concepts as soon as possible, provide strong guidance and protection when they face moral choices, and encourage them to consciously practice moral principles.

4.2 Emphasize the Integration of Mainstream Social Values and Personal Moral Practices

The deep integration of the mainstream social value system and personal moral practice provides clear value orientation for college students, stimulates their inner moral consciousness, promotes their comprehensive personal development, and promotes the harmonious unity of social progress. the mainstream value system, as a concentrated embodiment of social consensus, provides college students with standards for judging right from wrong, goodness from evil. Through systematic educational guidance, college students can deeply understand the connotation and significance of integrated

moral education. As a touchstone for testing the level of values, personal moral practice also encourages college students to transform what they have learned into practical actions and actively cultivate their personal character. In this series of practices, they learned responsibility and accountability, experienced the significance of dedication and sacrifice, and further consolidated and deepened the effect of moral cultivation.

4.3 Establishing a Joint Guidance and Education Between Families and Schools

The concept of joint guidance education between family and school emphasizes the close cooperation and communication between them, creating a comprehensive and multi-dimensional growth environment for college students. Family education conveys traditional virtues and values through words and deeds, laying the early foundation for the initial formation of moral education for college students. On the school side, students are further required to establish correct values through systematic curriculum design, rich campus cultural activities, and strict discipline. the effective cooperation between family and school enables college students to receive consistent and positive value orientation during their growth process. By guiding them

to self-reflect, self-restraint, and self-improvement, they actively enhance their moral cognition and practical ability, reduce internal conflicts caused by personal behavior deviating from traditional cultural morality, and promote harmonious development between individuals and society. [3] This helps college students better integrate into society, adhere to moral bottom lines in complex and changing social environments, and ultimately become individuals with noble moral qualities.

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The Current Status of China's Agricultural Products Trade, Response Strategies

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Abstract: China has recently experienced a significant and sustained increase in its agricultural trade deficit. This trend is primarily due to the large import of land-intensive agricultural products like oilseeds, feed, and grains. Conversely, the country's exports are predominantly labor-intensive agricultural products. This imbalance results in an unbalanced trade structure. Furthermore, the trade mode is relatively straightforward, with general trade being the most common method. This article systematically analyzes the causes of the trade deficit from various aspects. These aspects encompass the agricultural product market's background, its current status, technological advancements, and consumer preferences. Additionally, it suggests measures to promote trade balance and bolster international competitiveness.
Keywords: Agricultural Products, Agricultural Product Trade Deficit, Trade Structure

1. THE CURRENT STATUS AND POLICY BACKGROUD OF CHINA'S AGRICULTURAL PRODUCTS TRADE

China's agricultural product trade deficit has continued to expand recently. There has been a significant increase in agricultural product imports, especially in land-intensive products such as oilseeds, grains, and feed, with a gradual increase in foreign dependence according to statistics from the Ministry of Agriculture and Rural Affairs of the Peoples Republic of China. In contrast, exports are concentrated in labor-intensive vegetables, fruits, and aquatic products. Specifically, agricultural products that require scarce land resources and have high production costs rely on imports, while domestic abundant labor resources give labor-intensive products an advantage in the international market. However, the overall technological content and added value of these exported products are low, resulting in an irrational trade structure. Additionally, China's agricultural product market policies are influenced by both domestic and international factors. In recent years, the government has actively promoted agricultural modernization and supply-side structural reforms, encouraging self-sufficiency in grain production and enhancing the diversity and stability of domestic supply. Moreover, SAEEDN et al(2021)stated that the implementation of the "Belt and Road" initiative and the RCEP agreement has increased opportunities for Chinese agricultural product exports, but it also brings certain challenges, especially in ensuring food safety, improving product quality, and brand building. Overall, the policy supports agricultural product trade, but it also has complex impacts on domestic production structure and supply-demand balance.

2. THE TRADE STRUCTURE AND MODE OF CHINA'S AGRICULTURAL PRODUCT MARKET

In recent years, China's agricultural product trade has continued to grow, with both imports and exports increasing. However, the total import volume is growing faster than the export volume, leading to a continuously expanding trade deficit. This trend reflects issues in the domestic agricultural product trade structure and supply-demand balance. An analysis of China's agricultural product trade structure (Jian, 2017) reveals that the country imports a large amount of land-intensive agricultural products such as soybeans, nuts, and grains mainly from countries like the United States, Brazil, and Indonesia, while its exports are dominated by labor-intensive products such as vegetables, fruits, and aquatic products, primarily sold to markets in the United States and Asia. This imbalance in trade structure has led to a substantial trade deficit. In terms of trade

mode, China's agricultural products are mainly traded through general trade, indicating that most of China's agricultural product exports are limited to direct sales without further processing. This indicates a low level of operation in China's agricultural product exports and a lack of corresponding agricultural product processing technology, resulting in lower added value compared to some developed countries' agricultural products. This single mode of trade limits China's flexibility in the international market and constrains the potential for agricultural product exports. Based on this situation, the main influencing factors of China's agricultural product trade deficit include agricultural product supply, demand, and international market competitiveness.

3. ANALYSIS OF THE CAUSE OF CHINA'S AGRICULTURAL PRODUCT TRADE DEFICIT

3.1 Domestic supply and demand changes have significantly impacted the trade deficit.

China's import growth rate of agricultural products far exceeds its export rate, leading to a clear positive impact of domestic production supply on the trade deficit. Particularly, with the significant increase in imports of agricultural products such as soybeans and corn, domestic production has had limited effects on alleviating the supply-demand gap, which is one of the main reasons for the expanded deficit. Secondly, domestic demand has further increased the trade deficit. With population growth and rising income levels, the annual demand for agricultural products has increased. Although China is a major agricultural producer, the per capita availability of domestic consumption of agricultural products is relatively insufficient, especially in high-quality agricultural products. the domestic supply capacity is inadequate, necessitating reliance on imports to meet demand, thereby further expanding the trade deficit. Furthermore, changes in consumer demand and the impact on the domestic agricultural product market reflect the transformation and upgrading of consumption structures. As residents' income levels rise, consumers gradually shift towards high-quality, safe,

and green organic food demands, slowing the market growth of traditional low-end agricultural products. Meanwhile, accelerated urbanization has changed consumption patterns, with more urban residents demanding a year-round supply of diverse agricultural products. This trend imposes higher requirements on cold chain logistics and supply timeliness for agricultural products, further increasing import demand.

3.2 The international competitiveness of agricultural products and technological development further widen the trade deficit.

China's agricultural products have relatively weak competitiveness in the international market, especially low-added-value labor-intensive products that dominate exports. These products have low technological content and face fierce price competition, making it difficult to form an effective price advantage and exacerbating the imbalance in trade structure, further intensifying the deficit. Finally, technological development affects China's agricultural product market by gradually influencing the supply capacity and market competitiveness of Chinese agricultural products. Currently, China has introduced intelligent, informational, and precise technological means in the agricultural field, such as big data analysis, drone management, and smart irrigation systems. These new technologies significantly improve production efficiency, reduce costs, and enhance product quality. However, due to regional differences in technology popularization, the level of agricultural modernization in eastern China is significantly higher than in central and western regions, and the urban-rural gap is also significant, restricting the balanced development of national agricultural production. But technical barriers to trade are becoming increasingly complex, with constantly raised plant health measures standards. Some countries even use intellectual property rights, exchange rates, and other related factors as standards for market access of which are essentially extensions of trade barriers, posing obstacles to China's agricultural product exports.

4. STRATEGIES IN RESPONSE TO THE CURRENT SITUATION AND CAUSES OF CHINA'S AGRICULTURAL TRADE DEFICIT

4.1 Optimize policy support and enhance domestic production capabilities.

The government should bolster policy support for land-intensive agricultural products by providing planting subsidies, enhancing infrastructure construction, and investing in agricultural technology. This will improve the self-sufficiency of domestic agricultural products and decrease dependence on imports. Simultaneously, it should regulate domestic agricultural product market prices to ensure their rationality, safeguard the interests of producers, and incentivize farmers to engage in active production.

4.2 Promoting the integration of production with sales and enhancing regional coordination.

Accelerate the construction of an integrated system for production and sales, promoting the connection between agricultural production and market demand. Utilize regional agricultural characteristic resources to establish a regional cooperation network, optimizing the distribution within the national agricultural product market, increasing the stability of agricultural product supply, and decreasing dependence on imports.

4.3 Building internationally competitive agricultural product brands.

Agricultural product brands with market potential should be actively created. Through branding and standardization development, enhance the international competitiveness and premium capability of Chinese agricultural products. In the process of brand building, the government and enterprises can leverage the "Belt and Road" initiative to expand the international fame of agricultural products, form unique product advantages, and thus increase exports.

4.4 Expediting the development of smart agriculture.

Vigorously promote the development of smart agriculture by applying technologies such as drones, precision fertilization, and the Internet of Things to improve land utilization rates and output while reducing costs. With the help of intelligent management methods, improve production efficiency and supply elasticity to respond to changes in market demand.

4.5 Intensify efforts in green development and quality safety assurance.

The government should strengthen the quality and food safety supervision of agricultural products and promote the development of green agriculture to meet the increasing demand for green, organic, and healthy agricultural products (Zhao, Liu, 2022). Developing a strict quality traceability system, ensure the quality of agricultural products to meet consumer demands, and gradually reduce the reliance on imported agricultural products by increasing market trust in domestically produced ones.

5. CONCLUSION

In summary, the continuous expansion of China's agricultural trade deficit is the result of multiple factors, including imbalances in the domestic agricultural production structure, upgraded consumer demand, and lagging technological development. To improve this situation, comprehensive measures need to be taken at various levels including policy, technology, market, and branding. By optimizing the production structure, enhancing international competitiveness, and strengthening quality and safety assurances, China can effectively narrow the agricultural trade deficit and achieve high-quality sustainable development in agriculture.

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Construction of Content System for Information Literacy Education in Universities Embedded in Engineering Education Professional Certification

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Abstract: Based on the different depths of information literacy content and the different levels of users, this article divides the information literacy education content system of universities embedded with engineering education professional certification into three different levels. They are information literacy education embedded in engineering students, information literacy education embedded in professional teachers, and information literacy education embedded in librarians. the article identifies the goals and content of information literacy education at different levels. On this basis, the article constructs a hierarchical content system for information literacy education.

Keywords: Engineering Education Professional Certification, Information Literacy Education, Universities, Content System

1. INTRODUCTION

The construction of the content system for information literacy education embedded in engineering education professional certification should be based on the different levels, stages, and learning needs of the educational objects. This system is a content system with multi-level teaching objectives, including multi-level teaching content, and can provide diversified educational forms. It is a progressive information literacy education content system from shallow to deep.

2. INFORMATION LITERACY EDUCATION EMBEDDED IN ENGINEERING COLLEGE EDUCATION

According to different stages of higher education, information literacy education embedded in engineering students can be divided into three stages: basic information literacy education, general information literacy education, and professional information literacy education.

2.1 Information Literacy Education At the Basic Level

Information literacy education at the basic level is the first step for college students to understand information literacy, and it is also the foundation for further information literacy education. the educational target at this level is freshmen in the first year of university. the stage of freshman enrollment is the stage for college students to adapt to new learning environments and methods. the goal of information literacy education at this stage is the primary education goal. the basic level of information literacy education is led by libraries and departments respectively.

The content of information literacy education led by libraries. Firstly, through the form of new student entrance training, students are familiarized with the functions, spatial layout, and service types of the library. Secondly, through regular courses such as Literature Retrieval and Utilization, students can master the knowledge and skills of information retrieval. Again, through specialized lectures and training, students will receive information literacy enlightenment education. Finally, through reading promotion, recommend relevant books on engineering disciplines to students.

The content of information literacy education led by departments. Departments can introduce relevant information about their majors to freshmen through special lectures

and other forms, guiding students to understand the characteristics of the discipline, the training objectives of the major, and the curriculum settings.

In summary, the main goal of basic level information literacy education is to provide college freshmen with a preliminary understanding of information literacy related theories, familiarize them with the basic resources of the library, clarify the direction of professional development, help students understand the relationship between professional learning and literature needs, and thus achieve the transition from passive learning to active learning.

2.2 Information Literacy Education At the General Level

Information literacy education at the general level is a deepening of basic level information literacy education. the educational target at this level is students in their second and third year of university. the goal of information literacy education at this level is the goal of intermediate education. the teaching focus of general level information literacy education is the connection and integration of professional core courses and information literacy education, that is, applying the concept, content, and methods of information literacy to the learning and research process of professional core courses. Therefore, the main body of general level information literacy education is the collaborative effort between libraries and departments.

The library collaborates with departments to offer professional information literacy credit courses. the course can adopt different forms of general core courses, public elective courses, and professional limited course selection according to the actual situation. Firstly, librarians of information literacy education should collaborate with professional teachers in the department to conduct research and evaluation on the information literacy abilities and learning needs of the students to be taught. Then, according to the needs of engineering education certification, they jointly design information literacy courses, clarify teaching objectives, grasp course knowledge points, allocate course hours reasonably, set corresponding credits, and develop an information literacy training plan suitable for

the department. Finally, the teaching content should revolve around the cultivation of information literacy skills in certification majors, which can include literature reading tools, commonly used digital tools in the profession, learning communities, etc.

The library and departments collaborate to carry out innovative information literacy education. According to the training objectives of the Engineering Education Certification Standards, the teaching of information literacy education at this stage should not only include the imparting of theoretical knowledge, but also attach importance to practical application in engineering. Departments can collaborate with libraries to carry out innovative information literacy education in professional competitions and innovation and entrepreneurship activities. Libraries should be guided by professional information literacy needs, and based on these needs, integrate the content of information literacy teaching into students' professional knowledge learning and practical activities. This type of course can combine the skills of information literacy with research problems in professional fields. the teaching content can revolve around course assignments, paper writing, internships and practical training, as well as in-depth research projects, patent searches, innovation and entrepreneurship, and so on.

Therefore, information literacy education at the general level will pay more attention to the learning of professional knowledge for engineering students, which can systematically utilize authoritative information resources in the discipline, and the cultivation and improvement of independent exploration ability in the learning and research process.

2.3 Information Literacy Education At the Professional Level

Information literacy education at the professional level is an enhancement of information literacy education at the general level. This level is mainly aimed at fourth year college students who are about to graduate. the goal of information literacy education at this stage is the goal of advanced education. At this stage, the information literacy education is mainly carried out by departments, and supplemented by libraries, which are closely

coordinated with the two important tasks of graduation design and thesis.

In the stage of thesis topic selection, firstly, the professional course teachers of the department provide the scope of thesis topic selection for the major, and then the information literacy librarians conduct relevant lectures and training. the teaching content can include search skills for databases such as CNKI and WANFANG DATA, collection and selection of foreign literature, writing of literature reviews, etc. During the research stage of a thesis, librarians can use excellent graduation theses as an example to organize teaching on how to select appropriate information resources, conduct professional searches, screen search results, and organize and manage literature. During the final draft of the graduation project and the graduation defense stage, the teaching content of information literacy education can include writing standards for papers, testing standards for papers, skills in courseware production, defense processes, and academic norms.

Therefore, information literacy education at the basic level, at the general level, and at the professional level, which are running through the entire four-year talent cultivation process for engineering students. These three levels constitute a continuous and interconnected content system for information literacy teaching. Through progressive information literacy teaching, the information literacy ability of engineering students can be systematically and continuously developed.

3. INFORMATION LITERACY EDUCATION EMBEDDED IN PROFESSIONAL TEACHERS

Professional teachers in universities undertake teaching and research tasks in different disciplines. They have professional and profound disciplinary backgrounds, grasp the current situation and development trends of their major, understand students' professional knowledge needs, and possess the ability of professional information literacy.

Firstly, the library should take into account the actual situation of the departments, which will undergo engineering education professional certification. Then, the library collaborate with the Academic Affairs Office and departments to develop a comprehensive plan

for cultivating teachers' information literacy. Implement education to enhance teachers' information literacy skills in a hierarchical, phased, and multi-channel manner.

4. INFORMATION LITERACY EDUCATION EMBEDDED IN LIBRARIANS

The librarian is not only a pioneer in carrying out information literacy education in universities, but also a leader in the concept of elemental education. So librarians must strengthen the cultivation and improvement of their own information literacy abilities, and become truly information literacy librarians.

For the re-education of librarians' information literacy, it is possible to reshape and enhance their own information literacy level through participating in industry training, academic conference exchanges, on-the-job learning, librarian information literacy ability assessments, librarian information literacy micro course competitions, case competitions, visiting sister colleges for learning, and other forms.

5. CONCLUSION

In summary, information literacy education embedded in engineering students, information literacy education embedded in professional teachers, and information literacy education embedded in librarians constitute the hierarchical content system structure of information literacy education in universities. This content system fully complies with the ACRL Framework's view that the current content of information literacy education should focus on introducing the core concepts of information literacy into the educational process of various disciplines and majors, and also conforms to the OBE idea, which emphasizes that engineering education is always a result oriented education.

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The Role of Art Education in Nurturing Cultural Identity and Global Awareness

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Abstract: This paper explores the multifaceted role of art education in fostering students' cultural identity and global awareness. It begins by defining the concepts of cultural identity and global awareness and their significance in the context of a globalized world. the study then delves into how art education, through various mediums and pedagogical approaches, serves as a powerful vehicle for students to engage with diverse cultures. By analyzing different art forms such as visual arts, performing arts, and traditional crafts, it illustrates how students can gain a deeper understanding of their own cultural heritage as well as that of others. the research also examines the impact of international art exchanges and collaborative projects on students' perspectives, promoting cross-cultural understanding and empathy. Additionally, it addresses the challenges faced in implementing such art education initiatives, including curriculum design, teacher training, and resource allocation. Strategies and recommendations are proposed to overcome these challenges and enhance the effectiveness of art education in cultivating students' cultural identity and global awareness, ultimately preparing them to be active and informed global citizens.

Keywords: Art education; Cultural identity; Global awareness; Cross-cultural understanding; Pedagogical approaches

1. INTRODUCTION

In an era of increasing globalization, the need to cultivate cultural identity and global awareness among students has become a crucial aspect of education. Art education, with its unique ability to transcend language and cultural barriers, plays a vital role in this process. It offers a platform for students to explore, express, and understand different cultures, thereby enriching their personal and social development.

2. DEFINING CULTURAL IDENTITY AND GLOBAL AWARENESS

2.1 Cultural Identity

Cultural identity refers to an individual's sense of belonging and identification with a particular culture or group. It is shaped by various factors such as language, traditions, values, and art forms. For example, a student growing up in a Hispanic community may identify with the rich heritage of Hispanic art, music, and dance, which forms an essential part of their cultural identity. Understanding and embracing one's cultural identity provides a foundation for self-esteem and a sense of place in the world.

2.2 Global Awareness

Global awareness involves an understanding and appreciation of the interconnectedness of the world. It includes knowledge of different cultures, global issues, and the ability to view events from a global perspective. In a globalized society, being globally aware enables individuals to interact effectively with people from diverse backgrounds and contribute to global solutions. For instance, being aware of environmental issues on a global scale can inspire students to take action and advocate for sustainable practices.

3. ART EDUCATION AS A MEDIUM FOR CULTURAL EXPLORATION

3.1 Visual Arts

Visual arts, such as painting, sculpture, and photography, provide a tangible and visual representation of different cultures. Through the study of art history, students can trace the evolution of cultural expressions and understand how art reflects the values and beliefs of a society. For example, analyzing the works of European Renaissance painters reveals the cultural and intellectual climate of that period. Moreover, contemporary visual arts often incorporate elements from multiple

cultures, further promoting cross-cultural understanding. Students can also create their own visual artworks inspired by different cultures, thereby deepening their connection and respect for cultural diversity.

3.2 Performing Arts

Performing arts, including music, dance, and theater, offer a dynamic and immersive experience of different cultures. For example, learning traditional African dance not only acquaints students with the rhythms and movements unique to African cultures but also imparts an understanding of the cultural significance and social context of these dances. Music from around the world, with its diverse melodies, rhythms, and instruments, can transport students to different cultural landscapes. Theater productions can also explore cultural themes and stories, inviting students to empathize with characters from different cultures and gain insights into their ways of life.

3.3 Traditional Crafts

Traditional crafts are an integral part of cultural heritage. Engaging in activities such as pottery, weaving, and wood carving allows students to learn about the skills, materials, and cultural traditions associated with these crafts. For example, learning Japanese origami not only teaches students the art of paper folding but also exposes them to Japanese aesthetics and cultural values of simplicity and precision. Traditional crafts can also serve as a means of cultural preservation and transmission, as students become custodians of these age-old traditions and can share them with others.

4. THE IMPACT OF INTERNATIONAL ART EXCHANGES AND COLLABORATIVE PROJECTS

4.1 Cross-Cultural Understanding

International art exchanges and collaborative projects bring students from different cultures together. For example, a joint art project between students from the United States and China may involve creating a mural that combines elements of American pop art and Chinese calligraphy. Through such collaborations, students have the opportunity to communicate, share ideas, and learn about each other's cultures directly. They can break down stereotypes and prejudices and develop a more accurate and empathetic understanding of different cultures.

4.2 Global Perspective Building

These exchanges and projects also help students develop a global perspective. They learn about global art trends, cultural similarities, and differences. For instance, students may discover that certain themes, such as the celebration of nature or the expression of human emotions, are universal in art, albeit with different cultural manifestations. This realization broadens their view of the world and encourages them to think beyond national boundaries and consider the global implications of their actions and creations.

5. CHALLENGES IN IMPLEMENTING ART EDUCATION FOR CULTURAL IDENTITY AND GLOBAL AWARENESS

5.1 Curriculum Design

Designing a curriculum that effectively integrates art education with the cultivation of cultural identity and global awareness is a complex task. It requires a balance between teaching local and global art forms, ensuring that students have a comprehensive understanding of both. Additionally, the curriculum needs to be adaptable to different age groups and educational levels. For example, younger students may need more hands-on and experiential activities, while older students can engage in more in-depth research and critical analysis.

5.2 Teacher Training

Teachers play a crucial role in implementing such art education initiatives. However, many teachers may lack the necessary training in teaching about diverse cultures and global issues. They need to be equipped with the knowledge and skills to guide students in exploring different art forms and understanding their cultural contexts. Professional development programs should be provided to teachers to enhance their cultural competence and pedagogical strategies for promoting global awareness.

5.3 Resource Allocation

Access to art resources from different cultures can be a challenge. Schools may need to invest in art materials, books, and digital resources that represent a wide range of cultures. Additionally, arranging international art

exchanges and inviting guest artists from different countries may require financial resources. Adequate funding and resource allocation are essential to ensure the success of art education programs focused on cultural identity and global awareness.

6. STRATEGIES AND RECOMMENDATIONS

6.1 Curriculum Integration
Integrate cultural and global awareness components into the art curriculum at all levels. For example, include units on world art history, cultural art traditions, and contemporary global art movements. Use project-based learning and interdisciplinary approaches to make the learning more engaging and meaningful. For instance, a project could involve students creating a multimedia presentation on a specific culture's art and its relationship to the environment.

6.2 Teacher Professional Development
Offer regular teacher training workshops and courses on cultural diversity in art education. These could cover topics such as teaching about different art forms, facilitating cross-cultural exchanges, and using technology to access global art resources. Encourage teachers to participate in international art education conferences and exchanges to gain firsthand experience and insights.

6.3 Resource Sharing and Community Engagement
Schools can collaborate with local museums, art galleries, and cultural organizations to access art resources and expertise. They can also establish partnerships with international schools and organizations for art exchanges and joint projects. Community engagement can involve inviting local artists from diverse backgrounds to conduct workshops and sharing students' artworks with the community to promote cultural understanding and dialogue.

7. CONCLUSION
Art education has a profound and far-reaching role in nurturing students' cultural identity and global awareness. By leveraging the power of various art forms, international exchanges, and collaborative projects, students can develop a rich understanding of different cultures and a global perspective. Although challenges exist in curriculum design, teacher training, and resource allocation, with appropriate strategies and recommendations, art education can effectively prepare students to be active and informed global citizens. As the world continues to become more interconnected, the importance of art education in this regard will only continue to grow, and educators must strive to harness its potential to the fullest.

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Research on the Path of Integrating Shandong Merchants Culture into the Professional Competence of Vocational College Business Students

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Abstract: As an important component of traditional Chinese culture, Shandong merchants culture embodies rich business wisdom and management concepts, providing significant support for improving the professional competence of vocational business students. This paper explores the relationship between Shandong merchants' culture and professional competence, proposing various methods such as innovation and entrepreneurship education, career planning, professional course design, integration of school and enterprise cultures, as well as social practice and internships, to effectively incorporate Shandong merchants culture into vocational business education. Research indicates that through a deep integration of Shandong merchants' culture and vocational education, it is possible to cultivate modern business talents with excellent professional competence, laying a solid foundation for the students' future career development.
Keywords: Shandong Merchant'S Culture; Vocational Business Education; Professional Competence

1. INTRODUCTION
With the rapid growth of China's economy, the demand for business talents is on the rise, and professional competence, as a vital part of higher vocational education, has gradually gained widespread attention in academia and the educational community. Vocational business education must not only equip students with solid professional knowledge but also enhance their professional competence to meet the needs of modern development. Shandong merchants culture, as an essential component of traditional Chinese culture, is rich in business wisdom and management principles; its incorporation into vocational business education will provide crucial cultural support and theoretical guidance for improving students' professional competence. This paper aims to explore how Shandong merchants culture can be effectively integrated into vocational business education to enhance students' professional competence.

2. THEORETICAL BACKGROUND
2.1. the Concept of Professional Competence
Professional competence refers to the comprehensive qualities individuals possess in their professional activities, including knowledge, skills, attitudes, and values. It not only reflects individual professional capabilities within specific fields but also encompasses basic qualities, behavioral habits, and professional ethics related to work. Professional competence typically includes dimensions such as professional knowledge, vocational skills, professional ethics, adaptability, and self-development awareness. the enhancement of professional competence is crucial for individual success in the workplace, as it impacts personal job performance, team collaboration, and overall corporate performance.
2.2. the Connotation and Characteristics of Shandong Merchants Culture
Shandong merchants culture is the sum of the material wealth, social wealth (including systems and norms), and spiritual wealth created by Shandong merchants, encompassing their wealth accumulation,

financial management techniques, management systems, business arts, business ethics, business spirit, trade routes, cultural beliefs, social customs, architecture, sculpture, calligraphy, and collections, forming an entire civilization system. Shandong merchants culture has distinctive regional features, deeply rooted in the land of Shandong and influenced particularly by Confucian culture, characterized by values of virtue in business, integrity as fundamental, prioritizing righteousness, achieving profits through righteousness, ensuring long-term benefits, benevolence in treating clients, and being tolerant and adaptable.

2.3. the Relationship Between Shandong Merchants Culture and Professional Competence

Shandong merchants culture is closely connected to professional competence; its values of integrity, obligation, and morality shape professional ethical standards; business wisdom and management experience enhance economic and management skills; the philosophy of treating clients with benevolence improves teamwork and interpersonal communication skills; the spirit of tolerance and adaptability cultivates adaptability and innovation awareness; the concept of learning and inheritance promotes self-development awareness. By integrating these aspects, Shandong merchants culture provides vocational business students with rich connotations and practical guidance for professional competence, enabling them to better meet future workplace challenges and become modern business talents with comprehensive qualities and strong adaptability.

3. THE NECESSITY OF INTEGRATING SHANDONG MERCHANTS CULTURE INTO THE PROFESSIONAL COMPETENCE OF VOCATIONAL COLLEGE BUSINESS STUDENTS

Integrating Shandong Merchants Culture into the education of vocational college business students is not only necessary but also beneficial for developing essential professional competencies. the cultural heritage serves as a valuable tool for fostering integrity, promoting innovation, and enhancing teamwork, all of which are pivotal

for preparing students for successful careers in the business domain.

3.1. Influence of Shandong Merchants Culture on Enhancing Students' Professional Competence

Shandong Merchants Culture, deeply rooted in the rich historical and cultural context of the Shandong region, incorporates a wealth of business philosophies, ethical principles, and practical wisdom that can significantly influence the professional competence of vocational college business students. This culture emphasizes values such as integrity, responsibility, and ethical trade practices, which are crucial for cultivating well-rounded business professionals.

By immersing students in Shandong Merchants Culture, they are encouraged to adopt a mindset that prioritizes ethical decision-making and social responsibility. This cultural infusion nurtures their understanding of the significance of maintaining integrity in business practices, ultimately shaping them into trustworthy professionals who can positively impact the business environment. Furthermore, the cultural exposure provides students with contextual insights into professional behaviors and norms in the marketplace, allowing them to navigate dynamic business landscapes more effectively.

3.2. Advantages of Integrating Shandong Merchants Culture in Education

3.2.1. Cultivating Integrity and Responsibility
One of the most profound benefits of incorporating Shandong Merchants Culture into vocational education is the emphasis on integrity and responsibility. This culture instills a strong sense of ethical conduct and accountability in students. By learning through case studies and historical examples of successful Shandong merchants, students can appreciate the long-term benefits of practicing honesty and responsibility in their professional lives. This foundation encourages them to become leaders who prioritize ethical practices, fostering trust among colleagues, clients, and stakeholders.

3.2.2. Promoting Innovative Thinking
Shandong Merchants Culture is characterized by its adaptability and innovative spirit, qualities essential for success in today's fast-paced business world. By engaging with this

culture, students are inspired to think creatively and pursue innovative solutions to business challenges. Educational programs can be designed to emphasize entrepreneurial practices and problem-solving strategies that reflect the innovative approaches of historical merchants. This fosters an environment where students feel empowered to explore new ideas and approaches, ultimately enhancing their capacity for innovation in various business contexts.

3.2.3. Enhancing Team Collaboration Skills
Another key advantage of integrating Shandong Merchants Culture into vocational education is its focus on community and collaboration. the principles of teamwork and collective success resonate deeply within this culture, providing a solid framework for developing students' collaboration skills. Group projects and collaborative learning experiences rooted in Shandong Merchants values can help students appreciate the importance of teamwork in achieving common goals. By participating in team-based activities and engaging in cultural simulations, students learn to communicate effectively, resolve conflicts, and leverage diverse perspectives to enhance group outcomes.

4. PATHS FOR THE INHERITANCE OF SHANDONG MERCHANTS CULTURE AND ENHANCEMENT OF PROFESSIONAL COMPETENCE FOR VOCATIONAL BUSINESS STUDENTS

Shandong merchants culture provides abundant resources and practical guidance for enhancing the professional competence of vocational business students. By implementing the following specific approaches, it is possible to effectively combine Shandong merchants culture with the enhancement of students' professional competence, thereby cultivating high-quality business talents that meet modern societal needs.

4.1. Innovation and Entrepreneurship Education
Innovation and entrepreneurship education is an important way to achieve the inheritance of Shandong merchants culture. As one of the cores of Shandong merchants culture, innovative and flexible business thinking encourages students to explore and attempt

boldly in practice. Vocational colleges should establish dedicated innovation and entrepreneurship courses, inviting successful entrepreneurs and business leaders to share successful cases from Shandong merchants culture to inspire students' entrepreneurial spirit. Additionally, by organizing innovation and entrepreneurship competitions, students are encouraged to brainstorm within teams and integrate the ideas of Shandong merchants culture into the preparation of business plans, fostering their understanding of business operations and practical capabilities.

4.2. Career Planning
Career planning is an important developmental module for vocational business students, and its effective implementation can significantly enhance students' professional competence. Schools should provide systematic career planning guidance, helping students understand their interests and the demands of the job market, thereby setting personal career goals. By utilizing the inheritance of Shandong merchants culture, schools can design relevant lectures or workshops inviting industry experts to share experiences of successful career development and the application of Shandong merchants culture in career paths, making students aware of the importance of traditional culture in modern workplace environments, enhancing their sense of professional identity and mission.

4.3. Professional Course Design
Professional course design should incorporate elements of Shandong merchants culture to improve students' professional competence and expertise. Course content in business disciplines can be intertwined with the management philosophies, business ethics, and market operation models from Shandong merchants culture, deepening students' understanding of real commercial activities through case studies. Furthermore, dedicated courses related to Shandong merchants culture, such as "Shandong Merchants Spirit and Modern Commerce, " can guide students to appropriately apply traditional business wisdom in modern economic contexts, enhancing their analytical and problem-solving abilities.

4.4. Integration of School and Enterprise Cultures

The integration of school and enterprise cultures is a key aspect of enhancing students' professional competence. Vocational colleges should actively collaborate with local enterprises and business associations to incorporate Shandong merchants culture into school-enterprise cooperation, forming a robust feedback mechanism for teaching. By closely connecting with enterprises, students can be encouraged to participate in cultural construction and project practices within companies, allowing them to experience the charm of Shandong merchants culture in practical work. Moreover, businesses can provide training on Shandong merchants spirit and career guidance, strengthening students' understanding and recognition of corporate culture, enhancing their professional competence and ethics.

4.5. Social Practice and Internships

Social practice and internships are significant segments for students to combine theory with practice, providing opportunities to immerse themselves in real business environments. Vocational colleges should establish practice activities related to Shandong merchants culture, such as organizing student visits to outstanding local enterprises, participating in trade shows, and engaging in community service, encouraging students to experience and understand the practical application of Shandong merchants culture in practice. During internships, businesses can conduct relevant professional competence training based on the characteristics of Shandong merchants culture, using real business cases and scenarios to help students enhance their overall quality and professional skills.

5. FUTURE PROSPECTS

In future educational practices, further integration of Shandong merchants culture will face certain challenges, such as how to combine traditional culture with modern education and how to align with emerging occupational development trends. Therefore, vocational colleges should establish a diversified education mechanism, integrating resources from various sectors to promote the deep integration of Shandong merchants culture and vocational education.

6. CONCLUSION

Shandong merchants culture provides rich cultural resources and educational principles for vocational business education, and its integration can effectively enhance students' professional competence. By closely combining innovation and entrepreneurship education, career planning, professional course design, school-enterprise culture integration, social practice, and internships with the enhancement of professional competence for vocational business students, it can effectively cultivate business talents with solid knowledge bases, strong professional ethics, and innovative capacities. In the face of increasingly fierce workplace competition, it is necessary for schools to continuously explore and improve these pathways to adapt to the development needs of the economy and society, promote the inheritance and development of Shandong merchants culture, lay a solid foundation for students' career paths, and drive high-quality and full employment for graduates.

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Optimised Application of Pharmaceutical Packaging Materials and Development Trend of New Materials

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Abstract: With the rapid development of the pharmaceutical industry, pharmaceutical packaging materials play an increasingly important role in protecting the quality of medicines, ensuring the safety of medicines, and enhancing the patients' experience of using medicines. In recent years, new pharmaceutical packaging materials and their optimal application have become a research hotspot, and their development trend is becoming more and more obvious. Pharmaceutical packaging materials play an important role in the circulation, storage and use of drugs, and are one of the key factors in ensuring the quality and safety of drugs. With the continuous progress of science and technology and the increasing demand for healthcare, pharmaceutical packaging materials are also being continuously developed and optimised. the purpose of this paper is to discuss the optimal application of pharmaceutical packaging materials and the development trend of new materials, in order to provide useful reference and inspiration for the development of pharmaceutical packaging industry.

Keywords: Pharmaceutical packaging materials; Optimised application; Development trend

1. INTRODUCTION

The development of pharmaceutical packaging materials has gone through many stages, from the initial glass bottles, paper packaging to modern plastics, metals, composite materials, etc., and its function has also expanded from simple protection, isolation, marking, etc., to more fields such as intelligence and personalisation. However, with the improvement of people's awareness of environmental protection and the need for sustainable development, pharmaceutical packaging materials need to meet the protection of drugs at the same time, but also need to consider its impact on the environment and sustainability issues. As an important part of pharmaceutical packaging, the selection and application of its materials have a crucial impact on the quality, safety and efficacy of pharmaceuticals [1]. With the continuous progress of science and technology and the improvement of people's health awareness, the research and application of pharmaceutical packaging materials are constantly developing and changing. the aim of this study is to explore in depth the optimal application of pharmaceutical packaging materials and the development trend of new materials through the methods of literature review and case study, and to analyse the advantages and disadvantages of existing pharmaceutical packaging materials as well as the advantages of new materials, with a view to providing useful references and inspirations for the development of the pharmaceutical packaging industry.

2. THE IMPORTANCE AND ROLE OF PHARMACEUTICAL PACKAGING

2.1 Protecting drug quality and ensuring drug safety

Pharmaceutical packaging materials play an important role in protecting the quality of drugs. High-quality packaging materials can effectively prevent pharmaceuticals from being affected by the external environment, such as humidity, temperature, light, etc., so as to ensure the effectiveness and stability of pharmaceuticals. Suitable packaging materials can also reduce the risk of contamination during the production, storage, transport and use of drugs [2], ensuring drug safety. For example, the use of aseptic packaging can effectively prevent drugs from microbial

contamination and ensure the safety of drugs.

2.2 Enhance patients' medication experience

The influence of drug packaging materials on the patient's medication experience should not be ignored. Humanised packaging design can improve the patient's identification of drugs and convenience of use, such as easy to open, accurate dosage, etc [3]. In addition, beautiful and comfortable packaging design can also enhance patients' mood for medication and help improve patient compliance.

2.3 Environmental protection and sustainable development

With the increasing awareness of environmental protection, people's requirements for pharmaceutical packaging materials are also getting higher and higher. Traditional pharmaceutical packaging materials often have a greater impact on the environment, not only difficult to degrade, but also may release harmful substances. Therefore, the development and promotion of biodegradable and environmentally friendly pharmaceutical packaging materials has become a top priority. Degradable pharmaceutical packaging materials have significant environmental advantages. Compared with traditional materials, degradable materials can decompose rapidly in the environment, reducing the pollution of soil, water and other environmental elements. At the same time, the substances produced in the degradation process also have less impact on the ecological environment [4]. Therefore, the promotion of the use of degradable pharmaceutical packaging materials can help reduce the burden on the environment and is conducive to the achievement of environmental sustainability.

3. OPTIMISED APPLICATION OF PHARMACEUTICAL PACKAGING MATERIALS

Pharmaceutical packaging materials have a pivotal position in the quality protection, safety and validity of drugs. Pharmaceutical packaging not only needs to protect the drugs from the influence of the external environment, to ensure its quality stability, but also to ensure the safety of patients in the process of use. With the continuous development of science and technology and people's higher requirements on the quality of drug packaging, drug packaging materials are also continuously improved and optimised to meet the increasingly stringent standards.

3.1 Characteristics and Limitations of Traditional Pharmaceutical Packaging Materials

Glass is a traditional pharmaceutical packaging material with high chemical stability and heat resistance. But it is fragile, heavy, non-recyclable, etc. Plastic is a lightweight and inexpensive pharmaceutical packaging material that can be made into various shapes and sizes for ease of use. But it is difficult to degrade, may produce harmful substances, etc. Paper packaging material has good plasticity, environmental friendliness and printability, and is less costly. It can provide basic protection for medicines and can be recycled [5], but has poor barrier properties and is prone to moisture absorption.

3.2 Characteristics and Advantages of New Pharmaceutical Packaging Materials

Polymer materials have good chemical stability, barrier properties and mechanical properties, lightweight and unbreakable, but also has antibacterial, anti-mould and other characteristics, can extend the shelf life of drugs. Metal materials such as aluminium, stainless steel, etc. have excellent barrier properties, corrosion resistance and mechanical strength, suitable for the need for high sealing of pharmaceutical packaging, can protect the drugs from the external environment and recycling. Composite material is a new type of material composed of two or more materials, with the advantages of each component material, usually composed of paper, plastic, aluminium foil, etc., with excellent barrier properties, mechanical properties and environmental protection. In practical application, suitable packaging materials should be selected according to the characteristics and needs of drugs to achieve the best packaging effect.

4. DEVELOPMENT TREND OF NEW MATERIALS FOR PHARMACEUTICAL PACKAGING

4.1 Application of nanotechnology in pharmaceutical packaging

The application of nanotechnology in pharmaceutical packaging has become a

research hotspot. Nanopackaging materials can improve the stability and extend the shelf life of drugs, and also improve the bioavailability of drugs. At present, the application of nanotechnology in pharmaceutical packaging mainly includes nano-coating, nano antimicrobial agents and so on.

4.2 Application of biodegradable materials in pharmaceutical packaging

With the enhancement of environmental protection consciousness, the application of biodegradable materials in pharmaceutical packaging has received more and more attention. Biodegradable materials can be naturally degraded after being discarded, reducing the pollution of the environment. At present, the application of biodegradable materials in pharmaceutical packaging mainly includes biodegradable plastics, biodegradable paper and so on.

4.3 Application of intelligent packaging in pharmaceutical packaging

Intelligent packaging refers to packaging with intelligent functions, which can monitor, track, control and other operations of drugs through electronic devices, sensors and other technologies [6]. Intelligent packaging can improve the safety and reliability of drugs, and also improve the efficiency of drug management. At present, the application of intelligent packaging in pharmaceutical packaging mainly includes RFID tags, intelligent sensors and so on.

5. CHALLENGES AND COUNTERMEASURES OF NEW PHARMACEUTICAL PACKAGING MATERIALS

5.1 Problems and Challenges Faced by New Drug Packaging Materials

5.1.1 Production Cost and Price Problems
New pharmaceutical packaging materials often use advanced production processes and technologies, resulting in higher production costs. These high costs may eventually be passed on to consumers, leading to an increase in drug prices [7]. How to reduce the production cost under the premise of ensuring the quality of drug packaging is an important issue facing new drug packaging materials.

5.1.2 Performance stability problem
New drug packaging materials need to have excellent performance stability to ensure the quality and safety of drugs. However, in practical application, some new drug packaging materials may have problems such as aging and deformation, affecting their protective effect and service life. How to improve the performance stability of new drug packaging materials is one of the urgent problems to be solved.

5.1.3 Regulatory standards and supervision problems
As new pharmaceutical packaging materials may have differences in raw materials, production processes and uses, the existing regulations and standards may not be able to fully cover their safety and effectiveness. In addition, there may be a certain lag and difficulty in the approval and supervision of new pharmaceutical packaging materials by the regulatory authorities. These problems may restrict the promotion and application of new pharmaceutical packaging materials.

5.2 Strategies and Suggestions to Meet the Challenges of New Drug Packaging Materials

5.2.1 Strengthen R&D and Reduce Costs
In order to reduce the production cost of new pharmaceutical packaging materials, it is necessary to strengthen research and development, optimise the production process and technology, and improve the production efficiency. At the same time, technical cooperation and exchanges with other fields can be explored to learn from advanced production and management experience to further reduce costs.

5.2.2 Improve regulations and strengthen supervision
Regarding the regulation and supervision of new pharmaceutical packaging materials, it is suggested that the relevant departments should update and improve the relevant regulations in time to clarify the classification, standards and safety requirements of new pharmaceutical packaging materials. At the same time, supervision should be strengthened and a sound approval and supervision mechanism should be established to ensure the safety and effectiveness of new drug packaging materials. In addition, international cooperation and exchanges should be strengthened, and international advanced experience should be learnt to improve China's regulations,

standards and supervision level in the field of new drug packaging materials.

5.2.3 Enhance Consumer Awareness and Market Promotion

In order to better promote and apply new pharmaceutical packaging materials, it is necessary to strengthen market publicity and promotion, and improve consumer awareness and trust of new pharmaceutical packaging materials. the advantages and application fields of new pharmaceutical packaging materials can be introduced to consumers by organising exhibitions, forums and other activities; at the same time, cooperation and communication with pharmaceutical enterprises can be strengthened to promote the application and popularisation of new pharmaceutical packaging materials in the pharmaceutical industry.

6. CONCLUSION AND PROSPECT

With the rapid development of science and technology, the application of new drug packaging materials in the pharmaceutical field is becoming more and more extensive, which has brought many benefits for the protection of drug quality and the improvement of patient experience. However, new drug packaging materials still face certain challenges in terms of production cost, performance stability and regulatory standards. the implementation of strategies and recommendations such as strengthening R&D, reducing costs, improving regulations, strengthening supervision, and increasing consumer awareness is expected to address these challenges and promote the sustainable development of new pharmaceutical packaging materials. In the future, new pharmaceutical packaging materials will continue to develop in the direction of environmental protection, safety and intelligence, bringing more innovations and breakthroughs to the pharmaceutical industry. the research, development and application of new pharmaceutical packaging materials will not only help improve the overall level and competitiveness of China's pharmaceutical industry, but also contribute to the development of the global pharmaceutical field. In meeting the challenges, China should actively participate in international competition and cooperation, and

continuously improve its innovation ability in the field of pharmaceutical packaging materials. In addition, the government, enterprises, research institutes and all walks of life should work together to build an innovation platform, cultivate professional and technical talents, and promote industrial technological innovation. In conclusion, the development of new pharmaceutical packaging materials in the pharmaceutical industry is very broad prospects, but also need to overcome a series of challenges. While giving full play to the advantages of new pharmaceutical packaging materials, we should seriously study and solve the problems it faces to promote the sustainable and healthy development of the pharmaceutical industry. Through scientific and technological innovation and industrial upgrading, China is expected to make more breakthroughs in the field of pharmaceutical packaging materials, and make greater contributions to the global pharmaceutical industry for the benefit of human health.

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Exploration of Cultivating Outstanding Talents in Turbine Engineering Technology Under the Background of Maritime Power

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Abstract: This paper for the turbine engineering technology outstanding talents under the Marine power strategic background, based on the turbine engineering technology personnel training objectives and specifications, based on the navigation talent training objectives and specifications, constructed the turbine engineering technology outstanding talent training course system, turbine engineering technology course content, teaching methods, the practice of turbine engineering technology teaching team and practice base. This paper introduces the main achievements and existing problems in the cultivation process, and puts forward suggestions for the next improvement.

Keywords: Outstanding Seafarers, Marine Engineering, Teaching Reform

1. FOREWORD

In 2018, the Ministry of Education and the Ministry of Transport jointly issued the Opinions on the Implementation of the Education and Training Plan for Excellent Engineers, proposing to train a large number of internationally competitive and innovative engineering and technical personnel. With the in-depth implementation of Chinas maritime power strategy, higher requirements have been put forward for Marine engineering and technology professionals, not only to master the basic knowledge of Marine turbine engineering, electrical automation, automatic control and so on, but also to have strong turbine engineering construction and management ability, as well as certain foreign language and computer application ability. Combined with the construction and development of turbine engineering technology major in our school, this paper explores the training of outstanding talents, constructs the curriculum system of excellent talents training with the characteristics of our school, reforms the teaching team, teaching content and teaching method of turbine engineering technology major, and achieves certain results. But there are also some shortcomings, which need to be further improved in practice.

2. REVISE THE TRAINING PLAN AND BUILD AN EXCELLENT TALENT TRAINING CURRICULUM SYSTEM OF "FOUR SHIPS ALTERNATING"

According to the law of the Peoples Republic of China Marine crew competency examination and certification rules combined with the reality of school Marine professional development, on the basis of "ability to standard, employment oriented" talent training mode, analyze the development prospect of turbine engineering technology and industry demand, combined with turbine engineering technology students training objectives and specifications, put forward the cultivation of "four ship alternate" mode. That is, " 1 (school ship)+0.5 (enterprise ship)+1 (school ship)+0.5 (enterprise ship) four ship alternate, navigation major students through the Marine crew competency examination, must go through two 0.5 (enterprise ship) to work on the ship or at sea for a period of time, to obtain the corresponding certificate of competency.

3. PROMOTE THE TEACHING REFORM AND ESTABLISH THE TEACHING MODE OF EXCELLENT TALENT TRAINING COURSE OF "CURRICULUM CERTIFICATE INTEGRATION"

Turbine engineering technology professional main training goal is for shipping enterprises, training with good professional ethics, strong

job adaptability and good navigation quality, competent for shipping enterprise basic management positions, technical positions and management positions, and has a strong career development potential of turbine engineering senior talents in the field of Marine technology. Therefore, in the teaching content, employment orientation, the "navigation skills" course into the core curriculum system, "task-driven" and "project-oriented" in the emphasis and the training of students practical working ability. In order to achieve the above training objectives, the teaching mode of "curriculum certificate integration" has been formed through school-enterprise cooperation, professional experimental practice base and teaching team through school-enterprise cooperation. Specifically, the curriculum system takes the working process as the guidance, takes the cultivation of students vocational ability as the center, takes the teaching projects and tasks as the carrier, and organically combines the theoretical knowledge, practical skills and comprehensive quality.

4. ESTABLISH SCHOOL-ENTERPRISE COOPERATION TO BUILD "1+1" AND "DOUBLE TEACHERS AND DOUBLE ABILITIES" TEACHING TEAMS

In order to promote the training of outstanding talents, our school has adopted the combination of "bringing in" and "going out" in the construction of teachers, with teachers as the main body, and strengthening the construction of high-quality "double teacher and double ability" teaching team. the school employs industry and enterprise experts as part-time teachers to form a teaching team. the school regularly carries out teacher training and school-enterprise cooperation and exchanges, establishes a teaching team construction mode of school-enterprise cooperation and combination of work and study, actively explores new ways of teaching team construction, and accelerates the construction of a teaching team with reasonable structure, professional and part-time combination that meets the requirements of education and teaching reform. In order to further strengthen the cooperation between school and enterprise, a teaching team with

enterprise experts as part-time teachers has been established, and a "double-teacher" teaching team has been built.

5. RELYING ON ENTERPRISES, BUILD A "MULTI-LEVEL AND MULTI-SUBJECT" PRACTICAL TEACHING SYSTEM

Take the reform of practical teaching system as the starting point, rely on enterprises, strengthen school-enterprise cooperation, build a practical teaching base, and improve the practical teaching management system. Guided by the social needs and the requirements of industrial enterprises, according to the professional characteristics and talent training objectives, with the turbine maintenance and management, turbine engineering, Marine electrical and automation, ship turbine engineering management and turbine engineering supervision as the core of practical teaching, a "multi-level and multi-subject" practice teaching system is constructed. the curriculum system with practical teaching as the core has been constructed, engineering training and vocational training are organically integrated, Through the mode of "project guidance, module construction and hierarchical implementation", the theoretical curriculum learning and practical operation training re organically integrated, and the practical teaching module of "three levels" has been designed. According to the concept of "learning by doing, doing by learning", the mode of "students lead, teachers guide and implement jointly" is adopted to organize students to carry out practical teaching.

6. CONCLUSION

Turbine engineering technology is the outstanding talent training program in China. Due to the late start of navigation education in China, weak teachers, low enthusiasm of students for learning, incomplete teaching facilities and other reasons, the quality of talent training in turbine engineering technology is uneven. This study is based on the Marine power strategy, with the support of China seafarers education development foundation, relying on the existing conditions and platform, combined with the current national implementation of "excellent

engineer education training plan" background and turbine engineering technology professional talent training objectives and specifications, carried out the turbine engineering technology professional outstanding talent training practice exploration, to the major students learning enthusiasm has improved significantly, the teaching effect is remarkable. At the same time, some suggestions and improvement measures are also put forward, hoping to provide some reference for the further training of outstanding talents under the background of the maritime power strategy.

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Exploration of Methods to Improve the Ideological and Moral Cultivation of College Students

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Abstract: The hope of the motherland for college students is the future of the nation. Whether it is primary education, secondary education, or high school education, the ultimate goal is to create excellent college students who excel in both production and education for the country, and become the backbone of promoting social development. the current university education places too much emphasis on cultivating students' professional skills, while neglecting the cultivation of students' ideological and moral qualities. Although universities have ideological courses, they often become mere formalities. This article explores effective methods for improving the ideological and moral cultivation of college students and proposes relevant suggestions.

Keywords: College Students; Ideological and moral cultivation; Ideological education work.

1. INTRODUCTION

With the reform of China's education system, the Ministry of Education has clearly stated that universities should attach importance to the ideological education of college students. Although each school has taken relevant measures, it is not difficult to find that there are still shortcomings. School managers should solve these problems one by one, because in today's international competition, only by ensuring the mental health, positive thinking, and professional qualities of the new generation of young people can they occupy an advantageous position in the fierce competition for talents. In addition, this also has a promoting effect on the implementation of the strategy of rejuvenating the country through science and education and strengthening the country through talent.

2. ON CAMPUS PRACTICAL PATHWAYS

Campus, as the main place for college students to study and live, is the most critical educational venue for their ideological and moral education. Schools should fully utilize their resources, organize various moral practice activities for college students, and apply the content learned in ideological courses to practice.

2.1 Dormitory Practice Deployment

Dormitory is an important activity place for students during their school years, and it is also a classroom for ideological and political education. Teachers can personally organize ideological and political courses during class time, or assign homework to students, allowing them to conduct practical activities in their majors, classes, dormitories, or groups. Firstly, teachers can use dormitories as an example in the classroom to instill correct hygiene concepts in students and encourage them to discuss the content of the aforementioned news; Secondly, after the completion of the ideological course, teachers can collaborate with the college to hold a dormitory competition with the theme of "the most beautiful dormitory", requiring students to beautify the dormitory in a simple way, but the main standard is to maintain the cleanliness and hygiene of the dormitory environment. This way, students will be attracted by the activity to clean the dormitory and use existing tools to decorate the dormitory environment. Again, teachers can have students clean and tidy the corridors of the dormitory building on a professional, class, or dormitory basis. Students can dispose of paper scraps, convenience boxes, beverage bottles, and other garbage in the corridors into the trash can, implementing civility into their daily lives. the main purpose of these practices by teachers is to make students understand that

although there are dedicated cleaning ladies in the dormitory building, this is an environment where everyone lives together, so it is necessary to maintain the cleanliness of the dormitory building together. Teachers can have students conduct regular hygiene checks on each other's dormitories. If any problems are found that are not tidy or hygienic, they can urge them to rectify them immediately, so as to help college students develop good hygiene habits.

Teachers need to strengthen students' collective consciousness in ideological and political courses. Most contemporary college students are only children and are living away from their families for the first time, which inevitably leads to friction with roommates. Therefore, university ideological and political teachers should clarify dormitory order in the classroom and teach them how to establish friendly partnerships with roommates. Although dormitories are a world of 4-6 people, they reflect a small society. Teachers need to help students establish correct communication concepts through dormitories, so as to ensure that they can quickly integrate into this large community after leaving campus in the future.

2.2 Classroom Practice Outline

Currently, some college students have been challenging the bottom line of the functions of university classrooms, treating them as restaurants and leisure entertainment rooms, and even some students regard them as dormitories. After investigation, it can be found that it is a common objective fact in major universities in China for college students to bring breakfast to class, chat and play games in class, and take naps while sleeping. To address this issue, firstly, counselors and class teachers in each college should help students establish correct values, clarify the main functions of the classroom, and emphasize the main tasks and responsibilities of college students through college meetings or class meetings; Secondly, students can develop the habit of self-examination, or arrange for the student union or class monitor to conduct inspections specifically to address the aforementioned issues. By adopting a dual approach, college students can not only recognize their shortcomings in the classroom, but also

experience classroom rules and civility, thereby enhancing their comprehensive literacy.

Schools should use classrooms to carry out activities related to ideological education for students, such as speech contests, debate contests, red song contests, etc. When designing activity themes, they should focus on the issue of ideological and political cultivation education. For example, teachers can hold speech contests with the theme of "The Function of the Classroom" to further help students clarify the function of the classroom and improve their political and ideological level.

3. OFF CAMPUS PRACTICAL PATHWAYS

Through extracurricular practice, based on local characteristic textbooks, students are organized to participate in extracurricular activities with goals and plans. Through the process of participating in activities, students' ideological and moral awareness is enhanced through deep learning. In practical operation, such extracurricular activities are highly sought after by students. So, in order to better integrate theory with practice, the learning method of off campus practice should become a generator for the cultivation of ideological, moral, and political concepts among current college students. Based on this, universities need to achieve the following two points: first, strengthen the construction of classroom teaching practice bases in learning content; second, develop innovative and feasible off campus practice methods.

Carry out public welfare activities. Most college students in today's era are only children. In their growth process, they give less, gain more, take more, and contribute less. This makes some of them selfish, do not care about others, and rarely feel the pain of others. If teachers only use political ideology courses for teaching, it is impossible to fundamentally change this situation. Therefore, schools can carry out relevant public welfare activities, such as organizing students to accompany lonely elderly people in nursing homes or organizing them to take care of children with physical disabilities in special education schools, so that they can experience the joy of dedication in practice, strengthen their

awareness of "giving roses to others, leaving fragrance in their hands", and stimulate their interest in helping others. This also. It will make them treat their classmates whom they spend time with with with a more peaceful attitude. By carrying out public welfare practice activities, college students can truly experience the meaning of life, which will naturally teach them to care for others, respect the elderly, and form excellent moral qualities.

4. FAMILY PRACTICE PATHWAYS

Teachers should recognize that the family is an indispensable aspect of students' ideological and political education, and at the same time, it serves as a platform for students to practice their ideological and moral cultivation. When cultivating students' ideological and moral qualities, teachers must not neglect this aspect of the family. Currently, many college students are studying abroad. When they return home from vacation, they put down their luggage and play online games or go out to play with friends from their hometown. They rarely help their parents with household chores. To address this, teachers need to assign "homework" with the following specific requirements: firstly, do their own things; Secondly, cook a meal for your family during the holiday period; Thirdly, regularly assist parents in cleaning up; Fourthly, we must be proactive and never compromise on the above three points. It is not difficult to find that the tasks assigned by teachers are not difficult to achieve. the purpose of family ideological and political education is not to require students to do a certain amount of household chores, but to cultivate a sense of diligence, help them form the correct value orientation, and assist them in forming the correct family concept.

5. PAY ATTENTION TO MENTAL HEALTH EDUCATION FOR COLLEGE STUDENTS

In the process of cultivating students' ideological and political cultivation, the most crucial point for schools is to pay attention to the mental health education of college students and improve their ability for self growth. Firstly, schools should focus on understanding the psychological characteristics of students, and based on the

reality of the "only child generation", help students improve their psychological environment and create a relaxed and pleasant university atmosphere for them, so that they can engage in learning and daily life with positive and healthy emotions; Secondly, schools should not solely entrust the work of improving students' ideological and political literacy to ideological education teachers. Instead, ideological education should be integrated into all subjects to achieve a subtle and influential effect on students. Once again, schools should establish relevant psychological counseling institutions on campus, improve the psychological records of college students, and enhance the mechanism for psychological crisis intervention.

6. CONCLUSION

In summary, all universities must increase the importance of ideological and moral education for college students, and provide ideological and moral education for students in multiple aspects, so as to improve the overall ideological and moral level of college students. Only in this way can we cultivate pillar talents with positive energy and both morality and ability for the country, and better contribute to the future development of our country, helping the country realize the Chinese Dream.

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Practice of Teaching Reform in Ship Auxiliary Machinery Course

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Abstract: With the continuous expansion of enrollment in vocational colleges, the proportion of young teachers in vocational colleges is constantly increasing, and young teachers will become teachers in vocational colleges in China The main force in the teacher team. Due to the inadequate knowledge structure of young teachers and the lack of relevant teaching experience, the educational and teaching abilities of most young teachers in vocational colleges are relatively weak. In view of this, analyze the current situation of teaching ability of young teachers in vocational colleges, and propose strategies to enhance the teaching ability of young teachers in vocational colleges based on the constituent elements of teachers' teaching ability.

Keywords: Vocational Colleges; Young Teachers; Teaching Ability; Improvement Strategy

1. INTRODUCTION

Teaching ability is the core competency in the composition of teachers' professional abilities, and it is the core element to measure their professional level. It directly affects teaching The effect determines the quality of education and teaching. However, currently, the teaching ability of young vocationalteachers is generally in urgent need of improvement, and relevant theories and practices have become But the results are very few. This article analyzes the current situation and reasons for the teaching ability of young teachers in vocational colleges, and proposes ways to improve their teaching ability in order to Provide valuable references for vocational colleges.

2. ELEMENTS OF TEACHING ABILITY OF TEACHERS IN VOCATIONAL COLLEGES

2.1 Teaching Cognitive Elements

The so-called teaching cognitive ability refers to the analytical ability of teachers towards educational goals, directions, means, tasks, student characteristics, and educational contexts. It is the basic condition for improving teachers' comprehensive literacy and professional abilities, improving educational quality and effectiveness, and achieving educational goals. At present, vocational colleges in China generally focus on the employment of students in the education and teaching process, and attach great importance to the cultivation of students' practical skills and other comprehensive qualities. This requires teachers to have strong educational and teaching abilities. However, the actual situation is that young teachers in vocational colleges generally lack systematic teacher education and only receive simple teaching theoretical knowledge training before taking up their positions, which clearly cannot meet the teaching objectives and requirements of vocational colleges. Therefore, it is necessary to strengthen the cultivation of cognitive abilities in education for young teachers in vocational colleges, promote their rapid growth, and thus improve the quality of classroom teaching and educational effectiveness.

2.2 Teaching operation elements

The so-called teaching operation ability refers to the ability of teachers to solve various problems and confusions in the process of real education, including language organization ability, modern multimedia teaching equipment application ability, practical operation ability, and the ability to fully stimulate students' learning autonomy and enthusiasm. Vocational colleges shoulder the heavy responsibility of cultivating technical and applied talents for frontline positions such as social production, social construction, social management, and social services. It is very important to cultivate students' practical

skills. This requires vocational college teachers to not only have solid theoretical knowledge, but also strong practical operational abilities. Only the perfect integration of various educational operational abilities can create a strong teaching atmosphere, ensure the orderly development of educational activities, and achieve the ultimate teaching goals.

2.3 Elements of Teaching Innovation

The so-called teaching innovation ability refers to the ability of teachers to creatively form new educational concepts, methods, and plans through the overall grasp of educational goals and student characteristics in the actual teaching process, fully utilizing their professional knowledge and teaching experience. It comprehensively demonstrates the autonomous initiative of in-service teachers to fully utilize and apply their academic and professional level and scientific research achievements in practical educational activities. Vocational college teachers must possess excellent comprehensive abilities in order to cultivate students' cognitive abilities and job competence for social and professional positions in the process of education and teaching. Educational innovation ability is the highest level of comprehensive abilities among teachers.

3. CURRENT SITUATION OF TEACHING ABILITY OF YOUNG TEACHERS IN VOCATIONAL COLLEGES

3.1 Differences and non teacher nature in the source of teaching staff

At present, the majority of teachers in vocational colleges are teachers who either graduate from universities or directly enter vocational colleges from enterprises. the former theory Knowledge is relatively solid, but professional and practical skills are lacking, and basic teaching methods and skills are not proficient; the latter has abundant resources Rich professional practical experience, able to closely follow professional development and grasp social needs, but lacking certain basic theoretical knowledge and teaching methods Ability methods.

3.2 The system for cultivating vocational teachers is not perfect enough

Improving the teaching ability of young teachers in vocational colleges is an important means for vocational colleges to promote the improvement of education quality, and it is necessary to establish a more comprehensive system To ensure and standardize the effective operation of vocational teacher training through institutional mechanisms. Relevant systems for improving teachers' teaching abilities in various vocational colleges

In terms of mechanism, although we have been exploring a scientific and effective path and constantly improving it, the management system for vocational teacher training funds is not perfect enough, and the training funds, training time, and training quotas are limited; Secondly, some universities have inadequate regulatory mechanisms in the field of improving teaching capabilities, resulting in lower overall teaching management levels.

3.3 The teaching ability evaluation system is not sound.

At present, the evaluation of young teachers' teaching abilities in vocational colleges is mainly qualitative, lacking a systematic, comprehensive, and scientific quantitative evaluation system. Although some universities have established assessment systems, there are still issues such as incomplete consideration of indicator selection and insufficient participation of evaluation objects. In addition, the evaluation process is also too administrative, and there is a common phenomenon of re evaluation rather than feedback.

4. STRATEGIES FOR IMPROVING THE TEACHING ABILITY OF YOUNG TEACHERS IN VOCATIONAL COLLEGES

4.1 Strengthen one's own knowledge reserve and consolidate the foundation for improving teaching ability

A comprehensive knowledge reserve is the basic condition for young teachers to flexibly control the teaching classroom. Strengthening their own knowledge reserve is the effective integration of ontological knowledge, conditional knowledge, practical knowledge, and international perspective, to help teachers comprehensively improve their teaching ability. Firstly, young teachers should continuously absorb professional subject

knowledge, fully utilize the resources provided by the school for knowledge updates, and actively understand relevant fields and interdisciplinary knowledge on the basis of consolidating their professional knowledge, in order to achieve integration and improve teaching cognitive abilities.

4.2 Improving the Teacher Evaluation System

A sound teacher evaluation system is an important guarantee for improving teaching ability, which helps to enhance the position of teaching in the hearts of young teachers, stimulate their teaching enthusiasm, and balance the investment of teaching and research energy. At the same time, a scientific evaluation subject and process are of great significance for the effective improvement of teaching ability. Increase the proportion of teaching evaluation in evaluation. Universities should adopt a one vote veto system for teaching assessment, strictly monitor the completion of teaching tasks, and examine both the quantity and quality of teaching. the focus should not be limited to various quantitative indicators such as teacher hours and student grades, but should pay more attention to qualitative indicators, comprehensively understand the quality of teacher teaching, encourage teachers to use personalized teaching methods, develop diverse forms of teaching classrooms, and create teaching fun for teachers.

4.3 Constructing a multi-level teaching ability training system for young teachers in universities

The teaching ability of young teachers is a continuous process of improvement, and it is necessary to develop a multi-level, multi-form, and comprehensive training system based on the characteristics of different stages to provide mechanism guarantees for sustainable development. Deepen pre job training. At present, pre job training mainly focuses on imparting higher education, higher education regulations, and basic knowledge of professional ethics for teachers in higher education institutions, in order to enhance the theoretical foundation of teaching for young teachers.

5. CONCLUSION

Young teachers are the hope for the development of higher vocational education in China. With the rapid development of vocational education in China, it is crucial to pay attention to the cultivation and improvement of young teachers' teaching abilities. Vocational colleges must deeply recognize the important role of young teachers in the teaching process of vocational education, attach great importance to the training and cultivation of young teachers, prioritize the cultivation of young teachers' educational and teaching abilities in the development plan of school education, take multiple measures simultaneously, and effectively improve the teaching abilities of young teachers. Only in this way can vocational colleges ensure the quality of talent cultivation in rapid development.

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Research on the Value and Path of Ideological and Political Teaching in Higher Vocational Colleges Empowered by Qi Culture

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Abstract: Integrating local characteristic cultural resources into the teaching of higher vocational colleges is the direction of curriculum ideological and political research and exploration, which is not only an important aspect of socialist core values education in higher vocational colleges, but also an important means to cultivate students' cultural aesthetics, inherit Chinese excellent traditional culture and enhance students' comprehensive quality. As an important part of Chinese traditional culture, Qi culture, with its unique charm and profound connotation, provides precious spiritual wealth and educational resources for colleges and universities. Integrating Qi culture into classroom teaching is not only a respect and inheritance of traditional culture, but also a profound innovation of education.

Key words: Qi Culture; Ideological and Political Education in Courses; Path;

1. INTRODUCTION

Curriculum ideological and political education is the key to realize the fundamental task of cultivating people by virtue in higher vocational colleges, and it is also an important channel of ideological and political education in schools. the main position of curriculum ideological and political education is all kinds of courses and their teaching process. Curriculum ideological and political education should make good use of this main position to give full play to the educational function, help students achieve spiritual growth, promote the promotion of virtue, and cultivate outstanding talents for socialist construction with Chinese characteristics. This is in natural spiritual agreement with Chinese excellent traditional culture. As an important part of Chinese excellent traditional culture, Qi culture has become an important resource for ideological and political teaching in higher vocational colleges with its profound historical background, unique local characteristics and distinctive humanistic characteristics. Rooted in the fertile soil of Qi culture, integrating excellent regional culture into ideological and political teaching is the key to Unicom's professional course teaching and ideological and political education, which is conducive to breaking through the blocking point of the combination of professional knowledge teaching and ideological and political education, enhancing the systematicness and pertinence of ideological and political education, fully releasing the educational function of professional courses, and forming a new pattern of ideological and political education with full, whole and all-round education.

2. THE ESSENCE OF QI CULTURE

2.1 The Origin and Development of Qi Culture

Qi culture originated from Qi State in the early Western Zhou Dynasty, and Qi State began to form a unique regional culture under the governance of Jiang Taigong. Qi is adjacent to the sea in the east, which benefits from fish and salt. Its geographical position and economic development model laid the foundation for the formation of Qi culture. In the Spring and Autumn Period, Qi became the first of the five tyrants in the Spring and Autumn Period, and Qi culture was further developed. By the Warring States Period, Jixia Academy of Qi State had become an important

place for a hundred schools of thought to contend, and Qi culture was inclusive, absorbing hundred schools of thought's thoughts such as Confucianism, Mohism, Taoism, France, Yin and Yang, and forming a rich and diverse cultural system.

2.2 Core values of Qi culture

2.2.1 The spirit of change and innovation

Qi culture has a strong sense of change and innovation. For example, when Guan Zhong was in harmony with each other, he carried out a series of political, economic and military reforms, including the reform of land tax system, which broke the traditional well-field system and improved farmers' enthusiasm for production. This spirit of reform and innovation embodies Qi culture's attitude of keeping pace with the times and being positive and enterprising.

2.2.2 Open and inclusive thinking

Because of its geographical location and economic development needs, Qi has frequent foreign exchanges. Jixia Academy is a gathering of scholars from all over the world, where different ideas exchange and collide. Qi culture can accept various cultures and ideas, reflecting an open and inclusive mind.

2.2.3 The concept of pragmatism and merit

Qi culture pays attention to practical effects, whether in agriculture, commerce or military affairs. For example, Qi attaches great importance to commercial development and makes the country rich and strong by developing fish and salt trade. Militarily, Qi paid attention to the practical application of military strategy and trained famous military strategists such as Sun Wu.

3. THE PRACTICAL SIGNIFICANCE OF INTEGRATING QI CULTURE INTO THE COURSE IDEOLOGICAL AND POLITICAL EDUCATION TEACHING IN HIGHER VOCATIONAL COLLEGES

Helping enhance students' sense of cultural confidence and inherit excellent traditional culture Qi culture is an essential part of Chinese excellent traditional culture. Integrating Qi culture into the course ideological and political education allows students to deeply understand the charm and value of traditional culture, thereby enhancing their sense of national identity and pride. For example, when discussing the history of Qi

culture in university language courses, talk about the glorious achievements and profound connotories of Qi culture during its development period. This makes students feel the grandeur of traditional culture.

Helping improve the quality of talent cultivation in higher vocational colleges and shape correct values the core values of Qi culture, such as innovation, openness, inclusiveness, and practicality, have significant implications for shaping the values of vocational students. Integrating these values into the course ideological and political education can cultivate students' awareness of innovation, inclusiveness, and practical spirit. For example, integrating the spirit of innovation in Qi culture into entrepreneurship courses can stimulate students' entrepreneurial enthusiasm and creativity. Additionally, using stories of characters from Qi culture can cultivate students' professional ethics. For example, introducing how Guan Zhong assisted Duke Huan in achieving hegemony, his loyalty, and dedication can serve as future career role models for vocational students. In professional ethics courses, incorporating Qi culture-related content can help improve students' professional ethics level.

Helping open up new perspectives for school ideological and political education and optimize the curriculum ideological and political education model Incorporating representative local culture such as Qi culture into classroom teaching provides new ideas and approaches for ideological and political education in higher vocational colleges. the existing course content of ideological and political education is relatively limited, while the integration of Qi culture brings fresh material. the diverse and rich elements of Qi culture are highly attractive to young students, making the content more relevant to their lives and experiences, closely related to course content and student life activities. This approach not only helps explain theoretical knowledge vividly but also sparks students' interest and emotional resonance, enabling both theory and practice to be lively and appealing rather than being dry and dull. Thus, it enhances the appeal and persuasive power of ideological and political education, making it more temperature-sensitive and emotionally resonant.

4. THE PATH TO INTEGRATING QI CULTURE INTO THE COURSE IDEOLOGICAL AND POLITICAL EDUCATION TEACHING IN HIGHER VOCATIONAL COLLEGES

4.1 Updating the teaching concept

4.1.1 Establish the concept of cultural education

Teachers in higher vocational colleges should realize the importance of culture in the process of educating people and regard Qi culture as an important educational resource. In the teaching process, we should not only impart knowledge, but also pay attention to the inheritance of culture and the cultivation of students' values. For example, teachers should make clear the educational goal of Qi culture in instructional design, and make it run through all aspects of teaching.

4.1.2 Strengthen the idea of collaborative education

The integration of Qi culture into ideological and political teaching requires the cooperation of all departments of the school. Academic Affairs Office, Student Affairs Office, Propaganda Department and other departments should form a joint force to jointly promote the application of Qi culture in ideological and political teaching. For example, the Academic Affairs Office can formulate relevant teaching policies to encourage teachers to integrate Qi culture into the curriculum; the Student Affairs Office can organize student activities related to Qi culture; Propaganda Department can strengthen the promotion of alignment culture.

4.2 Building a curriculum system for the integration of Qi culture

4.2.1 Excavate the elements of Qi culture in the curriculum

All professional courses have the potential to incorporate Qi cultural elements. For example, in the course of tourism management, we can explore the elements of tourism resources development and tourism culture inheritance in Qi culture; In the course of mechanical manufacturing specialty, the craftsman spirit in Qi culture can be introduced. Teachers should deeply study the curriculum content and find out the combination point with Qi culture.

4.2.2 Adhere to the unity of theoretical teaching and practical teaching.

At present, the integration of excellent traditional culture and curriculum ideological and political education is not ideal, and theoretical teaching is still the main one, with homogeneous theme content and single interactive form. When Qi culture is integrated into curriculum teaching in higher vocational colleges, it is necessary to accurately integrate the "soul" of excellent Qi culture with curriculum teaching in practice. Specifically, we can start from three aspects: First, we must enhance interactivity, for example, let students participate in classroom narration in person, and through hot issues debate, individual or group reports, etc., we can not only deepen the understanding of alignment culture in the theoretical study stage, but also stimulate internal learning motivation in personal participation; Secondly, we must further explore professional practice resources, lead students into museums, memorial halls and other cultural education bases, and promote the integration of traditional culture and offline practice by conducting cultural research and reading exchange meetings; In addition, we should make use of the teaching forms that students like to see and hear, such as cultural experience activities, historical drama performances, etc., so that the young people immersed in them can change from "bystanders" to "participants" in history and culture, promote learning, thinking, practicing and realizing, enter the mind and take root, and spread the seeds of Qi culture into the hearts of young students.

4.2.3 Give full play to the advantages of "Internet+Education".

With the continuous development of the Internet, the application scope of "Internet+Education" has been continuously expanded, and the changes in digitalization and online in higher vocational colleges have also provided new innovation opportunities for ideological and political education. Teachers can collect and display relevant materials of Qi culture through Internet resources and technologies, such as making multimedia teaching contents such as micro-videos. In addition, more extensive ideological and political education can be carried out with the help of massive open online course platform and online teaching platform. This teaching method breaks the

limitation of time and place, and provides more students with the opportunity to learn Qi culture.

4.3 Strengthening the construction of teachers

4.3.1 Improve teachers' Qi culture accomplishment

Teachers are the key to integrate Qi culture into ideological and political teaching. Schools should improve teachers' Qi cultural accomplishment through training and academic exchanges. For example, teachers are organized to attend special lectures and academic seminars on Qi culture, so that teachers can deeply understand the connotation and value of Qi culture.

4.3.2 Cultivate teachers' ideological and political ability

Teachers should not only have Qi cultural accomplishment, but also master the teaching methods of ideological and political courses. Schools can carry out curriculum ideological and political teaching and training, and improve teachers' ability to organically combine Qi culture with curriculum ideological and political education. For example, training teachers how to skillfully introduce Qi culture elements in the teaching process and how to cultivate students' values through Qi culture.

4.4 Creating a campus atmosphere of Qi culture

4.4.1 Build Qi culture campus landscape

Higher vocational colleges can build the landscape of Qi culture theme on campus, such as Qi culture corridor. These landscapes can make students feel the atmosphere of Qi culture at any time on campus and play a subtle educational role.

4.4.2 Carry out Qi culture campus activities

Schools can carry out colorful campus activities of Qi culture, such as Qi culture knowledge contest, Qi culture calligraphy and painting exhibition, etc. These activities can attract students' active participation and deepen students' understanding and love of alignment culture.

To sum up, Qi culture, with its rich historical background and outstanding local advantages, provides inexhaustible valuable teaching resources for curriculum ideological and political education in the new era. In the process of teaching reform of integrating Qi culture with curriculum ideological and political education, higher vocational colleges should design and create teaching forms with curriculum characteristics according to their own situation, promote the seamless integration of classroom teaching and Qi culture, and concise and complete curriculum design path, so as to improve the quality of personnel training in higher vocational colleges and cultivate high-quality skilled talents with cultural self-confidence, correct values and good professional ethics for the society.

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Vocational Undergraduate Education Precision Employment Service Strategy

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Abstract: Vocational undergraduate education precision employment service work, aimed at through a series of scientific and reasonable measures to help students find their own professional, interest and career planning to match the job. the implementation of precision employment services for vocational education needs to be carried out in a number of ways, including improving the employment guidance service system, adjusting the structure of talent development, broadening employment channels, strengthening psychological guidance for employment, improving the skill level of job matching, and strengthening cooperation between schools and enterprises and the integration of maternity and education. Through the implementation of these measures, the employment quality and satisfaction of vocational education students can be effectively improved, and more high-quality technical skilled personnel can be trained for society. Accurate employment service strategies can promote the adjustment and optimization of talent training structure, so that talent training can better meet market demand and social development trends.

Keywords: Vocational Undergraduate Employment Service, Strategy, Precision, Quality Of Employment

1. BACKGROUND AND SIGNIFICANCE OF PRECISION EMPLOYMENT SERVICE

Vocational education, as an important part of the education system, is of great significance for the development of talents with professional skills and technical knowledge. Precision employment support is a key part of ensuring that these talents can successfully find employment and realize their personal values and social contributions. Through targeted employment support, vocational education students' employment quality and satisfaction can be improved, and the phenomenon of blind employment and frequent job changes can be reduced, thereby promoting their steady employment.

2. CURRENT PROBLEMS

2.1 The structure of employment guidance service teachers is unreasonable

Most vocational college employment guidelines service teachers are mainly derived from in-house guidance officers, counselors, etc., which makes it difficult to provide accurate and personalized employment advice services.

2.2 Talent development does not match market demand

Some vocational education institutions have a disconnect between the professional setting and curriculum content and market demand, which makes it difficult for graduates to find suitable jobs.

2.3 Narrow access to employment

Vocational students in poor areas often face limited access to employment, a single local economic structure, and fewer enterprises to provide employment opportunities.

2.4 Students' employment concepts need to be changed

Some students have a "slow employment" phenomenon, lack enthusiasm and initiative for employment, and need to guide them to positive employment pressure through targeted support.

3. PRECISION EMPLOYMENT SERVICE STRATEGY

3.1 Improving the employment guidance service system

strengthening the construction of employment guidelines courses, inviting professional teachers and industry experts to participate in the curriculum design and teaching. Improve the quality of employment guidance teachers by improving their ability to provide guidance

through professional training and practical experience sharing. To achieve personalized employment guidance services, students are provided with precise employment guidelines and career planning advice through "one solution for a lifetime" and other means, helping them to clarify career goals and formulate career plans. At the same time, we are actively building a platform for cooperation between universities and enterprises to provide more internships and employment opportunities for students. Career experience activities and career guidance workshops are held to expose students to and understand the characteristics and requirements of various industries earlier.

3.2 Adjust the talent development structure

With the rapid development of science and technology and the continuous adjustment of industrial structure, the demand for talents in the employment market is constantly changing. the demand for talents in traditional industries is gradually saturated, while the demand for talents in emerging industries such as artificial intelligence, big data, new energy and other fields is growing day by day. Therefore, it is particularly important to adjust the structure of talent training to match the demand of the employment market. Adjust the professional setting and curriculum content in accordance with market demand and industrial development trends. Strengthen cooperation with enterprises, carry out activities such as university-industry cooperation and order training, to enhance students' practical capabilities and employment competitiveness. Guide students to choose a suitable major and program based on their interests and career plans. At the same time, the curriculum is optimized to ensure that the curriculum content is closely aligned with market demand.

3.3 broadening Employment Channels

Actively introducing industrial projects to promote local economic development and provide more job opportunities for students. We will strengthen ties and cooperation with enterprises, establish a network of university-industry cooperation, and provide students with internships and employment opportunities. Use alumni resources to find jobs and accurately recommend students to employers. Broadening employment channels is one of the key measures to help job seekers

successfully find employment, which requires the joint efforts of the government, universities, society and individuals to form an employment service system with multi-party coordination and resources sharing. This will help to improve the quality and efficiency of employment and promote the steady development of the economy and society. the government can introduce relevant policies to encourage enterprises to absorb employment, especially small and medium-sized enterprises and private enterprises. Provide incentives such as tax incentives and financial subsidies to support enterprises in creating more jobs. Strengthen the construction and management of public employment service agencies, providing services such as job orientation, career guidance, and vocational training. Hold various job fairs to create an exchange platform for job seekers and employers. Provide supportive policies for entrepreneurship, such as entrepreneurial loans and entrepreneurial incubators, to encourage job seekers to start their own businesses. Hold entrepreneurial competitions to inspire entrepreneurial enthusiasm and explore entrepreneurial projects. Colleges and universities should organize campus job fairs and invite more high-quality enterprises to enter the school for recruitment. We will strengthen cooperation with enterprises and establish a cooperation mechanism between universities and enterprises to provide more internships and employment opportunities for students. Organize activities such as career planning competitions to help students identify career goals. Social institutions should play the role of industry associations, talent service agencies and other social organizations, providing vocational introduction and vocational training services. Encourage social organizations to organize various job fairs and employment assistance activities. Individuals should actively improve their own quality, strengthen professional knowledge learning and skills upgrading, and improve their employment competitiveness. Develop good communication skills, teamwork skills and stress resistance. Expand job search channels, pay attention to various job listings and employment policies, and actively participate in job fairs and talent exchange events. Use online platforms, social

media, etc. to expand your network resources and find employment opportunities.

3.4 Strengthen employment psychological orientation

Pay attention to the mental health of students and identify and resolve their psychological problems in a timely manner. We can help students to enhance their sense of self-efficacy and boost their job confidence through talks and psychological counseling. Strengthening employment psychological guidance is crucial for job seekers, especially in the current competitive employment market, where a good psychological state is one of the key factors for successful employment. Recognize yourself and clarify your goals. Job seekers need to have a clear understanding of their career interests, abilities, and values, which will help them be more clear about their career goals during the employment process and avoid blindly following others or choosing a career that is not suitable for them. By participating in career assessments, self-exploration, and other means to understand their career inclinations and strengths, they can better plan their careers. Cultivate a positive mindset and maintain an optimistic attitude, believing that they have the ability to find a satisfactory job, and this positive attitude can stimulate the motivation and confidence of job seekers. To cope with employment pressure, job seekers can alleviate employment pressure by making a reasonable employment plan, enhancing their employment competitiveness, and actively participating in job fairs. Learn to adjust your mentality, face setbacks and failures bravely, draw lessons from failures, summarize experiences, and continuously improve their abilities and qualities. Seek external support, communicate with family, friends, teachers, or career counselors, share their employment confusion and psychological problems, and seek their advice and support. Participate in employment guidance courses or activities, which not only help job seekers understand the employment market and industry trends, but also provide practical job hunting skills and psychological adjustment methods. These strategies can help job seekers better cope with various challenges and difficulties in the employment process, maintain a positive attitude, and successfully achieve employment.

3.5 Improving the level of human-job matching technology

Using technologies such as big data and artificial intelligence to build an employment intelligence platform, it can achieve the precise matching of students and jobs. Establish dynamic tracking and feedback mechanisms to adjust professional setting and employment guidance strategies based on the employment situation of graduates and feedback from employers. Strengthen the collection and analysis of data, establish a complete database of graduates seeking employment and a database of employers recruiting. Use big data technology to conduct in-depth analysis of these data and mine employment needs and employment trends. Promote information construction, build a "smart campus" to realize the informatization and intelligence of management and services. Use new media and new technologies to broaden the way of employment services and improve the convenience and efficiency of employment services.

3.6 Strengthen cooperation between schools and enterprises and the integration of teaching and learning

Cooperation between universities and enterprises is an important way to implement targeted assistance. By establishing close cooperative relationships with enterprises, we can jointly formulate talent development programmes, develop curriculum resources, and build practical training bases to achieve the deep integration of education and industry. This not only enhances students' practical abilities and job competitiveness, but also provides enterprises with talent support that is more in line with market needs. Strengthening school-enterprise cooperation and industry-education integration is an important measure to improve the quality and efficiency of employment; through the establishment of long-term cooperation mechanism, resource sharing and complementary advantages, joint training and order-based training, it can provide students with more practical opportunities and employment channels, and promote the technological innovation and industrial upgrading of enterprises.

3.7 Reform the teaching model

With the development of economy and society

and the constant changes in the employment market, the traditional teaching mode has been difficult to meet the current needs of enterprises for talents, so it is necessary to strengthen the reform of teaching mode, aiming to cultivate more high-quality talents with innovative spirit and practical ability to adapt to market demand and enhance the employment competitiveness of graduates. The employment guidance curriculum emphasizes a student-centered approach, integrates industry needs, and enhances students' job competitiveness through a variety of teaching methods such as mock interviews, resume production, and workplace role-playing. This teaching model not only helps students master job search skills, but also inspires them to actively explore career development, further promotes students to combine theoretical knowledge with practice, and enhances their ability to solve practical problems. In order to further improve the teaching effectiveness, the curriculum also needs to introduce an online learning platform so that students can study and review anytime, anywhere. In addition, curriculum design requires a series of self-assessments and feedback sessions that allow students to understand their progress and shortcomings in real time, so that they can improve targeted. Strengthening the reform of teaching mode is an important way to enhance the employment competitiveness of graduates and adapt to market demand. By combining theory and practice, introducing case teaching, promoting project-based learning, strengthening school-enterprise cooperation, and using digital technology, we can cultivate more high-quality talents with innovative spirit and practical ability, providing strong talent support for economic and social development.

4. CONCLUSIONS AND OUTLOOK

The precision employment support strategy for vocational education is an effective way to improve the employment quality and satisfaction of vocational education students. By improving the employment guidance service system, adjusting the structure of talent development, broadening employment channels, strengthening employment psychological guidance, and improving the skill level of job matching, students can be provided with more precise and effective employment support. In the future, with the development of the economy and society and the continuous progress of technology, vocational education precision employment support strategy will need to be continuously adjusted and perfected to meet the new market needs and talent development requirements.

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Study on the Implementation Program of Exercise and Fitness to Promote Adolescent Mental Health

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Abstract: The purpose of this study is to explore the promotion effect of physical fitness on adolescent mental health, and to propose a set of effective implementation programs. Through the literature review method and other research methods, the research found that exercise and fitness can not only improve the self-esteem and self-confidence of teenagers, but also relieve their pressure and anxiety, and enhance their social communication ability. Based on this, this paper puts forward the construction of physical education teachers through the reform of school physical education curriculum, the promotion of family physical education, the combination of physical education and strengthening the construction of physical education teachers, in order to promote the mental health of teenagers.

Key words: Sports and Fitness; Youth; Mental Health; Implementation Plan; Self-Esteem; Self-Confidence; Social Skills

Juvenile mental health problems have increasingly become the focus of social attention. With academic stress, family environment and social relationship complexity, adolescents face great psychological stress [1]. As an effective intervention, exercise fitness is widely believed to promote mental health among adolescents. This study aims to deeply analyze the positive impact of sports fitness on adolescent mental health, and propose a feasible implementation plan to provide scientific basis for the healthy growth of adolescents.

1. TYPE OF ADOLESCENT MENTAL HEALTH PROBLEMS

1.1 Depression

Depression is a common adolescent mental health problem, especially in the critical period of adolescent growth, patients usually show continuous low mood, strong inferiority complex, easy to self-blame and other characteristics. They may lose interest in the activities they are usually interested in, be indifferent to the things around them, and even have negative and pessimistic thoughts. In severe cases, adolescent depression patients may even be suicidal, which not only has a huge impact on their own physical and mental health, but also brings great pain and distress to the family and society [2].

1.2 Anxiety Disorders

Anxiety disorder is another common mental health problem in teenagers. Patients may show excessive worry, tension, irritability and other emotional states, accompanied by palpitations, chest tightness and other physical discomfort symptoms. These symptoms may intensify as adolescents study, socialize, or face challenges, thereby affecting their normal life. For adolescents, academic stress, interpersonal relationships and self-identity may be contributing factors for anxiety [3]. For adolescents with anxiety disorders, timely psychological intervention and treatment are crucial to help them adjust their mindset and enhance their ability to cope with stress.

1.3 Psychological eating disorder

Psychological eating disorder, the main performance is anorexia and bulimia, which is also a common psychological problem in teenagers. Teenagers with anorexia may focus too much on diet and weight, leading to malnutrition and physical health problems; while those with binge eating may show uncontrollable overeating, followed by strong feelings of self-blame and guilt. These symptoms may affect the normal life and study performance of the adolescents. For

adolescents with psychological eating disorders, professional psychotherapy and necessary medical intervention are needed to help them adjust their diet, improve their nutritional status, and correct poor eating habits.

1.4 Attention tional deficits

Attention deficit disorder is also one of the common psychological problems in teenagers, and patients usually show the characteristics of inattention and large mood fluctuations. These symptoms may affect adolescents learning and social skills, making it difficult to adapt to the environment and establish good interpersonal relationships. Pharmacotherapy and psychological counseling are equally important for patients with attention deficit. Parents and educators should provide a good learning environment and emotional support to help them overcome difficulties and improve their study and quality of life.

2. THE PROMOTION EFFECT OF EXERCISE AND FITNESS ON ADOLESCENT MENTAL HEALTH

2.1 Improve self-esteem and self-confidence

For teenagers, participating in sports and fitness activities is not only a process of improving their physical fitness, but also an important driving force for the development of mental health. In the process of sports, teenagers constantly challenge themselves and experience the joy of success and the sense of achievement. This positive feedback mechanism from the inside out helps them to form a correct self-perception of themselves as capable and capable individuals, thus significantly improving their self-esteem and self-confidence [4]. This increase in confidence will be directly reflected in all aspects of daily life, allowing them to cope with a more calm and confident manner to challenges in their studies, social interaction and even their future career.

2.2 Reduce stress and anxiety

Adolescence is one of the two stages of prominent stress and anxiety in life. Multiple pressures, such as academic competition, interpersonal relationship and self-identity, are intertwined, which pose challenges to the psychological state of adolescents [5]. Exercise and fitness, as a positive coping strategy, has been scientifically proven to effectively alleviate these psychological stresses. When teenagers devote themselves to exercise and fitness activities, their attention will shift from worry and stress to the challenges and fun brought by exercise. Through physical exercise, they produce endorphins and other "pleasure hormones", which help regulate emotional states and balance the nervous system, thus reducing stress and anxiety.

2.3 Improve emotion regulation ability

Exercise and fitness have a significant effect on the emotional regulation ability of teenagers. On the one hand, sports exercises the willpower of teenagers and makes them more resilient in the face of setbacks and difficulties; On the other hand, the successful experience during exercise and the resulting positive emotions teach teenagers how to view failure correctly and learn to learn from failure to improve their emotional self-regulation ability [6]. Teenagers who adhere to exercise and fitness for a long time perform better in emotional stability, and they can take a more rational and mature way to deal with negative emotions, which has a long-term and positive significance for the maintenance and promotion of mental health.

2.4 Enhance social communication capacity

Sports provide rich social scenes for teenagers, especially in team sports, the coexisting environment of cooperation and competition greatly exercises the social communication ability of teenagers [7]. For example, in some team activities, teenagers must learn to communicate effectively with others, work together, and respect their opponents and teammates, which are indispensable skills for teenagers to build good interpersonal relationships and social networks. In addition, by participating in team sports, teenagers can also experience the joy of team success, understand the role and value of individuals in the collective, so as to enhance the sense of self-worth and social confidence, which will have a positive impact on the long-term social adaptability and mental health development of teenagers.

3. IMPLEMENTATION PLAN OF EXERCISE AND FITNESS TO PROMOTE ADOLESCENT MENTAL HEALTH

3.1 Reform of school physical education curriculum

With the continuous reform of education career, in the school education system, physical education course occupies a vital position, it is not only to improve the adolescent physical quality, cultivate sports skills and tactical accomplishment has a direct effect, also can effectively promote youth team cooperation ability, tenacity quality and the formation of healthy attitude [8]. Therefore, schools should deeply innovate the concept and content of physical education curriculum, truly take teenagers as the center, and carefully design and implement diversified sports projects from the age characteristics and interests of teenagers.

For young youth, interesting and interactive sports, such as basketball, football, swimming, dance and martial arts, to stimulate their sports potential and develop good sports habits, more competitive and strategic sports, such as basketball, football and track teams, to help them improve their professional skills and develop their sense of responsibility and responsibility. At the same time, it pays attention to the combination of theoretical knowledge and practical operation, introducing sports appreciation courses, sports physiology knowledge lectures, so that teenagers can not only master the basic principles of various sports, but also deeply understand the great significance of sports for physical and mental health.

3.2 Establish the campus sports activity system

In order to create a strong campus sports culture atmosphere and comprehensively stimulate the lasting sports enthusiasm of teenagers, the school must establish and improve the campus sports activity system. To be specific, schools should establish a perfect organization mechanism of sports competitions and activities, regularly hold sports events and fun sports meetings at different levels such as school level, grade and class, and set up rich awards to stimulate the enthusiasm of all young people to participate. In addition, the school can also actively expand off-campus resources, establish long-term cooperative relations with surrounding community sports institutions, and share sports facilities, jointly hold cross-border exchange activities, so that teenagers can have access to more diversified and professional sports resources, so as to effectively broaden the channels of youth sports activities.

3.3 Promotion of family sports activities

In the family field, physical activity occupies an irreplaceable core position. Parents play multiple roles in the growth process of teenagers. They are not only the guide of teenagers, but also the inspiration and companion of their interests and hobbies. In sports activities, parents should actively participate in, and become the light and companion of teenagers interest in sports. Through the interaction and cooperation with teenagers, parents can stimulate their sports potential and help them discover and develop their interest in sports.

Family sports activities can not only make teenagers feel the fun and challenge of sports, but also promote the physical and mental health development of teenagers. In the activities, teenagers can exercise their physical quality, improve their sports skills, and cultivate their team spirit and the sense of competition. At the same time, the family sports activities can also enhance the parent-child relationship, so that the family members are more closely linked together, and spend a vibrant and healthy life time together.

3.4 Combination of physical education and mental health education

In the school education system, the integration of physical education and mental health education is of great significance. Combining physical education with mental health education can help teenagers develop in an all-round way and improve their physical and mental health level. Effective combination methods include integrating psychological counseling content into physical education courses, such as teaching emotional management skills in basketball games, and cultivating teamwork spirit in team sports. Through the practice of physical activities, teenagers can better understand and master the knowledge of these psychological counseling, so as to improve their psychological quality and mental health level.

Schools can also organize professional mental health lectures or counseling services to provide targeted psychological support and help for teenagers. These lectures or

counseling services can provide timely and effective strategies to solve the psychological distress that adolescents may encounter in physical activities, so that teenagers can feel the care and support of the school. Through such joint teaching, the school can not only help teenagers to develop a positive outlook on life and perseverance, but also significantly improve their overall mental health level.

3.5 Strengthen the construction of physical education teachers

Strengthening the construction of physical education teachers is the core link to improve the quality of school physical education work. Physical education teachers should not only have solid professional teaching ability, but also pay attention to and master certain knowledge and technology of mental health education, so as to integrate psychological counseling in physical education teaching. Physical education teachers should have a keen insight into the psychological dynamics of teenagers in sports, timely find and effectively solve the possible psychological barriers or problems, so as to ensure that teenagers not only get comprehensive development in physical quality, but also get the same attention and cultivation in mental health.

4. CONCLUSION

In short, exercise and fitness have a significant promotion effect on adolescent mental health. Through the implementation of school physical education curriculum reform, the establishment of campus physical activity system, the promotion of family sports activities, the combination of physical education and mental health education and strengthening the construction of physical education teachers, the mental health level of teenagers can be effectively improved. In the future, relevant scholars should continue to deepen the research on the promotion effect of exercise and fitness on adolescent mental health, explore more effective ways of exercise and fitness, and provide more comprehensive support for the healthy growth of teenagers.

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Case Analysis of Ideological and Political Elements Based on the Course of Mathematical Thoughts and Methods

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Abstract: This article takes the content of calculus as the theme, recounts the stories of ancient Chinese mathematicians and calculus, the development history of modern calculus, as well as the fundamental theorem of calculus. It explores and analyzes the ideological and political elements hidden in mathematical ideas, and presents classroom implementation strategies. The organic integration of mathematical thought and ideological and political education in the curriculum guides students to perceive the beauty of mathematics in ideological and political education, and understand the meaning of life through mathematical thought, thus achieving the training goal of cultivating students with both integrity and ability.
Key Words: Mathematical Thought; Ideological and Political Education; Fundamental Theorem of Calculus

1. MATHEMATICS AND IDEOLOGICAL AND POLITICAL EDUCATION

1.1 Mathematical Thoughts and Methods

Mathematics, as an abstruse discipline, is not merely a simple aggregation of numbers, formulas, and logical reasoning. Instead, it is an indispensable cultural heritage. Throughout the course of history, the status of mathematics cannot be overlooked. During the Wei and Jin Dynasties, the mathematician Liu Hui's method of cutting a circle involved continuously subdividing the circle to approximate its true area. As he put it, "The finer the cutting, the less the loss. Cut it again and again until it cannot be cut any further, then it will coincide with the circle and there will be no loss." This idea laid the foundation for the limit theory and the concept of definite integral. Mathematical thought is a broad concept. It encompasses the contributions of mathematicians, the history of mathematics, the aesthetics of mathematics, mathematics education, and the cultural elements in the teaching process. It represents the ideas, spirits, methods, and viewpoints of mathematics, as well as their formation and evolution processes.

1.2 Integrating Ideological and Political Education into Courses

Integrating Ideological and Political Education into Courses profoundly addresses the fundamental practical question of "how to cultivate people", which lies at the core of educational work. General Secretary Xi Jinping has emphasized that education is of great significance to the country and the Party. Integrating ideological and political education into the teaching of courses highlights the primary task of education, that is, "what kind of people to cultivate." As the main front for national talent cultivation, schools must regard all courses as important carriers for educating people. With moral education as the guide, they should unswervingly implement the fundamental task of fostering virtue through education, integrate ideological and political work into the entire process of education and teaching, ensure that "ideological and political courses" and "integrating ideological and political education into courses" move in the same direction, give play to the collaborative role of education, and achieve the goal of cultivating talents with both moral integrity and professional competence.

1.3 The Ideological and Political Value in Mathematical Thoughts

Many of the essential ideas in mathematics are in harmony with correct life values. The reason for exploring the mathematical values within mathematical ideas is that these ideological and political elements are inherently embedded in mathematical thinking. Through proper guidance, students can be subtly influenced by the intrinsic values during their learning of mathematical ideas, thus achieving the goal of cultivating moral character and fostering talents. This should not involve crudely combining ideological and political education with mathematics courses, or forcing ideological and political education merely for the sake of it.

Mathematical ideas express life values in many aspects. For instance, learning about the stories of ancient Chinese mathematicians can cultivate students' sense of national pride, stimulate their patriotic spirit and sentiment, and encourage them to study hard, keep delving, and contribute to the country. Take the various proofs of the Pythagorean theorem as an example. It shows that there can be multiple ways to solve a problem, and students need to keep thinking and exploring, not stick to a specific method, let alone be stubborn. Many aesthetics are also reflected in mathematical ideas. For example, the "golden ratio" often appears in many fields of art, and the " $\varepsilon - N$ " language in mathematical analysis reflects a kind of concise beauty. The connotations in these mathematical ideas require students to experience them gradually, to improve their aesthetics and morality, enhance their ability to distinguish right from wrong, and form a good outlook on life and the world.

2.TAKING THE FUNDAMENTAL THEOREM OF CALCULUS AS AN EXAMPLE

2.1 Teaching Content

2.1.1 Ancient Chinese Mathematicians and Calculus

In the long history of China, although there was no systematic explanation of calculus, some of the research achievements of these predecessors were essentially the same as the ideas of calculus, and to some extent, they had already touched upon the field of calculus.

Liu Hui, an ancient Chinese mathematician, used the "circle - cutting method" to calculate the area and circumference of a circle when annotating "The Nine Chapters on the Mathematical Art". Essentially, this method embodies the idea of integration. By dividing the circle into infinitely many small sectors and calculating the sum of the areas and circumferences of these small sectors, an approximation of the area and circumference of the circle can be obtained.

Zu Chongzhi and Zu Geng made outstanding contributions in the history of Chinese mathematics. Zu Chongzhi's most renowned achievement was calculating a highly precise approximate value of pi. The "approximate ratio" is 3.1416, and the "dense ratio" is 3.1415926. This accomplishment preceded similar European calculations by nearly a thousand years. Zu Geng's most famous contribution was the proposal of "Zu Geng's Principle", also known as the "equal - power volume principle" or "Zu Geng's axiom". This principle states that if the cross - sectional areas of any corresponding parts of two solid figures are equal, then the volumes of these two figures are also equal. This principle played an important role in the later development of integral calculus in Europe.

Ideological and Political Element 1: Using the stories of ancient Chinese mathematicians as an introduction to showcase the advancements of ancient Chinese mathematicians, cultivate a sense of national pride and patriotism, and enhance students' cultural and national confidence. Telling students about the spirit of mathematicians in discovering mathematical truths, and at the same time inspiring students to take them as role models, to generate a learning spirit of being good at discovery, constantly exploring, and being brave in delving into academic knowledge.

The stories and achievements of these three mathematicians not only reflect the highly developed state of ancient Chinese mathematics, but also have had a profound impact on subsequent mathematical research. Although their work did not form a complete system of calculus, the ideas and methods they used in solving specific mathematical problems laid the foundation for the later development of calculus.

Ideological and Political Element 2: The stories of ancient mathematicians also remind

students to be adept at thinking and summarizing the results of their discoveries, and to analyze problems at a deeper level. It serves as a reminder that students should not merely look at the surface of things, but rather see through to the essence of the problem. Only by delving from the surface to the core can they achieve more development and gain more rewards, thus cultivating a correct outlook on life and values.

2.1.2 Newton, Leibniz and Calculus

The systematic development of calculus is usually attributed to two great scientific pioneers, Newton and Leibniz. In the works of Newton and Leibniz, the classical analysis of infinitesimals was established and completed, that is, calculus was established and completed.

The "Tractatus de Methodis Serierum et Fluxionum" by Newton marked the birth of calculus, yet it was flawed in many aspects. Through over 20 years of unwavering efforts, Newton continuously improved and refined his calculus theory, completing three papers on calculus successively (in 1669, 1671, and 1691). However, they were published very late (in 1711, 1736, and 1704 respectively), and the last one was published nine years after Newton's death.

Leibniz began his mathematical research in 1673 and developed the theory of calculus independently of Newton. His work mainly focused on finding a universal symbol system to simplify and unify mathematical expressions. He introduced the concepts of "integration" and "differentiation" and created the calculus symbols we use today, such as $\int$ (the integral symbol) and d (the differential symbol). In 1684, Leibniz published "A New Method for the Infinitesimal Calculation", which was the first publicly - released paper on calculus. In this paper, Leibniz described in detail his rules of differentiation and integration and demonstrated how to use these tools to solve geometric problems.

Ideological and Political Element 1: Starting from the perspective that calculus is the study of the pair of contradictions between differentiation and integration, students are guided to deeply understand the law of the unity of opposites and learn to use the method of contradiction analysis. This enables students to gradually realize that the law of the

unity of opposites reveals the fundamental content of the universal connection of things and the internal driving force of their eternal development. It provides the fundamental method for people to understand and transform the world - the method of contradiction analysis. It is of great significance to cultivate students' ability to adhere to using the law of the unity of opposites to recognize and solve problems.

Ideological and Political Element 2: Leibniz's creation of calculus symbols shows that the language used to express theorems should keep pace with the times. This not only facilitates readers' understanding but also tells us that in life and work, we should be good at adapting and changing, and never remain stagnant without making any alterations.

The dispute over the priority of calculus between Newton and Leibniz is one of the most famous controversies in the history of mathematics. Although Newton's and Leibniz's work had many similarities, their notations and methods differed.

Newton claimed that he had developed calculus long before Leibniz, while Leibniz insisted on his independent discovery. This controversy led to a long - standing opposition between mathematicians of the two countries and influenced the development of the European mathematical community.

Although it is now generally accepted that Newton and Leibniz developed calculus independently, Newton's work was more recognized in the UK, while Leibniz's notations and methods were more popular on the European continent.

Ideological and Political Element 3: The controversy between Newton and Leibniz, to some extent, demonstrates the relativity of truth. At that time, different scientific communities might judge who was right based on their own standards, which reflects the relativity and multiplicity of the cognition of truth. The contradiction in the controversy, that is, the contention between the two scientists over their contributions to calculus, ultimately promoted the development and recognition of the calculus theory. This embodies the principle in dialectics that the two sides of a contradiction interact and struggle with each other, thus propelling the development of things.

2.1.3 The Fundamental Theorem of Calculus
Also known as the Newton - Leibniz formula, it is named in honor of the great contributions made by the two great men to the study of calculus. The content of the theorem is as follows: Let $f(x)$ be a continuous function defined on the interval $[a,b]$, and $F(x)$ be an antiderivative of $f(x)$, that is, $\dfrac{dF(x)}{dx} = f(x)$. Then the Newton - Leibniz formula is expressed as:

$$\int_a^b f(x)dx = F(b) - F(a).$$

Here, $\int_a^b f(x)dx$ represents the definite integral of $f(x)$ over the interval $[a,b]$, $F(b)$ and $F(a)$ represent the values of the antiderivative $F(x)$ at b and a respectively.

The Newton - Leibniz formula clearly establishes the connection between differentiation and integration, and it has extensive applications in various fields, especially in physics. Chinese astrophysicists need to use integral methods to analyze and interpret astronomical data in the research of cosmic background radiation and black - hole physics. In China, calculus methods are widely applied in the design of spacecraft orbits and dynamic analysis, which is of great significance to the success of the Shenzhou spacecraft missions and the Chang'e lunar exploration projects.

Ideological and Political Element 1: The Newton - Leibniz formula reflects the relationship between continuity and change in nature. It indicates that the development of things is continuous, with each instant being a continuation of the previous one. The overall change can be understood through the accumulation of countless instants. This also elucidates the relationship between quantitative and qualitative changes, meaning that the accumulation of quantity can trigger a qualitative leap. It educates students that whether in study or daily life, they should be down - to - earth. Whatever they do, they should take one step at a time, and possess the patience and perseverance to overcome various difficulties.

Ideological and Political Element 2: The

story of how the fundamental theorem of calculus has been gradually applied in various fields, achieving remarkable results, shows that major technological breakthroughs stem from advancements in fundamental theories. This serves as a reminder to students that if they aim to fulfill their lofty ideals and achieve success, they must start from the smallest details and not be overly eager for quick gains. Success is built upon a solid foundation of incremental efforts, and patience in the pursuit of knowledge and skills is crucial. Rushing to achieve goals without a proper groundwork often leads to disappointment, while consistent dedication to basic principles paves the way for significant achievements.

2.2 Practice Process

Students play a central role in the classroom. Teachers should skillfully ask questions to inspire students to think actively and participate actively. When imparting classroom content, two strategies can be adopted: First, "Knowledge and ideological and political education go hand in hand", that is, while imparting professional knowledge points, intersperse life philosophies to ensure that students are highly concentrated and active in thinking, and achieve good teaching results. Second, "Impart knowledge first and ideological and political education later", that is, at the end of the course, conduct a summary and improvement to promote students' in-depth thinking. The specific practices are as follows:

Firstly, when explaining the history, ideas, methods, and knowledge of mathematics, emphasize students' active recognition and acceptance of "ideological and political elements". Guide them by integrating real-life situations to stimulate their awareness of autonomous learning.

Secondly, select appropriate biographies, videos, and current affairs materials, and skillfully integrate national policies, patriotic feelings, and the spirit of craftsmanship into teaching to help students understand the development trends of the world and China and recognize their historical missions and responsibilities of the times.

Thirdly, combine mathematical ideas, methods, knowledge, and social practice to interpret ideological and political elements, explain the generation of theories from reality,

and adapt to the times and keep pace with the times.

In the end, moral education is not only carried out directly through facts and reasons, but also subtly integrated into the curriculum.

2.3 Class summary

To better integrate the ideological and political thinking of the course with the mathematical thought, not only should the ideological and political education be implemented into the daily teaching, but also students should be encouraged to use their spare time to think after class, such as assigning some political homework, letting students watch videos, or reading some articles to complete clock in activities. Let the students receive the course education in their spare time, but also repeatedly taste the ideological and political content, and then get their own harvest and progress, so that they can have a higher perspective and a broader vision to face their own life path.

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