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Research on the Cultivation Path of Craftsmanship Spirit in Vocational Colleges: from the Perspective of Skills Competition

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Abstract: The spirit of craftsmanship is gaining increasing attention from both society and the education community. Along with professional knowledge, continuous research, and innovation have become decisive factors in determining the quality of products. In this context, vocational colleges strive to cultivate high-quality skilled talents, making the cultivation of craftsmanship spirit a crucial component of vocational education. This study explores the cultivation path of craftsmanship spirit through the lens of skills competitions, with a special emphasis on developing students' perseverance. The research conclusions of this article hold significant reference value for the implementation of vocational education policies.

Keywords: Skills competition; Cultivation path; Craftsmanship spirit; Vocational education

Online publication: July 03, 2023

1. Introduction

In recent years, skills competitions have become integral to vocational education. They offer students an opportunity to showcase their abilities and apply what they have learned in a practical setting ^[1]. Moreover, participating in these competitions allows students to gain valuable experience in teamwork, time management, and communication ^[2]. Additionally, skills competitions serve as a platform for students to network with professionals and potential employers, increasing their chances of finding employment after graduation ^[3]. Therefore, it is imperative for schools to pay attention to the cultivation of students' craftsmanship spirit if they wish to succeed in these competitions. The cultivation of craftsmanship spirit is equally important as professional courses for vocational college students. While professional courses equip students with technical skills and knowledge, the cultivation of craftsmanship spirit teaches them the value of attention to detail, dedication, and commitment to quality ^[4]. These qualities are essential for success in any vocational field, as they enable students to produce high-quality work that meets the expectations of their customers and employers. Additionally, cultivating a craftsmanship spirit can help students develop a sense of pride in their work and a passion for their chosen profession, motivating them to continue learning and improving throughout their careers.

The cultivation of craftsmanship spirit is beneficial for vocational college students preparing for skills competitions. Such competitions demand not only technical skills but also attention to detail, creativity, and dedication to produce high-quality work. By instilling these qualities in students, the cultivation of craftsmanship spirit can help them meet the demands of the skills competition. Students with a strong sense of craftsmanship are more likely to produce outstanding work in competitions, increasing their chances of

success. Additionally, the cultivation of craftsmanship spirit can help students stay focused and motivated throughout the preparation process, leading to better performance and outcomes ^[5].

Scholars have long recognized the significance of craftsmanship spirit in skills competitions and conducted extensive research on the topic. However, there is a lack of research on the cultivation path. This study fills the gap by analyzing two skills competition cases and drawing valuable conclusions. These findings hold significant reference value for innovating the cultivation mode of craftsmanship spirit in vocational colleges.

2. Research status

Numerous scholars have dedicated their efforts to studying skills competitions. For instance, Qi investigated the positive impact of vocational skills competitions on enhancing students' practical abilities, emphasizing the importance of adjusting teaching content and reforming teaching methods ^[6]. Wan analyzed the development of higher vocational education propelled by vocational skills competitions and suggested that building a reasonable teaching system and changing teaching evaluation methods are effective ways to promote its development ^[7]. Liu analyzed the benefits of participating in agricultural product quality and safety testing competitions in promoting the teaching level of agricultural product quality and safety testing ^[8]. In another study, Wu analyzed the role of skills competitions in advancing the metalworking internship curriculum in a school, which enhances students' understanding of the course content and exercises their practical skills ^[9]. Finally, Wan discussed the key technologies of the skills competition of "modern electrical control system installation and commissioning" and shared strategies for achieving favorable results ^[10]. Scholars have researched the cultivation of craftsmanship spirit in vocational education. Zhang focused on the current situation of cultivating craftsmanship spirit among students in metallurgical vocational colleges, highlighting the importance of pursuing vocational ideals for career development ^[11]. He suggested a four-dimensional approach to cultivating craftsmanship spirit, involving the state, school, teachers, and students. Similarly, Gao studied the cultivation path of craftsmanship spirit in modern vocational education and proposed that integrating craftsmanship into classroom teaching is necessary for students to develop the competencies required for enterprise positions ^[12]. In contrast, Song viewed the cultivation of craftsmanship spirit as a crucial task of moral education in schools, requiring joint efforts from individuals, society, and the state ^[13].

Scholars have examined skills competitions from various angles and have come to a consensus on their vital contribution to the growth of vocational education. However, scholars have relatively little research on the cultivation path of students' perseverance. This article conducts relevant research from the perspective of skills competitions and proposes several targeted suggestions.

3. Challenges faced

In addition to professional extracurricular activities, the improvement of students' comprehensive quality is the primary task of vocational education. The comprehensive quality includes a lot of content, and this article only focuses on the issue of willpower, which plays an important role in the preparation and participation in skills competitions.

Students' lack of willpower can significantly affect their preparation for the skills competition. Skills competition requires students to spend long hours practicing, refining their techniques, and overcoming challenges. Without willpower, students may become easily frustrated or discouraged, leading to a lack of progress and poor performance in competitions. For example, students are preparing for a cooking competition. The competition requires the students to prepare a complicated dish with a specific set of ingredients and a time limit. Without willpower, the students may become frustrated with the difficulty of the dish and give up before they have fully mastered the recipe. They may also struggle to stay motivated

to practice and refine their technique, leading to a lack of progress and poor performance in the competition. Similarly, in a technical skills competition, a lack of willpower can lead to a lack of progress in mastering the necessary skills. For instance, students preparing for a welding competition may struggle to master a particular welding technique. Without perseverance, they may become discouraged and give up on practicing the technique, leading to a lack of progress and poor performance in the competition.

Overall, willpower is a crucial quality for students preparing for the skills competition. Without willpower, students may struggle to overcome the challenges of competition and fail to reach their full potential. Cultivating willpower and endurance is an important topic and also an important aspect of cultivating the spirit of craftsmanship.

4. Cultivation path

We focused on cultivating willpower and endurance and studied the path of cultivating craftsmanship spirit.

4.1. Logic diagram

In **Figure 1**, we illustrate our research process, which began with theoretical exploration. We focused on two specific areas of interest: willpower and endurance. To begin with, we analyzed two typical cases related to these topics, specifically looking at the preparation process and work in skills competitions. These cases demonstrated the significance of willpower and the importance of endurance training for succeeding in skills competitions. Afterwards, both the teacher and participating students organized and summarized these cases. Subsequently, we applied these findings in both the classroom and skills competitions. We then evaluated the application's effectiveness through a survey questionnaire, and from our analysis, we derived valuable insights. We used this feedback to optimize the original two typical cases, emphasizing their applicability in teaching. This part of our research focused on practical implementation.

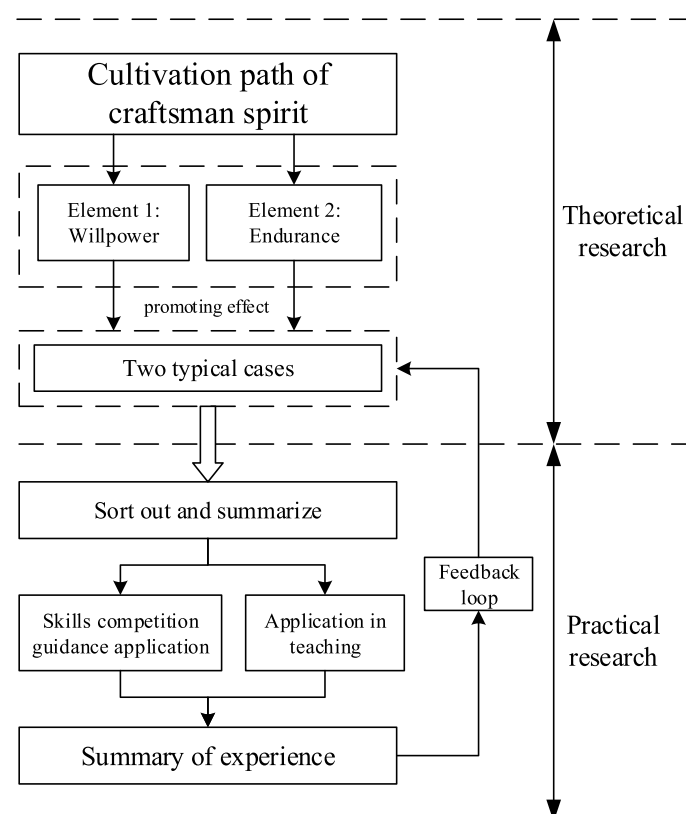


Figure 1. Logic diagram of the cultivation path of craftsmanship spirit

Our cultivation path for craftsmanship spirit has two distinctive features. Firstly, it is a feedback loop, not a one-way street. The effectiveness of teaching is the key to the cultivation of craftsmanship spirit, and whether students accept this teaching mode plays a crucial role. Therefore, we continuously analyze and optimize cases through student survey questionnaires to improve teaching quality. Secondly, our cultivation path involves students' case studies, which have strong persuasive and infectious power. As students may have encountered similar experiences or expect to face them in the future, they are highly receptive to our classroom teaching content. It is worth noting that many students in our craftsmanship spirit cultivation program are also interested in skills competitions, and they proactively registered for competitions and sought advice from teachers on the competition rules. This is a significant affirmation of our research work.

4.2. Data analysis

In order to analyze the effectiveness of the cultivation path of craftsmanship spirit, we conducted a survey and analysis of teaching experiments. The survey is a single-choice question, including the following five questions:

Q1: Do you think the cultivation of craftsmanship spirit is very important?

Q2: Do you think the cultivation of craftsmanship spirit should pay attention to methods?

Q3: Is it more conducive to your understanding to explain the craftsmanship spirit through skills competition cases?

Q4: Is willpower very important in both learning and work?

Q5: Is the cultivation of endurance important in both learning and work?

Table 1. Data analysis results

	Q1	Q2	Q3	Q4	Q5
Class 1	33	31	33	32	25
Class 2	31	24	32	33	25
Class 3	32	33	34	34	26

An analysis was conducted on the students from three classes. These three classes are labeled as Class 1 (33 students), Class 2 (33 students), and Class 3 (35 students). Statistical analysis was conducted on the agreed data, and the results are shown in **Table 1**. From the feedback from classmates, it can be seen that using real cases can be a very effective way to help students in vocational colleges understand and recognize the spirit of craftsmanship. Real cases can provide concrete examples of how the principles of craftsmanship are put into practice in various industries and professions. By studying real cases, students can see how skilled practitioners apply their knowledge, expertise, and attention to detail to produce high-quality products or services. They can also see how practitioners overcome challenges and solve problems in their work, and how they continuously strive to improve their skills and techniques. The cultivation of willpower and endurance should be highly valued by vocational education practitioners. Willpower and endurance are essential skills for success in any profession or industry, and they are particularly important in vocational education, where students are preparing for careers that require a high degree of skill and expertise. Willpower is the ability to stay focused on a goal or task, even in the face of distractions, difficulties, or setbacks. Students who develop strong willpower are better able to persevere through challenges and setbacks, and they are more likely to achieve their goals. Endurance, on the other hand, is the ability to sustain effort over time, even when faced with fatigue or discomfort. Students who develop endurance are better able to work for extended period of time, and they are more likely to produce high-quality work.

5. Specific suggestions

5.1. Cultivate craftsmanship spirit in teaching

Cultivating the craftsmanship spirit should be an important aspect of teaching in vocational colleges. The craftsmanship spirit emphasizes the importance of quality, innovation, and dedication in one's work, which are essential qualities for success in vocational fields.

By fostering the craftsmanship spirit in teaching, vocational colleges can help students to develop a deep appreciation for their chosen field of study, a commitment to excellence, and a willingness to continually improve and innovate. This can help students to become more engaged and motivated in their studies, leading to better academic performance and a greater likelihood of success in their careers. In addition, cultivating the craftsmanship spirit can help to promote a culture of respect for vocational trades and skilled labor, which are often undervalued in society. By emphasizing the importance of quality and dedication in one's work, vocational colleges can help to instill a greater sense of pride and respect in students for their chosen field of study. Thus, the cultivation of the craftsmanship spirit in teaching can help to prepare students for successful careers in vocational fields, while also promoting a greater appreciation for skilled labor.

5.2. Cultivate craftsmanship spirit in various ways

Adopting various modes is important in cultivating the spirit of craftsmanship in vocational colleges. Students have different learning styles and preferences, and a one-size-fits-all approach may not be effective in developing the craftsmanship spirit in all students.

Vocational colleges can adopt various modes to cultivate the craftsmanship spirit, such as hands-on training, apprenticeships, mentorship programs, project-based learning, and competitions. These modes can help students to gain practical experience, develop problem-solving skills, and build relationships with experienced professionals in their chosen field of study. In addition, vocational colleges can incorporate soft skills training, such as communication, teamwork, and leadership, into their curriculum to complement technical training and help students develop a well-rounded skill set. Furthermore, vocational colleges can leverage technology and online resources to provide students with access to a wide range of learning materials and opportunities, including virtual simulations, webinars, and online communities.

6. Results

It is very important to cultivate the spirit of craftsmanship in vocational colleges. The craftsmanship spirit emphasizes the importance of quality, innovation, and dedication in one's work, which are essential qualities for success in vocational fields. By fostering the craftsmanship spirit in teaching, vocational colleges can help students to develop a deep appreciation for their chosen field of study, a commitment to excellence, and a willingness to continually improve and innovate. This can lead to better academic performance and a greater likelihood of success in their careers. The skills competition is an important field for cultivating the spirit of craftsmanship. These competitions provide opportunities for students to showcase their skills, creativity, and dedication to their chosen field of study.

7. Conclusion

It is important to explore multiple models to cultivate the craftsmanship spirit of vocational college students. By exploring multiple models such as hands-on training, apprenticeships, mentorship programs, project-based learning, and competitions, vocational colleges can help students to gain practical experience, develop problem-solving skills, and build relationships with experienced professionals in their chosen field of study. This can lead to better academic performance, career success, and a greater contribution to society.

The skills competition is an important path for cultivating the craftsmanship spirit. Skills competition

can motivate students to strive for excellence, develop innovative solutions to problems, and continuously improve their skills. As an important way to cultivate craftsmanship spirit, skills competitions should be paid attention to by teachers and students in vocational colleges who actively participate in them.

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Author contributions

S.W. and M.C. conceived the idea of the study and wrote the first draft of the paper. Y.W. revised the format of the article.

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Enhancing Vocational Education through Innovative Skills Competitions: Challenges and Solutions

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Abstract: This study investigates the challenges encountered by vocational colleges when preparing for innovative skills competitions and proposes effective countermeasures. It highlights issues concerning students' motivation, limited financial resources and hardware, teacher capacity limitations, inadequate reward systems, and curriculum misalignment. Through meticulous research and analysis, this paper presents practical recommendations to mitigate these challenges. Suggestions encompass strategies to enhance students' motivation, increase financial support, provide professional development opportunities for teachers, revamp the reward system, and align the curriculum with competition requirements. By implementing these measures, vocational colleges can cultivate active student participation, elevate teaching quality, bridge the gap between education and industry demands, and equip students for success in innovative skills competitions.

Keywords: Skills competitions; Challenges and solutions; Vocational colleges; Teaching

Online publication: July 03, 2023

1. Introduction

In recent years, vocational colleges have increasingly recognized the importance of innovative skills competitions as a means to prepare students for the dynamic demands of the workforce^[1,2]. However, these competitions often face numerous challenges that hinder their effectiveness in nurturing students' innovative abilities^[3]. This paper aims to explore the problems faced by vocational colleges in preparing for innovative skills competitions and propose countermeasures to address these issues. We provide an overview of the research focus and highlight the significance of innovative skills competitions in vocational colleges. This presents the objectives of the study, which include identifying the key problems and offering practical solutions. The paper concludes by outlining its structure, which consists of a comprehensive analysis of the research status, an examination of the specific problems encountered, and a presentation of suggested countermeasures.

2. Research status

Previous scholars have devoted significant effort to studying the impact of skills competitions on students' practical abilities and the development of vocational education. For instance, Qi emphasized the need to adjust teaching content and reform teaching methods to enhance students' practical abilities through vocational skills competitions^[4]. Wan suggested that building a reasonable teaching system and changing teaching evaluation methods can effectively promote the development of higher vocational education

through skills competitions ^[5]. Furthermore, Wang found that participating in skills competitions significantly improve students' employability in higher education institutions and enhances their teamwork skills ^[6]. Liu highlighted the benefits of participating in agricultural product quality and safety testing competitions in promoting the teaching level of agricultural product quality and safety testing ^[7]. Li explored the improvement of teaching methods in secondary vocational schools, using the parts mapping and CAD drawing technology project competition as an example, and suggested ways to integrate relevant content into the teaching curriculum ^[8]. Wu analyzed the role of skills competitions in advancing the metalworking internship curriculum, which enhances students' understanding of the course content and exercises their practical skills ^[9]. Lastly, Wan discussed the key technologies of the skills competition of "modern electrical control system installation and commissioning" and shared strategies for achieving favorable results ^[10].

From the research of scholars, it is not difficult to see that the current skills competitions have become the focus of research in the field of education. They are essential to analyze the problems faced by the development of vocational college skills competitions and put forward targeted suggestions.

3. Problems faced

3.1. Lack of students' motivation

One of the prominent challenges encountered by vocational colleges in preparing for innovative skills competitions is the deficiency in students' motivation. This issue is characterized by a diminished participation rate among students, particularly those with lower grades, leading to a decrease in overall engagement. Several factors contribute to this motivation deficit, including inadequate awareness of the benefits associated with skills competitions, limited recognition and incentives for participation, and a prevailing perception that these competitions primarily cater to high-achieving students. As a consequence, the full potential of students across the academic spectrum remains untapped.

3.2. Insufficient financial resources and hardware

The insufficiency of financial resources and hardware presents a significant obstacle to the effective preparation for innovative skills competitions. Vocational colleges often encounter challenges in procuring and maintaining modern laboratories and equipment necessary for students to thoroughly test and implement their innovative ideas. Inadequate funding impedes the establishment of well-equipped laboratories, hampering students' ability to conduct practical experiments and inhibiting their creativity and skill development. The lack of access to essential resources limits the scope and quality of projects that students can undertake, ultimately affecting their performance in skills competitions.

3.3. Teacher capacity limitations

Another critical issue faced by vocational colleges is the limitations in teacher capacity to provide effective guidance and support to students participating in skills competitions. Teachers may possess inadequate practical skills and relevant experience within the specific competition domains, which hinders their ability to offer comprehensive guidance. Insufficient training opportunities and tailored professional development programs further contribute to this capacity gap. Consequently, students may not receive the necessary mentorship, feedback, and expert knowledge required to excel in their competitive endeavors.

3.4. Inadequate reward system

The existing reward system for teachers involved in preparing students for skills competitions is often inadequate, resulting in demotivation and insufficient recognition. Despite dedicating significant time and effort to mentor students, teachers typically do not receive bonuses or commendations. Moreover, the time

invested in instructing students for skills competitions is not credited toward their teaching hours, which further devalues their contributions. This lack of recognition and tangible rewards undermines the dedication and commitment of teachers, potentially impacting the quality and effectiveness of their mentorship.

3.5. Curriculum misalignment

The misalignment between the existing curriculum in vocational colleges and the requirements of innovative skills competitions presents a notable challenge. The curriculum may inadequately integrate practical project-based learnings, real-world applications, and industry-relevant skills. This misalignment creates a gap in students' preparedness and skills, as they may not acquire the necessary competencies demanded by skills competitions. A comprehensive curriculum revision is necessary to incorporate the specific knowledge, techniques, and problem-solving abilities essential for success in innovative skills competitions, ensuring a seamless transition between education and industry demands.

4. Recommendations

4.1. Improving students' motivation

To address the issue of inadequate students' motivation in skills competitions, vocational colleges should implement a range of strategies. Firstly, mentorship programs should be established, pairing participating students with experienced mentors who can provide guidance and support throughout the competition process. Secondly, recognition and rewards should be offered to all participants, regardless of their academic performance, to incentivize active engagement. These can include certificates of participation, public acknowledgments, and opportunities to showcase their projects to a wider audience. Finally, a culture that celebrates innovation and highlights the benefits of skills competitions should be fostered to raise awareness and encourage more students to participate.

4.2. Increasing financial support

To overcome the challenge of insufficient financial resources and hardware, vocational colleges need to secure larger funding. This can be achieved through partnerships with industry stakeholders, government grants, and fundraising initiatives. The allocated resources should prioritize the acquisition of modern equipment and the establishment of well-equipped laboratories. Additionally, collaborations with industry partners can provide access to cutting-edge technologies and equipment, allowing students to explore innovative ideas and fully realize their potential in skills competitions.

4.3. Professional development for teachers

To address the limitations in teacher capacity, vocational colleges should invest in professional development programs tailored to the specific requirements of skills competitions. These programs should focus on enhancing practical skills, providing hands-on experience, and familiarizing teachers with the latest trends and techniques in relevant domains. Workshops, seminars, and collaborative projects involving industry experts can also contribute to the professional growth of teachers, enabling them to effectively guide and mentor students participating in skills competitions.

4.4. Revamping the reward system

To create a more equitable reward system, vocational colleges should recognize and appreciate the efforts of teachers involved in skills competitions. Bonuses, additional credits, or financial incentives can be provided to teachers based on their contributions to students' success in competitions. Moreover, the time spent on mentoring students should be counted toward their teaching hours, ensuring their efforts are duly

acknowledged and valued. This revamping of the reward system will motivate teachers, leading to enhanced commitment and support for students in skills competitions.

4.5. Curriculum alignment and integration

To bridge the gap between the existing curriculum and the requirements of innovative skills competitions, vocational colleges should collaborate closely with industry experts. Together, they can align the curriculum with the specific skills, knowledge, and practical experiences demanded by competitions. This alignment should emphasize project-based learning, real-world applications, and industry-relevant skills. Integrating practical training modules, internships, and industry partnerships into the curriculum will equip students with the necessary competencies to excel in skills competitions and meet industry demands.

5. Results and prospects

The implementation of the proposed measures can lead to positive outcomes for vocational colleges in preparing for innovative skills competitions. By enhancing student motivation through mentorship programs, recognition, and rewards, colleges can increase participation and engagement across a wider range of students. Additional financial support and modern equipment enable students to explore innovative ideas and enhance project quality. Professional development programs for teachers enhance their capacity to guide and support students effectively, while a revamped reward system recognizes their efforts and boosts their commitment. Aligning the curriculum with the competition requirements ensures that students acquire the necessary skills and knowledge demanded by the industry. These outcomes contribute to a more comprehensive approach to skills competitions in vocational colleges.

Looking ahead, continuous evaluation and improvement of the implemented measures are crucial. Regular assessment of student participation rates, project quality, and teacher satisfaction provide valuable insights into the effectiveness of the strategies. Ongoing collaboration with industry partners, experts, and stakeholders helps vocational colleges stay updated with the evolving demands of innovative skills competitions. Furthermore, research on emerging trends and best practices in skills competitions should inform future policy decisions and curriculum enhancements. By fostering a dynamic and adaptive environment, vocational colleges can prepare students to excel in skills competitions and meet the challenges of a rapidly evolving job market.

6. Conclusions

In conclusion, vocational colleges face challenges in preparing for innovative skills competitions, such as a lack of students' motivation, insufficient financial resources and hardware, teacher capacity limitations, inadequate reward systems, and curriculum misalignment. However, targeted strategies can effectively address these challenges. Enhancing student motivation, increasing financial support, providing professional development for teachers, revamping the reward system, and aligning the curriculum with the requirements of the competitions are key steps to overcoming these obstacles. These measures not only benefit students and teachers but also contribute to the overall advancement of vocational education. By embracing these suggestions, vocational colleges can empower students, foster innovation, and bridge the gap between education and industry demands. The continual evaluation and improvement of these strategies, coupled with collaboration and adaptability, will ensure that vocational colleges remain at the forefront of preparing students for the ever-evolving landscape of innovative skills competitions.

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Reform and Practice of the Course “Road Engineering Construction Technology and Organization” Based on Smart Classroom

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Abstract: Smart classroom is an inevitable result of the deepening integration of new-generation information technology and education means, and it is an unavoidable choice of university education informatization in the intelligent era. The Bridge-in, Outcomes, Pre-assessment, Participatory Learning, Post-assessment, and Summary (BOPPPS) model is used to construct the effective teaching mode of a smart classroom based on the analyses of the connotation and characteristics of a smart classroom, and the teaching reform and practice are carried out on the “Road Engineering Construction Technology and Organization” course. Through a questionnaire survey, it is found that the construction of a smart classroom effective teaching model can fully mobilize students’ learning enthusiasm and improve the efficiency and effectiveness of students’ learning.

Keywords: Smart classroom; BOPPPS model; Teaching design; Teaching evaluation

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1. Introduction

Smart classroom is a new form of a classroom in which information technology and subject teaching are deeply integrated ^[1], but the current classroom interactions are mostly shallow cognitive inputs such as check-ins, quizzes, etc., and lack of activities that can promote students’ deep processing of knowledge such as debates, games, reflections, and cooperative problem solving. The activities and interaction that are superficial do not promote the development of students’ higher-order thinking skills such as imagination and creativity. The use of a “smart classroom” to promote the deep integration of information technology and teaching is worthy of research and exploration. In this paper, an effective teaching model that integrates the characteristics of both the Bridge-in, Outcomes, Pre-assessment, Participatory Learning, Post-assessment, and Summary (BOPPPS) teaching model with the smart classroom is designed, and the course “Road Construction Technology and Organization” is chosen as an example to carry out teaching reform and practice, followed by testing the operability and effectiveness of the model in the process of practice, optimizing the adjustment plan, improving the teaching model to achieve the best effect, and at the same time, providing reference and basis for the teaching reform of similar courses and the development of information technology in universities.

“Road Construction Technology and Organization” course is a professional course of civil engineering that mainly consists of the following: the construction method of soil and stone roadbed; the construction method of asphalt pavement and cement concrete pavement; the construction method of stabilized soil pavement, industrial slag stabilized pavement and block and gravel pavement; and the method of

engineering construction quality inspection. Although the course covers a vast amount of knowledge, the maximum course duration was set at 32 hours, creating a relatively tight schedule. Due to the relatively dull course content and weak students' learning initiative as well as lack of classroom interactions, simple multimedia courseware was insufficient to pique students' interest during the previous teaching process. As a result, current students can only comprehend the course content to a superficial level.

BOPPPS teaching is a new teaching model oriented to educational objectives and centered on students. BOPPPS enhances the practicality as well as the operability of the teaching model. This paper discusses the integration of the smart classroom and BOPPPS teaching in the teaching of the "Road Construction Technology and Organization" course to optimize the teaching design, ensure the smooth implementation of teaching and provide feedback and evaluation of teaching effectiveness.

2. Construction of an effective teaching model of the smart classroom based on the BOPPPS model

The new teaching model is guided by an effective teaching theory, combined with the characteristics of a smart classroom and the specific implementation strategies of the BOPPPS teaching model, extending classroom teaching to before and after class.

2.1. Effective teaching design before class

In response to the problems of insufficient and ineffective pre-course guidance and the lack of relevance of the teaching design plan made by teachers before class, the three aspects of the BOPPPS teaching model, namely Bridge-in, Outcomes, and Pre-assessment, are advanced to the teaching design before class.

2.1.1. Bridge-in

Teachers may use the school's Smart Learning Heavy Industry platform to send students micro-lesson resources, digital teaching materials, online teaching videos or background information of discussion cases based on knowledge background and learning, and other pre-assessment materials. Students may learn independently and discuss interactively using the platform, and teachers can check students' progress and answer questions online through the Smart Classroom Information Technology (IT) platform, hence stimulating students' interest in learning while grasping basic information about the learning situation, and then conducting targeted classroom lectures [2,3].

2.1.2. Outcomes

Based on the introduction of knowledge nodes at an early stage, teachers may use the Smart Classroom IT platform to push the appropriate courseware to highlight the learning outcomes of this course. The key to an effective objective link is to make students aware of their learning direction and improve learning efficiency.

2.1.3. Pre-assessment

The pre-assessment link is an important prerequisite for the implementation of smart classroom teaching, which is used to examine the completion of students' pre-course study and the mastery of relevant basic knowledge so that teachers can conduct a comprehensive analysis of the learning situation, timely adjust the teaching methods and contents, and prepare a suitable teaching design plan. The pre-assessment should be based on the teaching objectives, contents, and students' abilities, and distributed to students through the Smart Classroom IT platform. It can be conducted in various ways, such as time-limited quizzes, assignments, discussions, etc. The teacher can then review and comment through the test evaluation system of the Smart Classroom IT platform.

2.2. Effective teaching design in class

2.2.1. Participatory learning

The participatory learning link is the key to the implementation of smart classroom teaching that emphasizes student-centered interactive teaching, which can stimulate students' interest in learning and active classroom atmosphere, mainly in the form of teacher-student interaction and student-student interaction. Teacher-student interaction refers to the teacher's comprehensive analysis of students' pre-course study situation, using the online classroom or live broadcast function of the Smart Classroom IT platform to create a learning situation, and through reasonable critical thinking and guidance, the teachers then give concise lecture on the course's content, key points, and queries in pre-course, guiding students to gradually comprehend the knowledge. This interaction method can use a variety of teaching strategies such as creating scenarios and promoting critical thinking that inspires to make classroom teaching more innovative, practical, sharing, and interesting. Student-student interaction means that students work in groups and cooperate to explore a specific problem and collaborate to accomplish the target task. In this process, teachers can issue cooperative inquiry tasks through the Smart Classroom IT platform, keep track of the task progress, and communicate, guide, and monitor students' participation and learning through the platform's learning data and pop-ups. The group discussion results are submitted by each group and reported by the group's representative, which is then evaluated by the group and commented on by the teacher, and targeted guidance is given to the queries raised by students in the process of comprehensive knowledge application ^[4-6].

2.2.2. Post-assessment

Effective teaching is not only about what the teachers have taught but also about what the students have learned, and post-assessment can be used to understand whether students have understood and mastered the knowledge nodes and achieved the expected teaching objectives ^[7,8]. Specifically, teachers can set up a post-assessment through the Smart Classroom IT platform, and students can complete and submit the assessment within a limited period of time. Based on the post-assessment results, teachers can then judge whether the teaching and learning objectives have been met, setting the stage for subsequent summaries and reflections on the course.

2.3. Effective teaching design after class

The post-class teaching activity stage mainly completes the Summary link in the BOPPPS teaching model. The main purpose is to summarize and extend the classroom teaching content, and this session requires academic students to submit a mind map as the post-class assignment. In addition to helping students consolidate what they have learned based on extended learning, students are required to study some typical construction cases by themselves in class.

2.4. Application of effective teaching mode of smart classroom based on BOPPPS model

This study has been applied in the course of "Road Construction Technology and Organization", and "Pavement Base Construction" is an important node of the course of "Road Construction Technology and Organization". The specific process of implementing the effective teaching mode based on the BOPPPS model in the intelligent classroom is shown in **Table 1**.

Table 1. The implementation process of intelligent classroom teaching of “Pavement Base Construction” based on the BOPPPS model

Teaching Sessions	Teaching content	Design Intent
Pre-assessment	<p>Sign in through the Super Star Learning Platform - Road Construction Technology and Organization Classroom before the class starts; consciously put away the cell phone when the class begins.</p> <p>Study questions were raised to review the key and difficult contents of the previous class and deepen students' impressions. The data of the questions can reflect the students' mastery of the content of the previous class.</p>	<p>Access to student attendance in real-time</p> <p>Use digital teaching tools to accurately assess students' prior knowledge and how well they have mastered the basics.</p>
Bridge-in	<p>Combine the images of pavement structure layering, point out the role of subgrade to carry on the construction of pavement subgrade, and guide students to think and discuss: the types of pavement subgrade, the scope of application of different types of subgrades, and other issues.</p>	<p>Use images to bring the students' notice to the topic and pique their interest.</p> <p>Introduce students to the content related to this course: base construction</p>
Objectives	<p><i>Knowledge Objectives:</i></p> <ol style="list-style-type: none"> (1) Know the types and characteristics of pavement subgrade and their conditions of application; (2) Be able to correctly describe the construction process of the granular type of subgrade; (3) Be able to correctly describe the construction process and precautions for cement, lime, and lime fly ash stabilized soil type. <p><i>Skill Objectives:</i></p> <ol style="list-style-type: none"> (1) Able to select suitable base materials (2) Prepare a semi-rigid subgrade construction process flow chart (3) Be able to carry out construction quality assessment of pavement subgrade in conjunction with specifications <p><i>Quality Objectives:</i></p> <p>Develop students' research skills and awareness of innovation and environmental protection</p>	<p>Let students know the teaching objectives to be reached in this course and clarify the learning objectives.</p>
Participatory Learning	<p><i>Class Discussion:</i> What are the types of base levels?</p> <ol style="list-style-type: none"> (1) Type and scope of application of granular base (2) Inorganic bonding material stabilized base (also called the semi-rigid base) type and scope of application (3) The construction process of different types of subgrade <p>During the teaching of the construction process, the construction video was played to keep the students interested.</p> <p>After the video is finished, students are familiar with the construction process of the plant mix method, they are then asked to discuss which construction machines appear in the video of the plant mix method construction as a means to emphasize the configuration and selection of base construction machines.</p>	<p>Let students fully discuss and the teacher summarizes to achieve a student-centered classroom effect.</p> <p>Learning Pass initiates discussions and generates word clouds that allow students to master the configuration of construction machinery.</p>

(Continued on next page)

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Teaching Sessions	Teaching content	Design Intent
Learning Objectives Assessment	StudyTalk releases an accompanying assessment to assess students' goal attainment promptly.	Use the Smart Learning Heavy Industry platform to understand students' mastery of the knowledge nodes in real-time, which then highlight the areas of poor mastery in the class summary. Let students summarize on their own, and the teacher will highlight the key points and difficulties during the summarization process.
Summary	<ol style="list-style-type: none"> (1) Substrate type and applicable conditions (2) The construction process of the granular base layer (3) The construction process of inorganic bonding material stabilized the base layer 	Students can then test their memory of the knowledge nodes explained in class, which is conducive to the improvement of the teacher's teaching methods.
Assignments	Case Study	Assign assignments to assess students' achievement of learning objectives.
Course Feedback and Enhancement	<ol style="list-style-type: none"> (1) <i>Expansion and Extension</i>: After the lesson, study the example of a water-stabilized layer construction plan in the "Expansion and Extension" column of the Super Star platform, summarize the construction process and precautions for cement-stabilized soil, and express opinions in the comment section. (2) <i>Course Feedback and Q&A</i>: Active feedback on learning issues and participation in interactive Q&A through online learning platforms or Internet means after the class. 	

3. Analysis of the effectiveness of smart classroom teaching based on the BOPPPS model

After the study of the course "Road Engineering Construction Technology and Organization", a questionnaire survey was conducted on the effectiveness of the new teaching model by using the questionnaire function of the Learning Pass platform. According to the four basic characteristics of effective teaching content, there are six question items ^[9,10]. The survey revealed that all students thought that the rich learning materials and clear learning objectives before class gave them a study direction and helped in study planning; 82% of the students thought that the pre-assessment allowed the students to understand how much they had mastered the basic knowledge through pre-course study; 96% of the students recognized the teacher's leading role and their main role in the teaching process, and believed that the problem discussions and group reports in class enhanced their enthusiasm and initiative in classroom teaching; 89% of the students believed that the group discussions in class could strengthen their cooperation and communication with their classmates; 85% of the students believed that the post-assessments and summaries could help them learn the course well and expand knowledge; 89% of the students think that the classroom environment and atmosphere created by the model can motivate them to learn better. This shows that the new teaching model is not only widely recognized by students but also has four basic characteristics

of effective teaching.

4. Conclusion

Guided by the effective teaching theory and the specific implementation strategies of the BOPPPS teaching model as well as the characteristics of the smart classroom, the effective teaching model of the smart classroom based on the BOPPPS model was constructed and practically applied based on the course “Road Engineering Construction Technology and Organization”. The results show that the teaching effect and quality of the teachers, students’ learning interest, classroom participation, and learning effect have been significantly improved under the new teaching model, which is well received by students.

Disclosure statement

The author declares no conflict of interest.

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Comparative Study of Internationalized Talent Cultivation Models in International Higher Education Programs

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Abstract: The internationalization of talent cultivation in the field of international higher education is a widely discussed topic among higher education institutions worldwide. This paper conducts a comparative study of domestic and foreign higher education institutions and identifies some differences in the internationalization of talent cultivation among different countries and regions. Firstly, the study summarizes the changes in talent cultivation through domestic study abroad programs and overseas study programs. Then, this paper introduces the “Knowledge-Practice-Research” international talent cultivation model in China and the international talent cultivation model in Japan as an example. Finally, this study compares the international talent cultivation models in domestic and foreign higher education institutions. The results indicate that the internationalization of talent cultivation models needs to be adjusted according to different training objectives, specific countries, and even regional circumstances to adapt to local characteristics and the international environment. Overall, different countries and regions have different emphases and characteristics in the internationalization of talent cultivation in higher education institutions. However, regardless of the country, higher education institutions should focus on enhancing students’ international perspectives and cross-cultural communication skills to adapt to the globalized economic and social environment.

Keywords: International higher education; “Knowledge-Practice-Research” international talent cultivation model; International perspective; Practical ability; Cross-cultural communication

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1. Introduction

With the accelerated process of globalization, exchanges and collaborations in the fields of economy, politics, and culture among countries have become increasingly frequent ^[1,2]. As an important method of talent cultivation, higher education also needs to adapt to this trend and provide better opportunities and platforms for nurturing talents with international perspectives and cross-cultural communication abilities ^[3,4]. Therefore, the internationalization of talent cultivation models has become a widely discussed issue in domestic and foreign higher education.

The internationalization of talent cultivation models in the field of international higher education is a global issue. The comparative study of the internationalization of talent cultivation models in international higher education is still in its early stages. Still, some scholars have already started to pay attention to this issue and conducted exploratory research. In foreign countries, higher education institutions in developed countries and regions such as Europe, the United States, Canada, and Australia have conducted in-depth

and mature research and practice on the internationalization of talent cultivation ^[5]. Among them, European higher education institutions focus on fostering cross-cultural communication and language abilities, encouraging students to participate in global exchanges and collaborations actively ^[6,7]. Higher education institutions in the United States emphasize the development of students' leadership and innovation spirit, encouraging them to actively engage in social practices and research projects ^[8,9]. In countries like Australia and Canada, higher education institutions pay more attention to cultivating students' career aspirations and social skills, advocating their active participation in social activities and volunteer services ^[10,11]. In China, many scholars have researched and explored the internationalization of talent cultivation models in international higher education, mainly involving curriculum design, educational methods, and faculty development ^[12,13]. Additionally, domestic higher education institutions have also actively explored and practiced the internationalization of talent cultivation models by offering programs such as cross-cultural communication training, overseas study, and international internships, striving to enhance students' international competitiveness and global perspectives ^[14].

Overall, research and practice on the internationalization of talent cultivation models in international higher education are quite active both domestically and internationally. Countries have certain differences in emphases, methods, and strategies. Still, they all aim to provide better opportunities and platforms for students and cultivate talents with international perspectives and cross-cultural communication abilities.

2. Method

2.1. The current situation of training internationalized talents in international higher education majors

The internationalization of talent cultivation in international higher education refers to the cultivation of high-quality talents with international perspectives, cross-cultural communication abilities, and global competitiveness through establishing cooperation and conducting academic exchanges worldwide ^[15]. Such talents possess sensitivity and understanding of different cultural backgrounds and social environments, enabling them to adapt and integrate into diverse global work and living environments. They demonstrate outstanding performance in various fields, positively contributing to global sustainable development and international peace and cooperation ^[16,17]. Achieving the internationalization of talent cultivation in international higher education requires universities to innovate and reform education, teaching, and cultivation models emphasizing interdisciplinary learning and cross-disciplinary studies, actively engaging in international exchanges and collaborations, and enhancing students' international literacy and competitiveness ^[18]. This paper focuses on the current status of internationalized talent cultivation by comparing the number of Chinese students studying in foreign countries and international students studying in China.

2.2. Internationalized talent cultivation models in foreign higher education

Internationalized talent cultivation has become an important indicator to evaluate whether a country's higher education possesses international perspectives and global competitiveness. As a member of developed countries, Japan holds a leading position in education, economy, technology, and various other aspects ^[19,20]. This paper analyzes a series of internationalized talent cultivation policies launched by Japan in recent years, such as the Global Human Resource Development Program, the Top Global University Program, and the Study Abroad Aid System. It summarizes the characteristics of its internationalized talent cultivation model. It provides references for constructing a new model of internationalized talent cultivation in China from the perspectives of the government, universities, and teachers.

The Japanese government considers internationalized talent cultivation as a fundamental strategy for 21st-century school education. Accordingly, it has formulated corresponding policies to promote

international exchanges in schools at all levels and actively cultivate students' international perspectives. In 2014, the Ministry of Education, Culture, Sports, Science, and Technology formulated the Global Human Resource Development Program to enhance the internationalization level of Japanese universities and provide financial support for various international education programs. **Figure 1** illustrates the indicator system of the internationalized talent cultivation model in Japanese higher education.

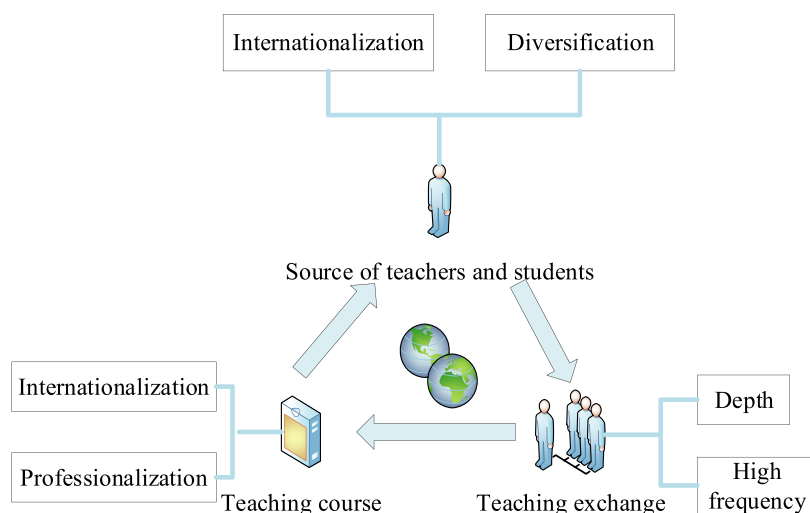


Figure 1. Internationalized talent cultivation system in Japan

2.3. Training model of domestic “Knowledge-Practice-Research” international talent

The talent cultivation model is based on the ideas, goals, and requirements of talent cultivation and represents the formalization of a certain set of ideas, goals, and requirements for talent cultivation. In the undergraduate program of Chinese International Education, although there are overall requirements for talent cultivation goals and specifications, the diversity of schools offering this major, their learning environments and employment prospects lead to diverse talent cultivation models in this field. Taking the Chinese International Education program at the Minzu University of China as an example, this paper proposes the “Knowledge-Practice-Research” internationalized talent cultivation model. **Figure 2** presents the system of the “Knowledge-Practice-Research” talent cultivation model.

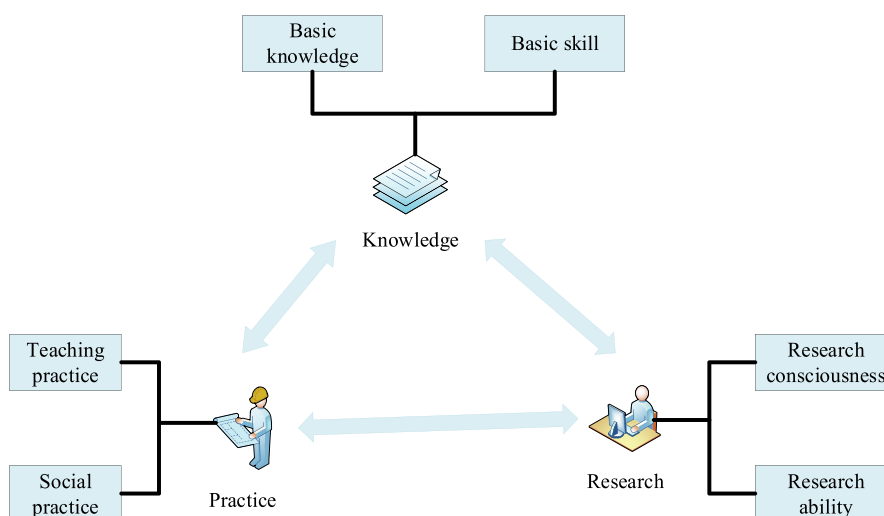


Figure 2. “Knowledge-Practice-Research” talent cultivation model

In **Figure 2**, “Knowledge” refers to the cultivation of basic knowledge and skills in the field, including Chinese and English language proficiency, as well as theoretical knowledge in literature, culture, and educational instruction. “Practice” involves students applying the knowledge and skills they have learned in specific teaching and practical activities under the guidance of teachers, testing their grasp of the knowledge and skills. “Research” has two implications: first, cultivating students’ research awareness and certain research abilities to prepare them for academic and professional Master’s programs, and second, developing students’ research abilities to identify, analyze, and solve problems encountered in teaching and practical activities.

3. Results

3.1. A summary of the current situation of nationalized talent training in international education majors

The major of international education aims to develop talents with international vision and intercultural communication skills to meet the needs of various industries in the context of globalization. Currently, International Education has gained recognition and development in many countries. There are also some differences in talent cultivation approaches among different countries. **Figure 3** illustrates the changes in the number of outbound and inbound students in China from 2010 to 2021.

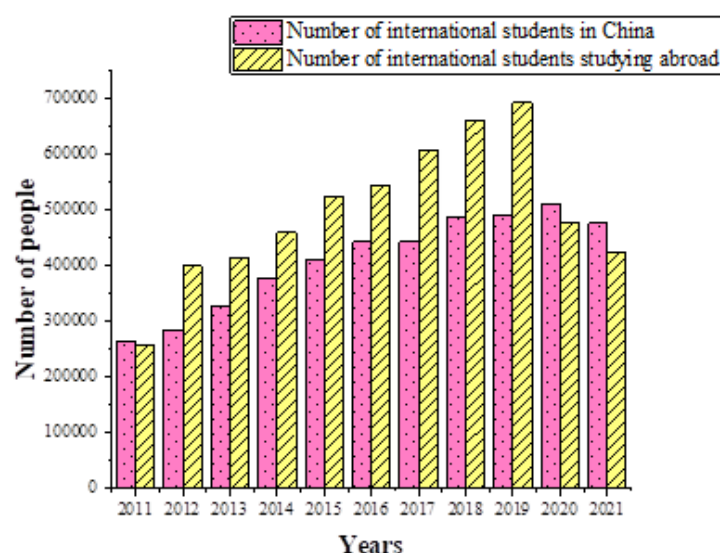


Figure 3 Situation of Outbound Study and Inbound Study in 2011-2021

In **Figure 3**, the number of Chinese students studying abroad showed a rapid increase followed by a slight decline and then a rebound. In 2019, the number of Chinese students studying abroad reached a record high of 665,000. It is expected that in the future, with further globalization and the strengthening of international educational cooperation and exchanges, the number of Chinese students studying abroad will remain relatively high. From 2010 to 2020, the number of international students studying in China showed an increasing trend year by year. Although the number of international students studying in China decreased significantly in 2020 due to the COVID-19 pandemic, it is expected that with the control of the global epidemic and the deepening of China’s opening-up policy, the number of international students coming to China to study will maintain a relatively high level.

3.2. Comparison of internationalized talent cultivation models in domestic and foreign higher education programs

There are some differences in the internationalized talent cultivation models between domestic and foreign higher education programs. However, education needs to focus on cultivating talents with international competitiveness to adapt to the development trend of the globalized economy. This paper will compare the “Knowledge-Practice-Research” internationalized talent cultivation model in domestic education with the internationalized talent cultivation model in foreign higher education programs, taking Japan as an example, in terms of talent cultivation objectives, main training directions, study courses, support for training programs, and competency requirements. The comparison is summarized in **Table 1**.

Table 1. Comparison of Internationalized Talent Cultivation Models in Domestic and Foreign Higher Education Programs

Index	“Knowledge-Practice-Research” Model (Domestic)	Japan (as an example) Internationalized Talent Cultivation Model (Foreign)
Talent Cultivation Objectives	Cultivating talents with international perspectives and cross-cultural communication abilities to meet global demands.	Cultivating talents with international perspectives and global competitiveness.
Main Training Directions	Focuses on the cultivation of basic knowledge and skills, practical application of knowledge in teaching activities, and research abilities.	Emphasizes interdisciplinary learning, practical experience, and research-oriented education.
Study Courses	Includes Chinese and English language proficiency, literature and culture, and theoretical knowledge in education.	Offers a wide range of courses with a focus on international affairs, language proficiency, and specialized knowledge.
Support for Training Programs	Provides support for academic and research activities, teaching internships, and opportunities for international exchanges and cooperation.	Offers funding support for various internationalization programs, such as global talent development plans and scholarships for studying abroad.
Competency Requirements	Requires research awareness and abilities, problem-solving skills, and preparation for academic or professional master's programs.	Focuses on developing global competence, including language proficiency, cross-cultural communication, and adaptability to diverse environments.

In **Table 1**, regarding the comparison of internationalized talent cultivation models in domestic and foreign higher education programs, talent cultivation aims to strengthen international cooperation and cultivate globally competitive and high-quality academic talents. However, there are slight differences in the objectives and approaches to cultivation due to national circumstances. Language proficiency and professional competence are essential in domestic and foreign programs. However, in domestic programs, there is a certain level of expectation for academic attitudes. Additionally, there are differences in policies, with domestic policies primarily focusing on government and university collaboration in establishing or participating in internationalization projects, while government initiatives primarily guide foreign policies.

4. Conclusion

In the context of globalization, an increasing number of countries are adopting transnational cooperation to integrate the advantages of different nations and provide students with diverse educational experiences and opportunities. This paper first analysed the current status of internationalized talents in higher education.

The results indicated an upward trend in international talent exchange in recent years, despite a decline in 2019–2020 due to the impact of the COVID-19 pandemic. However, with the overall recovery in recent years, the trend of talent exchange is expected to continue to rise. The paper then introduced the “Knowledge-Practice-Research” internationalized talent cultivation model in domestic education and the internationalized talent cultivation model using Japan as an example, followed by a comparison of these two models. The results show that internationalized talent cultivation models need to be adjusted according to specific training objectives and the specific circumstances of different countries or regions to adapt to local characteristics and international environments. This provides valuable experiences and insights that can be learned from other countries and regions, thereby promoting the global internationalization and exchange of higher education. However, it should be noted that most comparative studies have focused on developed countries, while there is relatively little comparative research on developing countries and regions. In the future, it would be beneficial to strengthen comparative research on developing countries and regions in order to have a more comprehensive understanding of talent cultivation models in various countries and regions worldwide.

Disclosure statement

The author declares no conflict of interest.

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Analysis of Winter Physical Training and Functional Reserve in College Physical Education Teaching

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Abstract: Physical training and functional reserve in winter physical education teaching can optimize the energy consumption of the body, regulate cardiopulmonary function, and stabilize emotions. It is essential to clarify the strategies of winter physical training and functional reserve as well as the existing issues in college physical education teaching, which subsequently improves students' physical functions and achieves comprehensive development goals.

Keywords: College physical education teaching; Winter; Physical training; Functional reserve

Online publication: July 12, 2023

1. Introduction

In recent years, along with the deepening of teaching reform, people have paid more attention to teaching quality while pursuing teaching content, especially in the development of physical education teaching work and activities. Meanwhile, it plays a role in promoting its overall development. To help achieve this goal efficiently, this article focuses on winter sports teaching and explores its physical training and functional reserve methods ^[1].

2. The importance of physical training and functional reserve in winter physical education

Exercise can alter specific physiological functions of the human body, which is concluded after long-term practices and studies, and has been widely acknowledged by society. Through winter training, the physiological functions of the human body can undergo positive changes based on the individual's stable state, and allow individuals to obtain ideal exercise effects, which is also the ultimate goal of winter training ^[2].

2.1. Optimization of the body's energy consumption

The types of energy consumption of the body are divided into natural consumption and exercise consumption. For individuals who do not exercise for a long time, the relevant functions of the body will slowly lose their original capabilities. The acquisition and improvement of their skills can be accomplished through physical training, which had good implications for the body's optimal use of energy.

2.2. Regulation of cardiopulmonary function

Individuals who often participate in sports often have a good cardiopulmonary function and a relatively

strong adaptability to various sports. In contrast, individuals who do not participate in sports often experience exercise overload, as their cardiopulmonary function will find it difficult to adapt to the exercise, and there is a high possibility of malignant, dizziness, fatigue, aerobic metabolic disorders, and other conditions. Physical training in winter can activate the inertia of muscles, accelerate the frequency of muscle contraction in a low-pressure environment, optimize cardiopulmonary function, and achieve the purpose of energy storage in the body ^[3].

2.3. Emotional balance

Individuals' emotions alter during the change in exercise intensity, and emotional fluctuations will affect not only physiological functions but also sports performance accordingly. To achieve a stable exercise emotion, individuals need to adjust the exercise intensity according to their requirements. Therefore, winter physical training allows individuals to adapt to the changes in exercise intensity and stabilize their mentality to a certain extent.

3. Current existing problems in college physical education teaching

In analyses of the current actual development of college physical education teaching, physical education teachers were found to pay too much attention to the explanation of textbook theories. Many physical education teachers use a single teaching mode to speed up the completion of teaching tasks. In the process of teaching work, the dynamic communication between teachers and students is lacking as the teachers are focusing on demonstration. In addition, although some colleges and universities in our country have set up special physical education departments, the investment in sports funds is lacking as compared with other teaching subjects. Some colleges and universities have problems with old sports equipment and insufficient professional venues. Moreover, some physical education teachers use various methods to help students meet the assessment standards, but they do not pay enough attention to the spiritual core of sports. Different sports have varying challenges, and some entail a risk of injury, hence some students may choose sports with minimal challenges to pass the course assessment easily, which could hinder the development of students' comprehensive sports quality.

4. Winter physical training and functional reserve strategy in physical education teaching

4.1. Teaching activities in combination with the natural environment

As the northern region of our country is colder during winter due to its natural environment, many sports events are idle in this period. In this context, the migratory bird-style terrestrial professional training has been transferred to the southern region, but its effectiveness has yet to be verified, and the expense is exorbitant. To reduce the economic burden while highlighting the role of training, some college physical education teachers utilize the characteristics of the winter climate to allow students to reserve their physical functions through circular training ^[4].

From the perspective of sports training during spring, the human body enters a burnout period, and physical training stimulates the vitality of the human body. If appropriate methods are used to train students, it can effectively adjust their relative functions of the human body and improve their sports performance. Therefore, physical education teachers should seize the opportunity of spring teaching to strengthen the training of students' physical fitness. Summer in our country is often scorching, and students will sweat a lot while exercising, leading to higher consumption of their body functions. Students will become lethargic if the replenishment is not timely. In order to prevent such situations, physical education teachers should employ flexible training methods that not only strengthen students' physical training but also optimize their sports skills which then effectively improve their sports performance. Wintertime is a vital period for performance improvement despite the human body skills have entered a period of fatigue from spring and

summer training. Physical education teachers should utilize wintertime as the harvest season to provide an important guarantee for the students' functional reserve. Physical education teachers should shift the focus from vigorous functional training to relaxing functional reserve. It is unwise to restrict the process of physical training by conventional and old habits and disregard the fundamentals of human movement. Instead, scientific and efficient methods should be applied while comprehending the law of nature, which then exert great influence on the human body. Therefore, adaptability is highly required to benefit sports training.

4.2. Adjustment of the training content according to the regional conditions

Winter training is a necessary component of physical education activities as it demonstrates a particular level of continuity. Currently, some colleges and universities in the northern region choose to shorten the winter training time in consideration of climate conditions, whereas some colleges and universities cancel winter training, hence reducing the physical fitness of students and hampering the cultivation of exercise habits. In order to solve the mentioned problems, physical education teachers can adjust the training time, preferably an hour arranged between 6:00 am and 5:00 pm, and can also be divided into the morning segment and the afternoon segment to complete the 1-hour training content, which is essential for students' sports training and positive cultivation of habits. In addition, teachers can utilize the campus infrastructure and arrange for physical training activities indoors, which included high leg lifts, barbell presses, barbell squats, etc., so that students can achieve functional reserves. Furthermore, teachers can formulate corresponding maintenance plans, regularly check and repair sports equipment, and remind relevant personnel to replace damaged equipment. Under the leadership of teachers, students can also participate in certain sports related to local climate conditions, such as skiing and skating exercises in cycles, hence achieving reasonable relief of students' learning pressure.

4.3. Improvement of students' physical fitness through scientific and effective training plans

The formulation of excellent training plans is crucial in the students' winter sports training. Some physical education teachers have continued the use of traditional training plans for a long time during physical education teaching, leading to no improvement in the students' physical fitness. There is also a high possibility of causing muscle wear and tear, which will eventually have an adverse effect on the students' physical health. Therefore, teachers need to formulate a qualified and efficient winter training plan, in combination with the actual situation of college students, to achieve a comprehensive and effective improvement of their physical fitness in a targeted manner. In the process of formulating the teaching plan, physical education teachers need to combine scientifically and effectively with the curriculum arrangement of colleges and universities to ensure the efficiency of the training plan.

For instance, physical education teachers can combine the actual characteristics of college students' professional courses, where the teachers of each subject can perform unified coordination work and make overall arrangements for course content and training plans. As advanced mathematics is intricate, physical education teachers may combine with the content of the subject list and offer physical education courses after advanced mathematics courses, hence relieving the learning pressure of students. In addition, teachers can effectively distinguish the students' abilities in a targeted manner during the process of winter training, where students' leg endurance is trained on the first day through barbell squat training, in which the weight of the barbell is determined based on the actual physical condition of the students, followed by pull-up exercises on the second day to strengthen students' back and arm muscles. Female students may perform exercises such as supine leg lifts to enhance their abdominal muscles and core stability. Within a week, the training of students' different body parts can be carried out to improve their overall physical fitness.

4.4. Optimization of the assessment and examination methods, and adjustment of the hierarchical learning status

In the process of physical education assessment for students, physical education teachers need to ensure the richness of assessment content and the rationality of assessment standards, while effectively combining teaching objectives and assessment methods at different levels, so as to achieve accurate and objective assessment of students' actual situation. The purpose of evaluating the learning situation is to avoid diminishing students' self-esteem caused by substandard test scores. Teachers should stimulate students' enthusiasm for physical education and physical training through scientific and reasonable assessments so that they can continue to work towards higher goals.

Physical education teachers need to combine the actual situation of groups at all levels as well as provide students with patience and targeted guidance during the physical training process. If students fail to achieve specific training goals, physical education teachers need to make corresponding adjustments based on the actual training situation. In the process of continuous feedback and adjustment, the physical training effects are continuously improved and optimized, the information on students' physical training is enhanced, and their interest in sports participation is stimulated.

5. Conclusion

In general, due to the constraints of winter weather conditions, it is challenging for students to achieve the goal of long-term physical training and functional reserve, which in turn restricts the improvement of their sports performance. In light of the current circumstances, physical education teachers should adopt appropriate methods to carry out winter physical education teaching in order to effectively stimulate students' sports enthusiasm while improving their physical performance, which then improves students' physical functions and achieves all-round development.

Disclosure statement

The author declares no conflict of interest.

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Discussion on the Cultivation of the Core Quality of Middle School Students' Physical Education in Primary School Physical Education Teaching

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Abstract: In the context of quality education, a wider exploration of physical education has been carried out, but at the same time higher requirements have been put forward for school sports courses. It is essential to pay attention to the teaching and training of physical knowledge and skills in physical education training as well as cultivate the core physical literacy of primary school students. The core quality of physical education is the main part of the basic quality of primary and middle school students, which is of great significance to their learning and development. This article will explore the training methods of primary and middle school students' basic quality in school physical education courses for reference.

Keywords: Physical education; Core literacy; Training strategies; Curriculum standards

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1. Introduction

In education, the basic position of physical education is very important. In addition to improving students' physical and mental health, it can also set them up for future success. By systematically understanding and practicing sports proficiently, students can develop their physical, mental, and moral character. The current age group is a critical moment for children's growth. Therefore, when conducting physical education classes, teachers should not only provide rich physical education courses but also pay attention to cultivating children's comprehensive quality to promote their overall growth.

2. The concept and characteristics of the core literacy of physical education

According to the latest syllabus, teachers need to use effective and scientific teaching methods to cultivate students' core qualities, so that they are proficient in all learning content and have good practical skills to better face daily life challenges. "Core literacy" can be understood as a comprehensive assessment of a person's professional level and ability. It can help a person understand and develop their professional field more comprehensively, as well as integrate into their professional field more quickly. For example, the word "sports" can be understood as a comprehensive evaluation of a person's professional level and ability, which can help a person understand and develop their professional field more comprehensively, as well as integrate into their professional field. Individuals can improve the mastery of their sport by putting their sports knowledge into practice^[1].

"Sports cognition" can be defined as an individual mastering the basic concepts of sports, including basic theories, methods, and steps, which then carry out better daily physical training and thus achieve a

good state of health. “Healthy” means that an individual has a certain awareness of health, will actively participate in daily physical training, and always maintain a positive attitude. “Good social adaptability” means that through effective training, an individual can not only improve physical and mental qualities but also integrate into the social environment more actively. Given precise definitions, a scientific basis for the setting of physical education courses and the construction of knowledge can be provided, so as to better cultivate students’ core literacy ^[2].

3. The importance and significance of sports core literacy

3.1. Lay a good physical foundation

Attention is given to the fundamental function of the body for enhancing physical fitness. In order to meet the needs of the times and the development of the economy and society, physical fitness is the capital of the revolution. Groups with high core physical fitness can certainly exercise for life, and they can also exercise independently and live a healthy life, and keep their bodies in a healthier state for a long time.

3.2. Improve the sports awareness of the whole people and enhance their physical health

Cultivating students’ sports core literacy enable students to exercise independently, which is conducive to improving students’ physical fitness. Students who master the fundamentals of sports, sports skills, and scientific methods of exercise are better able to improve their ability to exercise independently. This will be a lifelong benefit as it improves their physical awareness and enhances their physical fitness level.

3.3. Shaping comprehensive talents adapting to social development

Improving the professional quality of students in physical education enables them to have excellent psychological control skills. The level of work pressure across various industries in contemporary society is extremely high. Many mental diseases may arise if students do not have excellent self-regulation skills. To successfully handle social work in the future, students need to enhance their psychological control skills and social adaptation.

4. Main content of core literacy training in physical education

4.1. Cultivate healthy and hygienic behaviors.

In today’s society, maintaining physical and mental health and well-being has become everyone’s responsibility. Therefore, a good environment is required for physical and mental development in elementary school, so that children can enhance their physical and mental health through daily exercise and communication. Meanwhile, it is recommended to actively participate in various sports that allow children to continuously improve their physical and mental states during the process of sports and exercise, as a means to improve their physical and mental health. Hence, students’ development of good health and hygiene habits can be achieved through learning about their behaviors and habits ^[3].

4.2. Teach sports skills.

Children’s physical and mental health can be improved through systematic curriculum and targeted assistance. However, relying solely on the direct guidance and coercion of teachers may leave children feeling exhausted and reduce their physical fitness. Especially in elementary school, children’s cognitive levels may not be high enough. Therefore, teachers should take cultivating children’s core values of sports as a key task, and let children contact and practice various beneficial sports in class, thereby improving their overall quality.

5. Problems in the process of cultivating the core literacy of primary school sports

5.1. No established scientific training system

In order to improve children's physical fitness, their physical and mental health can be strengthened through a comprehensive physical education program. This requires a development of a comprehensive training plan and ensuring its implementation accurately. At the same time, teachers are required to guide children seriously and responsibly, so that they can better understand and be familiar with these contents. Through these measures, children may be able to better develop their physical fitness and be more willing to communicate with others, leading to better integration into society. Students can then realize the value of sports and find sports as a joyful and marvelous activity. Meantime, teachers are recommended to design a set of sports plans suitable for students according to their characteristics and allow them to participate in it so that the students' sports skills and core literacy can be better cultivated. However, currently, many primary school physical education courses have not established a complete training system, which makes them unable to fully develop their potential, thereby interfering with children's physique and ability development ^[4].

Due to the traditional education model, many primary school teachers lack pertinence when conducting physical training and only allow students to perform a single training. This leads to students' fatigue, reducing their enthusiasm for sports and hindering their development of core sports literacy.

5.2. Lack of attention to the cultivation of the spiritual quality of primary school students

Children's physical education needs to be improved so that they can not only use the acquired sports knowledge skillfully but also develop the perseverance that is crucial for their growth. Many outstanding athletes have won Olympic gold medals. Their tenacity and perseverance are the main driving forces behind all of these achievements. However, the current elementary school physical education teachers do not focus enough on fostering children's perseverance, which causes them to be easily frustrated when encountering challenges, lose interest in participating in physical exercise, and ultimately result in their ineffective development of core abilities. Resilience is vital to children's physical and mental health while providing a solid foundation for their future development.

In-depth research showed that many primary school physical education teachers are not aware of the importance of physical education courses in cultivating students' various qualities during the teaching process. For example, when teaching basketball techniques, they often focus on imparting knowledge and demonstrating techniques followed by allowing students to move freely and form teams to compete without paying attention to cultivating their spiritual qualities.

6. Strategies for cultivating students' core literacy in primary school physical education teaching

6.1. Stimulate participation interest and strengthen literacy cultivation

By using interests as a guide, the physical education classroom can be explored in greater depth to create a relaxed, harmonious, and fun-filled classroom atmosphere, help students to study more attentively, and enhance their understanding of classroom content. More people can be engaged through a variety of games to promote their active participation in the classroom content. For students of different ages, curriculum content can be formulated according to their personalities and their interest can be stimulated through appropriate teaching activities. At the same time, humanistic education should be the priority to broaden the scope of sports and moral education and to fully develop core abilities. Through the vibrant and challenging activity, students not only acquire knowledge faster and stimulate their competitive nature but also greatly improve the effectiveness of the classroom.

6.2. Pay attention to theoretical study and cultivate the foundation of sports culture

Generally speaking, primary school physical education includes a series of recreational and competitive sports, such as swimming, running, playing table tennis, and badminton. But some people think that it is more like a comprehensive course that includes both theoretical knowledge and practical operation. Therefore, when conducting elementary school physical education classes, teachers need to care about the physical and mental health of students and help them better understand and master the basic knowledge of physical education. The phrase, “to promote their self-awareness, they must be subjective,” emphasized the importance of effective classroom teaching in enabling students to comprehend and apply the phrase in depth to succeed, which will then develop their passion and devotion to sporting activities. Therefore, in order to improve the physical and mental health of primary school students, teachers need to continuously improve their teaching concepts and methods, and focus the curriculum on practical activities, such as improving physical and mental health through the use of various multimedia and sports equipment ^[5].

6.3. Strictly design the teaching process to cultivate rule awareness and cooperation ability

Rules, teamwork, and core competencies are essential in sports disciplines. Although competition is inevitable, adhering to the rules is more important. Teamwork is the key to improving the team's cooperation and competitiveness during the game and ultimately winning. Under the guidance of physical education core literacy, teachers should focus on cultivating students' awareness of rules and cooperation ability, so that they can better abide by the rules in daily life, study, and future life journey, and can establish a good relationship with other associations.

7. Conclusion

In primary school physical education teaching, cultivating students' core sports literacy is very important for the growth of students. Teachers should take the core literacy of students as an important criterion for measuring the physical ability of primary school students, fully consider the actual situation and needs of students, set up courses, and help them participate effectively. Moreover, teachers also need to integrate humanistic thinking into sports education courses that can not only cultivate their sports awareness but also cultivate their practical skills, which is crucial for their future development.

Disclosure statement

The authors declare no conflict of interest.

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Application Experience of Case-Introduction Teaching in the Pathological Regulation Teaching of the Lymphohematopoietic System

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Abstract: Pathology is the gold standard for clinical diagnosis and an important bridge between clinical work and basic disciplines. Therefore, training qualified clinical pathologists is very important for clinical work. It is challenging to diagnose lymphohematopoietic diseases in practice since they made up a large percentage of resident doctors' standardized training and there are numerous knowledge nodes associated with them. Therefore, this training base adopts the "case-introduction" teaching mode to help resident doctors master the knowledge nodes required by the outline in the study of lymphohematopoietic system pathology.

Keywords: Case-introduction teaching mode; Lymphohematopoietic system pathology; Regulation teaching

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1. Introduction

The standardized training of resident physicians has become a necessary experience stage in the lifelong education of medical students, and it is an important post-graduation medical education model ^[1]. The ultimate goal of the standardized training of clinical pathology residents is to cultivate qualified and independent practicing physicians who can undertake the work of pathological diagnosis ^[2]. In the past, the general training of pathologists mainly adopted the training mode of "passing, helping, and leading". Therefore, it is necessary to explore a new training mode in the standardized training of clinical pathology residents ^[3]. According to the characteristics of professional teaching and training, this training base implements the "case-introduction" teaching mode in the training work, which is of great significance to improve the quality of training.

2. The necessity of exploring new training models

The traditional pattern of pathological training and teaching begins with theoretical lectures, followed by practical image reading, and ends with quality feedback. This model is more practical in the teaching of relatively simple disease systems, and students can quickly master the content. However, it is not suitable for the teaching of multiple complex disease systems due to its difficulty, and the students are unable to comprehend the knowledge quickly which leads to forgetting the topic easily. Therefore, it is imminent to explore a new residential training mode. This training base takes the diseases of the lymphohematopoietic system as the entry point and conducts teaching through the "case-introduction" teaching mode, by which

the difficulties are solved and knowledge nodes are delivered, allowing the students to comprehend swiftly and easily. The “case-introduction” teaching mode is proven to be effective, hence it is well recommended for this teaching mode to be widely used.

3. Carrying out “case-introduction” teaching in the lymphohematopoietic system

There are many clinical and pathological diagnoses, and the diagnostic criteria of each system are different, especially the diseases of the lymphohematopoietic system, which is a major difficulty in teaching and learning. There are many types of classification in this system, and morphological diagnosis is difficult. Accurate diagnosis requires a comprehensive analysis based on the results of four aspects: clinical history information, pathological microscopic characteristics, immunohistochemical phenotype, and molecular genetic characteristics ^[4]. Meanwhile, molecular genetics has developed rapidly in recent years, and the WHO classification of this type of tumor has been continuously updated ^[5]. Therefore, in order to improve the diagnosis level of pathological resident trainees in diseases of the lymphohematopoietic system, it is necessary to have a systematic and comprehensive understanding and mastery of the structure, benign lesions, and malignant lesions of systemic diseases. Professional knowledge of clinical pathology given through the form of case studies allows resident physicians to get started quickly, find the skills and methods of clinical pathology learning, and improve the level of pathological diagnosis ^[6]. This method puts forward higher requirements for the teaching plan of the clinical pathology standardized training base, especially for the teaching work of the teaching teachers. The following is the operation method.

- (1) Selected standardized cases: the department is the national standardized training base for resident physicians, as well as the molecular pathology and early diagnosis laboratory of tumors in Hebei Province. It has a wealth of senior talents: the chief and the deputy chief physicians have experience of more than 5 years, all the teachers in this base have a Master’s degree or above, are engaged in the lymphoma subspecialty, and are under the tutelage of Beijing Friendship Hospital affiliated with Capital Medical University and Shanghai Ruijin Hospital pathologists who have rich experience in pathological diagnosis. The hardware facilities of this training base are complete: including Hisense multimedia pathological consultation and display teaching system, multi-head high-resolution microscope, Langjia electronic graphic analysis system, electronic medical record platform, pathological slide diagnosis, Chinese and English pathology books, and CNKI network database service platform based on Baoding First Central Hospital. The teaching team of this training base has 13 members, including the teaching director, the teaching secretary, and the teaching teachers (at least senior attending physicians who have been rated as attending physicians for more than 5 years), with solid basic knowledge of pathology, rich clinical knowledge of pathology, and rich experience in clinical teaching and familiarity with the clinicopathological manifestations of lymphohematopoietic system diseases, who are competent for this teaching and training mode. The teaching team draws up the teaching plan and lesson preparation in advance: each standardized case, with typical pathological morphology, is jointly selected by at least 2 leading teachers who are deputy chief physicians or above. In the process of preparing lessons, classic cases were selected, and theoretical knowledge was interspersed across the students to avoid the traditional phenomenon of “full classroom irrigation” ^[7]. Firstly, the outline requirements are clarified to master the content, including reactive hyperplasia, inflammatory lesions, common types of lymphoma, common leukemia and lymphoma involvement in bone marrow, metastatic cancer, hypersplenism, common lymphoma, and vascular tumors. Before carrying out accurate cases, the groundwork is initially laid out, and “onion skin” teaching (explained under a multi-head microscope) on basic knowledge such as the normal structure of lymph nodes and cell differentiation is given, followed by classification and explanation based on the students’ understanding. Three cases of reactive hyperplasia and inflammatory lesions each as well as two cases

of each pathological type of small B-cell lymphoma, diffuse large B-cell lymphoma, Hodgkin's lymphoma, and peripheral T-cell lymphoma are selected. Inflammatory lesions and lymphomas are explained step by step, from simple to difficult, at various stages of disease progression, in order to help students memorize knowledge nodes as quickly as possible.

- (2) Introduce standardized cases: the teacher and students observe pathological sections under a multi-head microscope. In order to improve students' interest in learning, selected standardized cases are introduced and clinical cases are used to guide lessons so that students have an intuitive understanding of clinical pathological forms. While explaining the theoretical knowledge and organizational characteristics of cases, clinical manifestations and meaningful examination results of patients are timely interspersed, allowing the integration of theory with practice, which is more helpful for pathology trainees to comprehend and memorize the knowledge quickly. For lymphomas that are difficult to be diagnosed by ordinary hematoxylin-eosin (HE) staining, interpret the results of immunohistochemical indicators, fluorescence in situ hybridization (FISH), and gene rearrangement are interpreted and the significance of each indicator, as well as its role in diagnosis, are explained, hence students are guided to form diagnostic ideas and established clinical thinking of pathological diagnosis to improve their competency. According to the training syllabus, the teacher sets up questions in advance and guides the students on how to diagnose lymphoma through dialectical thinking. The students think and solve before the class, and observe the slices under the microscope in practice to make a preliminary diagnosis. Competent students put forward corresponding auxiliary examinations and differential diagnoses. In the process of students interpreting slices under the mirror, the teacher inspires and guides the students through the questions set in the lesson preparation, requires every student to actively participate in the discussion, stimulates students' desire for knowledge and exploration spirit, and improves students' enthusiasm for learning. During the teaching process, the clinical pathological thinking of the trainees is cultivated, and their pathological diagnosis ability is improved.
- (3) After-class summary: each student will begin by summarizing each knowledge node before consulting with their teachers, followed by emphasizing the key knowledge nodes and further discussing raised problems before leading teachers to integrate and analyze, and repeat the process until the students can make a pathological diagnosis by combining clinical manifestations and theoretical knowledge, as well as comprehending and mastering the key knowledge nodes. Special lectures can be given on the knowledge nodes that are difficult to comprehend.
- (4) Conduct systematic courses: the success of practical operations stems from solid fundamental knowledge. According to the standardized training outline, we conduct basic and professional lectures and carry out standardized systematic courses. The combination of the latest WHO classification, molecular pathology, and other disciplines guides students to study systematically and comprehensively [8]. At the same time, with the development of network information in recent years, pathological diagnosis lectures have become more and more comprehensive, and the content of lectures by national pathologists has become more and more abundant. We use this resource to conduct systematic courses for undergraduate departments and organize students to learn the essence of lectures given by experts. During the lymphohematopoietic system course, the explanation of the lymphohematopoietic system is given by Mr. Wang Chaofu in Hengdao pathology, so that students can broaden their learning ideas, learn the latest diagnostic standards and changes, and keep up with cutting-edge progress of the times. And in daily external inspection work, if one encounters typical cases, especially difficult cases, subspecialty pathologists preside over regular clinical pathology multidisciplinary team (MDT), which can not only solve the problem of pathological diagnosis of difficult cases but also improve the clinical pathology of trainees. Knowledge training goes a long way.

Through systematic courses and participation in case consultation discussions, the clinical pathology knowledge of the trainees can be greatly improved.

4. Conclusion

The standardized training of clinical pathology residents is different from other clinical specialties and has the unique features of this specialty. The training content is set and implemented according to the characteristics of the specialty ^[9,10]. In order to cultivate qualified and excellent pathologists, clinical pathological diagnosis training is the core training content of the entire resident standardized training process. The application of case-introduction teaching has been affirmed and recognized by students. The team gave full play to its strength, explored various teaching modes to adapt to the characteristics of modern teaching, and diligently strived to cultivate excellent resident doctors.

Disclosure statement

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Application Experience of Eyesi Operation Simulation Training System in the Teaching of Cataract Surgery for Ophthalmology Masters

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Abstract: *Objective:* To explore the application effect of the Eyesi surgical simulator in the teaching of cataract surgery for professional ophthalmology postgraduate students. *Methods:* The professional postgraduate students who were trained in the third year of ophthalmology at the First Affiliated Hospital of Xi'an Medical University were selected as the research objects. After passing the theoretical examination, they were randomly divided into the pig eyeball group, Eyesi group, and pig eye + Eyesi group, with 5 students in each group. The pig eyeball, Eyesi surgery simulator, and pig eye + Eyesi surgery simulator were used for microscopic technique operation and cataract surgery steps training, respectively. After the training, the overall training effects of the three groups of postgraduates were scored, and questionnaires were used to objectively evaluate the three training methods. *Results:* The scores of the students in the pig eye + Eyesi group were better than those in the Eyesi group, and the students in the Eyesi group were better than those in the pig eyeball group. *Conclusion:* The Eyesi surgical simulation training system can evaluate the microsurgical skills of professional masters and improve their surgical skills. This system is of great significance for the training of the cataract surgery skills of professional masters.

Keywords: Surgical simulator; Microsurgical skills; Cataract surgery; Ophthalmology postgraduate students

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1. Introduction

In the modern medical field, ophthalmic microsurgery, as a highly difficult and high-risk surgical operation, is one of the skills that professional ophthalmologists must master^[1]. With the rapid development of society and the intensification of population aging trend, the demand for treatment of ophthalmic diseases is increasing. In order to ensure patient safety and treatment effect, it is necessary to have a high-level ophthalmologist team. The goal of professional Master's courses is to enable students to systematically learn and master professional knowledge and skills, improve their overall quality, and gradually become high-end professionals^[2]. Ophthalmic microsurgery is one of the most important skills, and its uniqueness and particularity need to be established based on systematic, comprehensive, and in-depth mastery of relevant knowledge, and at the same time, it is necessary to gradually improve the skill level through repeated practice and continuous exploration^[3]. Only by fully understanding and mastering the skills of ophthalmic microsurgery and combining them with the objectives of the professional Master's course can one truly become an outstanding and professional ophthalmologist^[4].

In postgraduate teaching, due to the limitation of actual conditions, many colleges cannot provide enough opportunities for clinical practice, resulting in certain difficulties in the training of postgraduates in

ophthalmic microsurgery, especially in the training of cataract surgery techniques. In addition, there are problems in the training of graduate students in ophthalmic microsurgery due to the boundaries and insufficient coordination between disciplines [5]. Some graduate students did not receive enough guidance and support, so they had to rely on their learning and exploration, resulting in unsatisfactory results; some graduate students only studied in the classroom, lacked practical opportunities, and could not master the skills of ophthalmic microsurgery [1].

With the continuous development and improvement of surgical simulator technology, more and more schools and hospitals have begun to apply surgical simulators in ophthalmic microsurgery education [6]. Eyesi surgery simulator has many advantages, such as repeated practice anytime and anywhere, improving students' skill level, reducing surgical risks, etc. At the same time, the surgical simulator can also provide instant feedback and guidance to help students correct mistakes and improve skills in the process of operation [7]. Through the rational use of surgical simulators, students' skills and self-confidence can be improved, surgical risks can be reduced, and the development and progress of ophthalmology can be promoted. In order to better deal with the challenges and problems in surgical simulator training, it is necessary to optimize surgical simulator technology through continuous research and practice, reduce costs, improve efficiency, and allow more students to benefit from surgical simulator training.

2. Materials and methods

2.1. General information

In this study, 15 graduate students majoring in ophthalmology were selected as the research objects, and they were divided into three groups according to the random grouping method: pig eyeball group (group A), Eyesi group (group B), and pig eye + Eyesi group (group C), 5 people in each group. Among them, group A used pig eyes for practice and training in ophthalmic microsurgery; group B used the Eyesi simulator for practice and training in ophthalmic microsurgery, and receive corresponding real-time feedback and guidance; group C used both pig eye and Eyesi simulators for microsurgery operations and practice. Inclusion criteria of the study included: (1) aged between 18 and 35; (2) having professional background knowledge and basic skills in ophthalmology; (3) not having severe hand or visual dysfunction; (4) being willing to cooperate with the experimental requirements, and willing to sign the informed consent. Exclusion criteria of the study included: (1) suffering from severe heart, liver, lung, and other organ diseases; (2) suffering from mental illness or psychological disorder; (3) having received microsurgery training or related skill practice in the past 6 months; (4) have used the Eyesi simulator for the operation and practice of ophthalmic microsurgery; (5) cannot participate in the whole experiment due to other reasons. Through the establishment of the inclusion and exclusion criteria of the above participants, this study will ensure that the background knowledge and basic skills of the participants are relatively uniform, and at the same time exclude the interference factors that may affect the experimental results.

2.2. Methods

All students received corresponding training within 3 months. The training content included 4 modules practicing surgical postures, operating microscopes, mastering surgical tools, and simulating surgical operations. The teaching teacher conducted a comprehensive overall rating (global rating scale, GRS) on the simulated operation process [8]. Meanwhile, the simulator will record the students' operation process and execution effect, and provide real-time feedback and guidance. Statistical analysis and comparison of all the data were performed to evaluate the surgical skill level and effect of students under different training methods.

2.3. Statistical methods

SPSS17.0 statistical software was used for data analysis. Normally distributed measurement data were expressed as mean \pm standard deviation (SD). Two independent sample *t*-tests and paired *t*-tests were used. All data tests were two-sided, and $P < 0.05$ was considered statistically significant.

3. Analysis of experimental results

3.1. Scores of different modules in each group

After 3 months of training and operation, the following data collected were statistically analyzed and compared (**Table 1**) to determine the surgical skill level and effect of students under different training methods.

Table 1. Score comparison of the three groups after differential surgical training (points)

Group	Number of people	GRS score	Posture for surgery	Microscope operation	Mastery of surgical tools	Simulated surgical operation
Group A	5	69.98	64.8 \pm 5.45	61.5 \pm 9.64	80.4 \pm 4.51	73.2 \pm 8.99
Group B	5	80.75	73.4 \pm 5.94	81.6 \pm 5.27	84.0 \pm 5.87	84.0 \pm 3.71
Group C	5	85.95	85.2 \pm 5.34	83.0 \pm 7.14	88.2 \pm 3.56	87.4 \pm 3.21

3.2. Comparison of different module scores

After simulator training, the GRS score, posture for surgery, microscope operation, mastery of surgical tools, and system scores of simulated surgical operations in group C were all higher than those in groups A and B (**Table 1**), and the scores of group C in the posture for surgery is higher than the comparison between A and B groups, which is statistically significant (**Figure 1A**). There were statistically significant differences between group C and group A in microscope operation, mastery of surgical tools, and simulated surgical operation (**Figure 1B—D**). Compared with group B and group C, there were statistically significant differences in surgical posture, microscope operation, and simulated surgical operation (**Figure 1A, B, D**).

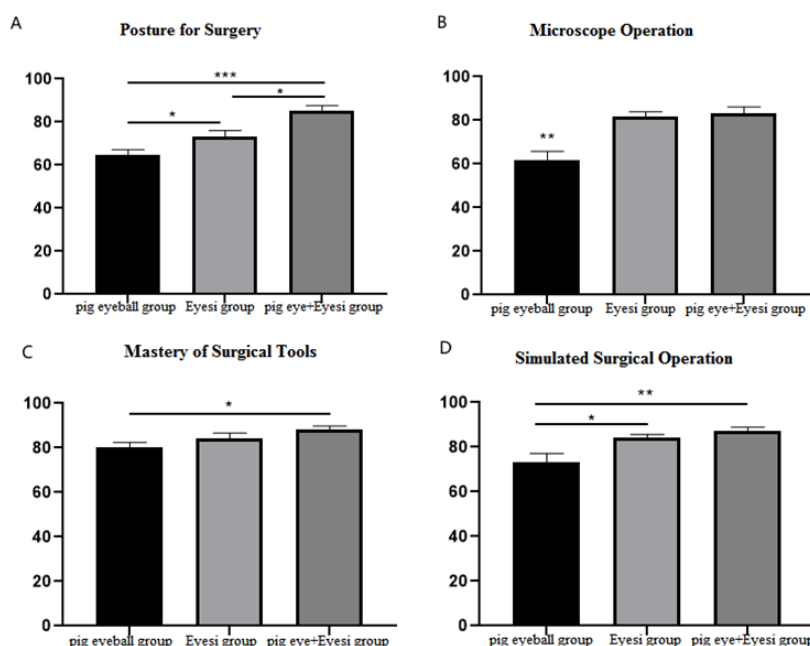


Figure 1. Comparison of performance scores of each group in different modules. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

In summary, the experimental results of this study show that the Eyesi simulator has obvious advantages in cataract surgery training. It can effectively improve students' surgical operation ability and surgical-related skills and has very important practical application value. The students in group C performed the best, suggesting that the combination of multiple practice methods can more effectively improve the students' surgical skills.

4. Discussion

Eyesi surgical simulator is a widely used intraocular microsurgery simulation training system, which aims to provide a near-real surgical experience through virtual reality technology^[9]. The surgical simulator is a very effective microsurgery practice tool. Students can perform operations and exercises of different difficulty and complexity through the simulator to improve their surgical skills. At the same time, the simulator can also provide timely feedback and guidance to help students find and correct mistakes^[10]. The use of the Eyesi simulator enables medical students to perform repeated surgical exercises without involving real cases and gain rich surgical experience^[11].

Professional master's education is a higher education course for those who have a certain professional background and want to deepen their professional skills and academic accomplishment. Professional masters put more emphasis on practicality and application, and cultivate students' innovative and practical abilities in the professional field^[12]. Combining the technical characteristics of the Eyesi simulator and the characteristics of professional master education, applying the Eyesi simulator to the teaching of professional masters will have positive effects. Firstly, it can better meet clinical needs by providing opportunities for repeated practice to strengthen students' surgical skills. Secondly, it can improve students' awareness and understanding of ophthalmic surgery and provide better support for related medical work. Finally, it can also provide valuable experience for the training of future medical talents.

Animal tissue such as a pig's eye is also a commonly used microsurgical practice tool^[13,14]. Students can further improve their surgical skills through the practice of pig eye surgery. It should be noted that relevant ethics and animal protection regulations should be followed when using animal tissues for practice^[15]. Studies have shown that the combination of multiple practice methods can improve students' surgical skills more comprehensively^[16]. Therefore, it is recommended to combine the above several practice methods to achieve a better teaching effect.

To summarize, the significance and advantages of the Eyesi surgical simulator in ophthalmic microsurgery training are obvious. In the actual teaching, the experimental results and the actual needs of the students should be combined, and various teaching resources and means should be flexibly used to comprehensively improve the students' surgical skills and overall quality.

Disclosure statement

The authors declare no conflict of interest.

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Research on the Integration Path of Taihang Spirit and Music Education Major in Colleges and Universities

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Abstract: A key strategy for raising students' humanistic aptitude is through music education. Culture is the soul of music and the source of innovation in music education. Under the current social education concept, it is advocated to carry forward excellent traditional and red culture in teaching, hence this paper further explores the path of integrating red culture into music education. The incorporation of the Taihang spirit, the most representative cultural resource in Shanxi, into music education in colleges and universities will promote the concept of Lide Shuren, further enhance students' training, and enable students to fulfill the dual education requirements.

Keywords: Taihang spirit; Colleges and universities; Music education major; Integration path

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1. Introduction

The Taihang spirit is an important cultural element that demonstrates the national integrity and unity of the Shanxi region. The Shanxi region has made great sacrifices and contributions to the victory of the Chinese Revolution. Colleges and universities have the responsibility to pass on excellent traditional culture. Therefore, the connotation of the Taihang spirit should be further explored in the professional teaching of colleges and universities, enriching its connotation in the new era, and promoting its inheritance and development.

2. The cultural connotation of the Taihang spirit

Shanxi has a long and rich history, and it is one of the main birthplaces of the Chinese nation and civilization. It is known as the "theme park" of Chinese civilization, with cultural relics above and below ground. The former headquarters of the Eighth Route Army and the general headquarters of the Hundred Regiments War in Huangyadong Wu Township of Shanli City, the former site of the Eighth Route Army Headquarters in Zuoquan Matian, and the main battleground of the Hundred Regiments War in Shinao Mountain in Yangquan are all shining with the light of heroes, condensing the commanders and fighters of the Eighth Route Army as well as the national spirit and integrity of the general populace who are indomitable, fearless, and united^[1]. The Taihang spirit is a national spirit developed during the Anti-Japanese War with patriotism and defense as its core, where the most essential thing is fighting for national independence, seeking national emancipation, and pursuing happiness for all people. It is always worthwhile to learn and inherit

the Taihang spirit.

3. The significance of integrating the Taihang spirit into the music education major of colleges and universities

3.1. Improve students' ideological and political qualities

Ideological and political education is an important issue in solving who and how to educate people. Since China is a socialist nation, students' fundamental ideological and political characteristics are crucial for their long-term growth. One of the key metrics for assessing the quality of a college/university education is ideological and political education. The impact of multiple values against the background of the current information society has made ideological and political education more challenging, and the integration of the Taihang spirit into music education may further innovate the path of ideological and political education, promoting the combination of ideological and political education with music, and shifting the paradigm of traditional text narration. The comparatively dull nature of education encourages the incorporation of ideological and political education with professional education, enhancing the outcomes of such education in music education professional courses. Students' interest in the Taihang spirit will assist in further enriching its connotation and promoting the Taihang spirit in conjunction with modern development ^[2].

3.2. Promote the inheritance of excellent culture

A crucial prerequisite for education in the modern era is to inherit excellent culture. Traditional exemplary culture develops with time, has unique historical significance, and is essential to the functioning of contemporary society. The Taihang spirit first emerged during the Anti-Japanese War, and it is a significant component of the nation's red culture and a record of the evolution of Chinese civilization ^[3]. The Taihang spirit embodies significant connotations such as patriotism, adversity, and unity. It is a crucial component of the socialist core values. Promoting the retention of red culture is now one of the educational objectives, along with promoting the development of spiritual civilization and cultivating students' patriotism. Therefore, the integration of the Taihang spirit into music education in colleges and universities can deepen students' understanding of the Taihang spirit and pass on the red culture to their offspring ^[4,5].

3.3. Improve students' music composition and innovation ability

Colleges and universities' music education not only require students to performance and appreciation knowledge but also creative and innovative ability. Culture is the source of creation and an important element in highlighting the importance of music. Music is an important cultural carrier. Enhancing students' understanding of the Taihang spirit and encouraging them to incorporate a variety of excellent cultural elements into their music learning while advocating performance skills can all result in the incorporation of the Taihang spirit into music education. This may also promote the combination of institutional education resources and social education resources. Utilizing the spiritual significance, notable figures, or significant acts of the Taihang spirit as a source of inspiration for musical works not only increases the artistic value of those works but also helps to spread awareness of the Taihang spirit and increase its influence in the modern era. More individuals are becoming aware of the Taihang spirit and advocating for the foundational fusion of culture, tourism, and sports.

4. Restrictive elements of integrating the Taihang spirit into music education in colleges and universities

4.1. Insufficient understanding of the cultural connotation of the Taihang spirit

To truly promote the combination of the Taihang spirit and music education in colleges and universities, the first prerequisite is to have a deep understanding of the Taihang spirit. The Taihang spirit can be found

in records of battlegrounds, stories of revolutionary figures, local diaries, and production and labor processes. The essence of the Taihang spirit is constantly deepened and evolved with the ongoing advancement of the times. For instance, the spirit of anti-epidemic in the new era leaves educators and students in the current music teaching with an inadequate or incomplete understanding of the Taihang spirit. As a result, the Taihang spirit is only conveyed through a small number of characters or stories, which not only diminishes the value of music teaching but also results in the production of musical works that have no intrinsic value [6]. The Taihang spirit is a distinctive cultural value concept displayed in the Taihang Mountain region. It has great influence and numerous educational undertones, including patriotism and adversity, which encourages its transmission in colleges and universities, and enhances the dissemination and influence of works.

4.2. Insufficient ability of educators to integrate resources

The ability to incorporate resources into the overall music education is insufficient, and limited representative figures or components of the Taihang spirit are employed for musical works creation [7]. The Taihang spirit is a type of culture as well as a type of spirit. Only by comprehending profoundly the connotations of culture and enhancing the carriers of culture can people genuinely support cultural innovation and inheritance. Currently, students are primarily taught through related musical works in music education. Understanding the Taihang spirit but failing to incorporate into regional folk music or Anti-Japanese War songs with contemporary needs results in insufficient ability to integrate resources in music professional teaching, which has an impact on both the educational function of colleges and universities as well as the outcomes of music education in those institutions.

4.3. Imperfect institution education mechanism

College and university education should not only have rich educational resources but also have a perfect guarantee mechanism. In light of the ever-increasing talent demands, improving the quality of education necessitates not only the involvement of educators and students but also a reliable and adaptable institution management system. The relationship between various professional educators in current institutions' music education is weak, and the boundaries between disciplines are obvious. The inclusion of off-campus educational materials into education has been hampered by inadequate communication between the institution and the outside world. The practice platform at the institutions is unreliable, and the management system at the institutions is archaic. This affects the quality of educational resources as well as the educators' motivation for creating them in collaboration. There are no prominent features to institutions' music courses. Under the backdrop of the present reforms in education, more flexible mechanisms are advocated. Therefore, the flawed educational system at institutions has an impact on the quality and direction of education, which in turn has an impact on higher education. Both the concept of cultural inheritance and the rational allocation of resources affect the practical effect of music courses, which prevents cultural inheritance from having a substantive role [8].

5. The integration path of Taihang spirit and music education major in colleges and universities

5.1. Dig deep into the spiritual connotation of the Taihang spirit and promote the development of a school-based curriculum

A deep understanding of the Taihang spirit is essential for promoting the integration of the Taihang spirit into music education in institutions. Therefore, it is necessary to delve deeply into the Taihang spirit's educational resources and develop courses that reflect its essence. To create a cohesive online and offline school-based curriculum, relevant videos are integrated into the existing curriculum [9]. The school-based curriculum ought to promote the use of audio and video in combination with dynamic presentations of the

Taihang spirit, in addition to highlighting the characteristics of the era in which students live. Additionally, it should incorporate phrases and images to help students visualize and develop the Taihang spirit and to inspire their musical works. Through repertory repertoire, new singing of popular songs, or musical creations related to the Taihang spirit content, students can better comprehend the Taihang spirit, allowing them to pass on the spirit through musical works.

5.2. Integrating the Taihang spirit into music teaching methods in colleges and universities

In the music teaching of colleges and universities, the traditional method of integrating the Taihang spirit should be changed into music teaching based on text narration or songs with red culture, innovate the integration of the Taihang spirit into music education, and promote the local characteristic folk songs and dances. Xiaohua Opera crews and Zuoquan folk song singers may be invited as guest educators at the institutions so that students comprehend various approaches to integrating the Taihang spirit with music education, altering the traditional music education and teaching model, enriching the content of music education, adapting local representative folk songs and dances in music education, and promoting music education to emphasize the spiritual concept of the Taihang spirit ^[10].

5.3. Promote the combination of school resources and extra-school resources

The institutions have excellent professional educators and a variety of educational resources, and there are many representatives of local characteristic folk songs and dance performers available outside of the school. There are certain limitations in promoting and publicizing the Taihang spirit solely by the institutions' music education conditions, as it has rich connotations and an excellent joint culture shaped by the culture and people of Shanxi ^[11]. Further integration of music education resources develops excellent musical works that can reflect the Taihang spirit. Therefore, to enhance educational outcomes during the process of inheritance, institutions, and extracurricular educational resources should be utilized. In addition to inviting certain performers of local characteristics folk songs and dances to join the teaching, the forces of music education both inside and outside the institutions should be mobilized. Both the expressiveness of musical compositions and students' understanding of excellent traditional culture can be improved. For instance, to emphasize the spiritual connotation of self-improvement and hard work in accordance with the scene and to express the joy of people harvesting or winning a war, the dance connotation and dance rhythm of Xiaohua opera can be utilized to create or adapt appropriate scenes to fit the theme of folk tunes, which enhances its expressive ability, promotes the Taihang spirit, and improve students' music creation and perception abilities. The connection between the songwriter and the listener improves the song's quality, making it both catchy and emotional. In general, educators embrace the systematic approach to music education, but they lack the necessary skills for musical practice. By promoting the collaboration of institutions and off-campus education resources, it can improve the comprehensive quality of music education majors in colleges and universities, and enhance their understanding of the Taihang spirit and local traditional culture. Further promoting the reformation of music education by changing the traditional educational mode of educator teaching and student practice allows students to acquire music perception ability through participation, increase the emotional resonance with songs or dances, and strengthen the Taihang spirit in their minds.

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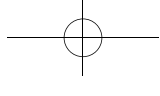
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