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Enhancing Practical Teaching Models for College Students Through Industry-University Cooperation

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Abstract: With the rapid development of higher education, industry-university cooperation has emerged as a crucial approach to enhancing the practical and innovative abilities of college students. However, the current practical teaching model for college students faces significant challenges and problems in the context of industry-university collaboration. On one hand, the teaching model suffers from fundamental deficiencies, including a disconnect between theory and practice, low levels of enterprise participation, and insufficient cultivation of students' practical abilities. On the other hand, specific issues such as a single cooperation model, mismatched teaching content with enterprise requirements, and a lack of practical platforms further constrain the effective enhancement of students' practical skills. Experimental testing conducted in this study revealed that the measures applied to the experimental group positively impacted students' practical and innovative abilities, leading to higher innovation scores in the experimental group compared to the control group.

Keywords: Industry-academia cooperation; College student practice; Teaching model; Innovation ability

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1. Introduction

With the acceleration of globalization and continuous technological advancements, the demand for high-quality talent in society has become increasingly urgent. However, the existing practical teaching model for college students exhibits numerous shortcomings, including a disconnect between theoretical knowledge and practical application, limited participation from enterprises, and inadequate cultivation of students' practical abilities. These challenges significantly hinder the quality and societal adaptability of talent development.

This study begins by introducing the background and significance of industry-university cooperation while identifying the challenges associated with the current practical teaching model for college students. It then clarifies the purpose and significance of the research. Following this, the study elaborates on specific research

components, including the exploration of industry-university cooperation applications, the construction and implementation of practical teaching models for college students, and related aspects. Through experimental testing, this study provides an in-depth analysis and discussion of the resulting data. Finally, it summarizes the research findings, highlights existing limitations, and proposes directions for future improvement.

2. Related work

In recent years, extensive research has been conducted both domestically and internationally on the practical teaching modes for college students in the context of industry-university cooperation. It is widely acknowledged that industry-university cooperation effectively enhances students' practical and innovative abilities and fosters a closer connection between talent cultivation and societal needs.

Awasthy *et al.* [1] proposed improving the cooperation framework between universities and industries to address issues such as limited collaboration models and ineffective outcomes. Giang *et al.* [2] explored the preparedness of higher education institutions for digital transformation toward Industry 4.0, aiming to enhance adaptability and competitiveness. Etzkowitz *et al.* [3] advocated for innovation in higher education by shaping entrepreneurial universities through experimental approaches and innovative proposals. Koutsouris *et al.* [4] analyzed the concept of the "ideal" higher education student and recommended institutional changes to align with this vision.

Li *et al.* [5] examined the development of an online management system for ideological and political education in colleges, focusing on improving its effectiveness and coverage. Aithal *et al.* [6] proposed a comprehensive student development and service provision model to promote holistic student growth. Additionally, scholars have increasingly emphasized the application of emerging technologies in education. For instance, Chen [7] investigated the potential educational applications of metaverse technology, while Resch *et al.* [8] employed service-learning methods to bridge the gap between teacher education theory and practice. Huang [9] emphasized the cultivation of core competencies for Chinese students through artificial intelligence-based education. Ling *et al.* [10] examined reforms in personality standards within the management systems of higher vocational education in China.

However, current research continues to face challenges, including inflexible collaboration models, mismatched teaching content with enterprise requirements, and a lack of practical platforms. These issues hinder the effectiveness of industry-university cooperation and limit the quality of talent cultivation.

3. Method

3.1. Application of industry-university cooperation

The application of industry-university cooperation serves as a crucial means to enhance the practical and innovative abilities of college students. Through such cooperation, schools and enterprises achieve resource-sharing and complementary advantages by jointly formulating talent training programs and conducting practical teaching activities. The basic framework of industry-university cooperation primarily includes university-enterprise collaboration and the integration of industry, university, and research [11,12].

By fostering close collaboration among schools, research institutions, and enterprises, scientific research projects can be jointly undertaken, promoting the deep integration of technological innovation with industrial advancements. This collaboration contributes a continuous stream of innovative capabilities to the

comprehensive development of the socio-economic landscape.

The basic model of industry-university cooperation can be summarized as follows:

$$IC = \{S, IR\} \quad (1)$$

The primary framework includes university-enterprise collaboration and industry–university-research integration, where *IC* represents the industry-university cooperation model, *S* represents university-enterprise cooperation, and *IR* represents industry–university-research integration [13].

To evaluate the outcomes of industry-university cooperation, this study employs a multi-factor functional relationship:

$$E = \{D, S, T, P\} \quad (2)$$

Here, *E* represents the effectiveness of cooperation, *D* denotes the depth of collaboration, *S* signifies students' practical abilities, *T* reflects students' innovative capabilities, and *P* includes evaluation indicators such as employment quality.

3.2. Practical teaching mode for college students

Under the background of industry-university cooperation, the reform and innovation of the practical teaching mode for college students have become imperative to enhance their practical and innovative abilities. The specific steps for implementing a practical teaching mode are outlined below:

(1) Formulation of a practical teaching plan: The practical teaching plan serves as the starting point for practical teaching activities. It should clearly define the objectives, content, methods, schedule, location, and assessment standards in alignment with professional training objectives and curriculum requirements.

(2) Preparation of practical teaching resources: Practical teaching resources, including teaching materials, experimental equipment, and venues, should be prepared in accordance with the practical teaching plan.

(3) Implementation of practical teaching:

(a) Classroom practical teaching: Methods such as case analysis, group discussions, and scenario simulations are employed to provide students with opportunities to apply theoretical knowledge in a controlled environment.

(b) Campus practical teaching: Activities such as theme-based events, book exchanges, and online practice sessions are conducted on campus to deepen students' comprehension of theoretical concepts.

(c) Social practice teaching: Students are organized to participate in activities such as visits, social surveys, and work-study programs, enabling them to engage with society, enhance their sense of social responsibility, and gain real-world experience.

(d) Practical operations: During the practical operations phase, teachers first demonstrate the experimental procedures and explain relevant principles and precautions. Students are then divided into groups to carry out the experiments, with teachers providing guidance and addressing errors as necessary. Peer communication and collaborative problem-solving are encouraged during this phase.

(4) Practice assessment and evaluation: Practical assessment involves two main components:

(a) Practice operation assessment: This evaluates students' practical skill levels.

(b) Practice report assessment: This assesses students' ability to summarize and analyze their practical experiences.

(5) Summary and reflection of practical teaching: Following the completion of practical teaching activities, teachers should organize sessions for students to summarize their experiences, share insights, and reflect on the practical learning process.

4. Results and discussion

4.1. Testing the effectiveness of practical teaching mode

(1) Determination of test objectives and indicators: At the initial stage of evaluating the practical teaching mode, the primary task is to establish clear and specific testing objectives. These objectives focus on assessing students' practical skills, knowledge acquisition, and innovation abilities. To ensure accuracy and objectivity, quantitative indicators and evaluation standards must be defined. These indicators should reflect students' performance across various dimensions and be both operational and measurable. By establishing precise objectives and indicators, a strong foundation is laid for designing subsequent testing plans.

(2) Design of the test plan: Based on the predetermined objectives, a comprehensive and feasible testing plan is developed. This plan provides detailed arrangements for key components, including testing content, methods, timing, and location.

(a) Content: The testing content combines the characteristics of practical teaching, incorporating assessments of practical skills, theoretical knowledge, and comprehensive application abilities.

(b) Methodology: Diverse methods such as practical demonstrations, written tests, and case analyses are employed to comprehensively evaluate students' capabilities.

(c) Scheduling: The testing schedule and location are planned systematically to ensure the smooth execution of the process.

(3) Implementation of the test: Once the testing plan is finalized, the test is organized and conducted in strict accordance with the outlined procedures. Efforts are made to ensure a fair and secure testing environment, providing equal opportunities for all students. Detailed records of students' test performance, including answer scores and time management, are maintained for subsequent analysis. **Table 1** illustrates the experimental data.

Table 1. Experimental data

Student number	Group	Answer score	Time management score
1	Control group	80	75
2	Control group	78	80
3	Control group	85	85
4	Experimental group	90	91
5	Experimental group	92	93
6	Experimental group	95	96

(4) Data collection and analysis: Upon completion of the test, students' scores and feedback are promptly

collected. During the data analysis phase, statistical methods are employed to conduct in-depth exploration and detailed evaluation of the results. Comparing scores across different testing stages allows for a comprehensive assessment of the practical teaching mode's effectiveness, highlighting students' strengths and areas for improvement. The findings provide robust support for enhancing teaching practices. Additionally, the testing plan is continuously refined and optimized based on student feedback to ensure its effectiveness in future applications.

4.2. Practical ability

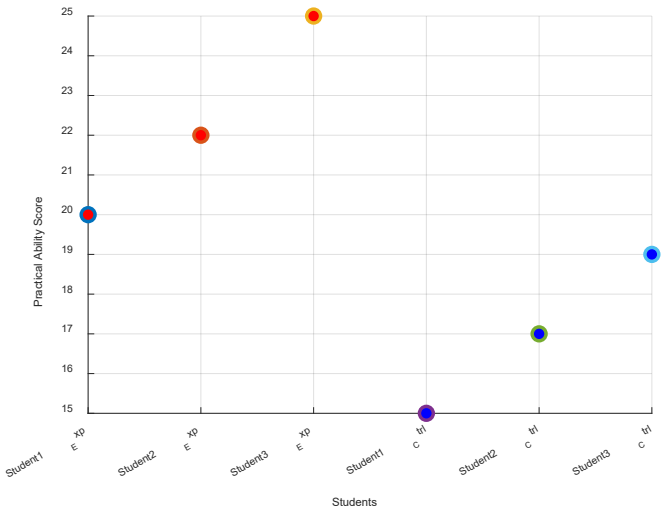

Figure 1. Comparison of practical ability

Figure 1 illustrates a comparison of the practical ability levels of students in the experimental and control groups. The score range is set between 15 and 25, with higher scores indicating stronger practical abilities. Data from the experimental group reveals that the practical ability scores of the three students are 20, 22, and 25, respectively, all of which indicate a high level of practical ability. In contrast, the scores for the three students in the control group are 15, 17, and 19, respectively, which are significantly lower than those of the experimental group. Notably, the lowest score in the experimental group (20) is higher than the highest score in the control group (19), strongly demonstrating that the measures implemented under the experimental conditions significantly enhanced students' practical abilities.

Further analysis of the data reveals an upward trend in the practical ability scores within the experimental group, increasing progressively from 20 to 25 points. This trend highlights a gradient or variation in practical abilities among students in the experimental group, but all scores remain at a high level, considerably surpassing those of the control group. While the control group also exhibits an upward trend, the increase is relatively modest, ranging from 15 to 19 points. This limited improvement may be attributed to traditional teaching methods or the absence of targeted interventions.

4.3. Innovation capability

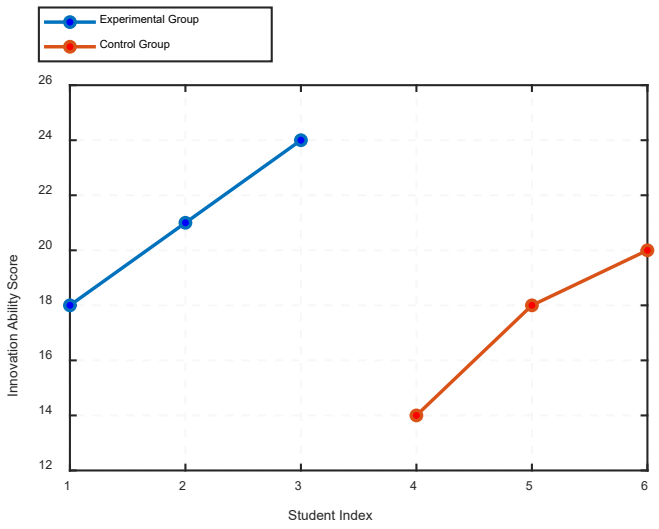

Figure 2. Comparison of innovation ability

Figure 2 presents a comparison of the innovation ability scores of students in the experimental and control groups. The innovation ability scores for the experimental group are 18, 21, and 24, demonstrating a clear upward trend as the scores increase progressively from the first to the third student. These results suggest that the measures implemented for the experimental group have contributed to the gradual improvement of students' innovation abilities.

In comparison, the innovation ability scores of the control group are 14, 18, and 20, respectively. Although the scores show an increase, the overall improvement is less pronounced than that observed in the experimental group. From the first to the second student, the increase is minimal, while a larger increase is observed from the second to the third student. Despite this improvement, the scores of the control group students remain consistently lower than those of the experimental group, further emphasizing the effectiveness of the measures applied in the experimental conditions.

5. Conclusion

This study investigates the practical teaching mode for college students within the context of industry-university cooperation. A substantial amount of experimental data was collected through rigorous testing, followed by an in-depth analysis and discussion of the findings. The results demonstrate that the practical teaching mode under industry-university cooperation can significantly enhance students' practical and innovative abilities.

However, certain limitations and challenges persist, including a lack of flexibility and diversity in cooperation models, outdated teaching content, and insufficient practical platforms. Addressing these issues is essential for optimizing the effectiveness of the teaching mode.

Future research should consider broadening the scope of the study to include a wider range of participants. Additionally, incorporating more diverse research methods, such as empirical studies and case analyses, could provide further insights. These measures would contribute to the continuous improvement and deeper exploration of the research outcomes presented in this study.

Disclosure statement

The author declares no conflict of interest.

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