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Exploration and Practice on Cultivating College Students' Innovative Practical Abilities: Integration of Competition, Teaching and Learning, and Empowerment via Digital Intelligence

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Abstract: The "integration of competition, teaching, and learning" model plays a key role in fully mobilizing college students' enthusiasm and initiative for learning, stimulating their innovative potential, and ultimately achieving the goals of "promoting teaching through competitions" and "promoting learning through competitions." "Empowerment via digital intelligence" specifically refers to building a flexible, independent, and open new human-machine collaboration environment for college students by relying on advanced digital intelligence technologies. When students are in this environment, their innovative awareness can be stimulated, their practical skills can be honed, and thus their innovative practical abilities can be significantly improved. Focusing on competitions of different forms and contents, such as physics academic competitions, physics experiment competitions, optoelectronic design competitions, and material-related competitions, and relying on digital twin platforms as well as advanced artificial intelligence (AI) technology, augmented reality (AR) technology, virtual reality (VR) technology, etc., this paper focuses on exploring effective strategies for cultivating college students' innovative practical abilities. By building a diversified practical platform, this paper aims to meet the personalized and diversified development needs of college students, comprehensively improve their innovative practical abilities, and, at the same time, inject strong impetus into the all-around development of college students.

Keywords: Integration of competition, teaching, and learning; Empowerment via digital intelligence; College students; Innovative practical abilities; Cultivation strategies

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1. Introduction

With the increasing depth of higher education reform, cultivating college students' innovative practical abilities has gradually become one of the important contents of university education and teaching reform. Stimulating college students' innovative awareness, cultivating their spirit of cooperation, and improving their practical abilities have not only become the internal demand for responding to international scientific and technological

competition, but also the inevitable trend for building a country with strong science and technology. However, under the traditional education and teaching model or talent training model, some universities have encountered a series of challenges and difficulties in cultivating college students' innovative practical abilities, such as outdated concepts, single methods, and a lack of resources. This may lead to the situation that the trained talents are difficult to meet the high requirements of social development for talents in the new era. Therefore, this paper proposes two new models, namely "integration of competition, teaching, and learning" and "empowerment via digital intelligence", in order to build a new teaching ecology, promote the innovation of talent training models, help cultivate more innovative, interdisciplinary, and application-oriented talents, and make a modest contribution to building a powerful country in education.

2. The significance of cultivating college students' innovative and practical abilities

2.1. Meeting the social demand for talents in development

At present, China is in a period of rapid social and economic development, and the social demand for talents is gradually shifting from "knowledge-oriented" to "innovation-oriented" and "practice-oriented", which is highly consistent with the goal of cultivating college students' innovative and practical abilities. Especially with the emergence and development of a series of emerging technology fields, the society's demand for high-quality, competent, and outstanding workers has become increasingly urgent, and cultivating college students' innovative and practical abilities is precisely the core path to meet this demand [1]. On one hand, from the macro perspective of national strategy, with the extensive implementation of the "Innovation-Driven Development Strategy", the development of more and more emerging industries relies on interdisciplinary talents who possess both innovative thinking and practical abilities. As the reserve force of such talents, the cultivation of college students' innovative and practical abilities deserves high attention. On the other hand, from the micro perspective of enterprise development, in today's era, the essence of competition among countries or in the market lies in the competition for talent. As the main platform for cultivating outstanding talents, colleges and universities should conform to the trend of the times and place the cultivation of college students' innovative and practical abilities at the core of talent development [2]. Only in this way can more high-quality talents for the new era be delivered to enterprises and society, and can enterprises achieve high-quality and sustainable development.

2.2. Comprehensively enhancing the quality of talent cultivation in colleges and universities

First of all, cultivating college students' innovative and practical abilities has forced the reform and innovation of traditional teaching models and methods in colleges and universities. The traditional teaching model has a serious problem of "valuing knowledge imparting over ability cultivation", and teachers have always been in a dominant position, which makes it difficult to fully arouse students' enthusiasm and initiative in learning. However, cultivating college students' innovative and practical abilities requires teachers to actively introduce diverse teaching methods, such as project-driven teaching, case teaching, and situational teaching. These innovative teaching methods can ignite students' passion for learning and practice, transform the classroom from a dull space into a vivid and engaging one, and thereby provide students with favorable opportunities and platforms for innovation and practice [3]. Secondly, cultivating college students' innovative and practical abilities relies on well-designed innovative practice projects. These projects often involve interdisciplinary knowledge

and skills, and may also include a series of competition activities. This not only breaks the limitations of traditional single-discipline teaching and promotes the integration of interdisciplinary knowledge, but also enables students to face various complex problems directly. This plays a positive role in improving their problem-solving abilities, innovative abilities, and practical abilities. With the deepening of educational and teaching reforms in colleges and universities, the quality of talent cultivation in schools will be significantly improved, and at the same time, a brand-new teaching ecology can be built.

2.3. Laying a solid foundation for college students' healthy development

Innovative and practical abilities serve as a strong driving force for college students to realize their personal values, and also act as an inherent support for safeguarding their healthy development, helping them grow into outstanding talents more needed by society and the country. On one hand, the process of innovation and practice is a process of tempering college students' will and character. It is conducive to fostering their firm will to persevere and courage to practice; at the same time, it hones their resilience, significantly enhances their ability to cope with pressure and setbacks, and thereby improves their overall quality. On the other hand, the cultivation of innovative and practical abilities helps college students realize their self-worth and strengthens their self-confidence and sense of honor. For example, with competitions as an effective platform, if college students achieve excellent results in competitions, their sense of honor and self-confidence will be greatly boosted. Such positive emotions help alleviate the anxiety and negative feelings that college students may encounter in the process of studying, daily life, internships, and practical training. They can consolidate students' psychological defense lines and comprehensively improve their mental health. This not only broadens the path for college students' future development but also enables them to face challenges and overcome difficulties with a more positive and optimistic attitude, thereby promoting their healthy and happy growth and development [4–5].

3. Effective strategies for cultivating college students' innovative practical abilities—From the perspective of integration of competition, teaching, learning, and innovation, and digital-intelligent empowerment

3.1. Construction of an intelligent teaching and practice platform

An intelligent teaching and practice platform helps transform the originally dull and tedious classroom into a vivid, interesting, and intuitive one. Its most prominent feature is its ability to closely integrate theory with practice, providing students with an immersive learning experience and achieving the goal of personalized teaching. Firstly, build multi-dimensional virtual simulation practice modules to give full play to the auxiliary teaching role of digital-intelligent technologies such as VR (Virtual Reality), AR (Augmented Reality), and digital twin. Teachers can develop virtual simulation experiment projects with higher matching degrees according to the characteristics of different disciplines, like physics and materials science. The purpose is to provide students with a more realistic and flexible practice environment, while ensuring the seamless connection between practical teaching and the industrial frontier [6]. Taking the digital twin platform as an example, teachers can use this platform to closely connect the digital world with the physical world. By promptly converting innovative ideas, raw materials, and other elements into digital models, a realistic, visualized, and refined digital factory is presented to students. This fully mobilizes their learning enthusiasm, promotes the in-depth integration of teaching and scientific research, and, more importantly, provides a strong platform support for cultivating college students' innovative practical abilities. From the students' perspective, they can use the

digital twin platform to conduct an in-depth exploration of the internal structure and operation mechanism of complex projects. Through bold innovation and repeated practice, they continuously optimize the design scheme, aiming to improve the precision and practicality of the projects. Secondly, create an interactive practice space with in-depth integration of online and offline [7–8]. Specifically, teachers can encourage students to break free from the constraints of traditional classrooms and use online innovative practice collaboration platforms to carry out cross-regional and interdisciplinary communication and practice. Students from different regions, different schools, and different majors can form online innovative practice groups, select their own projects, and complete discussions and practices. In this process, on-campus teachers and enterprise mentors can form a dual-tutor team to provide students with professional guidance and timely assistance, so as to fully stimulate students' innovative potential and continuously temper their practical abilities. In addition to online innovative practice, colleges and universities should also cooperate with enterprises, scientific research institutions, and other parties to build offline practice bases for students. These bases are equipped with advanced experimental equipment and create realistic work scenarios, aiming to bring students an immersive experience, promote the rapid transformation of innovative ideas into physical products, and provide platform support for the incubation of college students' creative ideas [9].

3.2. Promoting the discipline competition-driven model

The key to the "integration of competition, teaching, learning, and innovation" lies in "competition." Taking this as a starting point, teachers can closely integrate competition, teaching, and learning, build a bridge between theoretical teaching and innovative practice, and promptly guide students to apply theories to practice, ultimately achieving the goals of promoting teaching through competitions and promoting learning through competitions. Studies have shown that cultivating college students' innovative practical abilities is an inherent requirement for advancing discipline competitions; conversely, advancing discipline competitions is an external driving force for cultivating college students' innovative practical abilities. The close integration of the two is an inevitable trend in talent cultivation in colleges and universities. Therefore, teachers should attach importance to the organic combination of discipline competitions and teaching content, providing strong support for the cultivation of college students' innovative practical abilities. Specifically, first of all, teachers can transform competition projects into teaching cases and integrate them into the daily teaching process, promoting the seamless connection between classroom teaching and discipline competitions. This not only deepens students' understanding and cognition of the theoretical knowledge they have learned, but also targets the improvement of their problem-solving and practical abilities [10]. For example, with physics academic competitions and physics experiment competitions as important carriers, teachers can conduct in-depth research and analysis of the competition content, introduce it into the classroom, and guide students to closely connect the knowledge they have learned to solve problems and summarize experiences. Ultimately, this achieves the goal of feeding back teaching through competitions and realizes a twice-the-result-with-half-the-effort teaching effect. Secondly, in order to fully arouse college students' enthusiasm and initiative in participating in competitions, colleges and universities can establish incentive mechanisms such as allowing competitions to replace courses or using competition achievements to exchange for credits. For students who have achieved excellent results in competitions, they can apply for additional corresponding credit rewards or apply for exemption from certain courses [11–12]. This is highly attractive to most college students. To help students achieve excellent results, on-campus teachers and off-campus mentors can form a "dual-tutor" team to provide timely and professional

guidance or assistance to students preparing for competitions. This enables students to face various challenges that may arise in competitions with greater enthusiasm and solid knowledge and skills, effectively improving their competition performance [13–14].

3.3. Deepening interdisciplinary integration

The cultivation of college students' practical and innovative abilities requires the collaborative promotion of multiple disciplines; it is difficult to achieve satisfactory talent cultivation results relying solely on the strength of a single discipline. Therefore, the primary task of colleges and universities is to form an interdisciplinary innovative teaching team composed of teachers from multiple disciplines, providing a solid teaching support for college students' innovative practice. For example, focusing on the theme of "Intelligent Optoelectronic Design", colleges and universities should actively invite teachers specializing in information technology, electronic engineering, materials science, and other fields to participate. Teachers from different disciplinary directions should take the initiative to undertake their respective responsibilities. By providing students with differentiated and professional guidance and assistance, they offer strong support for the advancement of themed projects [15]. On this basis, colleges and universities should establish a "project bidding and leadership appointment" system. In short, students can form interdisciplinary innovative practice teams on their own and "bid for" projects that they are interested in and competent for from the interdisciplinary innovation project pool announced by teachers. After multiple rounds of competitions, teachers can assign the corresponding projects to the winning teams. The purpose of this approach is to fully stimulate students' sense of competition, promote the integration between disciplines, and enable teams to generate innovative sparks through intense interactions, exerting a positive promoting effect on the cultivation of students' innovative abilities [16]. Furthermore, colleges and universities should continuously update their professional curriculum systems. By setting up interdisciplinary curriculum modules, they can broaden students' horizons, allowing students to accumulate experience and practice skills through the integration of interdisciplinary knowledge, thereby laying a solid foundation for their future practical work in professional positions.

4. Conclusion

To sum up, the cultivation of college students' innovative practical ability is not an achievement that can be accomplished overnight; it is notably systematic and long-term in nature. Based on the two dimensions of "integration of competitions, teaching, learning, innovation, and entrepreneurship" and "digital and intelligent empowerment", this paper expounds on the specific methods and implementation paths for cultivating college students' innovative practical ability. It aims to give full play to the powerful role of digital and intelligent technologies in empowering teaching and talent development, enriching students' experience in participating in competitions, and helping them accumulate valuable experience. It is hoped that this can promote the all-round development of students, lay a solid foundation for their future career paths, and make a modest contribution to the construction of an innovative country.

Disclosure statement

The authors declare no conflict of interest.

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