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Exploration and Practice of Integrating Experimental and Innovation Centers into the Development of Professional Talent in Regional Universities

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Abstract

With the rapid development of higher education, regional universities are playing an increasingly important role in supporting regional economic and social development. As a critical practical platform within the talent cultivation system of regional universities, the Experiment and Innovation Center provides comprehensive support for fostering practical skills and cultivating innovative thinking, enabling students to thrive and succeed. This paper analyzes the teaching status and unique characteristics of the nationally recognized first-class undergraduate program in Electronic Information Science and Technology at Yibin regional colleges. By leveraging the resource advantages of the Experiment and Innovation Center's demonstration base, it proposes an optimized pathway and framework for a multi-level cultivation model that deeply integrates into the talent cultivation system. The findings reveal that the multi-level cultivation model implemented in the Experiment and Innovation Center significantly enhances students' innovation abilities, practical skills, and capacity for solving real-world problems. Through multi-tiered practical projects and innovation training, the model effectively improves students' adaptability and competitiveness in real-world work environments. The research provides valuable insights for local universities seeking to enhance the quality of professional talent training and optimize teaching models. It offers strong reference and scalability for broader adoption and implementation.

Keywords: national first-class undergraduate program, Experiment and Innovation Center, Multilevel Training Model, Electronic Information Science and Technology, Educational Reform

1. Introduction

With the continuous development of higher education in our country, regional colleges and universities are playing an increasingly significant role in regional economic and social development. The talent training programs of regional colleges and universities should not only serve the practical demands of regional economic development but also cultivate application-oriented talents with strong innovation and practical skills (Wang 2024). However, at present, regional colleges and universities face numerous challenges in the process of talent training, such as a gap between traditional teaching methods and practical application, insufficient emphasis on innovation training, and limited depth in school-enterprise collaboration (Hou et al. 2022; Shao et al. 2023). These issues make it difficult for graduates to quickly adapt to real-world work environments, thereby affecting the overall quality of talent training to some extent. In this context, as an important practice platform within the higher education system, the Experiment and Innovation Center has emerged as a pivotal resource for enhancing students' comprehensive skills and fostering their innovative and practical abilities (Aithal and Aithal 2023). The Experiment and Innovation Center not only provides students with hands-on experiences and opportunities to apply their knowledge but also fosters the development of innovative thinking and technical expertise. Therefore, integrating the Experiment and Innovation Center into the professional talent training system of regional colleges and universities aligns with

national higher education reform objectives while meeting the specific needs of regional economic development.

In recent years, with the advancement of education reform, many scholars have carried out ongoing explorations and practices centered around the teaching reform of Experiment and Innovation Centers in regional universities. Cheng Zhuowei et al. proposed a "3-3-3" integrated model based on the concept of OBE (Outcome-Based Education), which places students at the center and focuses on the holistic cultivation of knowledge, skills, and competencies(Cheng et al. 2016). Through a combination of ideological and political guidance, practical teaching, and innovative training, Li Xuepeng et al. enhanced the engineering practice capabilities of students majoring in food science and improved the quality of talent training in regional colleges and universities (Li et al. 2021). Zhang Shurong et al. developed strategies for the cultivation of marine professionals in regional colleges and universities, emphasizing the optimization of the curriculum system, discipline construction, and teaching methods, aligning with the national Marine strategy's demand for professional talent (Zhang et al. 2024). Yang Zhongqiang et al. identified shortcomings in the practical teaching of Internet of Things engineering programs and proposed reform measures such as introducing the OBE concept, building a practical teaching system, and enhancing the construction of practice platforms, which have significantly improved students' innovative capabilities (Yang et al. 2024). Wang Guixia et al. analyzed the current state of chemical engineering programs in regional universities and suggested improving the quality of talent training and promoting high-level professional development through the integration of industry-academia-research collaboration and the construction of a "platform + module" training system (Wang et al. 2024). However, as a critical practical platform in higher education, there has been limited research on how Experiment and Innovation Centers improve the quality of professional talent training in regional universities.

To explore the innovative models and effective paths of the experimental and innovation center in regional universities for professional talent cultivation, the author takes the national first-class undergraduate major of Electronic Information Science and Technology in regional universities as an example, deeply analyzes the theoretical basis of the multi-level cultivation model of the experimental and innovation center integrated into talent cultivation, as well as the challenges and opportunities of professional talent cultivation in regional universities, and implements a series of teaching reforms and continuous improvements with the experimental and innovation center as the entry point. By analyzing the existing teaching resources, course design, and innovation platforms of the experimental and innovation center, a reasonable path optimization plan is proposed, and practical discussions are carried out in combination with actual cases, aiming to provide a set of new talent cultivation models for regional universities that can be referred to.

2. The Theoretical Basis for Deep Integration of Experiment and Innovation Centers into Professional Talent Training

2.1 Objectives and Requirements of Professional Personnel Training

The core objective of professional talent cultivation in regional universities is to develop high-quality application-oriented talents with a strong theoretical foundation, practical skills, innovative thinking, and a spirit of collaboration. Such talents should not only possess comprehensive professional knowledge and technical expertise but also be capable of solving complex problems in practical work and adapting to the rapidly evolving demands of society and industry (García-Pérez et al. 2021). By integrating the resources, platforms, and functions of Experiment and Innovation Centers, the objectives of professional talent cultivation are specifically reflected in the balanced emphasis on theory and practice, the enhancement of innovation and entrepreneurship capabilities, and the cultivation of professional ethics and social responsibility.

Among these, "balanced emphasis on theory and practice" requires students to master both foundational theories and cutting-edge knowledge in their professional fields while developing strong practical abilities, enabling them to apply theoretical concepts to address real-world challenges (Tariq 2024). "Enhancement of innovation and entrepreneurship capabilities" focuses on stimulating students' innovative thinking and entrepreneurial awareness through practical platforms such as experiments and innovations, fostering their ability to think independently and solve problems creatively in complex environments. Lastly, "professional ethics and social responsibility" emphasizes instilling a sense of ethics and responsibility in students, while also enhancing their teamwork, communication, and lifelong learning abilities, ensuring they are well-prepared to adapt to the dynamic professional landscape of the future.

In terms of ability requirements, it primarily includes expertise in professional knowledge and its application, innovative thinking and problem-solving abilities, technical operation and practical skills, teamwork and communication skills, as well as proficiency in information technology and data processing. Students must master the core theoretical concepts of their disciplines and demonstrate the ability to effectively apply this knowledge to

solve real-world challenges. In the face of rapid technological advancements and industrial transformations, professional talents must exhibit innovative thinking and a high degree of adaptability.

The talent cultivation goals of regional universities place a strong emphasis on developing practical skills, particularly in engineering and information-related disciplines, where experimental competence and hands-on technical skills serve as critical foundations for students' career success. Moreover, in modern professional environments, collaboration and communication are essential soft skills. At the same time, information-driven teaching methods and the use of big data analysis tools are becoming increasingly vital components of talent cultivation.

2.2 The Supporting Role of the Experimental and Innovation Center in the Cultivation of Students' Ability

The Experiment and Innovation Center serves as a platform for bridging theory and practice, enabling students to apply classroom knowledge to real-world operations through specific experimental projects. It also provides a space for students to freely explore and innovate, encouraging participation in scientific research projects, innovative experiments, and various competitions. By independently designing experiments, proposing hypotheses, and testing innovative ideas, students can enhance their creative thinking and research skills. This kind of practical training not only deepens students' understanding of professional knowledge but also cultivates their hands-on abilities and problem-solving skills.

Through the resources of the Experiment and Innovation Center, students gain access to advanced equipment and technologies in their professional fields. They improve their experimental operation skills and technical application capabilities through independent experiment design, data collection, and analysis. In addition, activities such as team projects, innovation competitions, and joint experiments provide opportunities for collaboration, allowing students to work with peers to complete tasks and engage in interdisciplinary exchanges. These diverse experiences significantly enhance students' teamwork awareness and communication skills. Moreover, the practical projects offered by the Center allow students to experience the real-world application of their knowledge and skills, fostering their professional ethics and sense of social responsibility.

2.3 Teaching Concept Combining Theory and Practice

Talent training in regional colleges and universities requires not only a solid theoretical foundation but also the ability to transform theoretical knowledge into practical skills through hands-on teaching, ultimately cultivating application-oriented talents that align with industry demands. Theoretical teaching provides students with a comprehensive knowledge framework and analytical skills, serving as the foundational stage of talent cultivation. However, theoretical instruction alone is insufficient to address the growing demand for multifaceted talents in modern society (Ge and Su 2024). Practical teaching bridges this gap by offering students opportunities to apply their knowledge, transforming theoretical insights into tangible skills.

The introduction of the Experiment and Innovation Center seamlessly integrates classroom knowledge with real-world applications through hands-on operations, experiment design, and problem-solving activities. This teaching model, which emphasizes the combination of theory and practice, highlights the complementary relationship between the two. Theoretical teaching guides and informs practical activities, while practical teaching, through feedback from experimental outcomes and problem-solving experiences, drives the refinement and innovation of theoretical instruction.

In the teaching process, students reflect on the theories they have learned by addressing practical problems encountered in practice, fostering the iterative development and continuous enhancement of theoretical instruction.

3. Construction and Development of Electronic Information Science and Technology Major

3.1 The Challenge of Professional Talent Training

Regional colleges and universities often face the challenge of limited resources such as funds, teachers, and equipment. Compared with key universities and those in first-tier cities, there are significant gaps in scientific research funding, experimental equipment, and innovation platforms in regional universities. The lack of scientific research funds restricts regional colleges and universities from acquiring advanced teaching and experimental equipment, which in turn limits the cultivation of students' hands-on operational and innovative abilities. The absence of high-precision test equipment and high-level laboratory platforms further restricts students' practical skills, making it difficult to acquire solid hands-on experience through high-quality experimental classes.

In addition, due to their relatively remote geographical locations, regional colleges and universities struggle to attract excellent teachers, resulting in a weaker faculty pool. Compared with key universities, regional universities face challenges in both the quantity and quality of their teaching staff. Many teachers in regional colleges focus

primarily on teaching, with limited time for scientific research and few opportunities to stay updated on professional frontier knowledge, which poses significant challenges to the cultivation of innovative talent.

Regional college students come from diverse backgrounds, with considerable differences in knowledge bases, learning abilities, and motivation. Some students have a strong foundation and excellent learning abilities, while others struggle with weaker foundations and a lack of motivation for independent learning. This diversity puts higher demands on curriculum design, teaching methods, and the realization of talent training objectives. Balancing the learning needs of different students and improving overall teaching quality with limited resources has become an urgent challenge for regional colleges and universities.

Due to the heterogeneity of the student body, a uniform teaching plan is often insufficient to meet the needs of all students. If the content is too complex, some students may struggle to keep up; if the content is too basic, students with stronger learning abilities may find it unchallenging and disengaging. Finding ways to provide appropriate learning content and resources for students at different levels, formulating flexible teaching programs, achieving full participation, and stimulating learning motivation are all key issues regional colleges and universities must address. Reforming teaching plans to be individualized and adaptable requires significant teaching resources and time, but the current limitations in regional universities make such reforms particularly challenging.

3.2 Opportunities for Professional Talent Development

In terms of professional talent training, although regional universities face challenges such as limited resources and diverse student backgrounds, they also have unique opportunities, especially in their close service to the regional economy and alignment with industry needs. Thanks to the special geographical advantages of their region, regional universities can gain a deeper understanding of the development dynamics of the regional economy, industrial structure, and technical needs. Therefore, regional colleges and universities can tailor their major offerings and course content to meet the demands of regional economic development. As the employment destinations for regional college graduates are primarily regional enterprises and industries, the orientation of the talents they train is clearer, with a focus on "application" (Yi et al. 2023) . This application-oriented talent training model aims to enhance students' practical abilities, innovation in application, adaptability, and employment competitiveness. By combining the regional characteristics of the curriculum with practical training, regional colleges and universities can develop high-quality applied talents who can directly serve the regional economy. This approach will not only help regional college students secure employment but also promote the sustainable development of regional industries through this mutually beneficial interaction.

4. The Experiment and Innovation Center is Deeply Integrated into the Path of Professional Talent Training

The development of electronic information science and technology is intrinsically linked to the direction of regional industrial demand. Therefore, the design of the multi-level training model for experiments and innovation carefully considers the characteristics of regional industries, such as the latest advancements in electronic manufacturing, information technology, and intelligent equipment. The curriculum system should be developed in close alignment with these industrial needs to ensure that students can master cutting-edge technologies with regional characteristics through practical experience while also receiving solid theoretical grounding. The experiment and innovation center has become a crucial means for regional colleges and universities to enhance the quality of talent training and cultivate application-oriented, innovative talents. It not only provides students with a comprehensive learning experience from theory to practice, but also offers strong support for the reform and innovation of regional colleges and universities' talent training models. The following is an in-depth exploration of the multi-level training model of the experiment and innovation center in talent training, examined from three aspects.

4.1 Experiment and Innovation Center Multi-Level Training Mode in the Talent Training Innovation Path Design

According to the needs of students at different learning stages and the demands of regional industries, the comprehensive semi-open model is gradually being implemented to design teaching and research laboratories. This model has developed into a hierarchical structure ranging from basic experiments to professional core experiments, and from confirmatory experiments to innovative practices (Figure 1). This training model allows students to conduct independent experiments or participate in scientific research projects during non-curricular time, thus overcoming time and curriculum constraints. By establishing an appointment system, students can visit the Experimental Innovation Center after class or on weekends to carry out extracurricular projects or innovative experiments. This open mechanism encourages students to explore independently, fully utilizes the equipment and resources of the Experimental Innovation Center, and enhances students' independent learning and hands-on abilities. Driven by competitions such as the College Student Electronic Design Competition, the College Student Intelligent Car Competition, and the College Student Innovation Competition, students are encouraged to use

laboratory resources to independently conduct experiments and form teams to work on innovative projects. This approach cultivates students' practical abilities and spirit of teamwork while stimulating their innovation potential.

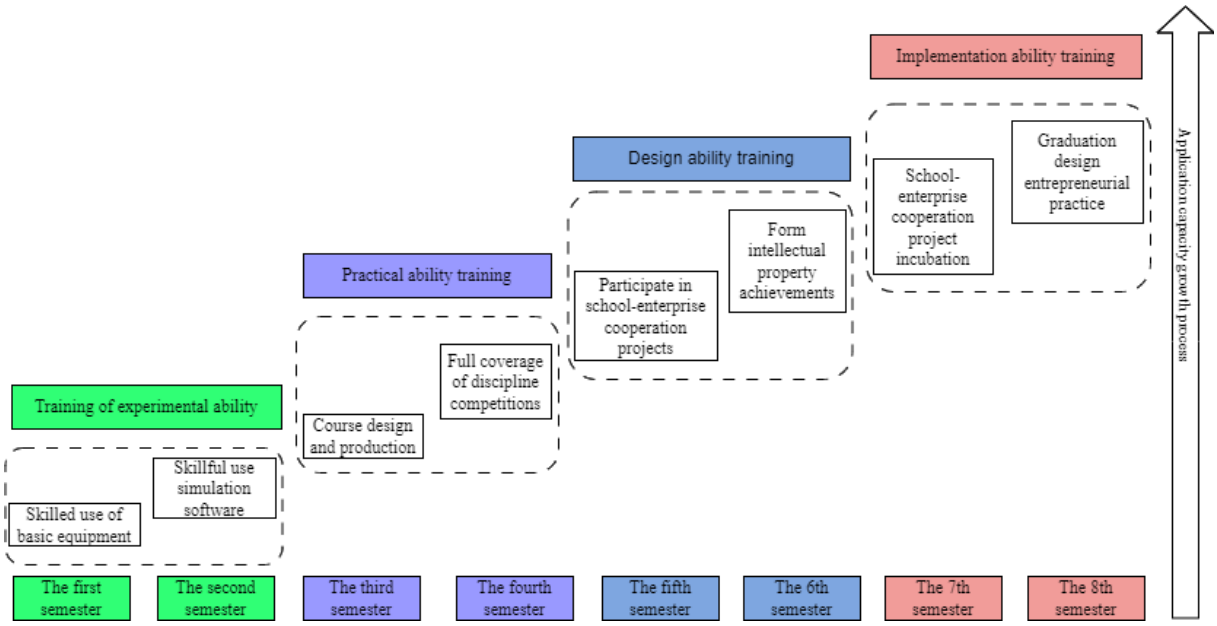

Figure 1. Multi-level cultivation mode path

In the initial stage, all basic laboratories are semi-open to freshmen, where students are trained to master fundamental experimental skills, such as circuit design and debugging, basic programming, etc., and become proficient in using various experimental testing equipment, such as digital fluorescence oscilloscopes, programmable DC regulated power supplies, and signal generators. At the same time, students can participate in the design and production of school-level practical competitions. In the intermediate stage, all core laboratories are semi-open to sophomore students, allowing for the introduction of more complex experimental content, such as the design and implementation of comprehensive courses in signal processing, communication, and control. Students continue to engage in national and provincial innovation and entrepreneurship projects and participate in relevant national and provincial discipline competitions, enhancing their ability to integrate multidisciplinary knowledge and solve complex engineering problems. In the advanced stage, all innovation and entrepreneurship practice and training rooms are semi-open to juniors and seniors to foster innovation abilities. Students participate in school-enterprise cooperation projects and complete graduation projects, transforming the results into patents, software, papers, and other formats, with the opportunity to further transform them through school-enterprise cooperation models.

Therefore, the multi-level training mode not only ensures that students master solid professional foundational skills but also helps them identify areas of interest for in-depth research during the progressive training process. Students can deeply engage with school-enterprise cooperation projects, write applications for innovation and entrepreneurship projects, and produce works, ranging from individual skill competitions to comprehensive design competitions. This progresses to high-intensity training for national and provincial discipline competitions, culminating in the formation of landmark results and the transition to result transformation. This approach significantly enhances students' innovative and comprehensive skills, driving the implementation and optimization of the multi-level training model in the talent training innovation pathway of the Experiment and Innovation Center.

4.2 The Experiment and Innovation Center is in the Path of University-Enterprise Cooperation and the Integration of Industry-University-Research

Through school-enterprise cooperation, the construction of off-campus practice bases is one of the key methods for the integration of production, learning, and research. By collaborating with regional enterprises, the Experimental Innovation Center has established long-term internship practice bases within these companies, allowing students to complete practical learning in a real-world enterprise environment. This not only provides students with genuine engineering practice opportunities but also offers them a better understanding of how theoretical knowledge can be applied in practical contexts. At the same time, enterprises can provide feedback based on the student's internship performance, helping schools optimize curriculum design and create a virtuous

cycle of theory and practice. For instance, Yibin regional universities's electronic information science and technology major has partnered with regional electronic information enterprises to jointly establish a laboratory, where students engage in hands-on operations like electronic product development and embedded system design.

The university-enterprise cooperation path, coupled with industry-university-research integration, focuses on the real needs of regional industries to create a cooperation mechanism. Regional universities in Yibin are situated in regions with characteristic industries such as electronic manufacturing, intelligent equipment, and Internet of Things (IoT) technology. Therefore, it is essential to establish close collaboration with regional enterprises in personnel training, developing practical courses and experimental content around the technical needs of these industries. By involving enterprise experts in course design and experiment guidance, we ensure that the course system aligns with the industry's actual requirements and enhances students' ability to solve practical problems. Additionally, universities jointly engage in industry-university-research cooperation projects with enterprises and research institutions, offering students more opportunities to access cutting-edge technologies and innovative projects. For example, in the field of electronic information science and technology, technical research or innovation projects are carried out in collaboration with enterprises in electronic product design and intelligent system development, enabling students to participate in real-world engineering development while still in school and accumulate valuable project experience.

4.3 Construction of the Innovation Mode of Cross-Integration of Multidisciplinary Laboratories in the Experiment and Innovation Center

Traditional experimental teaching typically focuses on individual subject-based experiments and lacks a focus on comprehensive problems and the exploration of innovative solutions (Kreijkes and Greatorex 2024). The multi-disciplinary laboratory cross-integration innovation model proposed in this paper is based on a teaching course group and integrates relevant experimental course equipment within the same laboratory. During the design of comprehensive experiments, equipment from multiple courses can be combined to complete integrated experimental projects. By adopting a problem-oriented approach, students can enhance their understanding of system integration across multi-disciplinary knowledge areas during comprehensive experiments. This approach fosters the development of skills to identify, analyze, and solve complex engineering problems, while also improving their ability to design innovative solutions (Figure 2).

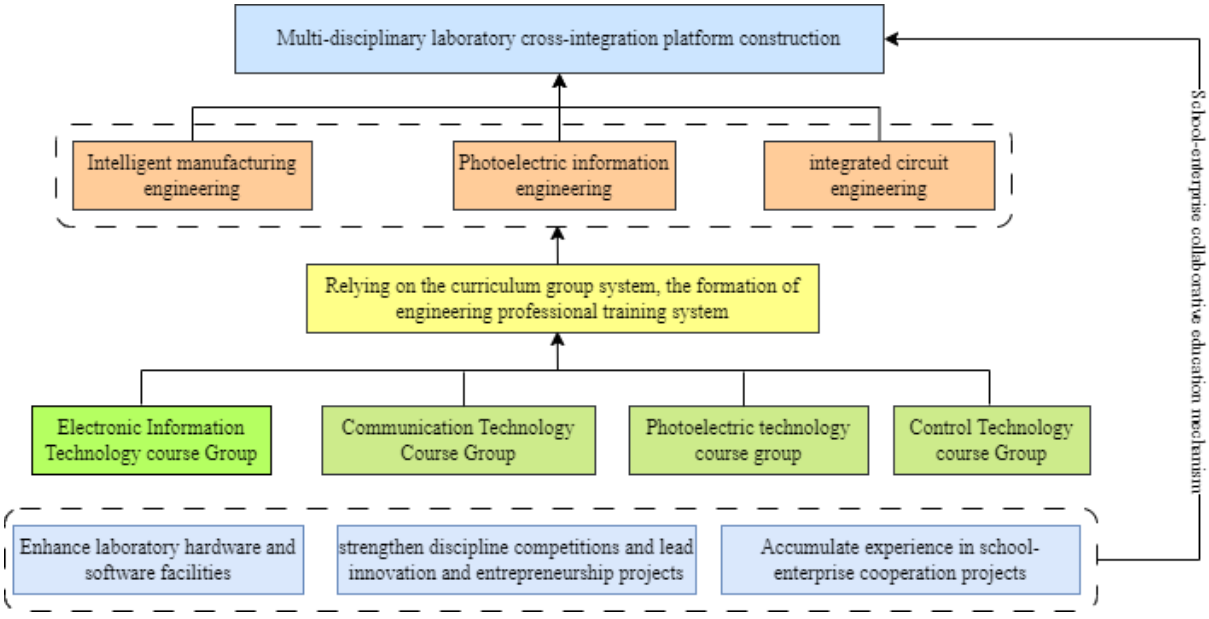

Figure 2. Multidisciplinary laboratory cross-fusion combined with curriculum group construction innovative model

With innovation and entrepreneurship practice projects at its core, the experiment and innovation platform for the electronic information major is constructed based on the engineering application model of "project-driven" teaching. Through a series of "golden course" construction measures, such as provincial and university-level application demonstration courses, the corresponding four innovative practical teaching and practice platform

systems are developed. These systems are built with the "four curriculum groups"—Electronic Information Technology, Communication Technology, Optoelectronic Technology, and Control Technology—as the fundamental units for supporting the construction of practical innovative courses for engineering majors in the department. This approach ensures that teachers' research and teaching form a closed-loop system, fostering the integration of teaching and research through a dual-chain development model.

5. Conclusion and Prospect

With the rapid development of higher education in our country, regional colleges and universities are playing an increasingly important role in serving regional economic and social development, especially in training applied and innovative talents. Although regional colleges and universities face many challenges in terms of resources, teachers, and equipment, the experimental innovation center can strengthen the teaching model by integrating resources, combining theory and practice. This enhances students' practical ability, innovative thinking, teamwork spirit, and overall comprehensive quality, while also improving their social adaptability. Taking the electronic information science and technology major at regional universities as an example, this paper deeply discusses the role of the multi-level training system of the experimental innovation center in talent training and proposes an optimization plan for integrating the experimental innovation center into the professional talent training system of regional universities. Through the implementation of a series of reform measures, remarkable results have been achieved in training high-quality applied talents, which provide valuable experience for regional colleges and universities to innovate their talent training models. In the future, the experimental innovation center will play an increasingly significant role in talent training at regional colleges and universities. To further improve the quality of talent training, it is necessary to strengthen the infrastructure of experimental innovation centers, increase investment in scientific research funds and experimental equipment, and introduce more practical projects and innovative resources through school-enterprise cooperation, and the integration of industry, university, and research. Additionally, the training and recruitment of teachers are crucial for promoting the reform of regional higher education. By enhancing teachers' professional development and updating their cutting-edge knowledge, regional colleges and universities can elevate their teaching quality and scientific research capabilities.

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