Exploring an Industry-Education Integration-Based Talent Cultivation Model for Comprehensive Practice Courses in Pharmaceutical Engineering: A Case Study of Zhaoqing University

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Abstract: This study examines a talent cultivation model for pharmaceutical engineering practice courses at Zhaoqing University within the framework of industry-education integration. By fostering university-enterprise collaboration, the program aims to enhance students' practical skills and market competitiveness. The study proposes curriculum reforms, including an optimized system, expanded training bases, and a dual mentor system involving faculty and industry professionals. These efforts align the curriculum with industry needs, enhance professional competence, and provide authentic production and research experiences. Industry experts' ongoing participation ensures timely updates and offers a replicable model for regional universities.

***Keywords*:** industry-education integration, pharmaceutical engineering, practice courses, innovation, teaching reform

1. Introduction

Industry-education integration is a key strategy for higher education reform, particularly in engineering [1]. The demand for practice-oriented talent is growing, and aligning education with industry is essential for improving quality and relevance [2]. This model emphasizes collaboration between universities and enterprises to ensure curricula reflect industry needs, connecting knowledge and skills. Pharmaceutical engineering focuses on practical fields like process engineering, drug R&D, and quality control. Zhaoqing University addresses these challenges by incorporating industry-education integration into its pharmaceutical engineering practice courses, enhancing students' skills and innovation while offering a model for educational quality improvement in regional universities.

2. Current Status of the Comprehensive Practice Curriculum at Zhaoqing University

Zhaoqing University's pharmaceutical engineering program integrates core subjects like pharmaceutics, chemical engineering, and pharmaceutical preparation, emphasizing the link between theory and practice. The curriculum aligns with national priorities, offering practice-oriented courses in drug R&D, formulation, and quality control. By incorporating modern pharmaceutical technologies and intelligent manufacturing, students acquire industry-relevant skills. However, challenges persist, such as limited resource-sharing platforms and faculty members' lack of practical industry experience, which hinders the integration of real-world technologies into the curriculum. Strengthening resources, increasing faculty industry engagement, and fostering deeper university-enterprise collaboration are crucial for addressing these issues.

3. Implementing Industry-Education Integration and Practice Courses

3.1 Curriculum Reform and Skill Development

To strengthen industry-education integration, Zhaoqing University reformed its pharmaceutical engineering curriculum, emphasizing practical skills and innovation. The revised curriculum links theory with practice, with an increased focus on practice-oriented courses. Core subjects such as pharmaceutical technology, drug analysis, and quality control are consolidated, and advanced technologies like intelligent manufacturing are integrated to align with industry needs. Industry experts contribute to course design, ensuring students gain exposure to current technologies and real-world applications, enhancing their practical competence.

3.2 Training Bases and University-Enterprise Collaboration

The university emphasizes integrating the construction of training bases with industry partnerships. By collaborating

with pharmaceutical companies, Zhaoqing University has developed joint practice platforms and off-campus training bases that span key stages of drug R&D, production, and quality control. These bases provide real-world environments where students engage in research and production activities, gaining hands-on experience in enterprise workflows and quality systems. This allows students to apply classroom knowledge, improve their understanding of industry trends, and increase their employability in the pharmaceutical sector.

3.3 Dual Mentoring and Innovation Projects

Zhaoqing University implements a dual mentor system, pairing enterprise mentors with university mentors. This approach combines industry expertise with academic knowledge, guiding students to understand industrial needs and emerging technologies. University mentors provide theoretical support, helping students integrate theory with practice. The university encourages students to participate in innovation projects and competitions, fostering creativity and engaging them with real technical problems. These projects help address practical challenges, creating a positive feedback loop connecting education, industry, and research, thus laying a solid foundation for students' professional development.

4. Teaching Model Innovation and Refinement

4.1 Aligning the Teaching Model with Industry Needs

The pharmaceutical engineering program at Zhaoqing University aligns its teaching model with industry demands. Course objectives emphasize clear, attainable outcomes that connect theoretical instruction with practical skills. The curriculum is regularly updated to reflect emerging industry trends, with industry experts contributing to course design, ensuring the integration of current technologies and practices. This enhances both theoretical understanding and practical abilities in students.

4.2 Integrated Learning Pathways

Zhaoqing University uses an integrated learning approach that combines classroom instruction, laboratory work, practical training, and workplace practice. Classroom teaching focuses on key theories, complemented by interactive and case-based learning methods. Laboratory courses emphasize hands-on learning through projects developed with industry partners, enabling students to simulate production processes and operate real equipment. Off-campus training further strengthens university-enterprise cooperation, allowing students to participate in research and production activities in industrial environments, building their professional competence and employability. The dual mentor system ensures continuous support, reinforcing students' skills and preparing them for the pharmaceutical industry.

4.3 Industry-Education Integration Outcomes

The industry-education integration model has significantly improved students' practical skills and innovative thinking. The integration of classroom learning, laboratory work, training bases, and workplace activities has enhanced students' professional competence. The dual mentor system and enterprise-based training bases provide valuable industry experience, strengthening students' competitiveness in the job market. Moving forward, Zhaoqing University will deepen industry collaboration, refine curriculum design, and continue improving teaching quality to cultivate application-oriented professionals who can meet the evolving needs of the pharmaceutical sector.

5. Evaluating the Impact of the Comprehensive Practice Curriculum

Zhaoqing University enhances students' practical skills and job readiness through industry-education integration. Collaborations with enterprises provide hands-on experience in areas like formulation and quality control, engaging students in solving real industry problems and developing teamwork. The dual mentor system allows students to apply theoretical knowledge in real settings, improving professional competence. Off-campus training bases are essential for job adaptability, immersing students in enterprise environments and accelerating their transition to employment. These bases improve employability and competitiveness. Additionally, the dual mentor system benefits faculty, keeping them updated on industry trends and enhancing teaching methods and the overall educational experience.

6. Conclusion

Zhaoqing University's pharmaceutical engineering program, guided by industry-education integration, has significantly improved students' practical skills and employability. Enhanced university-enterprise collaboration has created diverse learning platforms that immerse students in real-world production and research. The integrated learning pathway, supported by the dual mentor system, boosts professional competence, innovation, and adaptability. The program continues to improve,

offering a replicable model for talent development in pharmaceutical engineering.

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References

[1] Wang Lili. Exploration of new engineering talent training pathways under industry education integration based on "three leaderships and three coordinations" [J]. Higher Education Forum, 2022(5):83-86.

[2] Zhong Yunfei. Research on an industry education integration model for application oriented undergraduate programs under the background of new engineering [J]. Journal of Higher Education, 2021, 7(20):65-68.