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Innovation in engineering master's training model: A case study of Guangdong Pharmaceutical University in the field of biotechnology and pharmacy

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Abstract: Master of engineering (MEng) education focuses on developing applied talents with strong theoretical and practical skills, emphasizing alignment with industry needs to enhance hands-on training and innovation. The interdisciplinary Biology and Pharmacy program demands particularly high practical and innovative competencies. However, current models often lack sufficient practical components and industry relevance. To address this, Guangdong Pharmaceutical University partnered with companies like Perfect (China) and Nanxin Medical to create a "dual-scenario" model. Students engage in real-world enterprise projects, solving actual technical challenges while improving their research and practical skills. This approach bridges the gap between academia and industry, offering valuable insights for MEng education.

Keywords: engineering master; biotechnology and pharmacy; school-enterprise cooperation; project-driven

1 Cultivation requirements for master of engineering in biology and pharmacy

1.1 Characteristics of master of engineering cultivation

As an important component of professional degree education, Master of Engineering education has distinct characteristics. Its goal is to cultivate high-level applied talents, emphasizing the close integration of theory and practice, and focusing on students' ability to solve actual engineering problems. Compared to the traditional academic Master's cultivation model, the Master of Engineering places greater emphasis on practical teaching components, requiring students to possess strong engineering practice abilities and innovative awareness [1]. They must be able to apply the learned knowledge to real engineering projects, providing direct support and contribution to societal and industrial development [2].

1.2 Specificity of MEng cultivation in biology and pharmacy

The Biology and Pharmacy MEng program is an interdisciplinary field combining biology, medicine, pharmacy, and chemistry, requiring students to master both theoretical knowledge and engineering techniques to solve industry challenges [3]. As a fast-evolving high-tech sector, it demands strong innovation and practical skills in areas like drug development and biotech applications. Therefore, cultivation must emphasize both academic rigor and hands-on training to enhance

students' problem-solving abilities and research competence for industry needs.

1.3 Necessity and advantages of university-enterprise collaboration and project-driven approach

University-enterprise collaboration and project-driven learning are essential in cultivating MEng students in Biology and Pharmacy. The former establishes partnerships between universities and enterprises, leveraging academic research and industry resources for shared benefits. Students gain theoretical knowledge while engaging in real-world projects, enhancing problem-solving skills and employability [4]. Project-driven learning immerses students in practical research, fostering innovation, teamwork, and self-directed learning. Both models bridge theory and practice, preparing students for career success.

2 Current deficiencies in cultivation

2.1 Weak practical components

Current MEng programs in Biology and Pharmacy suffer from inadequate practical training components. The proportion of hands-on instruction lags behind theoretical coursework, limiting students' access to meaningful practice opportunities. Additionally, many practical exercises lack real-world relevance, failing to develop true problem-solving skills or prepare graduates for industry challenges. This disconnect between classroom training and professional requirements undermines the development of essential operational competencies.

2.2 Disconnection from industrial demands

The cultivation of MEng students in Biology and Pharmacy often fails to align with industry needs. Universities prioritize theoretical knowledge over practical market demands, creating a skills gap for graduates [5]. This mismatch forces employers to provide additional training. Weak university-industry collaboration further exacerbates the issue, as ineffective communication and lack of structured partnerships hinder proper talent development.

2.3 Insufficient cultivation of innovation capabilities

The MEng program in Biology and Pharmacy currently lacks effective innovation cultivation. Teaching methods remain rigid, relying heavily on traditional lectures without incorporating diverse pedagogical approaches, leading to passive learning and stifled creative thinking. Additionally, practical training lacks innovative project design, forcing students to mechanically follow preset procedures rather than engage in independent exploration, ultimately limiting their innovation development [6].

3 Practical innovations at Guangdong Pharmaceutical University

3.1 Construction of a "dual-scenario" cultivation model

To overcome existing educational limitations, Guangdong Pharmaceutical University has innovatively developed a "dual-scenario" cultivation model in partnership with leading enterprises including Perfect (China) Co., Ltd. and Nanxin Medical. This pioneering approach systematically alternates students between two complementary learning environments: the academic setting provides structured theoretical instruction to establish fundamental knowledge frameworks, while the industrial immersion scenario facilitates direct engagement with authentic engineering, enabling the practical application of classroom learning to solve real-world challenges. By strategically integrating institutional academic resources with corporate technological assets, this synergistic model not only enhances students' technical competencies and problem-solving abilities but also significantly expands their professional perspectives and interdisciplinary understanding.

3.2 Industry-driven problem orientation

The cultivation process prioritizes solving front line industrial challenges. Universities and enterprises co-design training plans, aligning research topics with market demands. Students directly engage with practical issues, such as drug development bottlenecks or medical device optimization, delivering solutions through applied research. This approach not

only advances corporate innovation but also cultivates students' responsibility and clarifies career trajectories.

3.3 Achieved outcomes

This innovative cultivation model has achieved multidimensional success. Students demonstrate stronger practical and innovative skills, boosting their employability. Corporate partners benefit from resolved technical challenges and streamlined R&D processes. Academically, the model creates a feedback-driven curriculum optimization system aligned with industry evolution, while supplying enterprises with job-ready specialists. This tripartite success simultaneously elevates education quality, corporate innovation, and industry-academia synergy.

4 Conclusion

The integrated "dual-scenario" cultivation model, grounded in industry-driven pedagogy, has proven particularly effective in overcoming three critical challenges in Biology and Pharmacy Engineering Master's education: practical skill development, industry relevance, and innovation capacity building. This successful paradigm not only establishes a transferable blueprint for sustainable academia-industry partnerships but also demonstrates considerable promise for revolutionizing applied talent cultivation in the biotechnology and pharmaceutical sectors, where theory-practice integration is paramount.

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Conflicts of interest

The author declares no conflicts of interest regarding the publication of this paper.

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