

## Exploration and Practice of Cultivating Pharmaceutical Postgraduates' Innovation and Entrepreneurship Ability by Combining Competition with Scientific Research Based on School Enterprise Cooperation

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**Keywords:** Pharmacy master; Reform; Teaching mode; Innovation

**Abstract:** Innovation is the driving force of national development, and the ability of independent innovation is the key to improve the comprehensive national strength. Therefore, innovation ability has gradually become a necessary ability. Chinese professional postgraduate education system has always focused on cultivating students' innovative and practical capabilities. However, the lack of innovation and practice ability of postgraduates is a prominent problem in the practice of graduate education in China. As a major that requires professional operating skills, there are also many problems with the training model of pharmacy masters. In recent years, we have been committed to the reform of the training model for postgraduates majoring in pharmacy. Based on the training model for a master's degree in pharmacy in the School of Pharmacy of Jiangxi Science and Technology Normal University, we have reformed the postgraduate training method, and formed the educational characteristics of pharmacy postgraduate innovation and entrepreneurship training that combines schools and enterprises, competitions and scientific research. Under the new teaching model, not only have students' performance improved significantly, but their innovative and practical abilities have also been improved.

### 1. Introduction

With the rapid development of China's higher education, the enrollment scale of master students is expanding, and the enrollment scale of professional master students is increasing year by year. The enrollment plan data and growth rate of postgraduate students in the recent three years as revealed in Table 1. The proportion of professional graduate students is increasing year by year, which is higher than that of academic graduate students in the near years. With the increase of the number and proportion of professional postgraduates, to explore how to better cultivate professional master students with innovation and practical ability is more and more important. The training goal of a professional master is to cultivate high-level applied talents in society. This kind of talent is very much needed in the technology-intensive and innovation-driven industry of biomedicine [1] [2] [3]. The development of a pharmaceutical professional degree in China is relatively late, and the traditional pharmaceutical postgraduate education focuses on the cultivation of scientific research personnel [4]. The teaching idea of graduate course is based on theoretical knowledge, and the participation of enterprises in the training process is not high [5] [6]. Despite a series of reforms, there are still some problems, such as low enthusiasm for school enterprise cooperation and lack of in-depth cooperation. Besides, the innovation and entrepreneurship ability of pharmaceutical master degree students is obviously insufficient. This has seriously affected the quality of master of pharmacy and the process of talent transportation from school to enterprise. To solve these problems, we take the school of pharmacy of Jiangxi Normal University of science and technology as the platform, and the Key Laboratory of Drug Design and Evaluation of Jiangxi Province as the core. Through continuous innovation and practice, we are committed to training applied talents, and established the "innovation and entrepreneurship" talent training model of pharmacy master degree. This teaching mode had cultivated more excellent students. This paper introduces the new teaching mode of master of pharmacy and discusses its advantages and achievements.

Table 1. Post graduate enrollment date in recent three years

Year	Total number of Master students (10,000)	Number of professional Masters (10,000)	The percentage of professional masters (%)	Percentage increase over the previous year (%)
2017	72.2	40.2	55.7	8.3
2018	76.2	43.9	57.7	2.0
2019	91.7	47.4	58.5	0.8

## 2. Methods

The Professional master of Pharmacy in Jiangxi science, and technology Normal University is the research object of this mode. Through the deep integration of school and enterprise, we have established an off-campus practice base group centered on research institutes and enterprises, an on-campus experimental platform group centered on the Jiangxi Provincial Key Laboratory of Pharmaceutical Molecular Design and Evaluation, and focusing on the mainline of cultivating innovative and entrepreneurial practical talents for pharmaceutical postgraduates, we should carry out the reform and practice of pharmaceutical postgraduate education, which combines ideological and political quality with professional ability, and results-oriented and task-driven. Take advantage of long-term cooperation between school and enterprise set up a "graduate university-enterprise cooperation training steering committee" to guide the cultivation of graduate students. In the enterprise to establish a "graduate school enterprise cooperation training Steering Committee" to guide the cultivation of graduate students, establish "school enterprise graduate innovation base platform", "school enterprise local cooperation and service platform" and "school enterprise order form cooperation training platform" in enterprises, and establish cooperation relationship with relevant enterprises. Various forms can ensure that pharmaceutical graduate students in the ideological and academic leaders, but also cannot lag behind in the industrialization or adapt to the needs of practical work in a short time.

During the process from theory to scientific research and production, pharmaceutical postgraduates have improved their understanding and practical ability, deepened their understanding of knowledge, and gradually cultivated the innovative ability and practical ability needed in their work [7]. Moreover, in the process of training, the school explored the implementation of the training mode of full teacher participation in the tutorial system, and the student training implemented the double tutorial system, that is, under the guidance of both internal and external tutors. The tutor on campus is the professional teacher with engineering practice experience, and the tutor off campus is the engineering and technical personnel of the cooperative enterprise. This ensures that students can not only learn theoretical knowledge, but also learn practical knowledge that cannot be learned in school. This school enterprise joint training mode has achieved excellent results, and has been encouraged and supported by the college of pharmacy and our school, as well as other similar colleges and universities.

Competition and scientific research combined with the method of improving pharmaceutical professional master's innovation entrepreneurship and practice ability is also very important. Tutors actively organize graduate students to participate in a series of academic exchange competitions, such as China College Students 'Internet+' Innovation and Entrepreneurship Competition, The Challenge Cup and China Innovation & Entrepreneurship Competition. National Pharmaceutical Postgraduate Academic seminar, and National Pharmaceutical Chemistry Conference. Students communicate with their peers through academic reports and wallpapers, to compete on the same stage, collide with each other, and broaden their horizon. In this way, they promote learning and innovation through competitions, to improve their innovative practical ability.

In the process of establishing this teaching mode, a set of practical teaching evaluation systems has also been formed. The system first has a set of the scientific and complete student evaluation system to strengthen the evaluation of students' comprehensive experimental ability. Through

written examination, oral test, field operation, design and defense, the quality and ability level of students are investigated, such as "Jiuzhou pharmaceutical class" students' graduation opening, project development, answer. The whole process of the debate is carried out in enterprises, and the defense committee is composed of teachers from schools and enterprises. Then, the teacher evaluation system is established, and the institutionalized quality standard is strictly implemented. Through peer evaluation, students evaluate teaching, and a special incentive fund is established to reward teachers and managers who have made outstanding contributions in practical teaching. Finally, there is a practical teaching supervision system to inspect the whole process of practical teaching.

### 3. Results

The training mode has achieved good results in practice. The innovation and entrepreneurship ability of graduate students is improved, and the practical effect is remarkable. For example, when taking part in the pharmaceutical engineering discipline competition, they broke through the encirclement among many "Project 985/211" universities and won one first prize and five second prizes of the state. The annual competition results and award rate ranked first in the province and among the top universities in China. The students' professional practice ability was significantly improved. In the national Internet plus innovation and entrepreneurship competition and Challenge Cup innovation and entrepreneurship competition, the provincial level has been rewarded for three consecutive years. In 2020, the team named "Lonktinib" and "Zhuyiqingguan" won the provincial gold award and bronze award in the China College Students 'Internet+' Innovation and Entrepreneurship Competition, entered the national competition, and won the national silver award and bronze award respectively. They also won the silver award in the 12th Challenge Cup competition. All these have improved the students' ability of innovation and entrepreneurship, and also brought honor to the school. In addition, students of the pharmaceutical college won the first prize in the National College Students' Pharmacy Forum in 2019, and won more than ten provincial-level awards at the pharmaceutical discipline seminar in Jiangxi Province by the teacher's Pharmacy Forum in 2019, and won more than ten provincial-level awards at the pharmaceutical discipline seminar in Jiangxi Province by the teacher's guidance.

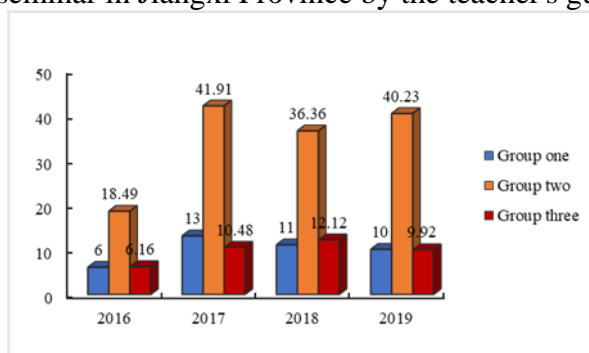


Fig. 1. SCI statistics published by graduates in recent year

As shown in Fig. 1, in recent three years, the total number of published papers has increased significantly, and the per capita impact factor is on the rise. They also won the fourth place in the province in Maker China competition. Through participating in these academic activities, the overall quality and ability of students have been significantly improved.

It has established a tutor guidance group with secondary professors, professors, associate professors, candidates of ten million talents project in Jiangxi Province, main discipline leaders of Jiangxi colleges and universities, young and middle-aged backbone teachers, outstanding youth fund talents of Jiangxi Province, and more than 10 high-end talents of enterprises as the core. During the training of master students in recent four years, the specific data of SCI published are shown in Fig. 1 and 14 graduate students 39 SCI papers were published by the first author (2.9 papers per capita and the average impact factor was 9.8). The average impact factor per capita

showed an upward trend, and there were 22 papers with  $IF > 3.0$ . Among these students, one won the National Award for graduate scholarship, 3 provincial awards, 22 provincial government scholarships, and 2 provincial excellent graduation theses. Among the 18 graduates, 12 were admitted to Tianjin University, Wuhan University, Dalian University of technology and other “Project 985/211” universities, with a doctoral promotion rate of 67% (Fig. 2). The employment rate of all previous graduates is 100%, which is highly recognized by employers and has a good social response.

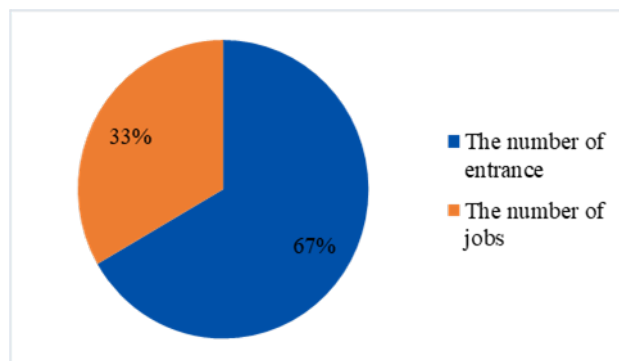


Fig. 2. Statistics of graduates' enrollment and employment.

As shown in Fig. 2, we could see most of the graduates choose to continue their studies

### Acknowledgment

We gratefully acknowledgment the generous support provided by the Education and Teaching Reform Project of Jiangxi Science & Technology Normal University. (JGZD-19-10-8 and JXJG-20-10-2)

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