

# Research on the High Quality Development of Biology Graduate Education in Local Normal Universities —Take Xinyang Normal University as an Example

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## Abstract

Taking Xinyang Normal University as an example, this paper makes an in-depth study on the high-quality development mode of biology graduate education in local normal universities. This paper reviews the development process of graduate education in China, points out that it has entered a high-quality development stage, and emphasizes the important role of local normal colleges and universities in it. The research puts forward the "12345" mode, namely "one focus, two improvements, three constructions, four efforts and five in one", which focuses on the quality of graduate education, improves theoretical literacy and practical ability, strengthens discipline, tutor and team construction, focuses on education and teaching, scientific research, practical application and institutional mechanism innovation, and realizes innovative development, coordinated symbiosis, sustainable development, characteristic development and open sharing. The implementation effect of the "12345" model was evaluated through questionnaires and interviews, and it was found that it has achieved remarkable results in improving graduate students' theoretical literacy and practical ability. At the same time, it puts forward strategies to further optimize the "12345" mode, including deepening education and teaching reform, strengthening the construction of tutor team, improving the internationalization level and serving the local economic and social development. Therefore, the "12345" model not only enriches the theoretical system of graduate education in Local Normal Colleges and universities, but also provides practical reference for other colleges and universities, which has important theoretical and application value.

**Keywords:** Local normal colleges and universities; Postgraduate education; "12345" mode.

## 1. Introduction

### 1.1. Research Background and Current Situation

#### 1.1.1 Research Background

In recent years, China's graduate education has developed vigorously, and its importance has become increasingly prominent. In the report 2020 on the progress of graduate education research in China, adhering to the guiding ideology of "gathering the research results of graduate education, displaying the research status of graduate education, guiding the research direction of graduate education, and improving the research level of graduate education", the report combs the progress of Graduate Education Research in China in 2019, covering nine topics, including the basic theoretical issues of graduate education, education quality, training, tutor team construction, enrollment and employment, moral education, discipline construction, education management, and "double first-class" construction, comprehensively reflects the research results of that year, and summarizes the annual research hotspots, research methods, and author group characteristics. In July 2020, General Secretary Xi Jinping made important instructions on graduate education [1], emphasizing that graduate education plays an important role in cultivating innovative talents, improving innovation ability, serving economic and social development, and promoting the modernization of national governance system and governance ability. In the same month, the Ministry of education, the national development and Reform Commission and the Ministry of Finance jointly issued the

opinions on accelerating the reform and development of graduate education in the new era [2] (hereinafter referred to as the opinions), pointing out that by 2035, China will initially build a powerful country with Chinese characteristics in graduate education. The opinions defines the guiding ideology, strategic objectives and reform measures for the reform and development of graduate education in the new era, which is the fundamental and action guide for accelerating the reform and development of graduate education in the new era, and defines the main line of work of "cultivating morality, serving needs, improving quality and pursuing excellence". In September 2020, the Academic Degrees Committee of the State Council and the Ministry of Education issued several opinions on further strictly regulating the quality management of academic degrees and graduate education [3], proposing to follow the rules, strictly enforce the system, strengthen the implementation, strictly strengthen the quality management of graduate students, and run graduate education to the satisfaction of the people. In this context, as an important part of China's higher education system, local normal universities shoulder the important mission of cultivating high-level innovative talents, and the high-quality development of their graduate education has far-reaching significance.

## 1.2. Research Status

### 1.2.1. Graduate Education has Entered a New Era of High-Quality Development

Graduate education in China has gone through the stages of focusing on quality, improving quality, connotative development and high-quality development [4]. Graduate education shoulders the important mission of high-level talent training and innovation and creation, is an important cornerstone of national development and social progress, and is the highest form of higher education in China [5]. The report of the 19th CPC National Congress clearly pointed out that "China's economy has changed from a high-speed growth stage to a high-quality development stage", and the victory of the 20th CPC National Congress opened a new era of graduate education reform and development [4]. The 2020 National Conference on graduate education pointed out that "to improve the quality of graduate education as the core, deepen reform and innovation, and promote connotative development", marking that China's graduate education has entered a new era of high-quality development stage.

### 1.2.2. The Scale of Postgraduate Education has been Gradually Expanded

Since 1999, the scale of postgraduate education in China has been expanding (Figure 1). According to the online data of China education, from 1999 to 2006, the scale of postgraduate education increased rapidly, and its growth rate was also relatively rare in the history of global postgraduate education [6]. According to the data of the national statistical bulletin on the development of education, China enrolled only 42000 postgraduates in 1994. The number of Postgraduates in 2017 exceeded 800000 for the first time. The number of Postgraduates in 2020 exceeded 1.1 million, and the number of Postgraduates in 2022 exceeded 1.2 million. From the perspective of the development scale of postgraduate education, the number of applicants for the postgraduate entrance examination in 2022 exceeded the number of undergraduate graduates for the first time, and China has become a "big" country in the global postgraduate education [4]. In 2023, the number of graduate students enrolled in China will reach a new high in nearly 20 years, indicating that the scale of graduate education in China is still expanding. Therefore, it is of great significance to further promote the high-quality development of graduate education to deeply understand and meet the needs of the people for graduate education.

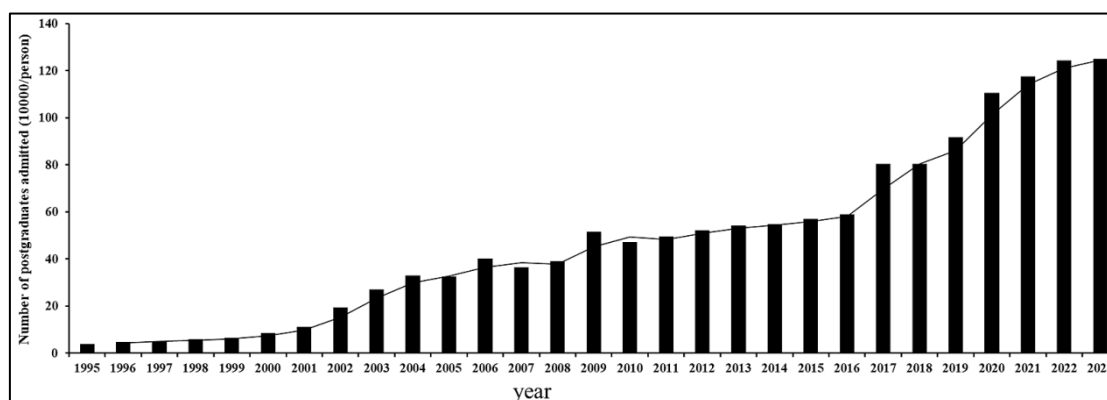
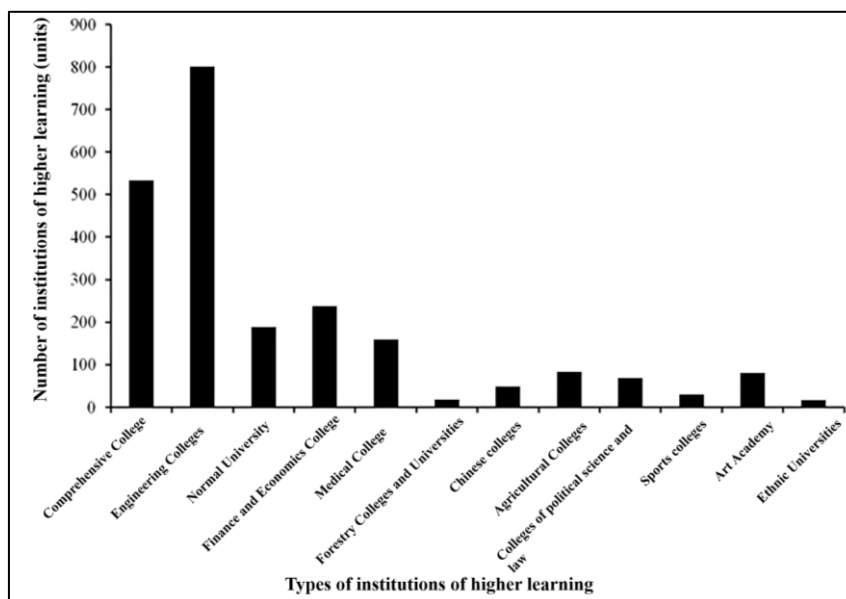


Figure-1. Changes in the number of graduate students admitted in China in the past two decades

### 1.2.3. Local Normal Colleges and Universities Play an Important Role in the Process of Graduate Education

According to the data released by the Ministry of education, as of June 15, 2023, there were 3072 institutions of higher learning in China, including 2820 ordinary institutions of higher learning and 252 adult institutions of higher learning. There are 864 graduate training institutions in China, including 578 ordinary colleges and universities. Colleges and universities have become the main position of graduate education in China. Among colleges and universities, the total number of engineering colleges, comprehensive colleges and universities and finance and Economics Colleges ranked the top three, and the total number of normal universities ranked the fourth (Figure 2). Among the 215 normal universities in China, there are 6 subordinate normal universities and 209 Local Normal Universities (accounting for 97%), which play an important role in the process of graduate education. At the same

time, local normal colleges and universities also shoulder the new mission of cultivating a large number of high-level top-notch innovative talents [4, 7] and supporting the high-quality development of graduate education in the new era.



**Figure-2.** Number of different types of institutions of higher learning in China

#### 1.2.4. The Demand of the Rapid Development of Life Sciences for Postgraduate Education

In the 20th century, life science developed rapidly, especially in the last 20 years of the last century, life science and technology made important progress [8]. The 21st century is the century of life science, and life science will become the leading discipline in the field of natural science[9]. With the rapid development of life science and technology, the scale of national biological postgraduate education is also growing steadily, and the society needs more high-level talents with high innovation ability and practical ability [10, 11]. Under the background of building a powerful country in education in the new era, how to meet the needs of the rapid development of life sciences and society in the development of postgraduate education in Local Normal Universities[12, 13], cultivate a large number of high-level top-notch innovative talents, and support the new mission of high-quality development of postgraduate education in the new era has become an important issue to be solved at present.

#### 1.2.5. "12345" Mode Promotes the High Quality Development of Graduate Education

In combination with the 16 years' practice of graduate education in the school of life sciences of Xinyang Normal University, the "12345" model for the development of graduate education in biology has been gradually constructed, that is, the "one focus, two improvements, three constructions, four efforts and five in one" model for the development of Graduate Education (Figure 3). This mode focuses on the quality of graduate education, focusing on improving the theoretical literacy and practical ability of graduate students. By continuously strengthening discipline construction, tutor construction and team construction, it focuses on graduate education and teaching, scientific research, practical application and institutional mechanism innovation, and integrates innovation and development, coordinated symbiosis, sustainable development, characteristic development, and openness and sharing (i.e. "five in one") into a new high-quality development mode of graduate education.

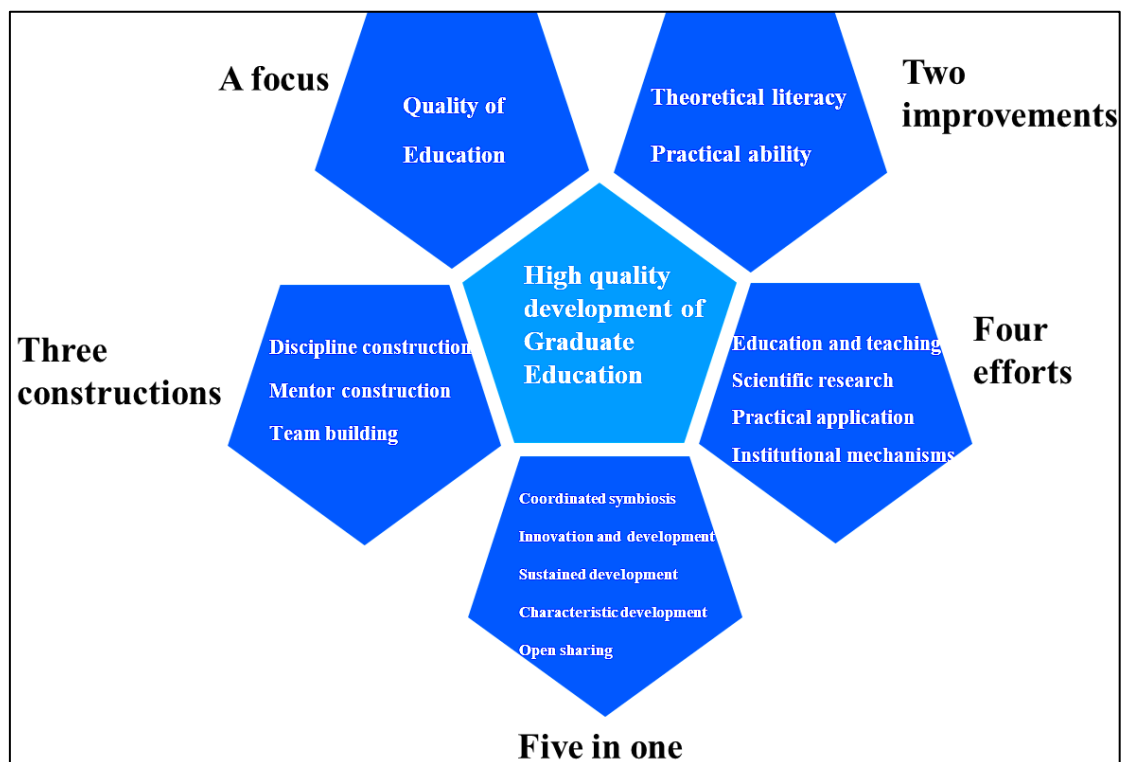


Figure-3. "12345" mode of graduate education development

## 2. Research Protocol

### 2.1. Research Contents

Domestic scholars have done a lot of research on the development mode of graduate education [14, 15], but most of the research only stays at the relevant theoretical level, lacking systematic research on it, especially the research and practical investigation and Analysis on the innovation of the development mode of biology graduate education in local normal universities are relatively rare. Based on the development of graduate education in the school of life sciences of Xinyang Normal University in the past 16 years, this paper determines the main direction and content of the research.

(1) Comprehensively combing the measures taken to strengthen the construction of "discipline tutor team", focusing on the scientific construction, summarizing the specific practices and experiences in the "three constructions", and investigating the promotion of the construction of "discipline tutor team" on the improvement of graduate students' theoretical literacy and practical ability.

(2) Focusing on reform and innovation, this paper comprehensively summarizes the experience of focusing on education and teaching, scientific research, practical application and institutional mechanisms (i.e. "four efforts") in the process of graduate education, and investigates its actual effect on the improvement of graduate students' theoretical literacy and practical ability.

(3) Investigate and sort out the "five in one" path of graduate education practice, and analyze its impact on promoting the high-quality development of graduate students.

(4) Comprehensively investigate and evaluate the quality of graduate education, analyze the causes of the problems, put forward high-quality development countermeasures, further optimize the development mode of graduate education, promote the continuous improvement of theoretical literacy and practical ability of graduate students, and ensure the high-quality development of graduate education.

(5) We will continue to deepen education and teaching reform, optimize postgraduate training programs, strengthen curriculum construction, strengthen teaching monitoring, and actively explore new paths for international training. With ability training as the core and innovation ability training as the focus, teachers are encouraged to participate in curriculum construction and teaching reform, actively explore, boldly practice and conduct in-depth research, so as to continuously improve the quality of teaching.

(6) Strengthen the construction of tutor team, strictly select, train and assess tutors, establish and improve the incentive and restraint mechanism, and comprehensively improve the academic level and educational ability of tutors.

Through the above research content, the "12345" mode for the development of graduate education is scientifically and reasonably constructed, the problems existing in the development process of graduate education are found and the reasons are analyzed, and the Countermeasures for the high-quality development of graduate education are put forward to further improve and optimize the mode of Graduate Education, so as to promote the high-quality development of graduate education.

## 2.2. Research Priorities and Difficulties

(1) The core task of this study is to systematically integrate the elements of "one focus, two improvements, three constructions, four efforts and five in one" to form an operable and popularized postgraduate education model. How to ensure the synergy and logicity among the elements is the difficulty that needs to be broken through.

(2) The summary and analysis of the "five in one" development strategy systematically combs the five strategies of "innovative development, coordinated symbiosis, sustainable development, characteristic development, and open sharing", analyzes its actual effect in improving graduate students' theoretical literacy and practical ability, and puts forward targeted optimization suggestions, which is the key link of the research. In this part, data and cases need to be deeply mined to ensure the scientificity and effectiveness of the conclusions.

(3) The basic work of the research is to comprehensively investigate and evaluate the quality of graduate education, comprehensively collect relevant data on the quality of graduate education through questionnaires, interviews, discussions and field visits, analyze the advantages and disadvantages of the current education model, and deeply analyze the root causes of the problems. This part needs to design a scientific and reasonable investigation scheme to ensure the authenticity and reliability of the data.

## 2.3. Technology Roadmap

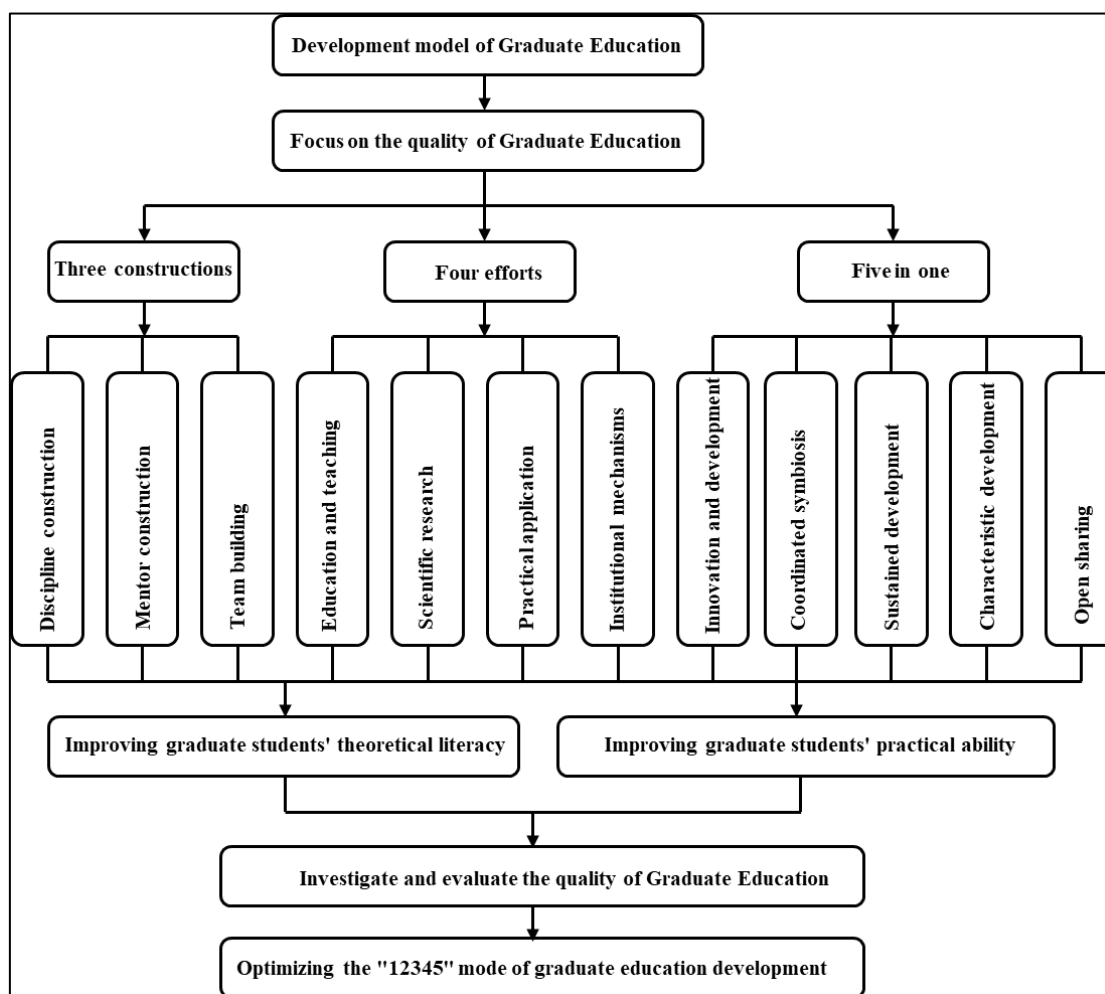


Figure-5. Implementation technical route

## 3. Research Results

Combined with the "12345" mode of postgraduate education development explored in the past five years, especially the actual situation of continuously strengthening the construction of "discipline tutor team" and the innovation and reform and development of "four efforts", the "12345" mode of biological postgraduate education development was investigated and analyzed in a multi-dimensional and systematic way through a variety of survey methods including questionnaire survey, in-depth interview, discussion and field visit, so as to innovate the development mode of postgraduate education, continuously improve the theoretical literacy and practical ability of postgraduate students, and promote the high-quality development of postgraduate education.

### 3.1. Investigation and Analysis of Strengthening the "Three Constructions" to Improve the Quality of Graduate Education

The school of life sciences of Xinyang Normal University has always attached importance to the construction of "discipline tutor team" (i.e. "three constructions") in the process of postgraduate education in the past 16 years. In



recent years, the college has continuously strengthened the construction of biological disciplines around the introduction of high-level scientific and technological talents, the cultivation of innovative talents, and scientific research teams. At present, the college has a provincial key discipline of biology, which has formed five distinctive discipline directions such as botany and genetics, and has been successfully approved as the dominant characteristic discipline group and the provincial characteristic backbone discipline group in Henan Province. Support a group of young tutors to visit and study in key universities or scientific research institutes at home and abroad, update knowledge and educational concepts, and promote the steady improvement of tutor guidance level. At the same time, through the establishment of tutor collaborative innovation mechanism and mutual exchange mechanism, the construction of tutor team knowledge structure system, the construction of communication platform, the construction of scientific management system and other specific measures, the construction of graduate tutor team and academic echelon has been continuously strengthened, and remarkable results have been achieved. Therefore, through a comprehensive review of the measures taken for discipline construction, tutor construction and team construction, this paper summarizes the specific practices and experience of the "three constructions", and discusses the actual effect of the "three constructions" on improving the theoretical literacy and practical ability of biological postgraduates, which provides important support for the high-quality development of postgraduate education in the future.

### **3.2. Investigation and Analysis of Strengthening the "Four Efforts" to Improve the Quality of Graduate Education**

The quality of education and teaching and the level of scientific research are the important basis for improving the theoretical literacy of graduate students. Focusing on graduate education practice and application production is an effective way to improve the practical ability of graduate students; Reforming the management system and mechanism and promoting the modernization of graduate education governance system and governance ability is an important guarantee for improving graduate students' theoretical literacy and practical ability. In recent years, we have revised the postgraduate talent training program, improved the curriculum system, updated the syllabus and teaching content, improved teaching methods, strengthened teaching management and scientific research training, and strengthened the quality monitoring of postgraduate education. We should pay special attention to the practice of graduate education, the cultivation of graduate students' practical ability, strengthen the construction of practice tutor team, and improve the degree of attention paid by tutors to the cultivation of graduate students' practical ability; Strengthen the organization and management of postgraduate practical ability training, establish and improve the practical ability training system; Pay attention to the process management of the cultivation of Postgraduates' practical ability to ensure the quality of the practice link; Carry out practical activities in a variety of ways, such as experiments, internships, social surveys, etc; Encourage graduate students to participate in various forms of competition activities, such as science and technology innovation competition, entrepreneurship competition, etc; Strengthen cooperation with enterprises and scientific research institutions to provide more practical opportunities for graduate students. Therefore, we comprehensively summarized the reform and innovation experience in graduate education and teaching, scientific research, practical application and system mechanism, and investigated the education quality of graduate students from the school of life sciences of Xinyang Normal University in the past five years. Based on the comparative analysis of the theoretical literacy and practical ability of graduate students, it is found that the "four efforts" promote the theoretical literacy and practical ability of graduate students, which has important value for improving the theoretical literacy and practical ability of graduate students and ensuring the quality of education.

### **3.3. Investigation and Analysis of "Five in One" Development Strategy on Improving the Quality of Graduate Education**

The quality of graduate education is the lifeline of graduate education. The high-quality development of graduate education should reflect the new development concept. The high-quality development of graduate education is innovative development, coordinated symbiosis, sustainable development, characteristic development and open and shared education [16]. In recent years, the school of life sciences of Xinyang Normal University has adhered to the development strategy of graduate education that integrates innovative development, coordinated symbiosis, sustainable development, characteristic development, and openness and sharing (i.e. "five in one"), and has always put morality cultivation and promoting the comprehensive development of graduate students through the whole process of high-level talent cultivation. It should not only serve the economic and social development of the region, but also serve the needs of the major strategy of rejuvenating the country through science and education and innovation driven development; In terms of the structure of teachers, the responsibilities and division of labor of the tutors inside and outside the school are clear, and the talents are cultivated cooperatively; In terms of the regional layout structure, the coordinated development of the layout of degree programs and the adjustment of regional economic structure and industrial structure; Coordinate the relationship and connection between industry, University and Research Institute, so that the three can truly achieve mutual benefit, mutual use and mutual inspection, so as to provide graduate students with rich practical opportunities, improve their practical ability, enhance their social service awareness, and further guide and deepen scientific research, so as to realize open cooperation and shared development. Therefore, a comprehensive survey of graduate students and graduate students shows that the "five in one" graduate education development strategy has a significant effect on improving the theoretical literacy and

practical ability of graduate students, which provides reference countermeasures for further improving the "five in one" graduate education development.

### 3.4. Scientific and Reasonable Construction of "12345" Mode for the Development of Graduate Education

In view of the comprehensive investigation and analysis of "three constructions, four efforts and five in one" to improve the quality of graduate education, this paper clarifies the effect of the "12345" mode of graduate education development on the improvement of graduate students' theoretical literacy and practical ability, finds out the existing problems in biological graduate education, puts forward specific improvement and development strategies, and further improves and optimizes the "one focus, two improvements, three constructions, four efforts and five in one" mode of graduate education development, which will promote the synchronous improvement of graduate students' theoretical literacy and practical ability, and ensure the high-quality development of graduate education.

## 4. Summary and Outlook

Based on the existing development model of graduate education, this study will further scientifically and reasonably construct the "12345" development model of graduate education. Through multi-dimensional and systematic investigation and analysis, this paper innovates the mode of graduate education, and puts forward the Countermeasures for the high-quality development of graduate education in local normal universities. Focusing on postgraduate education and teaching, scientific research, practical application and system and mechanism innovation can achieve the "five in one" high-quality development of postgraduate education, which is characteristic and representative in promoting postgraduate education, and has made important progress.

### 4.1. Theoretical Contribution

(1) Discipline construction can promote discipline development: through the "12345" mode, the college has significantly improved the overall level of the first-class discipline of biology and formed a number of characteristic discipline directions. The development of postgraduate education has promoted the exchange and integration between disciplines and enhanced the influence of disciplines.

(2) Strengthen the construction of scientific research platform: the college has built a number of provincial scientific research platforms, such as Henan Key Laboratory of tea plant biology. By holding academic conferences and inviting domestic and foreign scholars to give lectures, academic exchanges and cooperation have been strengthened, providing graduate students with a broad academic vision and development opportunities.

(3) Promote academic exchanges and cooperation: graduate students can timely understand the frontier trends of disciplines, broaden their academic horizons, establish extensive contacts with peer experts, and create more opportunities for future scientific research and career development.

### 4.2. Actual Results

(1) Promote the transformation of scientific and technological achievements: the college pays attention to the transformation and application of scientific research achievements and has established a close cooperative relationship with enterprises. For example, the "school enterprise R&D Center for tea processing and resource utilization" jointly built by the College of life sciences and Henan Jiuhuashan Tea Industry Co., Ltd. has promoted the transformation of scientific and technological achievements into real productivity and provided technical support for local economic development.

(2) Serving the development of local economy: Based on the advantages of Dabie Mountains' regional resources and the organic integration of multiple disciplines, the college has been successfully approved as a provincial advantageous and characteristic discipline group of "protection and utilization of Dabie Mountains' agricultural biological resources". Through the research on the protection and utilization of agricultural biological resources, it provides technical and intellectual support for the development of local agricultural industry, and promotes the sustainable development of local economy.

To sum up, the quality of education is the lifeline of graduate education, and the level of discipline mentor team construction is the key to determine the quality of graduate education. The scientific and reasonable construction of the "12345" mode for the development of graduate education, that is, focusing on the quality of graduate education, continuously strengthening discipline construction, mentor construction and team construction, taking discipline construction as the leading role, paying attention to the introduction, cultivation and collaborative development of excellent mentors and their team members, is the basis for the continuous improvement of graduate students' theoretical literacy and practical ability, focusing on the education and teaching, scientific research, practical application and institutional mechanism innovation of graduate students, and putting the new development concept through the whole process of graduate education, which is an effective strategy for the continuous improvement of graduate students' theoretical literacy and practical ability.

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