

# *Collaborative Cultivation of Agronomy and Biological Science Specialties with Demands Induction and University-Industry Cooperation*

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**Abstract**—To overcome the problems emerged during the cultivation of undergraduate students in the agronomy and biological science specialties and promote the personnel training quality in Hunan University of Humanities, Science and Technology, investigation and reforms have been made in the recent years. This paper analyzed the common problems during the cultivation of undergraduate students in these specialties, and introduced the related reforms in the past years' practice. Briefly, we built a scientific professional cognitive education model, encouraged the students to participate in the scientific and technological innovation and production, adopted the individualized cultivation for students, and cultivated the students with double tutors from the entrance to graduation. And our university also took measures to promote the young and middle-aged teachers' teaching levels and social demands serving ability orderly. Our university and other institutions had applied achievements and acquired good effects.

**Keywords**—*agronomy and biological science specialties; personnel training quality; reform; professional cognitive education model; undergraduate*

## I. INTRODUCTION

The College of Agriculture and Biotechnology of Hunan University of Humanities, Science and Technology has been working tightly with a number of large-scale enterprises including Hunan Haili High-tech Group Co., Hunan Five Stars Biotechnology Co., and Hunan Jiulong Economic and Trade Group Co., to form an innovation alliance in order to carry out the in-depth production, teaching and research cooperation since 2011. While doing the scientific research and innovation, we carried out the reform practices for the undergraduate innovative talents training in the agricultural and biological science specialties simultaneously, closely relying on the Collaborative Innovation Center for Field Weeds Control of Hunan Province and the Provincial University-enterprise Cooperation Talent Demonstration Base for Undergraduates in Agricultural and Biological Specialties, and all of the work was focused on improving the personnel training quality with the industrial guidance. The comprehensive quality of undergraduate students and the training effects have been improved effectively, and the social acceptance for students has

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been promoted significantly. During the past years, we constructed the professional cognitive education model to adapt the development and requirement from industries, set up the "1+2+1" course teaching mode which was carried out jointly by on-campus teachers and off-campus teachers, built the double tutorial model through which each undergraduate was guided by a specific on-campus teacher from entrance to graduation and several teachers from enterprises at different terms, and took some effective measures to promote the teachers' teaching and scientific research abilities. This paper analyzed the common problems and perplexities encountered during the cultivation of the undergraduate students in the agronomy and biological science specialties, and introduced our practice and successful experiences of collaborative cultivation with enterprises. Our achievements and experiences can be a helpful reference to the other universities.

## II. COMMON TEACHING PROBLEMS IN AGRONOMY AND BIOLOGICAL SCIENCE SPECIALTIES

### A. Students were lack of professional confidence

Many undergraduate students in the agriculture specialty and related specialties lacked the necessary interest and confidence in their majors, and some of them had no stable professional ideas after enrollment [1-2]. Some students even applied to transfer into more popular majors such as information engineering, electronic commerce, finance, and civil engineering, etc.

### B. Students were lack of the ability of innovation and application

Guided by the tradition training mode, the students were not taught in accordance with aptitude, and they seldom participated in the teachers' scientific researches and the various disciplines competitions [3]. Thus, their learning interests and innovative abilities could not be stimulated fully during their undergraduate stage.

### C. Insufficient practical teaching resources

The practical teaching contents of the agronomy and biological science specialties cover a wide range and are

changing rapidly, whereas the existing teaching resources in universities are limited and cannot meet the teaching needs [4-6]. These teaching materials are updated slowly, which cannot reflect the development trends of industries and enterprises. Through the collaborative training mode, the students will be cultivated jointly by both sides, and more of the practical teaching resources can be shared.

#### *D. Insufficient abilities of teachers to adapt to the university's transformation and development*

The existing knowledge structure of the teachers in the agronomy and biological science specialties in the local universities is not suitable for the transformation and development of these universities [7-9]. The universities should retrain the teachers, encourage them to become good at teaching and love teaching, and stimulate them to put the undergraduate education as the first priority in their work.

### III. METHODS FOR SOLVING TEACHING PROBLEMS

#### *A. Establishing a scientific professional cognitive education model*

The teachers should correctly guide the students to learn about the curricula setting, the key cultivation points, and the core competencies of these specialties, rather than simply introduced what they should study, how to do in the future, or something like the salary situation and employment in the industries. To achieve these goals, we took the following measures: firstly, we set up the professional introduction courses, drew up the outlines of the professional introduction courses with the industry experts jointly, and collected the opinions from the industry experts to clarify the objectives, tasks, and requirements of the courses; secondly, the teaching mode of the professional introduction courses of these specialties were reformed by using both on-site teaching and expert lectures, each accounting for half of the class hours, and the professional teachers in the on-campus practice bases held the on-site teaching, whereas the well-known industry experts held the lectures to interact with the students; thirdly, the teachers often went out to visit the relative enterprises and public institutions to learn about the industry demand for talents, and then introduced the urgent social needs for talents in these specialties to their students.

#### *B. Students were widely involved in scientific and technological innovation and production*

Relying on the provincial cooperative innovation center, a number of provincial and municipal innovation and entrepreneurship platforms were built including Zhongshi Edible and Medical Fungi Star Creation Base and Guanjin Medical Maker Base, to encourage students to take part in, forming the integration platforms for talents, markets, capital, and technological innovation achievements from the students.

#### *C. Individualized cultivation for students was adopted*

The teachers were organized to connect their scientific research programs with the students, the bidirectional choices were directed between the teachers and students, and the

students were encouraged to take part in the teachers' scientific activities. The students were organized to join the teachers' teams, and they applied for the projects of undergraduates' research learning and innovative experiment plans themselves, so as to stimulate the students' interest in scientific research and to train them according to their personality. Based on this cultivation mode, the students were organized to participate in the competitions of agricultural and biological sciences. And we also established the relative incentive mechanism to reward the students for their awards and research achievements such as papers, production standards, software knowledge properties, and patents.

#### *D. Cultivating students with double tutors from the entrance to graduation*

The students were trained jointly relying on the alliance units of the provincial innovation center. Each teacher supervised four or five students all the way around. After entering the professional practice and graduation thesis periods, the students were sent to enterprises including Hunan Haili High-tech Group Co., Hunan Five Stars Biotechnology Co., and Hunan Jiulong Economic and Trade Group Co., etc. to carry out their professional practice and graduation thesis work under the guidance of both on-campus tutors and off-campus tutors. Some of the students participated in the projects of the enterprise tutors to promote their innovative and application abilities, whereas some of the students carried on the projects of their on-campus teachers in the enterprises.

#### *E. Promoting young and middle-aged teachers' teaching level and social demands serving ability in an orderly way*

Three to five teachers under the age of 40 were selected according to these specialties to work in enterprises and research institutes every year, gradually forming a group of a double-qualified professional teaching team with one specialty and many abilities. Eight to ten teachers were selected to visit well-known overseas institutes and universities and participated in relative high-level international conferences every year, to broaden their scientific horizons and enhance their professional abilities.

### IV. INNOVATION POINTS OF OUR ACHIEVEMENTS

#### *A. Professional cognitive education model was innovated*

The education model was created and performed jointly by the university and enterprises according to the personnel demands from society. Under this education model, the students would form a correct and comprehensive understanding of their specialties, and gradually loved their specialties.

#### *B. Training mode of collaborative innovation talents in agricultural and biological science specialties was created*

Based on the idea of cultivating talents for the local economic needs, we basically relied on the advantages of the provincial collaborative innovation center and the plant protection discipline during cultivating students. As a result, the students were trained in accordance with their aptitude and

personality. Thus, both of the personality and ability of the students were developed jointly.

#### *C. Advantages of discipline and platforms were brought into the full potential*

The high-quality teaching resources of platforms and bases were shared, and the double tutors' system for undergraduate students were established, in which the on-campus tutors and off-campus tutors guided the students together throughout all their stages during education. Then the cultivation of students outside university and inside university was seamlessly docked, and the whole process cultivation and multi-party joint cultivation were implemented.

### V. POPULARIZATION AND APPLICATION OF ABOVE RESEARCH RESULTS

The first agricultural and biological science specialty, i.e. the biotechnology specialty, was created in 2007 in Hunan University of Humanities, Science and Technology. Since then, five relative specialties have been opened for undergraduate education. Through the recent years practice in teaching, we have made a lot of high-quality symbolized achievements, these achievements have been applied in our daily teaching and introduced to other universities and institutions, and have received positive responses.

#### *A. Personnel training quality was improved significantly*

The personnel training quality was improved and the social acceptance of the agronomy and biological science specialties was increased significantly, and the graduates quality was widely recognized by all walks of life. From 2017 to 2018, a number of publicly listed companies or industry-leading enterprises including Hunan Ava Seeds Co., Hunan Five Stars Biotechnology Co., Hunan Zhongshi Agriculture Bio-tech Co., Shenzhen Noposion Agrochemical Co., and Hunan Dafang Agrochemical Co. came to Hunan University of Humanities, Science and Technology to hold more than ten on-site job fairs successively. A large number of outstanding graduates emerged, and they either chose to start their own business careers themselves successfully or had been promoted to important positions in some relevant large scale enterprises.

#### *B. Significant achievements in undergraduate teaching quality engineering and subject competitions*

We acquired the significant achievements in the undergraduate teaching quality engineering, and built a number of provincial platforms. In 2015, relying on the local enterprise Hunan Jiulong Economic and Trade Group Co., Hunan University of Humanities, Science and Technology successfully set up Hunan Agricultural and Biological Science Talents Training Demonstration Base. In 2016, our university was successfully approved to set up Hunan Modern Agriculture and Bioengineering Virtual Simulation Experimental Teaching Center and Zhongshi Edible and Medical Fungi Star Creation Base.

In addition, the undergraduate students in these specialties achieved good results in the subject competitions in the past years. In 2017, the students in the agronomy and biological

science specialties won two second-class prizes and five third-class prizes in the Second National College Students Life Science Innovation and Entrepreneurship Competition; and in 2018, they won three second-class prizes and eight third-class prizes in the Third National College Students Life Science Innovation and Entrepreneurship Competition. From 2015 to 2018, they obtained two projects of national research learning and innovative experiment plan for undergraduate students, seven projects of provincial research learning and innovative experiment plan for undergraduate students, and three projects of industry-university cooperation and collaborative cultivation of the Ministry of Education.

#### *C. A number of influential teaching research and educational reform achievements were acquired*

Since 2016, sixteen papers on undergraduate teaching research and teaching reform on the agronomy and biological science specialties were published in the influential journals. Among them, four papers were indexed by CPCI-ssh. Furthermore, two textbooks were published.

#### *D. Significant achievements were made in the construction of teaching staff team*

Since 2016, the College of Agriculture and Biotechnology of our university has sent a total number of ten teachers to enterprises and scientific research institutes for training. Twelve teachers have visited or studied in some famous universities including the University of Bath Spa in UK, the University of Western Australia, the Vanung University, and the I-Shou University. A double-faculty teaching team with international perspectives has been formed.

#### *E. A number of achievements in scientific research were gained*

In the meantime, the teaching reforms had promoted the teachers' scientific research during teaching. In 2016, three achievements by the teachers in the agronomy and biological science specialties passed the provincial appraisal, all of which reached the international advanced levels or domestic leading level. And the teachers won the third prize of China Circular Economy Association in 2018 and the second prize of Loudi Science and Technology Progress in 2017. More than 80% of the undergraduate students in the agronomy and biological science specialties took part in the process of these scientific researches actively. For example, in the study of project "Investigation of weed species and control technology in *Camellia oleifera* forests in the hilly areas of the central Hunan Province", all of the students majoring in the plant protection and agricultural science of the 2016 grade took part in the investigation of weed niche of the middle part of Hunan Province. In the process of scientific researches, the teachers guided the undergraduate students' practice, and organized the scientific researches and teaching together organically. From 2015 to 2018, the undergraduate students published more than 30 scientific research papers. Among them, twelve papers were of first authors by the undergraduate students.

### F. Application of achievements

Some parts of the achievements were introduced to other universities and institutions and were welcome. The achievements were applied in Hunan University of Arts and Sciences, Shaoxing University of Arts and Sciences, Loudi Vocational and Technical College, Hunan Zhongshi Agriculture Bio-tech Co., Hunan Five Stars Biotechnology Co., and Lianyuan Fengleyuan Agricultural Development Co., etc. with sound effects (Table I).

TABLE I. MATERIALS OF APPLICATION AND EFFECT OF ACHIEVEMENT

No	Unit for application	Contents of application
1	Hunan University of Arts and Sciences	Practice teaching mode
2	Shaoxing University of Arts and Sciences	Using the self-compiled textbooks for practice teaching and subject competition
3	Loudi Vocational and Technical College	Practice teaching mode
4	Hunan Zhongshi Agriculture Bio-tech Co.	Practice training mode, teachers working full-timely in the enterprise and joint application for research projects, and students working in the enterprise after graduation
5	Hunan Five Stars Biotechnology Co.	Teachers working full-timely in the enterprise, teachers, students and enterprise personnel publishing paper jointly
6	Lianyuan Fengleyuan Agricultural Development Co.	Practice training mode, and teachers working in the enterprise and joint application for scientific research projects
7	Hunan Zhennong Technology Co.	Practice training mode, students applying scientific projects with off-campus tutors, and students participating in subject competitions.

## VI. SUMMARY

The agronomy and biological science specialties were not popular, and the profession ideas of the undergraduate students

in these specialties were not strong. These phenomena seriously affected personnel training quality. This paper analyzed the common problems in the cultivation of the undergraduate students in the agronomy and biological science specialties in Hunan University of Humanities, Science and Technology, and introduced the practice and experiences of our collaborative cultivation mode which was built according to the social needs. After several years of practice, the quality of undergraduate students was significantly promoted, the achievements of teaching research and educational reforms were used by the other universities and relative institutions, and the responses were positive.

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