

Nourishing Agricultural Spirit through Silent Infiltration: Exploration and Practice of Ideological and Political Education in the Plant Physiology Course at Henan Agricultural University

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Abstract: Curriculum ideological and political education is a way for higher education institutions to achieve the overall goal of moral education in the new era. Plant Physiology is the foundation course for the major of plant production at higher agricultural institutions, so there is rich material for ideological and political education. In accordance with the construction of new agricultural science and the strategy of serving national food security and rural revitalization, the teaching team of Plant Physiology at Henan Agricultural University has systematically carried out the following five tasks to build a trinity curriculum ideological and political education system of "knowledge transmission - ability cultivation - value guidance": reconstruction of teaching objectives, excavation of ideological and political elements, innovation of teaching models, reform of experimental teaching, and optimisation of assessment and evaluation. After many years of exploration and practice, this course has been named the Henan Provincial Quality Online Open Course and a first-class online course, and students have shown good progress in their professional ability, patriotism and practical skills. Systematically summarize the practical experience and theoretical reflection of building ideological and political education in the Plant Physiology course at Henan Agricultural University, provide a reference for the ideological and political education of foundational courses in agriculture-related majors, etc.

Keywords: Curriculum Ideological and Political Education, Plant Physiology, Henan Agricultural University, New Agricultural Science, Talent Cultivation System

1. Introduction

In 2020, the Ministry of Education issued the Guidelines for Curriculum Ideological and Political Education in Higher Education Institutions^[1], which clearly states that all universities and colleges should comprehensively promote curriculum ideological and political education, carry out the basic task of cultivating virtue through education, and give top priority to value shaping among the three tasks of value shaping, knowledge transmission and ability cultivation. The direction of the ideological and political education for all students at the university has been set by this policy. With the continuous development of the construction of New Agricultural Science, one of the first tasks for higher agricultural institutions is to cultivate high-quality agricultural and forestry talents who are knowledgeable and devoted to agriculture, have patriotic feelings and a global perspective, etc.

Plant physiology is the study of the basic functions of plants and how these functions are regulated by the environment. It is the first specialised course for majors in agronomy, forestry, horticulture and plant protection at higher agricultural and forestry institutions, and it is one of the basic courses in the series of agronomy courses. The modern Plant Physiology course at Henan Agricultural University has a long history. In 1999, 2005, 2018 and 2019, it was named one of the top university-level excellent courses, quality courses, core demonstration courses and quality online courses, respectively, and in 2019, it was also designated as a Henan Provincial Quality Online Open Course. Traditional teaching of Plant Physiology has focused too much on transmitting theoretical knowledge and training experimental skills, but at the same time, little attention has been paid to exploring value guidance and the functions of ideological and political education. Therefore, the all-round development of students in

intellectual education has not been achieved.

How to integrate ideological and political education organically into all parts of the teaching process for Plant Physiology and achieve a harmonious unity in the transmission of professional knowledge and value guidance has long been one of the main problems that the teaching team of Plant Physiology at Henan Agricultural University has been studying. Based on many years of teaching experience at Henan Agricultural University, this paper will present the conceptual construction, implementation path, practical effect and theoretical reflection of ideological and political education in the Plant Physiology course in an organised way, providing a reference for the ideological and political construction of foundational courses in agriculture-related majors during the new era.

2. Practical Exploration of Curriculum Ideological and Political Education in the Plant Physiology Course at Henan Agricultural University

The number of teachers in the Plant Physiology Department at Henan Agricultural University is more than ten. It is a teaching team with rich teaching experience, a reasonable structure and an enterprising spirit. In 2019, it was named a Henan Province Outstanding Basic Education Institution. Recently, in the course teaching achievement project "Research on Strategies for Improving the Ideological and Political Education Effect of the Plant Physiology Course", our team has conducted all-round and in-depth exploration in the construction of curriculum ideological and political education.

2.1 Three-Dimensional Restructuring of Teaching Objectives

The original teaching goals of Plant Physiology were mainly the transmission of knowledge and the cultivation of abilities. In accordance with the concept of curriculum ideological and political education, the teaching team has carried out a three-dimensional restructuring of the course objectives and established a trinity objective system of "knowledge - ability - value".

At the level of knowledge objectives, students should be able to learn the basic theories and fundamental knowledge of plant physiology systematically and understand the basic laws of life activities in plants. At the level of ability objectives, students should be able to use their knowledge of plant physiology to analyze and solve practical problems in agricultural production, and master the basic operation skills of plant physiology experiments. At the level of values and goals, students need to strengthen their love for agriculture, rural areas and farmers; cultivate a sense of social responsibility in their studies for the country and society; develop a scientific spirit and innovative thinking ability; form a concept of ecological civilisation, and be environmentally conscious.

With the addition of the above aims, the Plant Physiology course will no longer be a general knowledge course but rather a combination of professional training and ideological and political education.

2.2 Systematic Excavation and Organic Integration of Curriculum Ideological and Political Elements

Based on the knowledge system of plant physiology, the teaching team has systematically extracted the ideological and political content in each chapter and developed specific ways of organic integration.

Chapter 1: Structure and Function of Plant Cells. In teaching the ultrastructure of plant cells in this section, we will use the dialectical materialist view of "the unity of structure and function" to help students develop systematic thinking and a holistic view. At the same time, by adding the discovery history of cellular totipotency, one can also demonstrate the spirit of exploration and inquiry in science.

Chapter 2: Water Physiology of Plants. Teach students how plants absorb, transport and lose water in this section, and then relate it to the actual situation of water scarcity in China to help students develop an ecological civilization mindset of water conservation and protection of water resources. At the same time, according to the research practice of breeding drought-resistant crop varieties, it can be seen that plant water physiology research is needed to ensure food security.

Chapter 3: Mineral Nutrition Physiology of Plants. When teaching the physiological functions of essential mineral elements, this section will introduce the idea of "harmonious coexistence between humans and nature" and present the demand for scientific fertilisation to protect the ecological environment. Showcasing the excellent achievements of Chinese scientists in the field of plant nutrition

research can inspire students' national pride and give them the confidence to serve the country through science.

Chapter 4: Photosynthesis in Plants. Photosynthesis is the main subject of Plant Physiology, and it is also a chapter that is rich in ideological and political connotations. In teaching the process of light reactions and carbon fixation, the teaching team will introduce the dialectical idea of "unity of energy conversion and material transformation". At the same time, given that photosynthesis is closely related to grain yield, the teaching team has also pointed out that there is an urgent need to improve the efficiency of light energy utilisation to ensure food security for the country. By presenting the main achievements in the field of high photosynthetic efficiency breeding for rice in China, the teaching team can inspire students to take part in the development of science and technology in our country.

Chapter 5: Respiratory Metabolism in Plants. When teaching the physiological significance of respiration in this part, guide students to learn dialectically about the unity of opposites in "assimilation and dissimilation" and "synthesis and decomposition", and at the same time, connect it with the production practice of postharvest storage and preservation of agricultural products to cultivate their application of theoretical knowledge in solving practical problems.

Chapter 6: Transport and Distribution of Assimilates. To teach the concept of the "source-sink relationship" in the transport mechanism of organic substances, this part will use analogies with the dialectical relationship between national development and regional coordination and the dialectical relationship between individual contribution and social feedback to help students form collectivist values.

Chapter 7: Plant Hormones and Growth Substances. Teaching the physiological functions and applications of the five main groups of plant hormones in agriculture, this section can help students learn the "rule of moderation": Hormones can be used reasonably to promote plant growth and increase yield, but excessive use will harm the environment and food safety. Expand to education in scientific and technological ethics and cultivate students' sense of professional ethics as scientific and technological workers.

Chapter 8: Growth Physiology of Plants. In teaching the laws of plant growth in this part, life education will also be integrated to help students learn to live well and respect nature. At the same time, there are also cases of phototropism and gravitropism that show the ecological wisdom of mutual adaptation among organisms and their environment.

Chapter 9: Reproductive Physiology of Plants. In teaching photoperiodism and vernalisation, this section will also introduce the outstanding achievements of Chinese scientists in crop introduction and off-season breeding to show their high-minded spirit of strictness, practicality and service to the country. At the same time, by linking it to the problem of food security, students can also develop a sense of patriotism and social responsibility for the country.

Chapter 10: Stress Physiology in Plants. Stress physiology is one of the frontrunners in plant physiology and can also be applied to carry out ideological and political education in schools. To teach about the adaptive mechanisms of plants to stress from drought, salinity, low temperatures and high temperatures, this section will use the metaphor of "adversity tempers, self-improvement" to help students face difficulties and problems in their studies and life with a positive attitude. At the same time, by linking to the main achievements in crop stress-resistance breeding in China, it can also inspire students with science and patriotism.

2.3 New Explorations in Teaching Models

The teaching team is actively exploring and innovating teaching models in the construction of the curriculum for ideological and political education to improve the relevance and effectiveness of ideological and political integration.

Flipped Classroom and Blended Learning. The two ways of teaching are deep-transformed blended teaching and flipped classrooms, and the goal is to achieve a good combination of presenting theoretical knowledge and cultivating high-level cognitive abilities. Before class, students are taught some basic knowledge on the China University MOOC platform; during class, teachers guide students to have an in-depth discussion and case study of problems with ideological and political values as the main content of classroom discussion; after class, extended learning and ideological and political reflection are carried out on the online platform. The teaching mode will change how ideological and political education is conducted; it will no longer be top-down transmission but rather student-centered

discussion and exploration.

Case teaching and scenario building. Based on the knowledge points in each chapter, the teaching team has prepared teaching cases with ideological and political significance. For instance, in the teaching of photosynthesis, a team can present the moving stories of Academician Yuan Longping and his team in their research on high photosynthetic efficiency in rice; when teaching stress physiology, one can take the excellent achievements of Chinese scientists in desertification control as a case to inspire students to take root in the western regions and serve at the grassroots level. The above cases can help people better grasp the abstract idea of values and arouse their interest in ideological and political education.

Research Competition-oriented Learning Model. A research competition mode has been added to the teaching goals to motivate students to use their knowledge of plant physiology in actual scientific research and build a three-dimensional cultivation system of "cultivation of scientific thinking - improvement of practical ability - development of values and emotions". By taking part in the innovation and entrepreneurship competitions "Challenge Cup" and "Internet Plus", students have gained some practical application of their professional knowledge and strengthened their sense of responsibility and mission to serve agriculture, rural areas and farmers.

2.4 Integration of Ideological and Political Education in Experimental Teaching

Plant Physiology experiments are required parts of the course and also serve as an important link for ideological and political education in the curriculum. In line with the educational reform projects led by Henan Agricultural University, the teaching team has been exploring all kinds of ways and methods to organise the integration of ideological and political education with experimental teaching.

An example of how to integrate ideological and political education into the experimental curriculum is taken from the determination experiment of nitrate reductase activity in this section. The four types of ideological and political education in this experiment are as follows: First, by presenting the excellent results of China in the area of efficient use of nitrogen fertilizers, students' sense of national pride is aroused. Second, by learning the standard operating procedures and safety precautions of the experiment, students will be trained to be diligent and practical in their scientific research, and to take responsibility for laboratory safety. Third, in a group, they will learn to cooperate and communicate by doing so. Finally, in the data analysis stage, the students learn that accurate data and academic honesty are necessary to maintain the spirit of research ethics.

Introduction of Virtual Simulation Experiments. The team has taken the initiative to introduce the technology of virtual simulation experiments and has built a three-dimensional teaching model of "experimental exploration, theoretical expansion and ideological and political integration". Virtual simulation experiments can solve the problems of time and place restrictions in traditional experimental teaching, reduce experimental costs and safety risks, and most importantly, give students many opportunities to try and explore freely in a safe environment to spark their interest in learning and promote innovation and thinking.

2.5 Construction of the Industry-University-Research Collaborative Education Mechanism

The Goal of Plant Physiology is to solve problems in agricultural production. The teaching team is building an industry-university-research collaborative education model and expanding the classroom into the field and production site.

The team frequently organises trips for the students to visit all sorts of training bases, such as agricultural science and technology parks, seed industry enterprises, agricultural cooperatives, etc., so that they can learn some knowledge and gain some practical experience. Students can see the actual process of plant growth and development in the field with their own eyes, learn about the technical problems of agricultural production firsthand, and discover how knowledge of plant physiology can help ensure food security and promote green development of agriculture. Based on all-around practical experience, students will strengthen their sense of identity in agriculture and rural areas, farming, etc., and turn their general knowledge into a concrete awareness of these values.

3. Implementation Effectiveness of Curriculum Ideological and Political Education in the Plant Physiology Course

After many years of continuous construction and exploration, the ideological and political education in the Plant Physiology course at Henan Agricultural University has achieved good results.

3.1 Main Results of Teaching Reform

In 2019, it was chosen as a Henan Province Quality Online Open Course, and the course team was named one of the top basic teaching organisations in Henan Province. The teaching team has published several educational research papers on the construction of curriculum ideological and political education, such as "Exploration of the 'Flipped Classroom + Live Broadcast' Teaching Model in Plant Physiology", "Exploration of Experimental Teaching Reform in Plant Physiology under the Innovative Talent Cultivation Model", and "Practice of Teaching Reform in Plant Physiology Course under the Background of Informatisation".

3.2 Significant Improvement in Teaching Quality

Based on the above practical results, the construction of curriculum ideological and political education has increased students' interest in learning and improved their grades. According to the above statistics, after the teaching reform, the proportion of students participating in experiments increased from 60% to 80%, and the pass rate for the final examination rose from 93.4% to 98.0%. Some improvements have been made in students' research literacy and teamwork. Most students said in the course evaluation that adding the content of ideology and politics made the abstract theoretical knowledge more concrete and interesting, thus increasing their motivation to learn.

3.3 Cultivation of Students' Ideological and Political Literacy

Through immersive education in the curriculum of ideological and political education, students have developed a stronger interest in agriculture, rural areas and farmers, and are more willing to serve at the grassroots level and participate in rural revitalization. In recent years, among the graduates of majors related to the Plant Physiology course, the proportion choosing to work in agricultural research institutions, seed industry enterprises and grassroots agricultural technology extension departments has been gradually increasing. The next group of outstanding students will now do their best to build a great agricultural country.

4. Problems and Opportunities

During the development of the curriculum for ideological and political education, some problems and difficulties have also arisen in the teaching team.

4.1 The Depth and Naturalness of Ideological and Political Integration need to be increased

In some chapters, the combination of ideological and political content is still in the form of "labeling" and "forced addition", and the organic integration of ideological and political education with the teaching of professional knowledge needs to be further improved. How to achieve the effect of "moistening things silently" in ideological and political education while keeping the disciplinary features of plant physiology still needs to be explored^[5].

4.2 The Gap in Teachers' Competence for Curriculum Ideological and Political Education Needs to be Closed

In order to teach the content of the curriculum for ideological and political education well, one needs to know the contents thoroughly and be able to use them effectively. There is a certain difference in the teaching ability of curriculum ideological and political education among the teachers in the team. Build a regular training system and a collective lesson preparation system to improve the general level of ability of all teachers in curriculum ideological and political education^[6].

4.3 The Assessment Mechanism Needs to Be Strengthened

It is difficult to quantify the effect of curriculum ideological and political education, and the old method of examination and assessment is not suitable for all-round evaluation of students' growth in this area. How to build a scientific and diversified evaluation system for curriculum ideological and political education and achieve process-oriented assessment of students' development in ideological and political literacy is a problem that needs to be solved in the next stage.

Looking ahead, the teaching team of Plant Physiology at Henan Agricultural University will fully embody the spirit of the Guidelines for Curriculum Ideological and Political Education in Higher Education Institutions and continue to strengthen the substantive development of curriculum ideological and political education. On the one hand, the team will continue to explore the ideological and political contents of the Plant Physiology course, expand the scope and depth of ideological and political integration, and find more ways to integrate with the distinct characteristics of agricultural sciences. At the same time, the team will also explore the digital empowerment of curriculum construction for ideological and political education, and with the help of artificial intelligence and virtual simulation technology, create an immersive and interactive scenario for ideological and political education that can give students more vivid and profound learning experiences.

5. Conclusion

Plant Physiology is a required course in agricultural institutions for training new-generation talents who will have a solid foundation in agricultural science and a genuine interest in it. The teaching team of Plant Physiology at Henan Agricultural University has focused on the basic task of promoting virtue through education, and in line with the construction of New Agricultural Science, has systematically strengthened the construction of curriculum ideological and political education in all aspects, such as teaching objectives, ideological and political content, teaching models, experimental teaching, assessment and evaluation, etc.; it has tentatively established a trinity system of curriculum ideological and political education consisting of "knowledge transmission—ability cultivation—value guidance". Based on the above experience, this system has improved the professional skills of the students and also aroused their interest in agriculture and rural life, as well as a sense of social responsibility towards the country and society; thus, it has achieved good educational results.

Curriculum ideological and political education is a systematic project that cannot be accomplished overnight. In the future, the teaching team of Plant Physiology at Henan Agricultural University will continue to take the cultivation of virtue through education as its foundation and strengthen agriculture and revitalize rural areas as its goal, persistently advancing theoretical innovation and practical exploration in the construction of curriculum ideological and political education, contributing to the cultivation of more new-type agricultural talents who are knowledgeable about and devoted to agriculture, and writing a new chapter in the great journey of serving national food security and comprehensively advancing rural revitalization.

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References

- [1] Ministry of Education. *Guidelines for Curriculum Ideological and Political Education in Higher Education Institutions*. 2020.
- [2] "Three Integrations, One Feedback": Exploration and Practice of Curriculum Ideological and Political Education in Plant Physiology. *Journal of Higher Education*, 2024(2).
- [4] Zhan Jie, Yang Meng, Yuan Pengli. Exploration and Practice of the "Four Integrations of Knowledge Chain, Ideological and Political Education, Science and Education, and Industry-Education" in the Teaching of Plant Physiology as a Basic Course in Agronomy. *Genomics and Applied Biology*, 2024, 43(7): 1286-1292.
- [3] Higher Education Department of the Ministry of Education. *Promoting Universities to Restructure*

Curriculum and Textbook Systems and Teaching Content, and Deeply Advancing Innovation and Education Reform in Universities. 2026.

[5] Guangming Net. *Deepening the Integration of Ideological and Political Education into Agriculture-Related Professional Courses to Cultivate Compound Applied Talents Who Know and Love Agriculture. 2025.*

[6] Shang Zhonglin, Kang Erfang, Chen Yuling, et al. *Thoughts and Practice of Integrating Ideological and Political Education in Plant Physiology Teaching. Journal of Higher Education, 2023(34).*