

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 strategic measure for higher education institutions to implement the fundamental task of fostering virtue through education in the new era. Plant Physiology, as a core foundational course for plant-production majors in higher agricultural institutions, contains abundant resources for ideological and political education. The teaching team of Plant Physiology at Henan Agricultural University, based on the context of New Agricultural Science construction and guided by the strategy of serving national food security and rural revitalization, has systematically constructed a trinity curriculum ideological and political education system of "knowledge transmission—ability cultivation—value guidance" from five dimensions: reconstruction of teaching objectives, excavation of ideological and political elements, innovation of teaching models, reform of experimental teaching, and optimization of assessment and evaluation. After years of exploration and practice, this course has been established as a Henan Provincial Quality Online Open Course and a first-class online course, and students have shown significant improvement in professional competence, patriotic sentiment, and practical abilities. This paper systematically summarizes the practical experience and theoretical reflections of the ideological and political education construction of the Plant Physiology course at Henan Agricultural University, with the aim of providing reference for the ideological and political education of foundational courses in agriculture-related majors.

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 explicitly requires the comprehensive promotion of curriculum ideological and political education in universities and colleges, the implementation of the fundamental task of fostering virtue through education, and emphasizes that value shaping is the primary priority among the trinity talent cultivation objectives of value shaping, knowledge transmission, and ability cultivation. This policy orientation has pointed out the direction for the ideological and political construction of various courses in higher education institutions. Against the backdrop of the deepening advancement of New Agricultural Science construction, cultivating high-quality agricultural and forestry talents who are knowledgeable about and devoted to agriculture, possess patriotic sentiment and a global perspective, has become the core mission of higher agricultural institutions^[2].

Plant Physiology is a science that studies the laws of plant life activities and their interactions with the environment. It serves as a core specialized course for majors such as agronomy, forestry, horticulture, and plant protection in higher agricultural and forestry institutions, occupying a central position in the agronomy course series. The modern Plant Physiology course at Henan Agricultural University has a long history. In 1999, 2005, 2018, and 2019, it was respectively rated as a university-level excellent course, quality course, core demonstration course, and quality online course, and in 2019, it was recognized as a Henan Provincial Quality Online Open Course. However,

traditional teaching of Plant Physiology often places excessive emphasis on the transmission of theoretical knowledge and the cultivation of experimental skills, while the exploration of value guidance and ideological and political education functions remains insufficient, resulting in a deficiency of prioritizing intellectual education over holistic student development.

How to organically integrate ideological and political education into the entire teaching process of Plant Physiology and achieve the organic unity of professional knowledge transmission and value guidance has become the core issue that the teaching team of Plant Physiology at Henan Agricultural University has long been exploring. Based on years of teaching practice at Henan Agricultural University, this paper systematically elaborates on the conceptual construction, implementation paths, practical effects, and theoretical reflections of the ideological and political education in the Plant Physiology course, with the aim of providing useful reference for the ideological and political construction of foundational courses in agriculture-related majors in the new era.

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

The teaching team of Plant Physiology at Henan Agricultural University currently consists of more than ten teachers. It is a teaching team with rich teaching experience, reasonable structure, and an enterprising spirit. In 2019, it was rated as a Henan Provincial Excellent Basic Teaching Organization. In recent years, relying on teaching achievement projects such as "Research on Strategies for Improving the Ideological and Political Education Effect of the Plant Physiology Course," the team has conducted systematic and in-depth exploration in the construction of curriculum ideological and political education.

2.1 Three-Dimensional Restructuring of Teaching Objectives

The traditional teaching objectives of Plant Physiology mainly focused on two dimensions: knowledge transmission and ability cultivation. Guided by the concept of curriculum ideological and political education, the teaching team has carried out a three-dimensional restructuring of the course objectives and constructed a trinity objective system of "knowledge—ability—value."

At the level of knowledge objectives, students are required to systematically master the basic theories and fundamental knowledge of Plant Physiology and understand the basic laws of plant life activities. At the level of ability objectives, students are required to possess the ability to apply Plant Physiology knowledge to analyze and solve practical problems in agricultural production, and to master the basic operational skills of Plant Physiology experiments. At the level of value objectives, students are required to enhance their affection for agriculture, rural areas, and farmers, as well as their sense of responsibility to the nation and society during the learning process, to cultivate scientific spirit and innovative awareness, and to establish the concept of ecological civilization and awareness of sustainable development.

The adjustment of this objective system has transformed the Plant Physiology course from a mere specialized foundational course into a comprehensive course that integrates both professional education and ideological and political education.

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

The teaching team, based on the knowledge system of Plant Physiology, systematically sorted out the ideological and political elements embedded in each chapter and designed specific pathways for organic integration.

Chapter 1: Structure and Function of Plant Cells. In teaching the ultrastructure of plant cells, this section incorporates the dialectical materialist viewpoint of "the unity of structure and function" to guide students in establishing systematic thinking and a holistic perspective. Meanwhile, by introducing the discovery history of cellular totipotency, it demonstrates the innovative spirit of scientists who dare to question and explore boldly.

Chapter 2: Water Physiology of Plants. In teaching the mechanisms of water absorption, transport, and loss in plants, this section incorporates the reality of China's water scarcity into the national context, guiding students to establish an ecological civilization awareness of saving water and protecting water

resources. At the same time, by connecting with the research practice of breeding drought-resistant crop varieties, it illustrates the significant importance of plant water physiology research for ensuring food security.

Chapter 3: Mineral Nutrition Physiology of Plants. In teaching the physiological functions of essential mineral elements, this section incorporates the concept of "harmonious coexistence between humans and nature" and introduces the importance of scientific fertilization for protecting the ecological environment. By presenting the outstanding contributions of Chinese scientists in the field of plant nutrition research, it enhances students' national pride and their belief in serving the country through science.

Chapter 4: Photosynthesis of Plants. Photosynthesis is the core content of Plant Physiology, and it is also the chapter with the richest ideological and political elements. When teaching the processes of light reactions and carbon fixation, the teaching team deeply expounds the dialectical idea of "the unity of energy conversion and material transformation." At the same time, by combining the close relationship between photosynthesis and grain yield, the teaching team emphasizes the critical significance of improving light energy utilization efficiency for ensuring national food security. By introducing the major achievements made in the field of high photosynthetic efficiency breeding of rice in China, the teaching team stimulates students' enthusiasm to serve the country through science and technology.

Chapter 5: Respiratory Metabolism of Plants. In teaching the physiological significance of respiration, this section guides students to dialectically understand the unity of opposites between "assimilation and dissimilation" as well as "synthesis and decomposition." At the same time, by connecting with the production practice of postharvest storage and preservation of agricultural products, it cultivates students' ability to apply theoretical knowledge to solve practical problems.

Chapter 6: Transport and Distribution of Assimilates. In teaching the transport mechanism of organic substances, this section introduces the concept of "source-sink relationship" and uses it as a metaphor to illustrate the dialectical relationships between national development and regional coordination, as well as between individual contribution and social feedback, thereby guiding students to establish collectivist values.

Chapter 7: Plant Hormones and Growth Substances. In teaching the physiological functions of the five major classes of plant hormones and their applications in agricultural production, this section guides students to dialectically understand the importance of the "principle of moderation": the rational application of hormones can promote plant growth and increase yield, whereas abuse may cause environmental and food safety issues. This extends to education in scientific and technological ethics, cultivating students' professional ethics awareness as scientific and technological workers.

Chapter 8: Growth Physiology of Plants. When teaching the laws of plant growth, this section integrates content on life education, guiding students to cherish life and revere nature. Meanwhile, by introducing phenomena such as phototropism and gravitropism, it elaborates on the ecological wisdom of mutual adaptation between organisms and the environment.

Chapter 9: Reproductive Physiology of Plants. When teaching photoperiodism and vernalization, this section introduces the significant contributions of Chinese scientists in crop introduction and off-season breeding, showcasing the noble spirit of being rigorous, pragmatic, and serving the country. At the same time, by connecting with the strategic significance of food security, it cultivates students' patriotic feelings and their sense of responsibility and mission.

Chapter 10: Stress Physiology of Plants. Stress physiology is a frontier field of Plant Physiology and also an important lever for curriculum ideological and political education. In teaching the adaptive mechanisms of plants to stresses such as drought, salinity, low temperature, and high temperature, this section uses the metaphor of "adversity tempers, self-improvement" to guide students to correctly face difficulties and challenges in their studies and life. At the same time, by connecting with the major breakthroughs achieved in China in crop stress-resistance breeding, it enhances students' scientific confidence and national pride.

2.3 Innovative Exploration of Teaching Models

The teaching team, in the construction of curriculum ideological and political education, actively explores and innovates teaching models, striving to enhance the relevance and effectiveness of ideological and political integration.

Flipped classroom and blended teaching. The team adopts modes such as deeply transformed blended teaching and flipped classroom, aiming to achieve an organic unity between theoretical knowledge transmission and higher-order ability cultivation. Before class, students learn basic knowledge through the China University MOOC platform; during class, teachers guide students in in-depth discussions and case analyses, focusing on issues with ideological and political value as the key points of classroom discussion; after class, extended learning and ideological and political reflection are conducted through the online platform. This teaching model transforms ideological and political education from a one-way inculcation by the teacher into active thinking and participation by the students.

Case teaching and scenario creation. The teaching team, centering on the knowledge points of each chapter, has carefully designed teaching cases with ideological and political implications. For example, when teaching photosynthesis, the team introduces the moving stories of Academician Yuan Longping and his team in their research on high photosynthetic efficiency in rice; when teaching stress physiology, it takes the outstanding contributions 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. These cases transform abstract value concepts into perceptible and comprehensible specific situations, thereby enhancing the appeal of ideological and political education.

Research competition-driven learning model. The team adopts a research competition-driven learning model, encouraging students to apply Plant Physiology knowledge to scientific research practice, thereby forming a three-dimensional cultivation system of "scientific thinking cultivation — practical ability enhancement — value and emotional shaping." Through participating in innovation and entrepreneurship competitions such as the "Challenge Cup" and "Internet Plus," students deepen their understanding of professional knowledge in practice while strengthening 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 an important component of the course and also a key link in curriculum ideological and political education. Based on the educational reform projects undertaken by Henan Agricultural University, the teaching team has systematically explored the pathways and methods for integrating ideological and political elements into experimental teaching.

Taking the determination experiment of nitrate reductase activity as an example, this section systematically demonstrates the specific approaches for integrating ideological and political elements into the experimental curriculum. This experiment incorporates ideological and political education from the following dimensions: first, by introducing the major breakthroughs in the field of efficient utilization of nitrogen fertilizer in China, it enhances students' national pride; second, through emphasizing awareness of standard procedures and safety during experimental operations, it cultivates students' rigorous and realistic scientific attitude as well as their awareness of laboratory safety responsibility; third, through completing the experiment in group collaboration, it cultivates students' teamwork spirit and communication skills; fourth, in the data analysis session, it emphasizes data authenticity and academic integrity, guiding students to adhere to the bottom line of research ethics.

Introduction of virtual simulation experiments. The team has actively introduced virtual simulation experiment technology and constructed a three-dimensional teaching model of "experimental exploration, theoretical expansion, and ideological and political integration." Virtual simulation experiments not only break through the temporal and spatial limitations of traditional experimental teaching and reduce experimental costs and safety risks, but more importantly, they allow students to repeatedly try and boldly explore in a safe environment, thereby cultivating their innovative thinking and critical thinking abilities.

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

The vitality of Plant Physiology lies in solving practical problems in agricultural production. The teaching team focuses on constructing an industry-university-research collaborative education mechanism, extending the classroom to the fields and production fronts.

The team regularly organizes students to visit practice bases such as agricultural science and technology parks, seed industry enterprises, and agricultural cooperatives for on-site teaching and practical training. In the fields, students observe the actual processes of plant growth and development

with their own eyes, experience the technical challenges of agricultural production firsthand, and deeply understand the important role of Plant Physiology knowledge in ensuring food security and promoting sustainable agricultural development. This immersive practical experience transforms students' affection for agriculture, rural areas, and farmers from abstract concepts into concrete emotional identification, and deepens it from superficial cognition into firm conscious action.

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

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

3.1 Remarkable Achievements in Teaching Reform

The course was recognized as a Henan Provincial Quality Online Open Course in 2019, and the course team was rated as a Henan Provincial Excellent Basic Teaching Organization. The teaching team has published several educational research papers on the construction of curriculum ideological and political education, including "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 Informatization."

3.2 Significant Improvement in Teaching Quality

Practical results indicate that the construction of curriculum ideological and political education has effectively enhanced students' learning interest and academic performance. Statistical data show that after the teaching reform, student participation in experiments increased from 60% to 80%, and the pass rate of the final examination rose from 93.4% to 98.0%. Students' research literacy and teamwork abilities were also markedly improved. Students generally reported in course evaluations that the integration of ideological and political elements made the originally abstract theoretical knowledge more tangible and emotionally engaging, and their interest in learning was significantly strengthened.

3.3 Cultivation of Students' Ideological and Political Competence

Through the immersive education of curriculum ideological and political education, students have developed a deeper affection for agriculture, rural areas, and farmers, and their willingness to serve at the grassroots level and engage in rural revitalization has significantly increased. In recent years, among the graduates from 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 steadily rising. Successive groups of outstanding students are now contributing their efforts to the construction of a strong agricultural nation.

4. Problems and Prospects

In the practice of curriculum ideological and political education construction, the teaching team has also clearly recognized some existing problems and challenges.

4.1 The Depth and Naturalness of Ideological and Political Integration Need to Be Improved

In some chapters, the integration of ideological and political elements still tends to be a matter of "labeling" and "forced insertion," and the organic integration of ideological and political education with the teaching of professional knowledge needs to be further deepened. How to achieve the effect of "moistening things silently" in ideological and political education while maintaining the disciplinary characteristics of Plant Physiology still needs continuous exploration^[5].

4.2 The Disparity in Teachers' Competence in Curriculum Ideological and Political Education Needs to Be Bridged

The effective implementation of curriculum ideological and political education depends on teachers'

depth of understanding and ability to integrate ideological and political elements. There is a certain disparity in the teaching competence of curriculum ideological and political education among different teachers in the team. It is necessary to establish a regular training mechanism and a collective lesson preparation system to promote the overall improvement of all teachers' competence in curriculum ideological and political education^[6].

4.3 The Evaluation Mechanism Needs to Be Improved

The effects of curriculum ideological and political education are difficult to quantify, and traditional examination and assessment methods are insufficient for comprehensively evaluating students' development of ideological and political competence. How to construct a scientific and diversified evaluation system for curriculum ideological and political education and to achieve process-oriented assessment of students' ideological and political competence development is a key issue that needs to be addressed in the next step.

Looking ahead, the teaching team of Plant Physiology at Henan Agricultural University will thoroughly implement the spirit of the Guidelines for Curriculum Ideological and Political Education in Higher Education Institutions and continue to deepen the substantive development of curriculum ideological and political education. On the one hand, the team will further excavate the ideological and political elements in the Plant Physiology course, expand the breadth and depth of ideological and political integration, and explore more pathways for integration with distinct characteristics of agricultural sciences. On the other hand, the team will actively explore digitally empowering the construction of curriculum ideological and political education, utilizing technologies such as artificial intelligence and virtual simulation to create immersive and interactive scenarios for ideological and political education, providing students with more vivid and profound learning experiences.

5. Conclusion

Plant Physiology, as a core specialized foundational course in agricultural institutions, shoulders an irreplaceable and important mission in cultivating new-type talents who are knowledgeable about and devoted to agriculture. The teaching team of Plant Physiology at Henan Agricultural University, closely centering on the fundamental task of fostering virtue through education and based on the context of New Agricultural Science construction, has systematically promoted the construction of curriculum ideological and political education from multiple dimensions, including teaching objectives, ideological and political elements, teaching models, experimental teaching, and assessment and evaluation, and has preliminarily formed a trinity curriculum ideological and political education system of "knowledge transmission—ability cultivation—value guidance." Practice has shown that this system, while enhancing students' professional competence, has effectively cultivated their affection for agriculture, rural areas, and farmers, as well as their sense of responsibility to the nation and society, achieving favorable educational outcomes.

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 fostering virtue through education as its foundation and strengthening agriculture and revitalizing rural areas as its mission, 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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