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Innovative Ideas and Reform Trends in Plant Physiology

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Abstract: Plant physiology, as a fundamental course for undergraduate students majoring in plant production in higher agricultural and forestry colleges, faces challenges such as updating teaching content, reforming teaching methods, tight study hours, and constantly emerging new knowledge and technologies. To address these challenges, it is urgent to reform and practice the teaching of plant physiology. This article analyzes the innovation and reform direction of the theoretical course "Plant Physiology" in domestic higher education institutions from multiple aspects such as teaching content, teaching methods and means, and assessment methods, based on the characteristics of the course. It introduces teaching reform measures, including the transformation of teaching concepts and the reform of teaching content, in order to improve the teaching quality of the course.

Keywords: Plant physiology; Innovation; Reform; Measures

1. Introduction

Plant physiology is a science that studies the laws of plant life activities and their interrelationships with the external environment. For students majoring in biological sciences, biotechnology, and horticulture, it is an important foundational course, and its teaching and research fields are constantly developing and innovating. Theoretical knowledge is the foundation of learning this course, so the improvement of the quality and level of theoretical teaching has attracted widespread attention from educators^[1]. The goal of teaching reform is to improve the quality and effectiveness of teaching, cultivate students' scientific literacy and practical abilities^[2]. This article analyzes the current development trend of theoretical teaching of "Plant Physiology" in domestic higher education institutions, and explores the reform ideas and directions of theoretical teaching in this course.

2. Reform measures

2.1 Update of teaching content

With the continuous deepening of research in plant physiology, teaching content needs to be updated in a timely manner, incorporating the latest research results into teaching. The teaching content not only includes traditional knowledge of plant physiology, but also incorporates new theories and technologies of modern plant physiology, such as stress physiology, signal transduction mechanisms, plant hormones, etc., to meet the needs of modern agriculture and scientific research, and to maintain the cutting-edge and scientific nature of the curriculum^[3].

2.2 Reform of Teaching Methods

The traditional lecture style teaching mode focuses on the teacher explaining the knowledge points, while students passively receive and lack interaction^[4]. The thinking enthusiasm of teachers and students cannot be stimulated, and the classroom atmosphere is stagnant. Students often slack off, sleep, and play with their phones. By guiding students to participate in teaching, actively think, explore, and be willing to practice. Adopting a combination of learning and teaching, flexible use of task-based teaching method, motivational teaching method, case analysis method, group cooperative discussion method, comparative teaching method, simulation training method and other teaching methods^[5], introducing, analyzing and researching theoretical knowledge in plant metabolism and energy metabolism, plant morphogenesis, and the relationship between plants and the environment to students, and strengthening the intuitiveness, vividness and research-oriented nature of teaching through the use of modern teaching methods such as multimedia, so that students can more intuitively see the micro level changes in metabolism and other processes inside the plant body, and further integrating the morphological structure of botany with the physiological part of modern science to form a knowledge system, which is conducive to the mastery and application of knowledge.

2.3 Construction of Course Resources

Utilize online teaching platforms to build online teaching resources, such as micro videos, teaching courseware, exercise sets, etc., to meet the needs of students for online learning and form a personalized and intelligent learning environment^[6]. In addition, as an important

foundational course in the field of plant physiology, the development of teaching materials plays a crucial role in cultivating high-level professionals in plant production and biology^[7]. Textbook construction not only includes updating content and improving quality, but also involves the synchronous construction of a series of supporting textbooks, as well as the creation of high-quality textbooks. The construction of a question bank is an important means to improve teaching quality and achieve the separation of teaching and examination. All members of the Plant Physiology course group participate in the construction of the question bank to ensure a wide coverage of questions, rich question types, and compliance with the requirements of the teaching syllabus^[8]. In addition, open MOOC platforms provide various forms of teaching resources such as videos, courseware, assignments, and discussions to promote teacher-student interaction and improve teaching efficiency.

2.4 Integration of ideological and political education into the curriculum

In the teaching of plant physiology, explore ideological and political education approaches that are in line with the course content, and incorporate scientific worldview, ecological civilization education, and other content into the classroom^[10]. For example, when teaching the development history of plant physiology, it is possible to emphasize the contributions of Chinese scientists in this field, such as Zhang Ting, Qian Chongzhou, Tang Peisong, and others who gave up their privileged lives abroad and returned to China to teach, laying the foundation for the development of plant physiology in our country. This can enhance students' sense of national pride and patriotism. When teaching the reproductive physiology of plants and the application of photoperiod theory, case studies can be used to cultivate students' scientific spirit of exploration and sense of responsibility in agricultural production.

2.5 Innovation in Assessment Methods

In the teaching of plant physiology, the innovation of assessment methods is an important means to enhance students' interest, cultivate innovative thinking and practical operation abilities. Establish a multi-level assessment model, not limited to traditional exams, but also including students' practical activities, scientific research participation, etc., to comprehensively evaluate students' learning outcomes. For example, as a final exam tool, students are required to test their mastery of comprehensive and design based experiments by randomly selecting questions and preparing and presenting their own design plans.

2.6 Implementation of Bilingual Teaching

Suggestions for implementing bilingual teaching in plant physiology courses are proposed to meet the needs of international education and enhance students' international competitiveness. A common mode is to mainly teach in Chinese, supplemented by English teaching, combined with simple foreign classroom language, focusing on helping students understand the teaching content and master professional knowledge. Faced with the challenges brought by a large number of professional terms, methods such as writing a bilingual table of commonly used professional vocabulary in plant physiology, annotating Chinese in lecture notes and courseware, and explaining word formation rules can be used to help students understand and memorize professional vocabulary.

2.7 Construction of Teaching Team

Build a teaching team that combines the elderly, middle-aged, and young to improve the teaching level and research ability of teachers, in order to promote the improvement of teaching quality. The teaching team should constantly strive for self-improvement and development, including further education of teachers and improvement of teaching methods. For example, South China Agricultural University encourages young teachers to visit abroad or pursue doctoral degrees to enhance the overall level of the teaching team. Each teaching team should have its unique characteristics and advantages, which can help improve teaching effectiveness and students' learning experience. For example, the plant physiology teaching team of the School of Life Sciences at Nanjing Normal University has achieved significant results in team building, virtual simulation experiment teaching, online course construction, and other aspects.

2.8 Integration with Production Practice

The combination of plant physiology and production practice is crucial, as it is not only a fundamental theoretical discipline, but also a highly practical discipline. The research content and tasks, emergence and development, opportunities and challenges faced by plant physiology are closely related to agricultural production. By studying plant physiology, students can understand the main metabolic activity mechanisms in plants, familiarize themselves with the impact of the environment on plant life activities, and learn about plant resistance to adversity; Master basic knowledge of plant metabolism, development, and stress physiology; Learn the methods for measuring major plant physiological indicators, flexibly apply theoretical knowledge to analyze and discuss relevant agricultural production issues, possess the ability to design and implement plant physiology related experiments, as well as the ability to discover, analyze, and handle problems, and cultivate students' ability to apply theoretical knowledge to practical production.

3. Summary

These reform measures aim to enhance the teaching effectiveness of plant physiology, cultivate students' research abilities, stimulate

their interest in learning, and strengthen the integration of theory and practice. Through these reforms, students can be expected to gain more comprehensive and in-depth knowledge in the field of plant physiology, laying a solid foundation for future academic research or career.

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