# Teaching Reforms of College Plant Physiology Course

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**Abstract:** The author puts forward some measures of reform in college plant physiology course based on her own teaching practices. Firstly, reforms in the contents of basic knowledge and experimental skill learning in plant physiology are suggested. Secondly, innovations in the teaching methods of plant physiology are suggested. Lastly, the integration of ideological education in college plant physiology courses was discussed.

Plant Physiology is a compulsory basic course in colleges for students of various majors in life sciences. Plant physiology is the science that reveals the processes and mechanisms involved in metabolism, energy conversion, information transmission, morphogenesis of plants and the relationship between plants and their environmental conditions. The task of the plant physiology course is to enable the students to master the laws of plant life activities and the relationship between plant life activities and environmental conditions through theoretical and practical learning. It lays a solid foundation for students to understand the physiological and biochemical indexes related to plant physiology and learn the technical methods and practical operation of the measurement of these indexes. This course aims to cultivate students' ability to use plant physiology knowledge to solve problems related to plants in production and daily life.

The 2020 National Education Work Conference and the National Medium and Long-term Education Reform and Development Plan Outline of China (2010 -2020) pointed out the direction for deepening the reform of the education system, updating the concepts of education and teaching, and improving the level of talent training[1]. Higher education in China is constantly promoting teaching reform, innovation and discipline development, and keeping pace with international education reform. In 2016, China became a full member of the "Washington Accord". The member states of the "Washington Accord" are accredited to the training programs of educational institutions, emphasizing educational concepts and teaching goals, and the accreditation standard is "outcome based education (OBE) ", focusing on the "output" of education, that is, cultivating the abilities of college students upon graduation[2].

## 1 Content Improvement of College Plant Physiology Course

The plant physiology course in colleges requires not only a solid theoretical foundation but also a mastery of various physiological and biochemical techniques. The curriculum reform must promote both theoretical and practical aspects to cultivate students' comprehensive ability in plant physiology.

### 1.1 Improvement of Theoretical Teaching Content

Theoretical knowledge is the basis for learning a course, so the improvement of the quality and level of theoretical teaching is the focus of the reform of the college plant physiology course. The content of plant physiology is extensive, involving many disciplines. Moreover, due to the rapid development of various subject areas, the difficulty of course teaching lies in the reasonable

arrangement of teaching time to teach some classical theoretical knowledge, and on this basis, to show the scientific advancements in different directions of plant physiology[3]. The research area of plant physiology is rapidly and continuously developing. With the continuous exploration of plant physiological activities, new theories and discoveries constantly emerging and are supplementing the original theoretical knowledge, and even some new theories had directly denied the old theories. For example, the three kinds of ion transmembrane transport carrier structures, "channels" and "pumps" theory that have remained unchanged for decades in plant physiology textbooks at home and abroad has been modified recently. The original theory believed that the "channel transport" in ion transmembrane transportation is a fast and passive process and the "pump" transport is a slow energy-consuming transport. This structure is considered to be two completely separate devices. However, in 2017, American scientists published a paper showing that in the K+ ion transport structure, and members of the "channel" and "pump" family are gathered together rather than separated. They are both part of a large complex, working together to exercise active transport. A "pump" subunit makes the energy input, and a "channel" subunit is considered the active transport performer. The new theory believes that channels and pumps cooperate with each other to jointly control the opening and closing of the entire channel. It redefined the concept of "channel" and "pump" [4]. Because of the fast development of the research areas in plant physiology, the contents of the theoretical teaching in college plant physiology also need to be improvement constantly.

### 1.2 Improvement of Experimental Teaching Content

Many of the existing plant physiology experimental courses are too old to reflect the progress of technology in the field. For example, the “small flow” method to determine the water potential of plant tissue is too cumbersome and the data reliability is low, so it is not used in the current scientific research. Therefore, in the course of plant physiology experiment in the future, we can introduce the convenient, fast and accurate pressure chamber and dew point water potential meter measurement methods that are commonly used scientific investigations[5]. We can also replace the anthrone sulfuric acid method for the determination of leaf chlorophyll content with the new chlorophyll meter. The traditional improved half leaf method for the determination of plant photosynthetic rate can be replaced by the advanced photosynthesis system measurement method. By introducing new technologies and methods into the plant physiology experiment class, not only the efficiency of experiment is improved, but also the accuracy of experimental data is increased. Moreover, students' interest in plant physiology research can be cultivated by using the more advanced technologies, and a certain foundation for future scientific research can be laid.

In addition to experimental skills learning, it is also conducive to plant physiology experiment course to encourage students to carry out scientific exploration, apply what they have learned, and cultivate students' ability to solve related problems. Under the guidance of teachers, a group of students are allowed to independently select topics, design experiments, complete an exploration project, collect data, analyze data, and complete written and oral reports. Through the exploration project, students' creative thinking, comprehensive ability to put forward and solve problems and team spirit are trained.

## 2 Improving the Teaching Model of College Plant Physiology Course

In traditional teaching of plant physiological courses, teachers usually concentrate on teaching theoretical knowledge in the limited teaching time. But students lack perceptual understanding of relevant plant physiology knowledge. Therefore, students' participation in class is not enough and the classroom atmosphere is easy to be dull. This result in the lack of enthusiasm among the students and thus the teaching is not very effective. Many students dealt with the exam by rushing and memorizing before the exam without a deep understanding of the content of plant physiology.

With the development and popularization of Internet technology, databases, and multimedia technologies, higher education has gradually entered the digital age[6]. In recent years, learners have deepened their understanding of distance learning under the network environment, and the forms of online learning have become more and more diverse. With the popularity of digital courses

such as Massive Open Online Course (MOOC) and Small Private Online Course (SPOC), various forms of science and popular science learning materials, as well as video lectures by famous Chinese and foreign teachers, have emerged on the Internet. For example, the textbooks of plant physiology published by China Higher Education Press are also equipped with many digital course resources, which contribute to the construction of digital course of plant physiology in colleges.

### 2.1 Application of MOOCs in the Teaching of Plant Physiology in Colleges

As an emerging teaching mode, MOOCs are enjoyed by teachers and students with unprecedented popularity, and more and more universities in the country have set up MOOC platforms. Different from traditional classes, MOOCs allow students to choose and access high-quality digital course resources at different places and times through digital platforms without time and space restrictions. MOOC overcomes the constraints of traditional classrooms that must be studied at a prescribed time and place. In traditional teaching classrooms, teachers are the main body of teaching activities, and students mostly only passively accept course resources. If MOOC teaching methods are properly introduced in plant physiology teaching, abundant network resources can be fully utilized[7]. In particular, some phenomena and physiological processes of plant physiology can be visually displayed through pictures, videos. This will make the teaching and learning process more diversified. It can improve the students' learning enthusiasm and greatly expand their understanding of the related knowledge about plant physiology.

### 2.2 Application of SPOC in the Teaching of Plant Physiology in Colleges

The SPOC course teaching model was first proposed and used by Professor Armand Fox from the University of California, Berkeley. It is a new teaching method developed based on the MOOC resources, with the characteristics of small scale and strong privacy [8]. The SPOC teaching model stimulates the teachers' teaching enthusiasm and classroom vitality, making the teachers as a real classroom controller. In the application of SPOC teaching mode in the teaching of plant physiology in colleges, the teachers are required to extract multiple knowledge points and themes in each chapter, and then decompose the teaching objectives of plant physiology according to knowledge, ability and quality requirements to establish unit learning modules and tasks. Then the teachers enable students to complete an online learning by setting up online unit guidance, online testing and other links. The offline classroom, the face-to-face teaching of plant physiology focuses on solving knowledge difficulties and organizes students for discussions. The effectiveness of plant physiology teaching can be substantially improved by the use of SPOC [9].

## 3 The Integration of Ideological Education to the Course

Ideological education in the teaching process of plant physiology will help students to establish a correct outlook about the world, life and ecological values to a certain extent [10]. At the same time, we should integrate Chinese traditional culture into the classroom teaching of plant physiology. This contributes to the guidance and cultivation of students' patriotism, confidence in Chinese traditional culture, promotion of the national spirit with patriotism and the spirit of innovation.

For example, in the introduction of Plant Physiology course, the story of scientists in the history of plant physiology research, and the contributions and silent efforts of Chinese scientists are emphasized to enhance students' national self-confidence and identity. So, students can firmly believe that "lucid waters and lush mountains are invaluable assets", strengthen ecological consciousness, and set up the idea of "serving the country by science and technology". In the chapter of Water Physiology, the proverb that "harvest or no harvest depends on water" emphasizes the important role of water. Through this proverb, we can guide students to save water, protect water resources and protect the earth. In the chapter on Mineral Nutrition, the proverb that "harvest more or harvest less depends on fertilizer" emphasizes the idea of sustainable development. Through this proverb, we can guide students to pay attention to sustainable agricultural development and increase their interest in agricultural development. In the chapter "Plant Hormones", through understanding the important role of hormones in agricultural production,

students can understand the principles of "small hormones of big contributions", and then stimulate students' enthusiasm for learning. In the chapter "Plant Secondary Metabolites", we explain the discovery process of Artemisinin by Tu Youyou, the Nobel Prize winner in China. Tu Youyou's discovery of artemisinin is a tortuous journey. She first got her inspiration from the Manual of Clinical Practice and Emergency Remedies by Ge Hong of the Eastern Jin Dynasty: "Using one quantity of Qinghao, plus two quantities of water, squeeze juice out of the substance, drinking the extracted juice would treat the symptoms of malaria." Her team succeeded through unremitting efforts and many failures. Her story would help the students to understand that success cannot be achieved overnight. The setbacks and failures encountered in life are not terrible. The terrible thing is that there is no perseverance to break the failure and stick to the end. In the chapter of Plant Adversity physiology, through the physiological changes of plants in plant physiology under adversity, the students are guided to face life adversity bravely and establish the determination and confidence to overcome difficulties [11].

## 4 Concluding Remarks

In a word, the teaching reform of plant physiology is of great significance in both professional construction and discipline construction. It is suggested that the teaching reform of plant physiology should be carried out from three aspects. Firstly, we should pay attention to the enrichment and renewal of theoretical and experimental teaching contents and improve students' learning enthusiasm. Secondly, we should pay attention to the application of the new teaching model in plant physiology teaching, improve the interaction between teachers and students, enhance the pertinence on teaching and increase the participation of students in learning. Lastly, we need to integrate ideological education into the teaching of plant physiology.

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## References

[1] Office of the Working Group of the National Medium and Long-term Reform and Development Plan Outline. Outline of the National Medium and Long-term Educational Reform and Development Plan (2010-2020) [M]. Beijing : People's Education Press, 2010.

[2] He Jingjing. China unanimously won the formal membership of the "Washington Agreement"----our country's engineering education achieves international multilateral mutual recognition. [N]. China Education Journal.

[3] Huang C S, Pedersen B P, Stokes D L. Crystal structure of the potassium-importing KdpFABC membrane complex [J].Nature, 2017,(546) : 681-685.

[4] Kang Yeqin. The "post-MOOC era" of online education --SPOC Analysis [J]. Tsinghua Journal of Education, 2014, 35(1) : 85-93.

[5] Zhou Tongjian. Under the background of "MOOC", the opportunities and challenges and countermeasures faced by the curriculum construction of higher forestry colleges and universities. [J]. Forestry Education in China, 2016, 34 (2) : 9-13.

[6] Zhang Kai, Wan Huafang, Liang Ying, et al. Innovative ideas and reform trends in the teaching of "Plant Physiology" theory course in colleges and universities. [J]. Journal of Southwest Agricultural University (Social Sciences Edition), 2013, 11(7) : 132-134.

[7] Qiu Weiguang. The value implication and generative paths of ideological and political education in curriculum [J]. Ideological & Theoretical Education, 2017(7) : 10-14.

[8] Li Ying. A Brief Talk on the Application of Scientific Research Teaching in Plant Physiology

Teaching [J]. Anhui Agricultural Science Bulletin, 2010,16(9): 214-215.

[9] Huang Tong, Luo Tong, Wei Qin et al. On the choice of classroom teaching methods of plant physiology[J]. Education Exploration, 2011 (8): 65-66.

[10] Xiong Fei, Wang Zhong, Gu Yunjie et al. Reform and Practice of Plant Physiology Course[J]. Journal of Yang zhou University, 2008,29 (1): 68-71.

[11] Wang Junsheng. Problems and Solutions in the Reform of Research Teaching in Colleges and Universities[J]. Higher Agricultural Education, 2013 (11): 73-76.