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Study on the Teaching Reform of Plant Physiology in the Context of Modern Education

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Abstract The Plant Physiology is characterized by wide coverage, strong theories and practicality, and limited class hour. In view of these characteristics, this paper introduced the reform of teaching methods, including reform of teaching content, reform of teaching methods and means, reform of experimental teaching and examination methods. It is expected to achieve the objective of improving the teaching effect of Plant Physiology.

Key words Plant Physiology, Teaching reform, Teaching methods

1 Introduction

Plant Physiology is a subdiscipline of botany concerned with the functioning, or physiology, of plants. It is a discipline that studies the rules of plant life activities and its regulatory mechanisms. Its main task is to study and elaborate various life activities, rules, and regulation mechanism of plants and their components, as well as effects of environmental changes on these life activities. Traditional teaching of Plant Physiology has the problems of paying close attention to theories but underestimating the practice, stressing research results but belittling research process, and attaching great importance to conclusions but neglecting interests of students, research thinking, research methods and research habits. In view of these problems, it is necessary to make reform of Plant Physiology, to improve its teaching effect.

2 Reform of teaching contents

At present, there is the problem of contradiction of few class hours, heavy tasks, and low innovation ability of students in the discipline of Plant Physiology, it is necessary to make the following adjustments to the teaching contents.

2.1 Combining the interests and direction of students It is necessary to properly adjust the teaching contents on the basis of the level and future development direction of students. Flexible teaching methods should be adopted and main teaching contents should be selected according to the characteristics of students. For the selected main teaching contents, it is necessary to introduce frontier teaching contents.

2.2 Explaining key contents and promoting students to learn by themselves The class hour of Plant Physiology is generally few. Thus, it is recommended to explain key contents. For those easy to understand, students may learn by themselves under

the guidance of the teachers. Teachers may evaluate the self-learning contents by many ways. For contents students not learn well, teachers should provide timely explanation and instructions.

2.3 Implementing network-aided teaching There are differences in learning ability of students. Putting the teaching and courseware of self-learning contents on the network, it is able to realize the purpose of listening to the teaching and learning related contents at any time.

2.4 Crossing disciplines and caring about hot spots of researches In view of characteristics of students, in the process of teaching, it is necessary to combine learning of the Plant Physiology with the development of cross disciplines, introduce the frontier progress and the latest achievements in Plant Physiology and cross disciplines to students, to stimulate interests of students and make students' knowledge system become unified system without separation.

3 Reform of teaching methods and means

3.1 Heuristic teaching The development of Plant Physiology is closely connected with the development of experimental science. Thus, in the process of teaching of Plant Physiology, it is feasible to start with classic experiments. In teaching the theories of Plant Physiology derived from classic experiments, teachers first give existing experimental conditions and possible experimental methods, encourage students to infer possible experimental results or ask them to discuss how to perform the experiment. Through thinking and discussion of students, the effect is better.

On the basis of experimental teaching, it is recommended to closely combine theoretical knowledge and experimental content of Plant Physiology. In the process of teaching theories, teachers may combine related knowledge of Plant Physiology. Besides, teachers may use flexibility and image of experiment to promote students' learning of theoretical courses, and use systematicness and knowledge of theoretical courses to promote the improvement of students in experimental design. In sum, it is required to combine theoretical learning and experimental learning and establish a

systematic knowledge system for students.

3.2 Interactive teaching Every chapter is arranged with certain class discussions with a group as the unit. The whole class is divided into 4 – 5 groups. Members of the group represent the whole group in turn to participate in the discussions. Scores of discussions are included into the coursework score of students.

In the selection of discussion topics, there are different ideas of key contents, difficult contents, and contents needing cooperation of several students. In this way, it is able to make students understand the key and difficult points of Plant Physiology in depth, and improve students' learning on the basis of understanding the key and difficult points of Plant Physiology. For contents that may have different ideas, it is recommended to encourage students to make scientific judgment on the basis of establishing scientific investigation and research methods. Besides, before participating in the class discussions, students in a group first organize to discuss ideas of the group, which not only improves students' knowledge of Plant Physiology, raises expression ability and teamwork spirit of students, and enhance the emotional quotient of students.

The discussions were first carried out by students. After completion of students, the teacher makes comment on the point of view of each group, points out the merits and drawbacks, and elaborates his/her own ideas on the topics discussed.

3.3 Network-aided teaching With the development of information technology, network-aided teaching becomes possible. On the basis of the construction of fine courses of Plant Physiology, it is recommended to increase class video contents, make the whole or partial contents of Plant Physiology into online videos, and put the videos on the fine course network of Plant Physiology. Students are free to choose to watch videos of difficult contents. However, the course task of students is not heavy, so students have sufficient spare time. If possible, it is able to make classroom videos of several professors, to make students freely choose different teachers.

3.4 Combination of a variety of teaching methods On the basis of multimedia teaching, it is recommended to combine blackboard teaching, animation display, and object teaching. At the same time of teaching the Plant Physiology with the aid of multimedia, teachers may give blackboard teaching, to avoid dull multimedia teaching. The range of Plant Physiology is wide. It is feasible to add vivid introduction pictures of corresponding plants in multimedia teaching materials, to stimulate students' learning interests. At the same time of classroom teaching, it is more persuasive to show students physical objects of corresponding contents. For example, when giving lecture of chlorophyll fluorescence phenomenon, teachers may bring the chlorophyll solution to let students watch the solution.

It is recommended to combine teaching contents with interests and direction of students. Besides, it is necessary to properly adjust the teaching contents on the basis of the level and future development direction of students. Flexible teaching methods should be adopted and main teaching contents should be selected according to the characteristics of students. For the selected main teaching contents, it is necessary to introduce frontier teaching con-

tents. Connection with other disciplines and hot research spots should be established.

For microscopic and abstract knowledge, such as the water absorption mechanism of cells, mechanism of root system absorbing mineral elements, pressure flow hypothesis of transport of organic matters, and performance of cell membrane at low or high temperature, it is recommended to make vivid explanation with examples and metaphors available in daily life. For the process of cells absorbing water, cell can be likened to a balloon in a basket, the basket is equivalent to the cell wall, the balloon is equivalent to the cell membrane, water can penetrate balloon surface, and the balloon is filled with water. Transport of apoplast and symplast for roots absorbing mineral elements can be likened to the difference between classrooms and aisles, and the middle of the classrooms is equivalent to plasmodesmata. As to the pressure flow hypothesis of transport of organic matters, it is not easy to understand for students. Teachers may compare it to the stream of people in the same direction. Such flow will promote molecules to move forward. Then, the two-way transport will be very easy to understand. Another example: the effect of cell membrane in temperature changes on the cells can be likened to changes of the balloon in winter and summer. In summer, the balloon becomes soft and is easy to burst during inflation; in winter, the balloon becomes crisp and is also easy to burst during inflation. Using vivid metaphors to describe unobservable changes in plant physiology is helpful for deepening students' understanding occurrence of certain physiological process of plants, avoiding mechanical memorizing and spoon-feeding teaching, and classrooms also become lively and interesting.

3.5 Expanded teaching On the basis of theoretical and experimental teaching, students complete requirements beyond the discipline and understand the physiological mechanism of plants in practice. For example, teachers may provide the nutrient solution for students, let students cultivate element-deficient plants, and create Plant Physiology interest publications.

4 Reform of experimental teaching

Plant Physiology is a very practical discipline, and experimental teaching is an essential part of learning of Plant Physiology. In view of the historical evolution of Plant Physiology in Northwest A&F University, we came up with the following recommendations for the reform of experimental teaching of Plant Physiology:

4.1 Students independently completing preparatory work for experiment In the past, teachers nearly undertook all tasks for preparation of experiment. However, students have complete ability to do experimental preparatory work. In the process of preparing reagents and cultivating materials, students can learn a lot of knowledge.

4.2 Students independently designing experiment Students can choose their own plant species, treatment types, control settings, and plant materials according to the existing experimental settings. However, in order to avoid the blindness of the students' choice, students should report their selection of experiment to teachers for approval.

4.3 Students adjusting the experiment scheme on the basis of experimental instructions

Students need adjust the standard curve concentration range, volume of buffer solution, and dilution concentration according to the plant types and differences in tissues and organs of plants. In the experimental arrangements, it is recommended to conduct easy experiment first and then conduct difficult experiment. Teachers should encourage students to adjust the experiment scheme with reference to methods of other students, to avoid inflexible learning of experiments in Plant Physiology.

5 Reform of examination methods

The examination is a main method for assessing academic performance of students and teaching effect. In the past, students were not active in learning Plant Physiology. They did not prepare lessons before class, and did not review the lesson after class. They just mechanically memorized main points. In this situation, it is required to focus on the examination. The examination includes the following parts:

- (i) Coursework score: 20% , including attendance, homework, class questions, and so on;
- (ii) Class discussions: 20% , including usual discussion, students participating in discussions on behalf of the group have score 10% higher than group members; groups with better discussions have higher score;
- (iii) Midterm test: 20% , midterm test is organized one or two times according to the teaching contents;
- (iv) Final examination: 40% , the test and examination of the whole parts of the discipline.

The Plant Physiology is a key course in the basic courses of various specialized disciplines of agriculture. It plays a role of linking the basic courses and specialized courses, and also plays a

key role in students' objective understanding the effect of macroscopic environmental factors on physiological processes of microscopic plants. Therefore, strengthening the teaching reform of Plant Physiology and improving the teaching effect will play an important role in improving students' grasping specialized knowledge and research ability. Teaching process is the process of interaction between teachers and students. Only the teaching that stimulates active learning interests of students is a successful teaching process. In the process of teaching, teachers should attach importance to the knowledge content, and consider emotion of students, to promote formation of excellent interaction of teaching and learning in peaceful attitude, rich knowledge, and humorous language.

References

- [1] ZHANG JS. Plant physiology [M]. Beijing: Higher Education Press, 2006. (in Chinese).
- [2] ZHANG LJ, LIANG ZS. Plant physiology [M]. Beijing: Science Press, 2007. (in Chinese).
- [3] WU WH. Plant physiology [M]. Beijing: Science Press, 2008. (in Chinese).
- [4] SONG YB. Study on plant physiology teaching reform of life science undergraduate [J]. Modern Agricultural Science and Technology, 2009 (21): 302-303. (in Chinese).
- [5] LI JH, DONG N, CHEN YL. Experimental teaching reforms of plant physiology [J]. Journal of Hebei Normal University, 2010, 12(4): 114-116. (in Chinese).
- [6] DAI HF, TANG JX, REN YX. Teaching reform exploration of comprehensive experiment for plant physiology [J]. Modern Agricultural Science and Technology, 2010(13):32-33. (in Chinese).
- [7] CHEN SS, TANG WP. A preliminary study of the teaching reform of plant physiology in normal universities [J]. Higher Education of Sciences, 2010, 91(3):74-77. (in Chinese).
- [8] WU SJ. Discussion on teaching reform of "plant-physiology" in university [J]. Journal of Changchun University, 2006, 16(6): 108-110. (in Chinese).

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greater debt pressure to operators and reduce their investment enthusiasm. As usage of information services will be abandoned owing to lack of knowledge, interest, available computers or unable to pay for information service fees for some rural population, therefore, software supporting of computer center, training and so on is essential.

MIIT has made it clear that vulnerable groups will be the key markets of broadband penetration, especially to improve the access conditions of public welfare institutions and low-income groups. In the light of bottlenecks of information interoperability, sharing and commonality, relatively scattered, large differences, low degree of sharing, it needs to promote the effective combination of information technology and rural agriculture. Management system and statistics, analysis and reporting system of agricultural information in rural areas were perfectly established and provided timely, comprehensive and accurate marketing information and reference material for peasants, Agricultural Material Department *etc.*

Information supply subject should pay attention to providing differentiated information products and improve the availability of

personal terminals. For rural residents in less developed and backward areas, it provides various types of application training around "government affairs informatization, business informatization and people's livelihood informatization" to raise the support for informatization talents in rural areas.

References

- [1] XIA J. Rural public information service regulation: challenges and prospects [J]. Journal of China University of Geosciences (Social Sciences Edition), 2013, 1:81-86.
- [2] CHEN X. New breakthrough of China's basic economic system [J]. Journal of Shanghai Jiao Tong University (Philosophy and Social Sciences), 2014, 2:6-9.
- [3] DU ZH. "Internet plus" background of the construction of information infrastructure vision [J]. Reform, 2015, 10:113-120.
- [4] LI Y, LIU Y. Construction of long-term mechanism of new rural information infrastructure construction in China [J]. Information Science, 2014, 3:81-85.
- [5] JING LB, MA Y. ICT infrastructure: investment methods and optimal policy tools [J]. Economic Research, 2013, 5:47-60.
- [6] GILLET SE, LEHR WH, OSORIO C. Local government broadband initiatives [J]. Telecommunications Policy, 2004, 28: 537-558.