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Teaching Reform and Practice of Plant Growth Environment Course in the Context of Application Transformation Development

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Abstract Through the personnel training program, revising the syllabus, optimizing teaching contents, reforming teaching methods, strengthening practical teaching links and reforming examination methods, this paper explored the teaching reform and practice of Plant Growth Environment Course, in order to improve the teaching effect, stimulate learning interests of students, and cultivate application type talents meeting social demands.

Key words Application transformation, Plant growth environment, Teaching reform

1 Introduction

As a new undergraduate university, Kunming University sets training personnel with high ideological morality, down-to-earth theoretical foundation, strong professional ability, and high comprehensive quality as objectives. A course, as an important foundation of professional teaching, is the carrier for training professional skills of students and improving their theoretical level. Therefore, how to effectively carry out classroom teaching is an important part of improving the teaching effect and cultivating innovation ability of students[1,2]. According to the objective of personnel training, Plant Growth Environment is a professional basic course of green food production and testing discipline. For teachers, in the course of teaching, they should made diversified reform in teaching content, teaching methods, teaching means and examination methods, to enhance the pertinence of teaching; for students, how to stimulate learning interests is a top priority. Therefore, it is required to transform the traditional lecturing of theoretical knowledge and concepts, transform the excessive attention to texts and theories, and improve teaching effect through taking advantage of innovative teaching methods. The Plant Growing Environment course has teaching characteristics of theoretical teaching, practical training and knowledge development. Therefore, only through reform of courses and combination with practice, may the ideal teaching effect of the course be really manifested, be able to cultivate practical personnel with solid theoretical knowledge, practical ability, and high adaptability.

2 Revising the syllabus to meet the demands of applied personnel training objective

Plant Growth Environment is a professional basic course, involving plant cell, tissue, organ morphology and development, flowering, pollination, fruit bearing, plant environmental meteorological conditions, moisture, nutrient metabolism and utilization, soil conditions, plant growth, plant population structure, community occurrence, development and ecosystem. It is a course covering wide scope of knowledge and multi-disciplinary penetration. In order to adapt to different personnel training objectives, different institutions have different teaching materials, course content setting, and teaching methods. Research-oriented universities generally select teaching materials with strong theory and system, and teaching contents focusing on theories and skills necessary for academic research, and pay close attention to research learning of students; skill-oriented universities generally select teaching materials with weak theoretical knowledge but high operation skills, and teaching contents focusing on knowledge and operation skills, flexible teaching methods and means, and many institutions extend the classroom to industries or enterprises. According to the personnel training mode "rapid start, great stamina, and innovation" and the practical personnel training objective "high ideological morality, down-to-earth theoretical foundation, strong professional ability, and high comprehensive quality" of Kunming University, the discipline revised the syllabus, reasonably selected teaching content, and adhered to taking basic theoretical knowledge as basis, taking skill training as means, to cultivate students with certain theoretical knowledge and high practical operation ability. The overall design idea of syllabus takes training of technical application ability and professional quality as main line, to promote combination of theory with practice and professional quality training with theoretical practice activities. Teaching activities take multimedia teaching and case teaching as guidance and take classroom experiment and training as a platform, to train practical ability and professional quality of students. It is required to establish the application ability evaluation criteria, optimize the knowledge structure, strengthen the practice teaching, and make effort to raise the ability of students of knowledge transformation, skill ability, and professional adaptation ability.

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3 Reforming teaching methods and means to improve the teaching effect

Classroom teaching mode is the teaching method used by teachers in classroom for learning of students. It is the "teaching students according to their aptitude" said by Confucius. It is the most direct and effective way to realize migration of teaching knowledge and skills and transformation of ability for ensuring teaching effect. Teachers should take different classroom teaching modes for different types of students in accordance with different courses and classrooms, to achieve excellent teaching effect. In the traditional classroom teaching mode, teachers give lecture, students listen to teachers, teachers raise questions, and students answer questions. Teaching hardware is relatively simple. Students participate in exercise, especially take the initiative to obtain knowledge, but have few opportunities of practical training. It is necessary to start from teaching, learning, exercise, design, and analysis[3,4], it is not merely classroom explanation and record of learning, but rather a process of learning, excise and integrated design with common participation of teachers and students. In such process, the master teaches the trade, but apprentice's skill is self-made. This reflects guidance of teachers and autonomous learning of students. The course teaching activities need division of labor, collaboration, making clear the subjects. Learning subjects are students[5], teachers' imparting, explanation, demonstration, and correction processes are important, but students have to understand and digest these to bring into play the desired effect. The role of teachers is to guide, evaluate, correct and track. The final results and performance depend on specific action and effort of every student. This is the excellent classroom course, students' grasping, understanding and actual effect will have difference in level. In addition, in the process of teaching, it is recommended to adopt the task-driven method. Teacher assigns probing learning tasks to students, students consult data and arrange the knowledge system, then select representative ones to discuss, and finally the teacher makes summarization. This teaching method is carried out by groups or by individual student. The teacher should assign specific task, other students should actively ask questions, and design contents, to reach the purpose of common learning. The task-driven teaching method allows students to train their ability of analyzing and solving problems, and cultivate their independent exploration and cooperation spirit in the process of completing tasks. Through the teaching, it is found that the Plant Growth Environment is a course having strong cross of theory and practice. Its knowledge is distributed in many disciplines, such as plant, meteorology, soil and ecology. It needs to grasp many experimental operation skills and technical links. Besides, it is necessary to use experimental skills to investigate, analyze or solve problems, so students need grasping sufficient basic theoretical knowledge, certain experiment investigation skills and operation ability. In other words, in the process of organizing this course teaching, students should first learn the task knowledge, concepts and related theories. On the basis of deepening the knowledge understanding and grasp, teachers should select experiments and exercises with wide scope and high correlation, students participate in specific task learning, excise and experience in the manner of working group or exchange. After completing the operation exercise, working groups should conduct exchange, feedback and summarization.

4 Approaches for implementation of course teaching project and ability training

However, the improvement of student ability is a gradual process. The course teaching includes experiments. Training is not merely stimulating students' interests in learning, but more important, it is a process of helping students to grasp knowledge and learning skills through learning process[6]. Thus, it is difficult to fully grasp the content of this course merely through classroom teaching and experiment. It is necessary to expand learning methods, deepen the digestion and extension of post-class knowledge, explore the production and experiment cases related to this course, and raise the demands of individual student for improving the course learning ability through comparison, classification, and summarization. Experiments involve the plant sampling, microscopic observation of plant cell, tissue and organ morphology, plant morphology development and organogenesis, soil nutrient determination for plant growth and development, such as measurement of available nitrogen, total nitrogen, available phosphorus, and available potassium, calculation of soil density and porosity, plant growth microclimate determination, temperature, humidity, light, and heat, plant population survey, community structure and development situation survey. Experiments and practical exercises provide a lot of practice opportunities. If we can deal with the relationship between theory and practice, the practical exercise will provide a more profound recognition and understanding of various experiment devices, as well as for grasping of instrument performance, function, and operation skills. For the contents originally not familiar, and even those learning items and tasks very difficult to understand, practical exercise operation improves students' understanding of learning items, and deepens understanding and grasping of knowledge and theory. Then, it is able to make the originally boring texts become vivid understanding and cognition model. Therefore, as long as we find a proper course learning method, through organizing classroom innovative teaching mode, bringing into play subject participation of students, it will naturally raise the learning efficiency, so as to fully manifest the learning effect.

5 Improving the course system and optimizing the teaching content

Kunming University set the Plant Growth Environment course in the green food production and testing discipline and took it as an essential compulsory course, to make students grasp basic theory of plant growth environment, basic skills, understand the application in agriculture, horticulture, and forestry, enhance students' practical ability, and increase their employment or entrepreneurial

opportunities. The course system consists of theoretical teaching and practice teaching. The theoretical teaching and practice teaching are 40 hours and 24 hours respectively. In the process of teaching, the course syllabus is constantly optimized, the teaching content is reorganized, and the content of the theory teaching is integrated into seven chapters (Table 1), and it is required to focus on the introduction of new knowledge, new technologies, such as the introduction of new knowledge and new technologies for the determination of N and K in the soil in the chapter of nutritional environment of plant growth. The practice teaching process is arranged from simple to complex, from the basic to the professional, first sensory then experience, and constantly strengthening, so that it is favorable for students' experience and understanding, thinking and exploration. The teaching content and time allocation are listed in Table 2.

Table 1 Arrangement of theoretical teaching

Chapter	Teaching content	Credit hours	Main and difficult points of teaching
Chapter 1	Plant growth and development and environmental conditions	2	The germination process and the influence factors of seeds; the correlation of plant growth; the main ways to control the plant growth and development; the effect of temperature and light on the flowering; the function of the flower principle in agricultural production
Chapter 2	Soil environment for plant growth	6	Effects of soil three-phase matters on plant growth and soil fertility; effects of soil basic properties on plant growth and soil fertility
Chapter 3	Nutritional environment for plant growth	8	The principle of plant absorbing nutrients and the properties of plant nutrients; the transformation process of nitrogen, phosphorus, potassium and trace elements in soil
Chapter 4	Light environment for plant growth	6	Effects of light intensity and sunshine time on plant growth and development; adjusting light environment of plant through plant adaptation to light environment
Chapter 5	Temperature environment for plant growth	6	Change rules of soil temperature and air temperature; effects of temperature on plant growth, and adaptation of plant on limit temperature; reasonable regulation of temperature environment for plant growth
Chapter 6	Moisture environment for plant growth	6	The importance of water to plant growth; conducting plant production using the ecological adaptability of plant to water; reasonable control of water environment for plant growth
Chapter 7	Climate environment for plant growth	6	The microclimate of farmland, the effect and regulation of microclimate in the protected area; regulation of agrometeorological elements in the facility environment
Total		40	

Table 2 Arrangement of practice teaching

No.	Name of experiment item	Credit hours	Main and difficult points of teaching
1	Collection and preparation of soil samples	4	Collection and preparation operating procedures of mixed soil samples
2	Determination of soil bulk density	2	Methods for determination of soil bulk density
3	Determination of soil pH	2	Methods for determination of soil pH
4	Observation and diagnosis of plant nutritional deficiency syndrome	2	Morphological diagnosis of major nutrient deficiency
5	Qualitative identification of chemical fertilizers	2	Methods for identification and determination of chemical fertilizers
6	Preparation of nutritional soil	2	The proportion of raw materials and the preparation method of nutritional soil
7	Determination of available nitrogen in soil	2	Principle of diffusion method for determination of available nitrogen in soil
8	Determination of available phosphorus in soil	2	Determination of available phosphorus in soil by Molybdenum and Antimony Colorimetry
9	Determination of available potassium in soil	2	Principle for flame spectrometry for determining soil available potassium
10	Observation of agricultural environmental factors	2	Observation method of light intensity, air temperature and humidity, and soil temperature and humidity
11	Determination of soil water content	2	Principle and methods for determination of soil water content
Total		24	

6 Reforming the course examination methods and establishing a reasonable examination system

In order to comprehensively and objectively evaluate the students' learning, we have made active exploration in the course examination methods, changed the traditional one time determination method through final examination, and strengthened the process examination. The total score of the course is determined as per regular performance (10%) + final examination (60%) + experiment examination (30%). The regular performance includes learning attitude, classroom questions, homework, and stage learning reports. In view of highly practical characteristics of the Plant Growing Environment course, the final examination adopts close book form, reduces mechanical memorization, and enhances examination of knowledge understanding and application ability. The paper types are more than 6. The calculation questions, analysis questions, and judgment questions account for more than 60%. It is recommended to reform the examination method, take the experiment report as main basis, and formulate the examination criteria for skills specified in syllabus, to evaluate operation skills of students. Through the above teaching reform practice, the teaching

contents are made close to enterprise and industry demands, teaching forms are made diversified, training of practice skills of students are valued, conforming to objectives of training of applied personnel. The feedback of the practice and employment enterprises also reflect that comprehensive professional quality of students is improved and students can rapidly adapt to demands of scientific research production of the industry. In sum, it is necessary to combine teaching and learning, to raise the course learning efficiency and strengthen the learning ability. In our opinion, the fundamental means is the innovation of teaching concept. It is recommended to stimulate learning interests of students, mobilize initiative and enthusiasm of students, and innovate on the learning scene and working process through overall teaching design, course unit design, organization of teaching activities, teaching methods, equipment and facilities, training content, and examination methods. Combined with the actual ability requirements and course knowledge, specific practice and application of theories as task design and training orientation, it is recommended to improve the pertinence and application characteristics of teaching process, design the knowledge system into a system combining ability exercise, task, training process, and knowledge learning, to practically improve ultimate ability of the course learning, and migration of learning ability, to make this course become the professional platform course.

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