

Exploration on the Reform and Construction of Molecular Biology Course for Application-oriented University

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Keywords: Application-oriented University, molecular biology, curriculum reform, construction

Abstract: Application-oriented University course refers to the type of applied technology as the orientation of running a school, which requires all majors to closely combine local characteristics, pay attention to the cultivation of students' practical ability, and embody the word "application" from the construction of teaching system. Molecular Biology, the core course of biotechnology specialty, has undergone a series of teaching reform and construction, aiming at improving students' problem-solving ability and comprehensive quality, so as to cultivate high-level and applied talents. After several years of curriculum reform and construction, including the determination of teaching objectives, the setting of teaching content, the design of teaching mode, the reform of teaching methods, the integration of curriculum ideology and politics, the design of teaching process, the reform of curriculum assessment and evaluation, etc., some achievements have been made in the teaching effect and curriculum evaluation of Molecular Biology. In the future, this course will continue to carry out "online+offline" course construction, deepen the reform of course assessment and teaching mode, and continue the student-centered and employment-oriented course reform and construction, so as to cultivate applied talents and meet the needs of society.

1. The characteristics of Application-oriented University education and teaching

In March, 2014, the reform direction of the Ministry of Education of China made it clear that more than 600 of the 1,200 ordinary undergraduate colleges and universities in China will gradually transform into applied technology universities, and the transformed undergraduate colleges just account for 50% of the total number of colleges and universities. Application-oriented University course refers to the type of applied technology as the orientation of running a school, not to academic type Ordinary undergraduate colleges, which are positioned for running schools, are relatively different from ^[1]. Application-oriented University course is type of education to meet the economic and social development of China, High-level applied talents promote China Popularization of higher education The process has played a positive role in promoting.

Application-oriented undergraduate course focuses on the word "application", which requires the concept of talents, quality and education that reflects the spirit of the times and the requirements of social development as the guide, so as to construct satisfaction and adaptation under the new

situation of higher vocational education. Economic and social developmentNeed a new subject direction, professional structure, curriculum system, update the teaching content, teaching links, teaching methods and teaching means, improve the teaching level in an all-round way, and cultivate strong Social adaptation abilityAnd competitive ability of high-quality applied talents^[2]. All majors are required to closely combine local characteristics, pay attention to students' practical ability, cultivate applied talents, and embody the word "application" from the construction of teaching system, the core link of which is practical teaching.

2. The position and function of Molecular Biology

In biological science and production practice, in order to improve the predictability of work, effectively control the heredity and variation of organisms, accelerate the breeding process, and carry out the breeding of animal and plant varieties and improved varieties, it is necessary to carry out under the guidance of genetics theory. At present, with the rapid development of life science, gene maps of human and rice have come out one after another. With the continuous emergence of new technologies and methods, the research scope of genetics has been greatly broadened and the research content has been deepened. Fierce competition will continue in the research fields of bioinformatics, functional genomics and functional protein Group in the world, and genetics, as a basic subject of biological sciences, is increasingly showing its importance.

Molecular Biology is a science that studies biological inheritance and variation, and it is a theoretical science with complete system and rapid development in biological science, which plays a great role in exploring the essence of life and promoting the development of the whole biological science. At the same time, it is a basic science closely related to production practice, which has a very important guiding role in animal, plant, microbial breeding and genetic disease prevention and control. Molecular Biology is one of the compulsory core courses for biotechnology majors.

In the application-oriented undergraduate teaching, a series of teaching reforms and constructions have been carried out on the course of Molecular Biology. The purpose is to train students to use genetic knowledge to solve many difficult problems in life and work, to improve their comprehensive quality by using the ability improvement in learning and the cultivation of experimental skills, and to cultivate high-level and applied talents for the society.

3. The course reform and construction of Molecular Biology

3.1 The determination of teaching objectives

The teaching objectives of this course are determined according to the orientation of running an applied undergraduate college, the needs of enterprises, the training objectives of professional talents and the requirements of the course content for students' comprehensive quality.

(1) Knowledge objective: students should master the basic concepts, principles and laws of molecular biology; Familiar with the application of molecular biology technology in medicine, industry and agriculture.

(2) Ability goal: students should have the basic ability to reveal the molecular mechanism of organism development at the molecular level (that is, the ability to apply theory); Cultivate students' basic ability (experimental research ability) to engage in problem analysis and research in related fields by using molecular biology research methods and experimental skills; Cultivate students' ability to learn, understand, judge, analyze and solve problems independently (that is, to explore, analyze and solve problems).

(3) Quality goal: It consists of four trainings and one purpose. Four cultivation: the course cultivate students' sense of teamwork; A down-to-earth attitude towards knowledge; Strict scientific style; Scientific and practical innovative thinking methods. One purpose: the course enable students to adapt to the changing and developing needs of society after graduation and become real applied

talents.

3.2 Setting of teaching content

The teaching content of this course is divided into three modules, of which module 2 is the core content of this course. The contents and class time of Molecular Biology are shown in Table 1.

Table 1: Course Content and Class Time Allocation of Molecular Biology

Modular block	main content	Chapter	school hours
Module i	Basic knowledge and theory	Chapter 1 Introduction	In class: 2
		Chapter 2 Cytological basis of heredity; genomics	In class: 8 Experiment: 8 Self-study: 2
Module II	Synthesis and regulation of biological macromolecules	Chapter 3 Structure and Replication of DNA	In class: 8 Experiment: 8 Self-study: 2
		Chapter 4 RNA biosynthesis	In class: 4 Self-study: 2
		Chapter 5 Biosynthesis Technology in protein	In class: 6 Self-study: 2
		Chapter 6 Regulation of Gene Expression	In class: 8 Experiment: 4 Self-study: 2
Module iii	Common molecular biology research techniques	Chapter 7 DNA damage, repair and gene mutation	In class: 8 Experiment: 4 Self-study: 2
		Chapter 8 Common Molecular Biology Research Techniques (Genetic Engineering)	In class: 4 Self-study: 4

3.3 Design of teaching mode

Adopt two combined teaching modes:

(1) The course teaching mode adopts the combination of "online and offline".

(2) The teaching mode of the course is the combination of face-to-face teaching in class and independent learning after class.

Online teaching is mainly for online testing, homework, doubts, answers, discussions, watching teaching videos, etc.

Students self-regulated learning after class: teachers used in-class discussion and questioning to test the effect of self-regulated learning. For example, in-class discussion, teachers ask questions about the more important contents in the textbook, and students study independently after class. In class, students discuss and talk about the contents in groups to understand the learning effect. Finally, the teacher summarizes and focuses on the important and difficult points; In-class questioning refers to the teaching content and experimental principles that are difficult to understand in class, so that students can consult the materials after class and test the learning effect by asking questions when explaining the corresponding content in class.

3.4 Reform of teaching methods

The reform of teaching methods of Molecular Biology can be divided into "teaching method" for

teachers and "learning method" for students.

Teachers' teaching methods:

(1) Situational teaching method: teachers create topics to stimulate thinking and complete exploration^[3]. Such as the mechanism that parents and children, brothers and sisters look very similar; What are the similarities and differences between the life cycles of lower organisms and higher organisms? What is the relationship between epigenetics and gene expression, and so on.

(2) Project-based teaching method: the teaching content is decomposed into multiple projects, and the problems are solved one by one through inspiration, interaction and discussion.

(3) Guided learning teaching method: For the content of autonomous learning after class, the teacher first puts forward some questions, so that students can think and explore purposefully and purposefully.

Students' learning methods:

(1) Inquiry affirmative learning method: that is, students explore the topics created by teachers together or by themselves, and finally determine the answers.

(2) Interactive discussion learning method: teachers' classroom questions and after-class learning contents are solved by teacher-student interaction and student-student interactive discussion.

(3) Experiencing participatory learning method: In the experimental operation and group discussion, teachers let every student participate in it and independently complete the experimental process or problem solving, so every student can experience the pleasure of gaining knowledge and results by himself.

3.5 Integration of ideological and political education in curriculum

According to the characteristics of each chapter of Molecular Biology course, the case of ideological and political education in the course is deeply excavated. Through case studies, the achievements of China in related fields are naturally integrated, and students' patriotic feelings, scientific spirit and innovative consciousness are cultivated and stimulated, so as to establish cultural self-confidence and institutional self-confidence and cultivate students' sense of social responsibility.

Conduct ideological and political education when explaining the structure and composition of chromosomes: In September 1999, the Human Genome Center of the Institute of Genetics of China Academy of Sciences was allowed to participate in the Human Genome Project, which was responsible for measuring 1% of the total sequence of the human genome, that is, 30 million base pairs on chromosome 3, so China became the only developing country to participate in the project. China's "1%" task is located on the short arm of chromosome 3, which is 30 million base pairs (1% of the human genome). Although it only accounts for 1%, this task is of great help to other subsequent genome sequencing in China. Through our country's work and achievements in sequencing the "Human Genome Project", students can enhance their cultural self-confidence and cultivate their scientific spirit and sense of social responsibility.

3.6 Design of teaching process

The teaching process is divided into the following six stages:

(1) Introduction of new lessons: teachers introduce new lessons by reviewing and summarizing, asking questions, taking quizzes before class and creating topics.

(2) Explanation of new knowledge: teachers adopt the "project-driven" teaching method, and giving theoretical explanation by inspiring, guiding and questioning at different levels. Teachers dynamically introduce the text and display of pictures in the whole process, combine with blackboard writing to deepen understanding.

(3) Process interaction: interspersed throughout the course. That is, teacher-student interaction and student-student interaction, so as to enliven the classroom atmosphere and improve the teaching effect.

(4) Quiz: teachers examine the important points of knowledge before, during or after class, after

a project or a section.

(5) Summary: It will be conducted at the end of each class or class. It is completed by teachers' summary, students' induction, or interactive answers to questions.

(6) Learning consolidation and knowledge expansion: that is, after the course is over, thinking questions, homework and autonomous learning content should be arranged to consolidate the knowledge in class and expand the width and breadth of learning.

3.7 Reform of curriculum assessment and evaluation

The course assessment system adopts the form of "N+2". The characteristics of assessment and evaluation: make a diversified, multi-angle and whole-process assessment of students' learning.

"N": usual grades (40%). It means diversified assessment-including attendance, homework, stage assessment, online test, quizzes, questions, answers and discussions.

"2": including class notes (10%) and final exam (50%).

In the whole learning process, students' learning and experiments are tested and evaluated.

There are three ways to detect and evaluate:

(1) Attendance assessment: teachers adopt the method of learning to sign in. (2) Classroom performance assessment: teachers ask questions at any time in the classroom, and use the functions of "rushing to answer" and "online testing" of Online program. (3) grade evaluation: teachers give grades in time for homework, online test, questioning, answering first, discussion and other links.

4. The innovation and characteristics of curriculum construction

4.1 The innovation of curriculum construction

4.1.1 Content innovation

First, we don't stick to textbooks, drive teaching projects with professional training objectives and drive teaching content with projects. The second is to carefully divide the contents of in-class teaching and extracurricular autonomous learning, highlighting the difficulties. The third is to introduce the hot spots and frontiers of molecular biology research and the important knowledge points that should be paid attention to in postgraduate entrance examination.

4.1.2 Curriculum model innovation

First, in-class experiments were changed to independent experiments after class, which strengthened experimental research and skills training. Second, the implementation of modular teaching mode makes the main line of "knowledge → wisdom → ability" more clear. That is, theoretical module, experimental module and autonomous learning module respectively play the role of cultivating students.

4.1.3 Innovation of teaching methods

The adoption of the teaching method of "group talk and discussion in class" in this course makes classroom learning and extracurricular learning more energetic.

4.1.4 Innovation of assessment methods

The first is to test the learning effect in the whole process. Diversification of process assessment (online testing, stage assessment, occasional quizzes, questions, and answers). The second is to pay attention to process performance assessment. Including classroom performance, experimental process performance and experimental results.

4.2 Characteristics of curriculum construction

(1) The course of molecular biology adopts the teaching mode of "online+offline" and "face-to-face instruction in class+autonomous learning after class"^[4]. Since 2020, influenced by the epidemic situation in COVID-19, online teaching is often used in the course. This course adopts "online+offline" mode, and the teaching method is flexible, so that teaching and learning are not limited by the environment.

(2) Situational teaching is closely combined with the growth and development of human body and the actual life, which greatly arouses students' interest in knowledge^[5]. The course makes the knowledge that the student learns useful, carries on the analysis and the solution question in the actual life, increases student's study interest and the study enthusiasm.

(3) The assessment content is refined at ordinary times. That is, the online test of each chapter is refined to every knowledge point, which makes students' learning more targeted and targeted.

(4) The combination of teaching and graduation design. The problems found in experimental teaching are transformed into graduation project, and through the experimental research of graduation project, the experimental methods are continuously improved to improve the teaching effect.

5. The effect of curriculum reform and construction

5.1 Teaching effect: evaluate from two aspects: theoretical system and experimental skills

Theoretical system: including the basic knowledge of the course, the basic ability training and the curriculum ideological and political education. Students' participation in the course has increased through the following reforms. For example, teacher-student interaction make the classroom guide and promote learning gradually form the main line. Student-student interaction make students' teamwork spirit gradually enhanced. Autonomous learning make students' subjective learning consciousness gradually develop^[6].

The teaching effect achieved: basic knowledge: the basic knowledge points are well understood and mastered. Basic ability: strong ability to analyze and reveal life phenomena. Ideological and political education: the cultivation of students' scientific quality and feelings for home and country is fruitful. Experimental skills: including explaining the basic principles of experiments, cultivating students' operational skills and analytical ability, and gradually improving students' academic performance.

The teaching effect achieved: Basic principles: Students have a thorough understanding of experimental principles and methods.

Operation skills: Students can complete the whole experiment independently. Analytical ability: Students can accurately analyze experimental data and phenomena^[7].

5.2 Curriculum evaluation

This course participated in the 2021 school course construction competition and the first-class course selection, won the second prize in the 2021 school-level course construction competition, was approved as a first-class course at the school level, and was directly recommended to participate in the 2022 provincial-level first-class course selection. At the same time, this course has been liked and affirmed by students over the years.

6. Curriculum continuous reform and construction plan

6.1 Continue to build "online+offline" courses.

(1) Online resources: continue to build online course resources, and flexibly use the platform for "online+offline" combined teaching.

(2) Teaching documents: continue to improve the teaching content, multimedia courseware and teaching auxiliary videos to adapt to the training orientation of applied talents and meet the requirements of subsequent courses and students' graduation.

(3) Teaching methods: continue to study teaching methods, so that students can fully integrate into the classroom and glow the vitality and vitality of the classroom.

6.2 Continuously deepen the reform of curriculum assessment and teaching mode

In daily teaching, it is found that individual students have poor learning initiative, poor state of attending classes, and the course test is not completed in time. In order to further improve students' participation in class and improve the teaching effect, two ways are adopted to deepen the teaching reform.

(1) Course assessment is more refined.

The assessment of the course runs through the whole process, the content is refined, online and offline are combined, and active and passive learning are distinguished. Objective: To make students fully digest and absorb basic knowledge; Mobilize the initiative of learning.

(2) Teaching mode is more suitable for students to learn.

The teaching mode is improved by flipping the classroom (learning before class), role exchange (asking questions in class), interactive inquiry (studying exercises together) and combining learning with research (innovative training). Objective: To embody the students' main role, enliven the classroom atmosphere, make students fully integrate into the classroom and improve the teaching effect.

In the teaching of biotechnology specialty for application-oriented undergraduates, we should continue to strengthen the student-centered and employment-oriented curriculum reform and construction of Molecular Biology, fully mobilize students' learning enthusiasm and initiative, and achieve the purpose of cultivating applied talents.

Acknowledgement

This work was supported by Molecular Biology, a first-class undergraduate course in Liaoning Province in 2022. Project Number: 40000148. The course type: online and offline mixed first-class course.

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