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A preliminary study on the construction of molecular biology "course politics" in colleges and universities

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Abstract: *By integrating humanistic literacy, scientific spirit, traditional virtues, and patriotic feelings into the teaching process of the molecular biology course, we can deeply excavate the "ideological and political" elements contained in the course. This not only realizes the purpose of ideological education but also effectively stimulates students' interest in learning. The integration helps in realizing the role flip of teachers and students by utilizing network resources and information technology platforms. In addition, the reform of the grading mechanism and construction of the course's ideological and political case base contribute to the overall transformation and improvement of the course. This allows students to learn from passive to active, and truly "love to learn, enjoy learning". It also improves the original final review mode of "remembering the dry rules".*

Keywords: *molecular biology; political thinking elements; course political thinking*

1. Introduction

The construction of Civics and Politics in colleges and universities has been comprehensively promoted with the issuance of the Guideline for the Construction of Civics and Politics in Colleges and Universities by the Ministry of Education in June 2020 [1]. This involves the incorporation of civic politics contents into professional courses, which aims to guide students in establishing a correct worldview, outlook on life, and values. However, this does not imply rigidly copying the content of civic politics courses into professional courses. Instead, the integration of civic and political factors into professional courses should be done reasonably, in accordance with the content of the courses, without explicitly revealing the civic and political content. These factors should penetrate organically and be fully implanted into the curriculum of each "organizational cell" [1]. Molecular Biology, a core course for senior students majoring in life sciences, serves the purpose of enabling students to systematically master the basic theories, knowledge, and experimental techniques of modern molecular biology. It guides students in understanding life phenomena from the molecular level, exploring the essence of life, and cultivating their experimental and analytical abilities. The course also aims to develop students' molecular academic thinking and foster a rigorous and realistic scientific attitude and work style. Furthermore, it exposes students to the latest research progress in the field of life sciences and related technologies, laying a foundation for further study in biology-related subsequent courses [2]. Notably, the introduction of "Civic and Political" elements in the teaching of molecular biology adds vividness to the course explanation and significantly boosts students' learning enthusiasm. It subtly cultivates students' Civic and Political qualities [3].

The molecular biology course is rich in political thinking elements. Through the introduction of scientific achievements, we can disseminate the courage of scientists to explore the truth, patriotism and love of family and the spirit of perseverance, thus stimulating students to pursue scientific aspirations and inherit the noble character of scientists; through the molecular biology, many of which are closely related to people's daily life and life and health, we can fully establish the relationship between knowledge and people, and things, and the life of the integration of knowledge with the help of rich and vivid examples to educate students, impress students, and fully inspire students to think and act as a political leader[4].Students, impress students, fully stimulate students' enthusiasm for learning, and establish a noble character cultivation; a cell is a world, through the study of molecular mechanisms within the cell, so that students realize that a cell, a living organism, a society is an indivisible whole, the individual can not be separated from the whole, the whole is made up of

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individuals, only different molecules, different individuals to assist each other, mutual constraints[5]. Only through the mutual assistance, mutual constraints and solidarity of different molecules and individuals can there be a healthy, harmonious and growing whole. Thus, through the excavation of the material's ideological and political elements, reasonable classroom design, the organic combination of ideological and political elements and professional knowledge, so as to create the "ideological and political genetic engineering" of the molecular biology course[6].

2. Comprehensive excavation of the course's Civic-Political elements

The "Molecular Biology" course incorporates various civic elements, emphasizing the interconnection between life, learning, society, and personal values and development. A comprehensive analysis reveals several key aspects. Firstly, it encourages students to approach scientific learning with enthusiasm, pursuing truth without fear of obstacles or hardships. For example, the research experiences of scientist Barbara McClintock in the textbook's "Chapter 2 DNA transposition" chapter exemplify this spirit. Secondly, the course promotes an understanding of the relationship between individuals and the collective, as well as individuals and society. Through the description of cooperative enzyme relationships during DNA replication in the textbook's "Chapter 2, DNA replication" chapter, students are encouraged to contemplate the importance of collaboration for survival and development. Just as components are integral to a machine, individuals are vital elements of a collective. Even the smallest screw, if used appropriately, can play a significant role in the rapid operation of a machine. Conversely, if removed from the machinery, individual parts lose their functionality. Thirdly, the course aims to establish correct ethical and moral values. The textbook's "Chapter 5 Gene Cloning Technology" chapter delves into molecular cloning, animal and plant cloning, and even human cloning, and introduces the 2019 "gene-edited babies" event. Students are encouraged to engage in discussions and form debate groups that consider whether scientific experiments should involve human subjects. This exercise stimulates deep reflection on the ethical aspects of scientific experimentation. Additionally, the course motivates students to study diligently and contribute to national development. Through the introduction and exploration of molecular biology's evolution in the textbook's "Introduction" and "Chapter 8 Enhancer," students realize the significance of learning. They can also draw inspiration from the achievements of former exemplary graduates from our college. Moreover, the course encourages students to care for others and foster unity and mutual assistance. For instance, the topic of "Chapter 2 SNP (Single Nucleotide Polymorphism)" highlights the differences among individuals. By introducing these variations, students are prompted to recognize the genetic diversity among individuals, treat those with genetic defects with kindness, and cultivate healthy living habits to care for their own and others' well-being.

3. Improvement of teaching methods

How to maximize the function of the network in today's booming information technology, how to infiltrate the "Civic and Political Genetics" into the professional courses, and how to let the students benefit from the new teaching mode are of vital importance. In the improvement of teaching methods, we change the role of teachers from traditional indoctrination to guidance, change the traditional lecture to mutual discussion, guide students to consult the information before class, discuss with students in class, and strengthen students' reflection on what they have learned after class[7]. The improvement of teaching methods is mainly carried out through the following measures:

① Increase students' interest in the whole course through the introductory lecture. The introduction is an overview of a course and a summary of the course's development history, which contains an overview of the content of the course, the professional status of the course, the connection between the course and the career prospects, as well as the scientific research achievements of famous scientists and the spirit of scientific research. The emphasis on the importance of the course and the combination of exciting stories will successfully stimulate students' interest in molecular biology and lay a good foundation for active learning in the semester.

② While explaining the theories of the course, we will help students to establish a correct outlook on life, values and morals. Molecular biology is not only a basic discipline for biology majors, but also a cross-discipline, and many important milestone advances are the products of the combination of many disciplines. Take the DNA double helix model as an example, its discovery combines the knowledge of biology, chemistry, physics, and Watson and Crick at the same time to win the Nobel Prize Wilkins at the time for this contribution to the DNA crystal X-ray diffraction pictures. Through

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the fact that the discovery of the double helix to educate students not to limit their vision in their own research in a small area, the development of science has always been to learn from all, inclusive and progressive.

③ Introduce social hotspots to enhance students' interest and sense of immersion. Compared with other courses, molecular biology is abstract and difficult to understand, but in fact many of the contents are closely related to people's lives and health. For example, when talking about the typical DNA recombination technology in molecular biology, we can use people's concern about genetically modified food as an entry point to guide students' thinking.

④Increase classroom discussion and guide students to information access. Since the discovery of DNA double helix in 1953, the development of molecular biology can be said to be rapid, the invention and discovery of new technologies, new methods and understanding and mastery of the mechanism of life, relying only on the content of the book has long been unable to keep up with the pace of development, only to master the changes in information technology, keep pace with the development of the profession, in order to turn passive into active, so that students can build up the confidence of the profession.

⑤ Introduce micro-courses, catechism platform on the fine course video, continuous learning and accustomed to teaching reflection, recommend and use high-quality online course resources.

4. Construction of effective grading mechanism

The construction of molecular biology course reflection involves a significant change in the assessment mechanism for students. The final assessment results of students consist of two parts: performance assessment and process assessment. Performance assessment, which accounts for 50% of the final score, includes midterm and final test questions. On the other hand, process assessment also holds a 50% weightage and comprises various components. It consists of a 20% evaluation of experimental skills, 10% assessment of the ability to access data reserves, and active participation in classroom and online discussions. Additionally, the score for process assessment is further divided into 20% for the experimental skills test, 10% for accessing data reserves, 10% for active classroom and online discussions, and 10% for completion of offline homework.

In the laboratory course, the total score is 100 points, which is divided equally into two categories: laboratory report and laboratory operation. The lab report's score is determined based on several indicators, including the completeness of the report, the neatness of assignments, the depth of discussion, comprehensive notes, and the quality of experiment results. On the other hand, the lab operation score considers factors such as active participation in experiments, proficiency in performing hands-on tasks, and reflecting on the experiment results.

5. Construction of the evaluation system for the effectiveness of course thinking and politics

After the end of the molecular biology course in July 2021, summarizing the lecture materials, a total of 11 discussion assignments were issued, and the total number of student participation in the discussion was 186 times, with an average of 4.4 times/person. College peers evaluated the course 2 times, highly recognized and gave a lot of effective suggestions, and the evaluation of the course was effective. The questionnaire survey shows that, compared with the traditional course, the recognition of the teaching method of molecular biology after the teaching reform reaches 88.1%, and the total evaluation grade meets the normal distribution, with 42 people in the class and 1 person failing the class.

6. Building a typical case base of course ideology and politics

The paragraph should be revised as follows: In order to integrate the elements of political thinking into the curriculum, the following measures were taken: screening typical courses, designing online and offline classes, and building a case library of course political thinking. The constructed cases include: "The structure of DNA" maps the sentiment of scientists, "RNA Basic Operation Techniques" maps to Nucleic Acid Detection Techniques of New Coronavirus Pneumonia and Medical Spirit, "Gene Editing Technology" maps to the Ethical and Moral Bottom Line of Science, and "Epidemiology of Pneumonia" maps to the Ethical and Moral Bottom Line of Science. Each case study incorporates

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various teaching methods such as lecturing on the mechanism of knowledge, introducing the case, group discussions, group presentations, summarizing, and assigning homework. By implementing these methods, students can gain a comprehensive understanding of the professional knowledge and also experience the positive impact of "Civic Politics" in a subtle manner. Additionally, the teaching of the "Gene editing technology" case study emphasizes the ethical and moral implications of scientific advancements, while the "E. coli lactose manipulator" case study highlights the values of thrift and waste reduction..

7. Conclusions

Under the premise of the construction of Civics and Politics in the molecular biology course, the introduction of network resources, information technology platform, role reversal of teachers and students, and flexible grading mechanism into the classroom, along with the integration of humanistic qualities, the spirit of science, traditional virtues, and patriotic feelings into the teaching process of professional courses, are the initial practices of this course under the background of the network+. According to Yang Yan et al., the course Civics is not only a teaching technique but also scientific research, serving as the core content for youth knowledge education in the new era [8]. Li Yingqiu et al. believe that the implementation of the curriculum Civics and Politics can improve the sense of mission and responsibility of every teacher in the education process [9]. In fact, the incorporation of Civics and Politics into professional courses not only does not hinder the absorption and digestion of students' professional knowledge but also stimulates their interest in learning, transforming the previous "deadlines and dry articles" of the final review mode into an engaging and active learning approach. This shift promotes a transition from passive to active learning and ultimately achieves "moral in teaching, teaching in fun" [10].

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