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Teaching Exploration and Practice of Ideological and Political Education in the Curriculum of Biochemistry and Molecular Biology

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Abstract: *In today's higher education context, which emphasizes comprehensive education, properly integrating ideological and political elements into professional courses to improve students' overall quality has become an important topic for teaching reform. The article examines the necessity and significance of ideological and political education in the biochemistry and molecular biology courses at medical colleges, and then elaborates on specific practical methods of ideological and political teaching in this course, such as teaching content design, method innovation, and teaching evaluation improvement. It demonstrates the implementation effect of ideological and political teaching in the biochemistry and molecular biology courses, as well as its positive impact on students' professional literacy, medical ethics, and social responsibility, through teaching practice, evaluation, and feedback. The research presented in this article has the potential to not only increase students' enthusiasm and understanding of professional information, but also to foster their medical ethics and social responsibility.*

Keywords: *Ideological and political education in the curriculum; Biochemistry and molecular biology; Teaching reform*

1. Introduction

In the context of globalization, higher education is increasingly emphasizing interdisciplinary and comprehensive teaching, aiming to cultivate talents in the new era who possess both professional knowledge and a sense of social responsibility [1-3]. Biochemistry and molecular biology are important basic courses in the field of life sciences, with their research objects involving the chemical composition of basic substances in living organisms, metabolic reactions, energy conversion, and other fundamental life activities. In the traditional chinese medical education system, biochemistry and molecular biology, as an important pillar of modern medicine, is of great significance for students to comprehensively understand the essence of life sciences and grasp the methods of modernization research in traditional Chinese medicine [4]. The quality of its teaching is directly related to the quality of medical talent cultivation. However, the current traditional medical education system, to a certain extent, has the problem of emphasizing theory over practice and knowledge transmission over value guidance.

In recent years, with the introduction and practice of curriculum ideology and politics, more and more educators have begun to pay attention to how to integrate ideological and political elements into professional courses. Curriculum ideology and politics refers to the integration of ideological and political education with professional courses, aiming to achieve mutual promotion between ideological and political education and professional education through reasonable design of course content and clever application of teaching strategies [5]. Curriculum ideology and politics is an important concept in Chinese higher education in the new era, which aims to guide students to establish correct world views, life views, and values through classroom teaching [6]. Biochemistry and molecular biology, as a frontier field in life sciences, not only reveal the mysteries of life but also provide important theoretical foundations for disease prevention and treatment. Therefore, integrating curriculum ideology and politics elements into the education of biochemistry and molecular biology not only helps students understand the meaning and value of life sciences, but also cultivates their scientific literacy and social responsibility.

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2. Teaching practices

2.1 Rational Design of Course Content

By thoroughly analyzing the characteristics and teaching objectives of biochemistry and molecular biology courses, we can explore the ideological and political elements embedded in them, such as scientific spirit, innovative thinking, team collaboration, and more. During the teaching process, we can combine specific teaching content to design corresponding teaching activities, such as case analysis, group discussions, practical operations, etc., to guide students to deeply consider the significant role of biochemistry and molecular biology in social development, as well as the social responsibilities they should assume as medical talents, thereby achieving the organic unity of knowledge transmission and value guidance [7-9]. The teaching team of our department has deeply excavated the ideological and political elements related to the knowledge points of the course based on the actual situation of students from traditional Chinese medicine colleges and universities, and written corresponding ideological and political cases (Table 1).

Table 1: The objective and case design of the ideological and political theories teaching in all courses of biochemistry and molecular biology

Course content	Teaching Case	Ideological and political dimension	Teaching effect
A brief history of biochemistry	Scientists like Wu Xian and Liu Sizhi helped to advance biochemistry. In 1965, the first crystalline bovine insulin was manufactured in China.	National feelings; National pride; Social responsibility	Make students identify with and have confidence in their own country's scientific and technological strength; cultivate their innovative spirit and practical ability; encourage them to contribute to scientific research and technological innovation; promote students' understanding and application of bioengineering and medicine; cultivate their sense of social responsibility.
The molecular structure of proteins	Case analysis of the "Sanlu Milk powder" incident	Social responsibility; Civic character	Encourage students to cultivate a sense of social responsibility and adhere to the fundamental principles of professional ethics.
The molecular structure of a protein	L. Pauling and R.B. Corey employed X-ray diffraction methods to examine the crystalline structures of amino acids and oligopeptides, ultimately formulating the concept of peptide units.	Scientific rigor and innovative mindset	Foster students' reverence for science, spark their spirit of inquiry, and fortify their scientific ethics and critical thinking.
Structure and function of nucleic acids	The Experimental Foundations and Discovery of the DNA Double Helix Structure by Watson and Crick	Scientific spirit	Foster students' rigorous and pragmatic scientific spirit, encourage cross-disciplinary integration, and cultivate versatile talents for modern society.
Molecular structure and function of enzymes	Application of isoenzymes in clinical medicine	Dialectical thinking	Cultivate students' dialectical thinking and approach diversity with objective, holistic, and scientific perspectives.
Biological oxidation	Complexes I, II, III, and IV comprise the respiratory chain, orchestrating oxidative phosphorylation for energy production.	Foster character and civic virtue	Foster students' teamwork, mutual support, and collective growth to realize their life's potential.
Phospholipid metabolism	Global scientists are diligently exploring the function and	Scientific rigor, national pride,	Foster students' reverence for science, cultivate their innovative

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	mechanism of PC metabolism in cell proliferation, differentiation, and cell cycle, as well as its role in diseases like cancer, Alzheimer's, and stroke. A breakthrough could yield novel targets for disease prevention, diagnosis, and treatment.	and societal accountability.	spirit and humanistic empathy, empowering them to actively engage in societal health issues, assume responsibility, and contribute to public welfare.
Ammonia metabolism	Through experiments, Hans Krebs and Kurt Henseleit, German scholars, pioneered the ornithine cycle theory to elucidate urea synthesis.	Scientific rigor, innovative prowess, and collaborative mindset.	Foster students' scientific and critical thinking, inspire appreciation for scientists' dedication and truth-seeking, cultivate scientific ethics and integrity, recognize the impact of research on academic and societal advancement, and enhance scientific literacy and understanding. Foster a spirit of cooperation and teamwork.
Synthesis of DNA	The discovery of reverse transcription developed the central dogma. A variety of cDNA libraries were constructed by cDNA method	Scientific spirit; Social responsibility	Students are encouraged to prioritize national and societal progress, fostering their innovative spirit and abilities to contribute towards societal advancement and national prosperity.
Reverse transcription	The investigation of retroviruses, harboring oncogenes, is a pivotal topic in virology, oncology, and molecular biology.	Dialectical reasoning, global collaboration, societal accountability, and scientific values.	The study of retroviruses highlights the significance of scientific collaboration, fostering global perspectives and collaborative spirits in students. It directs attention to public health, cultivating social responsibility and compassion for human health. Additionally, it involves virus utilization and vaccine development, prompting reflection on ethical issues in research, fostering sound scientific and moral values.
DNA damage and damage repair	DNA damage repair disorder is associated with many diseases, such as xeroderma pigmentosum and hereditary breast cancer.	Scientific literacy; Humanistic care; Social responsibility	Foster students' awareness of diseases' impact on patients and families, cultivating empathy and social responsibility. Encourage them to consider supporting patients, guiding comprehension of technology's value and risks, fostering sound scientific and moral values, and enhancing scientific literacy.
Protein synthesis	China's research and development achievements in antibiotics, hormones, antipyretic analgesics, analgesics and other drugs. Our country implements all free planned immunization for children.	National feelings; National pride; Social responsibility	Inspire students' pride in China's scientific prowess, fostering patriotism and motivating them to acquire professional knowledge, serve society, and repay their homeland.
Regulation of gene expression	Gene expression comprises constitutive and inducible/repressible forms, with notable differences in	Dialectical thinking; Scientific spirit	Cultivate students' dialectical thinking to grasp problem essences, shape scientific worldviews and values, guiding their future life

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	prokaryotic vs. eukaryotic regulation. Positive and negative regulations work synergistically, and eukaryotic expression is modulated by miRNAs and long non-coding RNAs.		development positively.
Molecular mechanism of cell signal transduction	Structural and functional alterations in signal transduction molecules offer targets for novel drug screening and development.	Scientific spirit; Social responsibility	Students are encouraged to excel in studies, enhance innovation, contribute to society through scientific advancements, and safeguard human life and health with medical technology.
The nature, function and corresponding deficiency of vitamins	Vitamin A and its derivatives curb tumor growth, while deficiency can cause night blindness, xerophthalmia, and more.	Scientific spirit; Health consciousness	Foster students' interest in scientific research, healthy lifestyles, scientific ethics, and a sense of responsibility.
Proteins encoded by proto-oncogenes are closely related to growth factors	R. Levi-Montolcini et al. discovered nerve growth factor, while S. Cohen discovered ECF in 1959. Both were awarded the 1986 Nobel Prize in Physiology or Medicine for their groundbreaking work on growth factors.	Scientific spirit; Innovative ability; National feelings	Spark students' interest in scientific research and innovation, fostering national pride in technological prowess. Nurture their awe for science and quest for excellence.
Principles and applications of common molecular biology techniques	K. Mullis invented PCR in 1983, revolutionizing molecular biology research. Its advantages of sensitivity, specificity, yield, reproducibility, speed, and simplicity make it the go-to method. PCR has propelled advancements in molecular biology and biotech, becoming a cornerstone of medical science.	Innovative consciousness; Scientific literacy	Enhance students' comprehension of molecular biology, genetic engineering, and related fields, boosting their scientific literacy and thinking. Understand PCR's applications in medical diagnosis, genetic testing, and disease screening, enabling informed decision-making, like selecting suitable testing methods.

2.2 Enhancing Practical Teaching Aspects

In the teaching practice of integrating ideology and politics into biochemistry and molecular biology courses, strengthening practical teaching aspects is of great significance for deepening the ideological and political connotations of the courses and enhancing the comprehensive quality of students. Practical teaching is not only an extension and application of theoretical knowledge, but also an effective way to cultivate students' innovative thinking, team collaboration ability, and social responsibility [10]. Aiming at the goals of integrating ideology and politics into courses, the practical teaching content can be integrated and optimized. While maintaining traditional experimental skills training, we can add experimental projects closely related to cutting-edge biotechnology and social hot topics, such as gene editing and disease model construction. These projects not only allow students to access the latest science and technology, but also guide them to consider issues such as scientific ethics and social impact, achieving an organic combination of knowledge transmission and value guidance.

3. Teaching Evaluation and Feedback

To evaluate the implementation effect of ideological and political education in biochemistry and molecular biology courses, we have adopted a diversified evaluation method. Firstly, through observation of classroom performance, we found that students showed higher enthusiasm and

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participation in discussing ideological and political content, indicating that they have a high interest and recognition of this teaching approach. Secondly, we evaluated students' understanding and mastery of the integration of ideological and political content with professional knowledge through survey feedback and exam score analysis. In terms of survey feedback, the teaching team conducted a questionnaire survey on the practical effects of ideological and political education in courses among students majoring in Biotechnology (27 students from the 2020 cohort), Acupuncture and Massage (53 students from the 2021 cohort, and 53 students from the 2022 cohort) at Nanjing University of Chinese Medicine (a total of 133 students). 127 valid questionnaires were collected, with a recovery rate of 95.49%. In the questionnaire survey, the reasons for students' recognition of ideological and political teaching in biochemistry and molecular biology courses are shown in Figure 1: students believe that ideological and political education helps promote knowledge expansion (78.8%), stimulate learning interest (78.25%), enhance their professional qualities (72.67%), cultivate patriotism (67.56%), establish correct world views and values (63.19%), understand medical ethics (61.52%), strengthen self-confidence (59.63%), cultivate scientific spirit (57.86%), enhance social responsibility (55.37%), develop dialectical thinking (38.72%), and foster a questioning spirit (29.76%). In summary, the teaching exploration of integrating ideology and politics into biochemistry and molecular biology courses has not only improved students' learning interest and participation, but also promoted their comprehensive quality development.

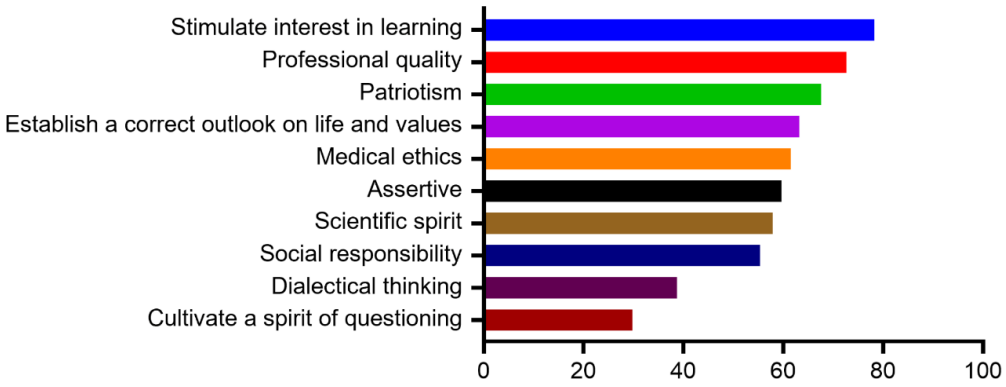

Figure 1: Analysis of reasons for students' acceptance of case-based ideological and political teaching.

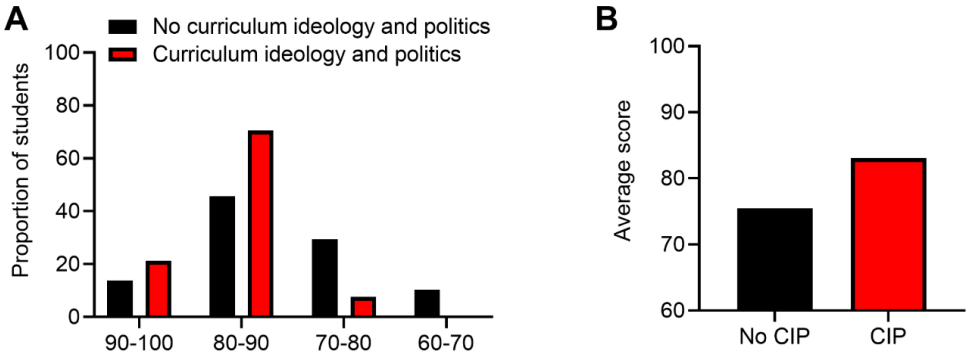

Figure 2: The ideological and political education in curriculum promotes the improvement of students' performance in biochemistry and molecular biology courses. (A) The distribution of students' exam scores in the ideological and political education group and the non-ideological and political education group. (B) The average exam scores of students in the curriculum ideological and political education (CIP) group and those in the non-curriculum ideological and political education (No CIP) group.

In addition, for the analysis of exam scores, the teaching team randomly divided 249 students from different majors at Nanjing University of Chinese Medicine into two groups: the non-ideological and political education class group (116 students) and the ideological and political education class group (133 students). The results of the score analysis are shown in Figure 2: From the overall distribution of exam scores, the number of students in the ideological and political education class group who scored between 80-90 and 90-100 points increased compared to the non-ideological and political education class group, while the number of students in the 60-70 and 70-80 score ranges decreased. Similarly, the average exam score of students in the ideological and political education class group (83.04 points) was significantly higher than that of the non-ideological and political education class group (75.44 points).

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The above data results indicate that the teaching exploration method of integrating ideology and politics into biochemistry and molecular biology courses has achieved initial success.

4. Teaching Effects

The integration of ideological and political education has facilitated students' understanding and mastery of professional knowledge. By incorporating ideological and political content, students have gained a deeper understanding of the disciplinary background, research significance, and future development direction of biochemistry and molecular biology, thereby igniting their enthusiasm and interest in learning. Secondly, the integration of ideological and political education enables students to cultivate scientific spirit and humanistic literacy in their studies, forming correct values and worldviews. They begin to pay attention to the social impact of biological science and consider how to contribute to society with their knowledge.

In addition, we have also observed significant improvements in students' teamwork, critical thinking, and innovative abilities. Guided by ideological and political education, students pay more attention to teamwork and learn to play their roles in the collective. At the same time, they also learn to view issues with a critical eye and constantly propose new perspectives and solutions. More importantly, ideological and political education stimulates students' innovative spirit, and they constantly try new methods and ideas in scientific research practices, injecting new vitality into the development of the discipline. In summary, integrating ideological and political education into the teaching of biochemistry and molecular biology courses can not only improve teaching quality but also cultivate more medical talents with social responsibility and innovative spirit in the new era.

5. Conclusion

Integrating ideological and political education into professional course teaching not only helps enhance students' understanding and application of professional knowledge, but also cultivates their sense of social responsibility and historical mission. The implementation of this teaching model not only enriches the course content but also strengthens students' learning motivation, enabling them to pay attention to society, reflect on life, and form correct values and worldviews while mastering professional knowledge.

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