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Exploration and Practice of Ideological and Political Education in the *Inorganic and Analytical Chemistry* Curriculum for the Post-COVID-19 Era

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Abstract

The integration of the Ideological and Political Education (hereafter IPE) into university curricula is a pivotal strategic measure for achieving the fundamental goal of fostering virtue through education, whichrepresents a key direction in higher education reform[1]. The post-COVID-19 era offers new opportunities for this initiative. Grounded in the context of this new era, this paper takes the Inorganic and Analytical Chemistry course within the Food Engineering and Technology major as a specific example. It thoroughly explores materials related to pandemic control policies, food safety, public health, and ideology. By incorporating the advanced deeds and exemplary figures emerging from the fight against the pandemic into teaching cases, this study aims to organically blend these elements with the instruction of professional knowledge. This approach seeks to enhance the effectiveness and appeal of IPE while promoting the Socialist Core Values[2]. Ultimately, this paper aims to provide a theoretical framework for realizing the tripartite educational objective—value guidance, competency cultivation, and knowledge transmission—through the *Inorganic and Analytical Chemistry* course in food engineering education[3].

Keywords

Ideological and Political Education (IPE); Post-COVID-19 Era; Inorganic and Analytical Chemistry; Implicit Education; Food Engineering; Teaching Case Studies

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1. Introduction

The integration of Ideological and Political Education (IPE) into curricula aims to seamlessly blend moral education with academic instruction. It serves as an implicit and complementary approach to formal ideological and political training. This systematic initiative identifies specialized courses as both the most critical and challenging aspect of implementation[4]. As stipulated in official policy documents, such integration constitutes a strategic priority aimed at enhancing talent development and achieving comprehensive moral education objectives[5].

In the post-pandemic context, educational paradigms have increasingly emphasized holistic student development, placing equal importance on character formation and intellectual growth. Within this framework, the incorporation of ideological and political elements into disciplinary teaching assumes heightened significance. This integration supports the cultivation of students' social consciousness, ethical responsibility, and worldview, while reinforcing national identity and fostering innovation capabilities.

2. The Core Values and Implementation Challenges of IPE in the Food Engineering Discipline

Within this overarching framework, the integration of IPE is particularly crucial for the Food Engineering and Technology major—a field directly bearing upon national food security and public health. In the post-COVID-19 era, the transformation of educational goals has become a central task in higher education curriculum reform, particularly in the application of the Inorganic and Analytical Chemistry course. With growing attention to food safety issues, education in this field must closely align with practical needs to cultivate well-rounded talents with scientific literacy and a sense of social responsibility. The necessity of the Inorganic and Analytical Chemistry course lies in its fundamental role in food safety and quality control. This course not only covers the qualitative and quantitative analysis of food components but also introduces cutting-edge scientific technologies such as nanomaterials to help students understand the application of modern technology in food safety testing. The integration of such advanced knowledge equips students with the ability to address future challenges while mastering traditional theories. Additionally, the course incorporates IPE to cultivate students' social responsibility and awareness of the rule of law. By analyzing food safety cases, students learn to apply chemical knowledge to solve practical problems while recognizing the importance of professional ethics and the role of the state in regulating the food industry. This educational model helps students establish correct values and enhances their sense of mission to serve society. The success of curriculum reform hinges on the adoption of diverse teaching methods and the establishment of a scientific evaluation system. Through case-based teaching, project research, and experimental exercises, students can consolidate theoretical knowledge in practice. Assessment methods such as project evaluations and report writing help comprehensively improve students' overall quality, enhancing both their academic level and their ability to solve practical problems in complex environments[6, 7].

The Food Engineering and Technology discipline is intrinsically linked to national livelihood and social security. In the post-pandemic world, issues of food safety, public health, and environmental sustainability have gained unprecedented global attention. Consequently, food engineers are expected to possess not only advanced technical expertise but also a profound sense of social responsibility, national commitment, and an innovative spirit. Effectively implementing IPE within this major is therefore paramount for cultivating professionals capable of meeting these complex societal demands. The *Inorganic and Analytical Chemistry* course provides a natural platform for this integration. As a foundational course, it addresses critical topics such as heavy metal pollution, pesticide residues, and food additives—all of direct consequence to public welfare. Infusing IPE into the teaching of these topics enables students to comprehend the broader societal significance of their professional knowledge, guiding them to establish sound values and recognize their future role in serving society and safeguarding national interests[8].

3. Characteristics of the Inorganic and Analytical Chemistry Course and Its Integration with IPE

Inorganic and Analytical Chemistry is one of the core courses in the Food Engineering and Technology major. Its teaching content covers the basic principles of inorganic chemical reactions and the application of analytical chemistry methods. The course requires students to master basic concepts, principles, and techniques of chemical reactions while developing the ability to apply theoretical knowledge to practical problems through experimental exercises. In the Food Engineering and Technology major, *Inorganic and Analytical Chemistry* is closely related to food testing, food safety, and environmental protection. The core content includes: (1) Reaction mechanisms of inorganic chemistry, providing the foundation for analyzing metal elements and minerals in food; (2) Application of analytical chemistry methods, such as atomic absorption spectroscopy (AAS) and inductively coupled plasma mass spectrometry (ICP-MS), widely used in detecting heavy metal pollution and pesticide residues in food; (3) Application of food testing technologies, which can not only be used for food quality control but also provide a scientific basis for ensuring food safety and promoting green environmental protection. These disciplinary contents are both highly theoretical and broadly applicable. In teaching, enabling students to understand and solve social problems such as food safety and environmental protection through these technologies is the key to integrating IPE. Many knowledge points in the *Inorganic and Analytical Chemistry* course are closely related to social issues such as food safety and environmental protection, providing natural opportunities for integrating IPE. By analyzing the connections between course content and IPE, teachers can guide students to think about the social significance and national responsibilities behind their professional knowledge while imparting it. (1) Food safety and national responsibility: Food safety is a critical issue directly related to people's livelihoods, and the state attaches great importance to it. By explaining how to use analytical chemistry methods to detect heavy metals and pesticide residues in food, the course helps students understand the important responsibility of food engineering technicians in ensuring food safety and serving national welfare. (2) Environmental protection and sustainable development: Green chemistry is an important concept advocated globally today. Many methods in analytical chemistry, such as the detection of harmful substances in food and environmental monitoring, are directly related to environmental protection and sustainable development. Teachers can explain green chemistry technologies and environmental protection regulations to guide students in understanding the social responsibilities of food engineers in promoting green food and environmentally friendly production[9].

4. Teaching Modalities and Implementation Pathways for IPE in the Post-COVID-19 Era

The post-COVID-19 era, characterized by rapid evolution in educational models, presents new opportunities for implementing IPE. The popularity of online education and flipped classrooms has broken through the limitations of traditional classrooms. The following are several teaching models that can effectively integrate IPE into the *Inorganic and Analytical Chemistry* course:

4.1. Application of Online Education and Interactive

PlatformsIn the post-COVID-19 era, online teaching has become the norm. Teachers can use online teaching platforms and multimedia resources to flexibly introduce ideological and political elements. For example, adding content about food safety policies and national environmental regulations to teaching videos and conducting post-class discussions on online interactive platforms can help students understand the efforts and achievements of the state and society in food safety and environmental protection while acquiring professional knowledge. Educators can incorporate a wider range of social issues into the curriculum, for instance, by examining global food safety challenges and analyzing China's corresponding strategies. By combining students' actual situations, further discussions can be held on how China addresses food safety risks through technological advancements, policy support, and international cooperation, thereby enhancing its competitiveness in international food safety. By guiding students to participate in these discussions, teachers can help them develop a global perspective and a sense of local responsibility, cultivating their international vision and social responsibility[10].

4.2. Flipped Classroom and Group Discussions

The flipped classroom model can help students learn course content independently, while class time can be used for deeper discussions and thinking. In the *Inorganic and Analytical Chemistry* course, teachers can use the flipped classroom to allow students to learn the basic principles of analytical methods in advance. Then, through group discussions and case analyses in class, students can discuss how to apply these technologies to food testing and environmental protection. Through interactive discussions with classmates, students can better understand the social significance behind the technologies and form ideas for solving social problems. For example, in a certain unit of the course, students can first learn the basic principles of technologies such as heavy metal pollution detection and food additive testing. Then, through group collaboration, they can analyze a food contamination incident. Each group can propose its own solutions based on the course content and share them in class. The teacher can comment on these solutions from a professional perspective and guide students to analyze their feasibility and social significance from the perspectives of society and national responsibility.

4.3. Project-Based Learning

Combined with Social PracticeProject-based learning can combine students' knowledge with practical problems. In the *Inorganic and Analytical Chemistry* course, teachers can organize students to participate in projects related to food safety and environmental protection, such as heavy metal pollution detection and food additive monitoring. Through practical social practice, students can more deeply recognize the social value of their professional knowledge and enhance their ability to solve practical problems. In these project-based learning activities, students can not only apply their knowledge to practical problems and complete actual testing tasks but also develop critical thinking, teamwork, and leadership skills. For example, teachers can organize students to cooperate with local food safety departments or environmental protection organizations to conduct field research, collect and analyze data, and finally propose meaningful suggestions. This process not only trains students' practical abilities but also deepens their understanding and awareness of social responsibility.

5. Design of Ideological and Political Teaching Cases for the Inorganic and Analytical Chemistry Course

Case Study: Food Safety and Public Health Security—Application of Inorganic Materials and Analytical Technologies in Preventing COVID-19 Transmission through Cold Chain Foods

Teaching Objectives:

Against the backdrop of the post-COVID-19 era, this case aims to enable students to master the application of inorganic chemical principles and analytical technologies in responding to public health emergencies. It guides students to recognize that the field of food engineering is not only concerned with traditional food safety but also closely linked to broader public health security, cultivating their scientific response capability and sense of social responsibility in public health crises.

Teaching Content:

(1) **Background and Problem Overview:** In the post-COVID-19 era, as the global community continues fighting the pandemic, the potential of cold chain foods serving as a route for virus transmission has drawn widespread attention. The course will introduce the basic characteristics of the SARS-CoV-2 virus and its risk of survival and transmission in cold chain environments, elaborating on the challenges this poses to the global food supply chain and public health security.

(2) **Application of Inorganic Materials and Analytical Methods:** This section explains the application of inorganic chemical principles and technologies in virus detection and prevention. It primarily includes: the principle of viral adsorption onto sampling swabs (e.g., flocked swabs) via electrostatic interactions; the role of inorganic ions (e.g., Na^+, K^+, Mg^{2+}) in viral transport media (VTM) in maintaining the stability of viral nucleic acids; and the decisive impact of Magnesium ions (Mg^{2+}) as key cofactors in RT-PCR detection accuracy. Additionally, the chemical principles of commonly used chlorine-based disinfectants (e.g., sodium hypochlorite) in environmental disinfection are briefly introduced.

(3) **Analytical Experiments and Simulation:** Through simulated experiments or virtual simulations, students will understand the key inorganic chemical factors involved in the processes of virus sampling, nucleic acid extraction, and detection. The experimental component emphasizes the importance of Standard Operating Procedures (SOPs) and the impact of factors such as interference from impurity ions on the reliability of detection results, fostering students' rigorous and

meticulous scientific approach.

Case Analysis:

Using the real-world incident where the outer packaging of imported cold-chain foods tested positive for SARS-CoV-2 nucleic acid at a specific location, triggering emergency testing and traceability efforts, the case provides a detailed analysis of the entire process—from on-site sampling and sample preservation to laboratory testing and result interpretation. Through this case, students not only learn the principles of specific detection technologies but also gain a deeper understanding of the frontline sentinel role that food engineers play in building a public health security monitoring network.

Ideological and Political Guidance:

The post-COVID-19 era places higher demands on global collaboration and the spirit of science. Instructors will guide students to contemplate how food engineering technologies can play a critical role in transnational public health incidents. The guidance will emphasize that technological innovation is a crucial pillar for safeguarding national security and public health, and that the authenticity and reliability of scientific data form the foundation for formulating effective prevention and control policies. Students will discuss the advantages of the system demonstrated by China's rapid response mechanism established for SARS-CoV-2 prevention and control in cold-chain foods, as well as the truth-seeking and pragmatic spirit that scientific and technological workers should uphold, along with a broad-minded sense of responsibility for the health of all humanity.

Through such course design, students will not only deepen their understanding of the practical applications of inorganic chemistry but, more importantly, establish a sense of mission to apply their professional knowledge in serving major public security needs, growing into outstanding engineering talents who are both technically proficient and socially responsible[11].

6. Conclusion

In conclusion, this study demonstrates that the deliberate integration of IPE into the *Inorganic and Analytical Chemistry* course is not only feasible but also highly effective in cultivating well-rounded food engineering professionals. By leveraging post-pandemic contexts and practical case studies, the course has successfully bridged specialized knowledge with social responsibility, innovative thinking, and a global outlook. This deep integration has equipped students with the ability to contextualize their technical skills within a framework of social responsibility, highlighting the course's immediate value in educating talents who can contribute to global challenges.

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Disclosure statement

The authors declare no conflict of interest.

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