Exploration and Research on the Course Teaching of "Environmental Health and Safety Management of Biopharmaceutical Enterprises"

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Abstract: Environmental health and safety management of biomedical enterprises is a professional course of biological engineering integrating theory and practice. Combining with the teaching objectives and contents of the course, this paper explores and practices the integration of ideological and political elements, mixed teaching, case teaching, production-teaching integration and teaching evaluation. The aim is to build a teaching model of professional ideological and political integration, university-enterprise teacher union, online and offline mixed courses, and provide reference for the implementation of other curriculum reforms.

1. Introduction

In 2016, China released the Outline of healthy China 2030 Plan, raising environmental and health issues to an unprecedented height. The sudden "COVID-19" has highlighted the important role of the biomedical industry in China's social and economic development, improving the enterprise environmental health and safety (EHS) management is the need of China's biomedical industry transformation and upgrading as well as sustainable development, but also the need for China's biomedical enterprises to fully participate in international competition. It is particularly necessary to implant the concept of EHS into the training of college students majoring in related majors, and cultivate the future engineering talents with the concept of EHS.

As an elective course for bioengineering majors, EHS management of biopharmaceutical enterprises is a comprehensive course with distinctive cross-cutting characteristics, covering policies related to safety production, occupational health and environmental protection,the main contents include accident cause theory, hazardous chemicals safety knowledge, production process safety, risk management, occupational health protection, public safety, etc. In actual teaching, combined with the professional characteristics of bioengineering, a special teaching system of EHS courses is formed, so that learners can understand the EHS management guidelines and action rules of biomedical enterprises, understand the overall framework of EHS goals, as well as master the way of establishing the EHS management system and the measures to reduce the hidden dangers of the environment, occupational health and safety, so as to meet the training needs of bioengineering professionals.

2. Establish the teaching objectives of the course

Based on the concept of engineering education certification, according to the role of the course in the curriculum system of the professional training plan, in the matrix of the corresponding relationship between the graduation requirements and the curriculum system, the support point of this course for the secondary indicators of the graduation requirements of the bioengineering major is determined. According to the support of the course for graduation requirements and the characteristics and content of the course, the teaching objectives of the course are determined, as shown in Table 1.

Table 1: Teaching objectives of EHS Management Course in Biomedical Enterprises

Course objectives	Supported Graduation Requirements Indicator Points
1. It is required to understand the connotation and significance of environmental protection and social sustainable development, be familiar with the environmental standards, environmental management systems and measures, environmental risk identification and control, environmental factors inspection and other knowledge of biomedical specialty, and understand the above development trend and its relationship with social sustainable development.	7.1. Understand the connotation and significance of environmental protection and sustainable social development.
2. It is required to master the basic knowledge of EHS (environment, health and safety) in biomedical enterprises, including personnel management, equipment management, material management, method management, environmental management, etc., as well as be able to analyze the resource utilization efficiency, safety precautions and social benefits to assess their impact on environmental and social sustainability.	7.2. Be able to analyze the efficiency of resource utilization, safety precautions and social benefits for actual professional engineering projects, to evaluate their impact on the sustainable development of the environment and society.
3. It is required to be familiar with the laws, regulations, norms and practical operations related to EHS in biomedical enterprises, understand the professional nature and responsibilities necessary for application-oriented talents, consciously abide by professional ethics and norms in engineering practice with legal awareness and industry quality.	7.3. Understand the professional nature and responsibilities of engineers, consciously abide by professional ethics and norms in engineering practice with legal awareness.
4. It is required to master the EHS management system construction model and system establishment skills of biomedical enterprises, be able to scientifically compile EHS "two books and one table", be familiar with the specific requirements of the implementation node of engineering project safety management, and be able to scientifically and rigorously apply to the actual engineering management and operation of enterprises.	11.2. Understand and master project safety management.

3. Innovate classroom teaching methods

3.1 Integrate ideological and political education as well as professional education to achieve moral education and nourish people quietly

HSE courses of biomedical enterprises include chemical safety, biosafety, occupational health, ecological environment protection and other contents, and ideological and political education has many entry points. Guided by "curriculum ideological and political", combined with professional characteristics, the courses excavate and sort out ideological and political education points, combine ideological and political education with professional quality education, emphasize the same frequency resonance of values in knowledge imparting to realize the double drive and parallel of imparting professional knowledge and internalizing socialist core value[1-2].

3.2 The integration of online technology and teaching guides students to explore personalized learning

The course utilizes the online course information technology platform to build an EHS online teaching model with high sense of reality, intuition and freedom, to establish more and better channels for two-way communication with students, so that students can complete theoretical learning, case discussion, practical operation and other tasks on the online platform. The flexible

cross-platform network teaching method facilitates students' ubiquitous learning habits, breaking through the limitations of fixed teaching hours, limited time and space, and harsh conditions of real cases; The introduction of pioneering self-testing questions, sharing reading questions, self-confident thinking and politics, and internal-driven honors enable students to complete inquiry-based and personalized learning, practice and discussion like games, and ensure the comprehensive achievement of the course objectives[3-5].

Table 2: Integrating design of course ideological and political elements and teaching content

Course Ideological and Political Education	Teaching Chapters	Case content	Ideological and political goals
Patriotic and dedicated education	Introduction	Cases of patriotic and dedicated researchers in Chinese biopharmaceutical industry	Establish a spirit of selfless dedication, hard work and innovation
Gratitude education	Chemical Safety	Cases of firefighters who died in the explosion accident in the Binhai area of Tianjin Port	Establish correct values and cultivate gratitude
	Biosecurity	The most beautiful "retrograde" case when the new crown epidemic occurred	
	Occupational Health	Examples of workers in hazardous occupations for education of their children	
safety awareness education	Chemical Safety and Process Safety	Typical major production accident cases (such as a particularly major explosion accident of Jiangsu Xiangshui Tianjiayi Chemical Co., Ltd.)	Get rid of the "lucky mentality" and establish safety awareness;
Environmental awareness education	environmental protection	The historical landmark pollution incidents in the industry and the illegal discharge of some industries and enterprises, resulting in serious environmental hazards and human health damage.	Strengthen the concept of green development
Safety Literacy Education	Risk management, emergency rescue	Industry typical enterprise risk assessment case report	Possess safety literacy in risk identification, accident prevention and handling
Scientific spirit, artisan spirit education	Risk management, process safety	Industry typical enterprise risk source information card	Adhering to scientific and rigorous work attitude
Legal awareness education	EHS management system	A series of laws, regulations and standards formulated by the state on safe production and green production.	Strengthen legal awareness and improve the quality of laws and regulations

3.3 Real case projects into the classroom to cultivate the ability to solve applied problems

The biomedical enterprise EHS management course describes the role and role of EHS in the sustainable development of enterprises, and focuses on enabling students to master the practice and application of EHS risk management in enterprise compliance management through specific case teaching. Relying closely on industry resources, the course team draws on common cases of environmental health and safety management systems and typical cases of EHS management systems of representative companies in the biopharmaceutical industry to sort out and summarize, and integrate them into risk management, environmental protection, chemical safety management, occupational health, process safety, emergency management, laboratory safety, typical enterprise cases and other module content. According to the framework of "conception (c)-design

(d)-implementation (i)-operation (o)", the typical work tasks of the industry are transformed into "learning projects" with educational and teaching functions.

Table 3: Course Teaching Case Portfolio

Teaching module	Core elements of enterprise case
EHS Reviews	The importance of EHS; EHS basic regulatory framework
Risk and security	Risk identification; Risk assessment; Risk control
Environmental protection and management	Waste water treatment, waste gas treatment, solid waste disposal, hazardous waste
Products safety	GHS classification, MSDS and labelling of chemicals; Basic knowledge of chemical toxicology
Occupational health	Occupational health hazard factors; Occupational health exposure risk assessment and control
Process safety	Process Safety Management elements and Process Risk Analysis (PHA)
Accident and emergency	Response capability assessment; Formulating emergency plans for accidents
Laboratory safety	Laboratory hazard identification and control, personal protection, emergency response and rescue
Typical enterprise case	Drug safety evaluation enterprise case, model animal production enterprise case, biological reagent production enterprise case, R&D and production CDMO enterprise case

3.4 Colleges and enterprises link up with teachers, and enterprise experts help the integration of production and education

Through the introduction of industry experts, a teaching team with senior industry background and rich industry experience is formed, and the course design adds practical contents such as industry research, innovation and synthesis to promote the transformation of the course teaching mode to the way of linkage between enterprises and colleges. According to the actual needs of the enterprise environment health and safety management, the two sides jointly formulate suitable course content and dopt diversified teaching methods, management methods and assessment to enhance students' sense of accomplishment after hard study.

Through direct contact with corporate mentors and corporate culture, students experience the development trend of the industry and the fierce competition for talents, and consciously establish a strong sense of crisis and a sense of mission that never waits, so as to stimulate the internal motivation of learning; enhance the cognitive depth of this profession and the industry, and understand the increasingly important role of professional EHS managers in enterprise management, it is necessary to master comprehensive EHS knowledge, rich management experience and communication and coordination ability, perseverance and persistent determination to shoulder the responsibility of spreading EHS concept.

3.5 Improve the assessment and evaluation method of the course, and ensure the quality and efficiency of the combination of qualitative and quantitative

The total score of this course consists of three parts: the usual score, the final theoretical assessment score and the practical assessment score. The usual grades are assessed in the "N" stage, including course chapter tests, assignments, discussions and other assessment links. The theoretical assessment at the end of the term is assessed by a standardized test question bank, and the practical assessment is based on case study, project reporting and exchange. Case studies, project reports and exchanges are completed by teamwork, and the results are evaluated by the corporate tutors of the course group.

The course team analyzes and discusses the achievement of course objectives (see Table 4)

according to the OBE concept, and the evaluation results are used for continuous improvement. Use the course quality assurance system of "control-evaluation feedback-improvement" to improve students' ability to comprehensively utilize knowledge and technical skills as well as analyze and solve complex environmental health and safety issues in practical projects.

4. Curriculum Reform Implementation Effectiveness

4.1 Teachers' ideological and political education awareness and ability are improved, and obscure professional courses bring out the ideological and political flavor.

Through ideological and political literacy learning as well as teaching method discussions, etc., the course teachers have strengthened their own abilities from the aspects of ideological and political education awareness, ability, and methods, and can better answer "what kind of people to train, how to train people, and for whom to train people." The course integrates concepts such as patriotism and value education into the course in the form of specific case expressions, which deepens students' understanding of professional knowledge, improves professional skills, and also enables students to enjoy ideological feasts and strengthen ideological and moral education.

Table 4: Evaluation of the achievement of course objectives

Course objectives	Assessment ratio (%)				
	Final assessment	Process assessment			Total
		Operation	Staged classroom tests	Practice report	
Course objectives 1			30%		30%
Course objectives 2	30%	10%			40%
Course objectives 3	10%				10%
Course objectives 4			10%	10%	20%

4.2 The degree of achievement is evaluated according to the requirements of engineering certification, and the achievement of the course objectives is good.

The research group evaluated the achievement of course teaching objectives for 74 undergraduates majoring in bioengineering in 2018. It can be seen from Table 5 that the results of the course performance assessment show that the achievement of course objectives is higher than the expected value (0.70); the results of the questionnaire survey show that the achievement rate of students' self-evaluation of course objectives is 100%.

Table 5: Evaluation of the achievement of course objectives

Course objectives	Evaluation method and evaluation results				
	Course performance assessment (assessment score evaluation method)		Student self-evaluation (questionnaire method)		
	degree of achievement	Achievement (achieved/unachieved)	Completely achieved percentage (%)	Achievement ratio (%)	Proportion not reached (%)
Course objectives 1	0.92	Achieved	41.67	58.33	0
Course objectives 2	0.87	Achieved	38.89	61.11	0
Course objectives 3	0.83	Achieved	38.89	61.11	0
Course objectives 4	0.76	Achieved	36.11	63.89	0

The evaluation results of both qualitative and quantitative aspects of the course show that students have a good understanding of environmental standards, environmental management systems and measures, environmental risk identification and control, environmental factor inspection points, etc. , and they also have a basic understanding of laws and regulations, norms, practical operation and the causes of safety accidents, as well as pay attention to cultivating legal awareness and industry quality. Through the study of enterprise EHS "two books and one table" compilation, the students preliminary master the enterprise EHS management system construction model and system build skills.

5. Conclusion

Teachers from school and industry experts from enterprises jointly create an online and offline hybrid course with simple language and rich industry and enterprise cases to impart the basic knowledge and risk management skills of the EHS industry to the hearts of every learner. Before entering the laboratory or work, every student can have basic safety and health awareness, master basic EHS knowledge to have the ability to protect themselves and others, making every future engineer realizes that "only engineers with the concept of benefiting mankind and sustainable development can make correct judgments and choices in the face of ethical conflicts".

References

[1] Du Chunan, Wang Zhipu, Zhang Haibing. Exploration and Research on ideological and political teaching of Chemical Health, safety and Environment (HSE) Course [J]. Journal of Higher Education, 201, 11: 181-184.

[2] Guo Li, Zhou Zhiqiang, Chen Ligang, et al. Chemical safety and environmental protection "course ideological and political" teaching reform practice [J]. Chemical higher education, 2019, 36(4): 31-34.

[3] Li Xueqin, Li Cuihua, Zhang Xiulan. Exploration on hybrid teaching of health and safety environment (HSE) introduction course [J]. Chemical higher education, 2020, 5(175): 67-69.129-131.

[4] Ai Bing, Zhang Lipeng, Liu Yuying, et al. Reform and Practice of Hybrid Teaching Mode of Engineering Chemistry Course based on Professional certification of Engineering Education [J]. Shandong chemical industry, 2019, 48(9): 211-213.

[5] Wang Yusheng, Song Xiaoyan, Zhang Tianjie. Journal of north China university of water resources and electric power (social science edition), 2019, 35(3): 39-42.