

Implementation of the Concept of Industry-Teaching Integration and Nurturing in the Context of New Engineering - Taking Principles of Boiler Course as an Example

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Abstract. At present, more colleges and universities pay attention to the combination of school and enterprise, the integration of industry and education, in the new engineering background to complete the integration of industry and education of the education model is the major universities to pursue the goal, this study is mainly based on the principle of boiler in a university in Texas as an example, combined with the characteristics of the local industry in Texas, respectively, in the concept of educating people, the teaching mode and the reform and other aspects of the exposition. Taking "Boiler Principle" as the research object, teaching the course in modules, combining the problems of coal-fired power plant boilers in actual operation, establishing an engineering case base, combining science and reality, stimulating students' interest in learning, and improving students' learning efficiency.

Keywords: Industry-education integration; Boiler principle; School-enterprise combination; Teaching reform.

1 Introduction

The construction of new engineering disciplines is a complex systematic project with wide coverage and influence and Chinese characteristics, which has a demonstration and leading role in the reform and development of Chinese higher education and requires clear connotation definition, scientific top-level design and reasonable construction planning^[1]. Under the background of new engineering, the core advantage of the talent cultivation model of industry-teaching integration lies in the ability to provide actual problem situations, practical and innovative environments as well as necessary related resources, to cultivate high-level applied talents oriented by industrial demands, and to improve students' innovative and practical abilities and their ability to solve complex engineering problems^[2,3]. Combining the advantages of local specialization, locality and characteristics of Texas, this study introduces the Principles of Boiler course as an example.

2 Defining the objectives of the course

In the course of Boiler Principles, it is necessary to clarify the course objectives so that students can master the basic principles, structure, performance and operation and maintenance of boilers. At the same time, it is also necessary to focus on cultivating students' practical ability and innovative consciousness to meet the demand for talents in industrial development. Boiler principle course belongs to the multidisciplinary cross-curriculum, the course in the OBE concept, the green thinking, ecological thinking, humanistic thinking, innovative thinking into the teaching objectives, the construction of value shaping, ability training, knowledge transfer trinity of the teaching mode, so that students from the mastery of knowledge extended to the endogenous emotional attitudes and professional integration of the new teaching objectives. Combined with the students' talent cultivation goals, the relationship between course objectives and talent cultivation is shown in Table 1 below.

Table 1. Relationship between Program Objectives and Talent Cultivation

Training Requirement	Teaching objectives of the course
knowledge objective	Understand boilers and their role in the national economy, identify the basic components of a boiler and retell the general work process
	Master the basic structure, performance index, working principle of boiler equipment, boiler design ideas and methods
competency objective	Ability to incorporate boiler thermodynamic calculations for boiler body design
	Ability to analyze technical problems in actual boiler operation in conjunction with theoretical knowledge
quality objective	Have some ability to analyze and judge professional issues
	Have a certain degree of humanistic and artistic literacy and cultivate a spirit of rigor and truthfulness
	Through the course, students will be promoted to establish the awareness of low-carbon environmental protection, energy saving and emission reduction
	Through the course, students will be able to respond positively to the national strategic objectives of "carbon peaking" and "carbon neutrality"

3 Optimizing course content

In terms of course content, cutting-edge technologies and latest achievements of the industry can be introduced to make the course content closer to actual production. For example, the design principle of new high-efficiency boilers, energy-saving and emission reduction technologies can be introduced to stimulate students' learning interest and enthusiasm. Combined with the needs of local enterprises in Texas, the course content is modularly divided, and its course content and lecture hours are allocated as shown in Table 2 below.

Table 2. Main content and credit hour allocation of the course

Main content of the course	Teaching hours
Module 1: Basic Working Principles and Introduction	12
Module 2: Boiler Design and Calculations	34
Module 3: Safe Operation of Boilers	10

4 Strengthening practical teaching

The concept of industry-teaching integration of education focuses on practical teaching, which enables students to better understand and master the course content through practical sessions. In the course of "Boiler Principles", experiments, practical training and other practical teaching sessions can be arranged to allow students to operate hands-on to deepen their understanding of the principles and structure of the boiler, in-class experiments are shown in Table 3 below.

Table 3. In-class experiments and credit hour schedule

Project name	Content and requirements	Teaching hours
Coal-fired power plant DC boiler demonstration experiment	Provide students with an understanding of the flow path of naturally circulating boiler water	2
Demonstration experiment of thermal system of 300MW unit power plant	To enable students to understand the working principle of different heating surfaces during the operation of power station boilers, the composition of the thermal system and its working principle	2
50MW turbine operation simulation demonstration experiment	Provide students with an understanding of the entire process of converting chemical energy into electrical energy in a coal-fired power plant boiler	2

At the same time, it can also cooperate with enterprises to carry out internship training, so that students can learn and exercise in the actual production environment. Combined with practical engineering for division teaching. This teaching method can improve students' image thinking ability and help them better understand and master abstract theoretical knowledge. Through the study of actual cases, students can better apply the theoretical knowledge to actual engineering and improve their practical ability^[4,5].

5 Introduction of industry mentors

Energy and power engineering major for our school focus on the development of professional, the professional talent training goal is ultimately positioned to cultivate innovative spirit, broad knowledge, strong ability of high-quality application-oriented talents, highlighting the cultivation of engineering application ability. However, at present, the overall level of students show poor theoretical foundation, understanding and acceptance ability is relatively weak, and the traditional teaching method of boiler principle is based on theoretical teaching, and the students have poor learning motivation and low interest, therefore, combining the actual engineering and theoretical courses with the new way of teaching with the traditional teaching method is both challenging and inevitable, through the use of this teaching method not only to broaden the students' horizons, stimulate the students' interest in learning the principle of boiler, but also to enhance the students' ability to learn. By using this teaching method, students can not only broaden their horizons, but also stimulate their interest in learning the principle of boiler and deepen their understanding of the basic theoretical knowledge^[6,7].

In order to better implement the concept of industry-teaching integration, industrial tutors can be introduced to participate in the course teaching. Industrial tutors have rich practical experience and professional knowledge, which can provide students with guidance and assistance closer to actual production. Through communication and cooperation with industrial tutors, students can better understand the industrial development trend and market demand, laying a solid foundation for future career development^[8-10]. Combined with the professional training needs, the teaching content is designed with the teaching objective of mastering the main design of power station boilers, and with the purpose of cultivating students' engineering literacy, reflecting the student development as the center.

6 Improving the evaluation system

In terms of evaluation, it is necessary to establish a perfect evaluation system, as shown in Figure 1 below, to comprehensively evaluate students' knowledge mastery, practical ability, and innovation consciousness.

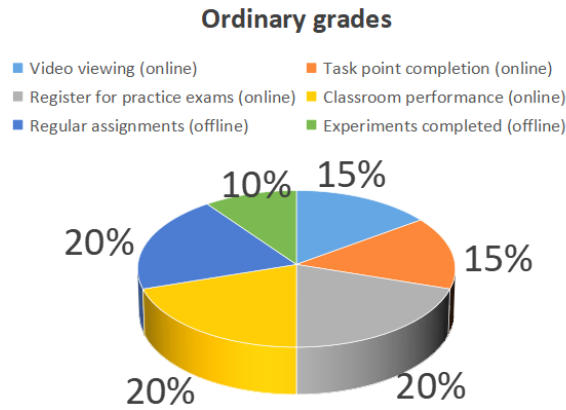


Figure 1. Evaluation system

At the same time, it is also necessary to focus on process evaluation and pay attention to the performance and development of students in the learning process. Through the improvement of the evaluation system, the effect of the implementation of the concept of industry-teaching integration and educating people can be better tested, providing useful reference for future teaching work. After the implementation of the case teaching method, the comparison of the performance of students in the three energy and dynamic majors is shown in Figure 2 below.

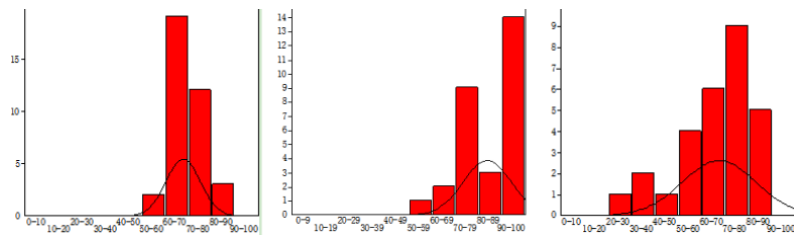


Figure 2. Analysis of final examination results of the last three classes of students

7 Conclusion

In conclusion, the implementation of the concept of industry-teaching integration and educating people in the context of new engineering disciplines is of great significance for cultivating high-quality talents. Taking Principles of Boiler course as an example, by clarifying the course objectives, optimizing the course content, strengthening the practical teaching, introducing industrial tutors and improving the evaluation system, we can effectively implement the concept of industry-teaching integration of educators and cultivate more high-quality talents in line with the needs of industrial development.

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References

- [1] Lin Jian. Future-oriented construction of new engineering disciplines in China[J]. Tsinghua University Education Research, 2017(2):10. DOI:10.14138/j.1001-4519.2017.02.002610.
- [2] Li Huifeng, Wen Yun. Exploration and practice of "integration of industry and education, school-enterprise integration and cooperative schooling" in higher vocational education[J]. China Vocational and Technical Education, 2015(25):4. DOI:CNKI:SUN:ZONE.0.2015-25-021.
- [3] Liu M,Wang Yonan et al. Exploration and Practice of Industry-Teaching Integration Graduate Student Training Mode Oriented by Industrial Demand[J]. Journal of Higher Education,2024,10(08):34-37.DOI:10.19980/j.CN23-1593/G4.2024.08.008.
- [4] Li Zhenbo,Cao Hongbo. Harvard Business School Case Teaching Operation Mode and Implications for China[J]. Degree and Graduate Education, 2018(11):66-71.
- [5] Castilho F M , Pereira C .Teacher Profile vs Student Profile: Processes of Teaching-Learning in the Subject of Music Education[J]. 2023.DOI:10.1007/978-3-031-09659-4_51.
- [6] Li Fangqin,Ren Jianxing. Reform and practice of experimental teaching in the course of Principles of Boiler[J]. Education and Teaching Forum,2016(18):2.
- [7] Sun Jianrong, Li Fangqin, "boiler principle" course teaching method reform exploration [J]. China power education: 2014(4):2.
- [8] Smith, J., & Johnson, R. (2022). The impact of industry-academia collaboration on higher education outcomes. *Journal of Higher Education Policy and Management*, 44(2), 156-172.
- [9] Taylor, A., & Brown, P. (2021). The future of higher education: Industry integration and innovative teaching methods. *Innovations in Education and Teaching International*, 58(3), 254-269.
- [10] Wang, C., & Lee, W. (2023). Exploring the factors influencing the implementation of industry-education integration in higher education: A case study approach. *Journal of Vocational Education & Training*, 75(1), 78-94.