ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202204_5(4).0037

Curriculum Reform and Practice of Printed Circuit Board Design and Production under the Dual Teaching of School and Enterprise

Xiaohe Yan[1, a], Yulin Tong[2, b] and Haicheng Yu[2, c]

[1]Wenzhou Polytechnic, Wenzhou, 325035, China

[2]Xingji electrical appliance co., LTD, Wenzhou, 325000, China

[a]xiaohewelcome@126.com, [b]Tongyulin2005@126.com, [c]13889401187@163.COM

Abstract

Schools and enterprises cooperate to build courses. Training objectives are determined according to enterprise posts. Different posts have corresponding curriculum knowledge and skill requirements. The three learning modules of the course are determined according to the course objectives. Each learning module formulates different objectives and requirements for students at different levels to realize targeted layered teaching. According to the content after the reform, carry out teaching implementation and analyze teaching evaluation.

Keywords

Course objectives; Learning module; Dual.

1. Introduction

In the era of knowledge economy, with the rapid development of science and technology, international competition has gradually evolved into talent competition. As an important way to cultivate high-quality talents, higher education has also attracted more and more attention. The dual teaching of schools and enterprises combines school education with social needs, classroom teaching with practical teaching, so that students can obtain professional knowledge, practical skills and work experience in the real world.In response to the demand for talents, the university requires the construction of various majors to cooperate closely with the enterprise, and the curriculum construction is connected with the specific posts of the enterprise, so as to truly realize the industry university cooperation. Taking the course of printed circuit board design and production as the entrance, this paper cooperates with Xingji Electric Appliance Co., Ltd. to jointly complete the exploration and practice of industry university cooperative education mode.

2. Curriculum Training Objectives

After preliminary investigation, the corresponding posts of printed circuit board design and production are circuit board tester, electronic draftsman, circuit board design engineer, etc. Professional principals, teachers, industry experts and enterprise engineers shall re analyze the knowledge points and skill points of the posts corresponding to the course, as shown in Table 1.

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202204_5(4).0037

Table 1. Corresponding post knowledge and skill requirements of printed circuit board design and production

Course corresponding post	Knowledge requirements	Skill requirements
Circuit board tester	Master certain basic knowledge of computer application and professional knowledge of professional design and drawing software; Master the professional theoretical knowledge of electrician, analog circuit, digital circuit, circuit board design, automatic detection, single chip microcomputer development and so on.	Proficient in the application and operation of circuit boards; Testing and maintenance of circuit board.
Electronic Draftsman	Master the classification, basic functions and selection standards of human electronic components; Master the professional theoretical knowledge of electrician, electronics, circuit design software, automatic detection, single chip microcomputer and so on.	Ability to design circuit schematic diagram and make printed circuit board diagram; The ability to independently develop small electronic products, and initially have the design ability of circuit foundation combined with single chip microcomputer system.
Circuit board design engineer	Master the knowledge of circuit board design, automatic detection, SMT, intelligent control and fieldbus; Master the manufacturing process of circuit board, the basic principle of communication and common methods of data acquisition.	Be able to formulate work plans and tasks according to the requirements of project tasks; PCB drawing design, PCB related debugging, and the ability to design PCB standard library; Circuit diagram design, component selection, circuit software development and debugging ability.

3. Course Content

Focusing on the ability achievement objectives of the course, this course determines three learning modules, namely circuit schematic design, printed circuit board drawing design and printed circuit board production. Each learning module is integrated into the real products of the enterprise to form sub tasks from primary to advanced. According to the construction of teaching objective matrix, each learning module formulates different objectives and requirements for students at different levels to realize targeted layered teaching, which is divided into three levels. Three progressive goals are formulated for students at three levels: primary goals, intermediate goals and advanced goals.

All students achieve the memory and understanding of factual and conceptual knowledge, achieve the primary goal, and strive for the intermediate goal; Most students are required to apply and analyze procedural knowledge, achieve intermediate goals, move forward to advanced goals, and realize the integration of industry and education; Excellent students achieve the evaluation and creation of metacognitive knowledge, deepen the integration of industry and education, and dare to climb the advanced goal.

Multiple tasks of the primary goal are designed by the members of the research group and enterprise technical experts; Many tasks of intermediate goals mainly come from the cases formed by the horizontal topics of teaching teams and cooperative enterprises to realize the integration of industry and education, and scientific research feeds back teaching. Some tasks also come from the cases of previous National College Students' electronic competitions to

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202204_5(4).0037

promote teaching and strengthen the integration of industry and education; The advanced goal is to encourage students to improve products on the basis of the original enterprise projects, so as to generate new projects with enterprises and deepen the integration of industry and education.

4. Teaching Implementation

The offline teaching venues of learning module 1 and learning module 2 are in the school, and the teaching is completed by the teachers in the school. The offline teaching venues of learning module 3 are in the cooperative enterprise, and the teaching is completed by the enterprise technical engineers. By combining the "dual" teaching and the "Internet plus" modern educational technology, we will build a new learning system and rely on the big data network platform to form a "three interlayered" mixed teaching mode with "interconnected schools and enterprises", "online and offline interconnection" and "interaction between teachers and students". Among them, accurate learning through the big data platform, and then accurate teaching objectives; Guided by the "dual" teaching, accurately design the teaching content, and build a diversified and hierarchical teaching resource base based on the network teaching platform; With the help of e-learning platform, learning data feedback, accurate teaching process organization; Through precision teaching, we can recognize the learning situation, integrate the teaching content, reconstruct the "before class, during class and after class" teaching activities, and make full use of the data analysis of the network platform at each stage to reflect the characteristics of precision teaching.

Before class, teachers log in to the e-learning platform, push learning resources, assign learning tasks, and conduct online counseling and learning situation analysis; Students accept the task, make full use of network resources for online learning and online testing, and feed back the confusion in learning to teachers through online communication.

In class, teachers adjust teaching methods by analyzing students' learning behavior data, and accurately design classroom teaching contents, including key and difficult explanations, task orientation and personalized guidance; Students conduct inquiry and autonomous learning through group discussion and strengthening key and difficult learning, division of labor and cooperation, operation training and personalized learning.

After class, teachers assign expansion tasks, carry out teaching evaluation and summary according to learning data, and selectively intervene in teaching for individual students; Under the guidance of teachers, students carry out autonomous learning and complete online review, online test and corresponding expansion tasks.

5. Teaching Evaluation

The traditional teaching evaluation of printed circuit board design and production is mainly based on school teachers, which is not conducive to the application of students' comprehensive knowledge and the evaluation of students' comprehensive quality. The process evaluation of enterprises participating in teaching can help enterprises find the fit point of participating in higher vocational college teaching, make enterprises realize the transformation from the role of "employing" to the role of "participating in educating", make the teaching content consistent with the post, and realize the seamless connection between the comprehensive quality of graduates and the needs of employers. At the same time, both schools and enterprises have set multi-dimensional assessment indicators according to skills and literacy. While emphasizing the training of post skills, they pay more attention to the improvement of students' safety awareness, efficient production, collaborative spirit, innovative spirit, mainstream values and other literacy. The specific evaluation system is shown in Table 2.

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202204_5(4).0037

Table 2. School and enterprise comprehensive evaluation system

Assessment items	Main indicators	evaluation criterion	Assessment and evaluation
Knowledge and skills	Design of circuit schematic diagram, design of printed circuit board diagram and production of circuit board	Flexible use of knowledge to solve practical problems, strong application ability	Enterprise engineers and lecturers evaluate various indicators in the teaching process
Professional quality	sense of worth	Enterprise values and social values	
	Teamwork ability	Close cooperation and tacit understanding	
	product quality	Keep improving and persevering	
innovation ability	Various design ideas and schemes	Use knowledge flexibly, dare to challenge and put forward new methods	
	Various processing technologies and methods		

6. Conclusion

The dual education of schools and enterprises makes full use of the two different training environments of schools and employers, which can enable students to practice job hunting skills in their study, learn the latest professional knowledge of the industry in their work, improve students' comprehensive ability and employment competitiveness, and realize the flow and transfer of knowledge and technology between universities and enterprises, So as to cultivate application-oriented talents suitable for the needs of employers and cultivate more high-quality compound talents for the society.

Acknowledgments

The paper was supported by three kinds of practical projects of the integration of industry and education from the department of education of Zhejiang Province, China in 2020(No.200)and by National vocational education teacher teaching Innovation team research project (SJ2020010102).

References

[1] Xiaohe Yan. Curriculum reform of printed circuit board design and production. international journal of social science and education research. VOL1, NO.10,2018:8-11.

[2] Katherine A. Kelley, Heather E. Hoops, Laurene Palmer,Norman A. Cohen,Karen J. Brasel. Implementation of a Medical Coding Curriculum for Surgery Residents[J]. The American Journal of Surgery, 2019.

[3] Xiaohe Yan. The Content of Creating PCB Component Footprints is designed and done. international journal of social science and education research. VOL3,NO.1,2020:63-67.

[4] Zhu Chao,et.Research on the Exploration and Practice of Course Ideological and Political Education in the Specialized Course of Science and Technology, Contemporary Educational Practice and Teaching Research.No.3,2020:203-204.

[5] Xiaohe Yan,Zexiang Zheng and Yulin Tong. Design and practice of scientific research feedback course case –a case study of“printed circuit board design and production”.international journal of social science and education research. VOL4,NO.7,2021:86-90.