Curriculum Development and Practice on "SMT Craft and Equipment" Course in Vocational College

Hehe Chen[1, a]

[1]Department of Electronic and Electrical Engineering, Wenzhou Vocational and Technical College, Wenzhou 325035, China.

[a]chenhehe626@126.com

Abstract

The course of "SMT Craft and equipment" in higher vocational and technical education has many problems, such as complicated knowledge points, difficult practical teaching and poor teaching effect, So the practical teaching of" SMT craft and Equipment" is usually very difficult. In order to solve these problems, this paper reorganizes the curriculum structure, changes the teaching mode, constructs the real classroom and improves the examination method to carry on the curriculum teaching reform, and then discusses and practices a teaching scheme of enterprise real production management mode. It is proved that, this teaching mode is conducive to more active participation of students in the classroom environment and helps improve the overall teaching effect.

Keywords

Vocational education, surface mounted technology, teaching mode, curriculum development.

1. Introduction

With the continuous development of electronic Technology, China has become a major manufacturer of electronic products in the world, which also promoted the rapid development of Surface Mounted Technology (SMT)[1,2]. Corresponding to the current situation of this development, China's electronic manufacturing industry has a growing demand for professional and technical personnel who master SMT knowledge in recent years . In order to meet this demand, many colleges and universities have developed SMT majors, formulated professional talent training programs and set relevant courses. For this reason, how to cultivate high-quality SMT professional technical personnel who are competent for the production of enterprises has become a common concern of vocational colleges.

"SMT Craft and equipment" is currently the core professional course for electronics majors in China. In the actual teaching process, this course has the following problems：

(1)Due to the complexity and variety of knowledge points in the course, it is difficult for students to learn the system of knowledge points and focus on them[3].

(2)This course requires a high level of skill practice and a high level of training environment. However, the reality is that it is difficult for many colleges and universities to equip with complete practical training equipment and conditions

(3)The traditional teaching mode is a classroom mode in which teachers mainly teach knowledge, which has a poor effect in actual teaching.

(4)Because it is very expensive to build a SMT production line, most colleges and universities are equipped with only one set of practical training equipment. For the classes with a large number students, the training session can not be launched

(5)Students' independent learning ability is poor and the learning effect is not good.

In order to solve the above problems, this paper carries on the teaching reform of "SMT craft and equipment" and discusses a new teaching mode. The teaching implementation process "takes the combination of theory and practice as the principle and take the vocational skills cultivation of SMT post as the key". In the classroom teaching reflects "learning in doing, doing in learning, and learning by exploring". In this way, students can master SMT knowledge and skills in real environment and practice, and improve their learning initiative and enthusiasm.

2. Design of Teaching Mode

2.1. Basic Ideas of Teaching Mode Design

The basic idea of this teaching mode design is" Closely integrate talent training programs——From jobs to course standards" .According to the talent training program of electronic information engineering technology and the talent demand of current social work positions, , the real operability of this course needs to be reformed, in order to better cope with the actual employment demand in the future, and make up for the school's SMT production line equipment is not perfect and other practical problems. This paper discusses a new teaching mode, which provides real products, real equipment, real positions and real environment in the classroom [4]. In this way, students can experience the real enterprise production environment through the limited teaching resources in the classroom.

Real products-----The classroom teaching mode is recommended to take the project-based teaching as the leading method, and all the topics selected in the class are selected from real projects.

Real equipment-----Introduce real SMT production line as teaching carrier. In order to solve the problem of large number of students and insufficient production equipment, some production equipment introduced offline programming software as a supplement. At the same time, we introduced the rotation system to improve the service cycle of equipment.

Real positions-----In the process of teaching, students should be assigned real positions and identities, such as workshop director, technical supervisor, and assembly line worker and so on. Workshop teaching is carried out in class to realize the supervision system of team leader managing small teams and team leader reporting to teachers. The rotation mode can be implemented in the context of teaching implementation so that students can experience the different responsibilities of different positions.

Real environment-----Use the real training environment, real project products, real post identity to create a real workshop atmosphere and environment.

2.2. Knowledge Structure of The Course

"SMT craft and equipment" is a multi-disciplinary integration course, the knowledge described is complex, and this paper reorganizes the knowledge structure of the course. In terms of overall knowledge system the course content is divided into four parts: base part, the manufacture part, design part, and management part, covering SMT components. These parts respectively cover SMT component identification, SMT process auxiliary materials, SMT production line equipment use and maintenance, SMT quality management and other content. In addition, a comprehensive practical project covering all the basic knowledge is designed on this basis. The knowledge teaching in the preface part of the course takes this real project as the research object to conduct the orientation teaching, then we advances step by step according to the required knowledge points of the project. Each knowledge point will arrange corresponding practical training process, so that students can combine theory with practical knowledge, and exercise students' hands-on, communication, innovation and analysis abilities.

2.3. 2.3. Classroom Organization Situation

In the traditional classroom, the teacher-led teaching of knowledge is not applicable to practical courses. This paper explores a new situation of classroom organization, which emphasizes the ability - oriented classroom. By setting up real positions for students, each student has his/her real identity, assessment methods, indicators to be completed and professional qualities to be observed in class. The basic teaching content is carried out in the mode of teacher-led and student-participation discussion, and the student-participation discussion is carried out in the mode of holding project group seminar. While the practical teaching department changes the traditional classroom mode to a student-centered learning mode that simulates the real production environment and introduces a new rotation mode. In this way, students can experience the corresponding extensive management mode in the virtual production positions. This process greatly strengthens the participation and enthusiasm of students, and also increases the autonomy of students in learning.

3. Application And Practice of Teaching Mode

3.1. Set Up Post Identity And Realize Hierarchical Management System

The teaching project is guided by the simulation of real work scenes. In class, students are divided into groups with appropriate purpose. The class is divided into two workshops with workshop as the unit. Each workshop shall be divided into several groups. Each group shall have a team leader to manage other members of the group. The teacher plays two roles in the whole process: the teacher and the technical supervisor, who are responsible for formulating the production tasks of the whole class and managing the students' classroom situation. The daily management mode of the class is carried out in the workshop management mode, as can be seen from Fig. 1. The workshop director is responsible for receiving tasks from teachers, decomposing the tasks, and assigning small tasks to a group leader. The group leader organizes and manages the production tasks of the group, conducts daily production organization, daily attendance check, process supervision and other processes. The team leader is the communication bridge between teachers, workshop directors, technical supervisors and team members. Daily teaching tasks are issued in the form of tasks and are assessed in groups. The whole teaching environment also deliberately imitates the production mode of the project team or workshop. Students experience the professional environment and working environment as "employees".

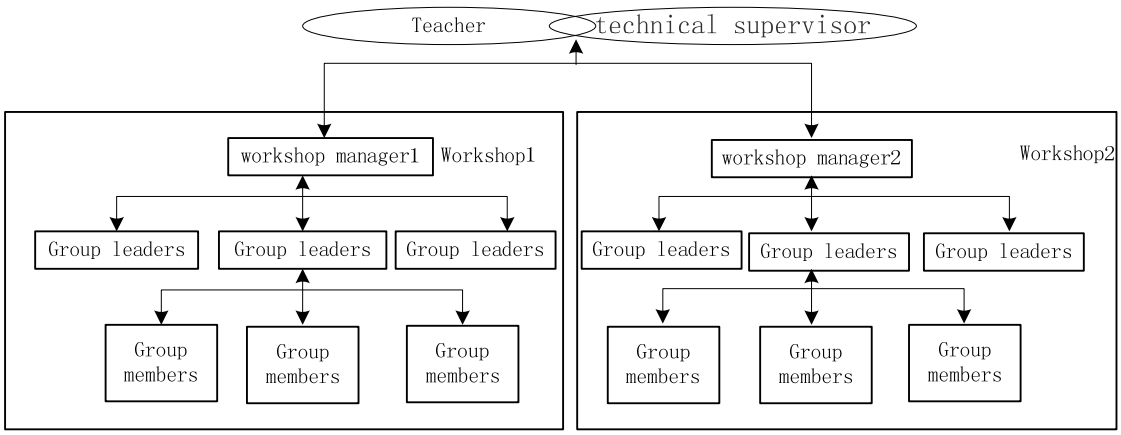

Fig 1. Daily Management of The Class

3.2. Project-Oriented Teaching Mode

Set up the "Production of simple electronic organ based on SMT" as a comprehensive practice project, which is taken from the real project of the enterprise. This project is based on the real project of the enterprise and is reformed. The knowledge points involved in this project are connected with all the knowledge and skills of the course. The whole teaching plan includes 15 class hours. In order to let students feel the real project design and production, the project arrangement completely simulates the production process of real products in the enterprise. The technical supervisor lists the technical indicators and requirements that need to be completed for this comprehensive project by issuing the task statement, while the workshop directors discuss the need to hold a project team meeting with the members of the group, break down the tasks in detail, and then assign each task to each team member. Technical supervisor can be invited to attend the meeting. In the end, both workshops need to produce results and determine the final winner through on-site display and evaluation.

3.3. Real Production Line Combined With Virtual Simulation Conditions

"SMT craft and equipment" is a practical discipline, students must go through a lot of production training to master SMT skills, for this reason, the construction of production training base is particularly important. A basic SMT production line shall consist of at least one printing press, one mounting machine and one reflow welding furnace. At present, many colleges and universities have configured basic SMT production lines, which provide a certain basis for practical training. However, the reality is that the cost of building a complete production line is relatively expensive, and the average university is equipped with only one production line at most. For the number of students in the centralized teaching mode in school is generally around 50. How to achieve better training results under the condition of insufficient practical training conditions is particularly important.

This paper discusses two methods to solve this problem. One is to adopt the method of grouping and rotating posts, so that the number of students can be dispersed at different stations of the production line and the recycling efficiency of the machine can be improved.

Secondly, seek some offline virtual simulation software to replace as much time as possible in the actual operation of the machine. Take the mounting machine for example, many models have developed offline programming software. When the tasks are assigned, students are required to use off-line programming software to write programs in the computer room, conduct basic verification, and finally conduct online verification and debugging on real machines. This can greatly alleviate the pressure of insufficient training resources.

3.4. Evaluation System

There are various ways of course evaluation system, emphasizing the dual track mode of process assessment and final assessment. And process assessment includes self-assessment of students, assessment of group leader, assessment of workshop director and technical supervisor, and Bonus assessment. Students' self-assessment accounted for 10 percent, group leader assessment for 20 percent, workshop director and technical supervisor assessment for 20 percent, and Bonus assessment for 10 percent.

Each evaluation should give the basis of the score and design the points in detail. At the same time, we introduce the classroom reward system. A good classroom atmosphere can often bring good teaching results. Students with high participation in class activities or who have the courage to make contributions in teamwork are rewarded with certain points. The purpose is to activate the classroom atmosphere and improve students' enthusiasm for participation. Finally, the introduction of enterprise assessment system, focusing on the cultivation of professional literacy. For example, the group leader evaluates and considers students' management ability and cultivation of good professional qualities. This task must be treated

fairly and openly in the process, and a certain score shall be given for each item according to various aspects such as attendance, assignment collection, task arrangement, task implementation, team cooperation and extra task completion. The sample table of is shown in Table 1.

Table 1. Project achievement composition

Achievement component			Assessment statement	score
1	Project integrity50%		Whether the corresponding technical documents are complete and the product functions are complete	
2	Bonus assessment 10%		Whether to take the initiative to contribute, undertake additional work	
3	Evaluation of superior leaders20%	Attendance	Whether to ask for leave, whether to be absent from work without reason, whether to be late and leave early	
4		Task performance	Whether the scheduled sub-tasks are completed on time, whether the arrangement is followed, whether the main tasks are undertaken, etc	
5		teamwork	Whether to obey the arrangement, whether to take the initiative to undertake the tasks within the group, etc	
6	self-assessment20%	Task implementation	Whether complete their own tasks	
7		Task commitment	The amount of work undertaken within a team	

4. Conclusion

Through the discussion in this paper, we reform the teaching mode of "SMT craftand equipment". A realistic workshop teaching mode is realized in the classroom. This teaching mode simulates the real workshop environment through real projects, real positions assigned to students by real equipment and real workshop environment, which enables students to establish the concept of "project" and effectively stimulates the enthusiasm and initiative of students. This not only helps students to be practical, deepen the theoretical knowledge they have learned, exercise their professional quality, but also exercise their teamwork ability, analyze problems, degrade the difficulty of tasks and issue tasks. Because of the introduction of enterprise design concept and method, the teaching content is closely combined with the front-line work of the enterprise, so that students are quickly familiar with the basic work of the front-line process control of the enterprise. For the graduating junior students, it is a very good internship experience in the simulation workshop.

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