

# Research and Exploration of Welding Training Course in Applied Technology University

Xuwei Hao <sup>1\*</sup>, Cong Zhang <sup>2</sup>

{1024674265@qq.com <sup>1\*</sup>, zhangcong1104@sina.com <sup>2</sup>}

Tianjin University of Technology and Education, Tianjin, China

**Abstract.** Welding training course is an important course for welding technology and engineering specialty. The training process has the characteristics of difficulty in mastering skills, high proficiency requirements, poor working environment, dust and noise hazards, which seriously affects students' enthusiasm for learning welding technology. Therefore, based on the practical needs of students and the needs of the society for future talents, this course combines the Tianjin Haihe Craftsman Cup competition, promotes teaching by competition, reorganizes the training module, innovates the organizational form, reforms the teaching method, integrates the craftsman spirit, encourages students to participate in the classroom independently, teaches students in accordance with their aptitude, and highlights the 'student-oriented' teaching concept. The training is carried out in the way of project and competition, and the time of the course is given to the students, so as to realize the transformation of theoretical knowledge to welding skills, improve the teaching effect of the course and the quality of personnel training, and provide some reference value for the reform of other related courses.

**Keywords:** Curriculum research; Welding training; Competition to promote teaching; Craftsman spirit.

## 1 Course introduction

Professional skill training ( welder advanced ) is a course to train students to fully and firmly master the operation skills and skills of welder advanced workers. The total hours of study are 480 hours and the scores are 12 points. Through this course, students can complete the technical operation of the intermediate and advanced work of this type of work, have basic process analysis ability and operation skills for products ( parts ), be able to skillfully use, adjust and maintain the main equipment of this type of work, correctly use welder machinery and tools, have good awareness of safe production and civilized production, and develop a good teaching outline of professional ethics.

Through the study of this course, students can have a basic understanding of the professional welding process. They can choose the welding equipment to carry out the welding operation, master the key points of the welding process, master the basic processing methods of this type of work, and reach the advanced technical level standard of the welder through the social skill appraisal. In the past two years, there have been many problems in the course teaching process, resulting in a general teaching effect. The author has innovated the teaching process and

carried out course research and exploration by analyzing the pain points in the current teaching.

## **2 Analysis of curriculum objectives and students ' situation**

### **2.1 Curriculum goals**

#### **2.1.1 Knowledge objectives**

Master the knowledge of welder 's safety production and civilized production, and initially establish engineering concept and engineering consciousness ; master the welding performance of commonly used welding materials and the welding of various materials, and can reasonably select various welding parameters ; master the evaluation method of welding specimens .

#### **2.1.2 Capacity building**

Understanding the performance, structure and principle of welding equipment, mastering the adjustment and maintenance methods of common welding machines, can solve the related problems in practical operation more skillfully. The positioning and welding of the workpiece will be reasonably selected, and the structural principle and installation method of the commonly used welding fixture will be understood. The causes of welding defects will be analyzed and prevention methods will be proposed.

#### **2.1.3 Personnel cultivation**

Understand the requirements of practical training teaching and develop good professional quality ; the skill level of welders meets the requirements of the third level of national vocational standards, and cultivates students ' craftsman spirit of excellence.

#### **2.1.4 Value guidance**

Cultivate the fine tradition of students ' dedication, hard work and labor glory ; to cultivate students ' team cooperation ability and communication ability ; cultivate students ' correct outlook on life, values and good quality; cultivate students ' quality consciousness, service consciousness, responsibility consciousness and innovation consciousness.

### **2.2 Analysis of student situation**

#### **2.2.1 Theoretical knowledge base**

The students are the fourth grade students of the university. They already have strong theoretical knowledge learning ability, but the theoretical knowledge and practical knowledge are scattered and not systematic. Students have learned the basic theoretical courses of welding, such as material science foundation, material engineering foundation, material structure characterization, metallurgy and heat treatment, thermal processing and transmission principle, arc welding foundation, welding metallurgy, welding structure, welding quality inspection and evaluation.

### 2.2.2 Practical operation basis

The students who have studied this course have studied the metalworking practice course, which has a certain practical basis, but the overall level of practice is uneven. In the teaching process of practical training course, we should pay attention to the combination of theory and practice, and adjust the teaching objectives according to the degree of students' mastery of knowledge. Therefore, the teaching method should allow students to practice more, pay attention to the combination of practical welding skills and theoretical knowledge, and achieve the goal of unity of knowledge and practice.

### 2.2.3 Characteristics of teaching motivation

Vocational skill training ( welder level 3 ) is an important practical training course for welding technology and engineering specialty. Most of the students have a strong interest in learning, and their enthusiasm and enthusiasm for learning are high. There are also some students who are not interested in welding specialty, so their interest in this course is not high. On the other hand, the purpose and practicability of students' behavior are significant. At the end of this course, students need to carry out the three-level professional skill appraisal of social welders. Therefore, it is particularly common for students to have only score and certificate theory. The analysis of the learning situation of students majoring in welding technology and engineering is shown in **Figure 1**.

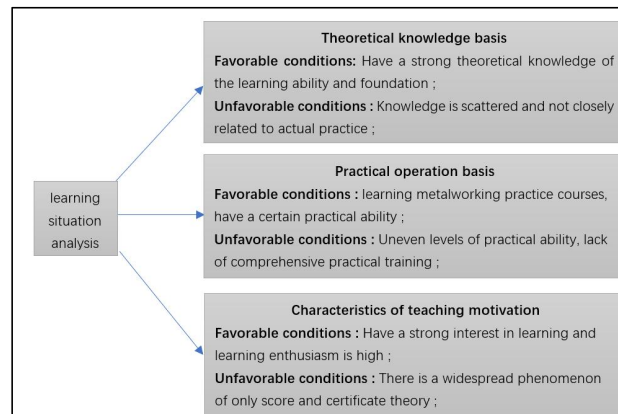


Fig. 1. Analysis of students majoring in welding technology and engineering

## 3 The key problems of curriculum teaching innovation

As an important practical training course for welding technology and engineering specialty, professional skill training ( welder level 3 ) has the following ' pain points ' problems found in the teaching process. As a ' hidden ' problem, it has always affected the achievement of teaching objectives and the improvement of teaching quality.

### **3.1 Teaching design lacks resonance**

The traditional practical training courses are mainly composed of teaching, demonstration operation and student training. They lack subjective initiative and are mostly carried out in a single teaching method based on teacher indoctrination. The final assessment of the course is based on the students' mastery of the training content and the quality of the parts processing, ignoring the improvement of the students' comprehensive ability and the mastery of the skills training learning methods. The form is relatively simple, and it is difficult to meet the current '00' college students' cognitive characteristics and learning characteristics.

### **3.2 The course content is difficult to master**

The learning of welder skills requires high technical and technical requirements for operation. The learning process requires students to have a high degree of understanding of skills and proficiency in practical training tasks. Although the students of this major are from technical schools, 96.3 % of them are lathe workers or fitters. The welding skills of students are almost zero. How to train students' skills in a limited time and make them master welding skills in a short time is one of the key problems to be solved. In addition, the working environment of the welding workshop is poor, the dust and noise are harmful, and it is difficult for the undergraduate to learn the enthusiasm of welding technology. Therefore, how to arrange the course content, assessment plan and learning goal is an urgent problem to be solved in the process of the course. [1]

### **3.3 The form of curriculum ideological and political single**

At present, in the teaching of welding practical training, the integration of ideological and political education is relatively simple in form. Teachers choose to directly introduce some ideological and political materials in the teaching process, explain to students in the classroom, and instill ideological and political connotation. However, other forms of ideological and political education model have not been constructed, which neither reflects the combination of explicit and implicit, nor reflects the collaborative education. Although teachers introduce curriculum ideological and political education as an important point of ideological and political education in the teaching process, from the actual development of curriculum teaching, there is a disconnection between welding training curriculum teaching and ideological and political education. Curriculum ideological and political education has not been effectively integrated and promoted in the curriculum, and has not played an ideal educational effect. [2]

### **3.4 Less attention to basic operation**

Welding is a more complex training course. The basic skills of basic operations have a huge and direct impact on the welding results, such as the use of welding tools, the interpretation of drawing content, and the posture of welding operations. Only by ensuring that students can accurately grasp these basic operations can the welding course be promoted in an orderly manner and ensure the quality of welding training learning. However, in the actual teaching arrangement process, schools, teachers and students did not pay attention to this practical training activity, resulting in students' lack of solid basic skills in welding, which affected the effect of practical training. Students do not understand the drawings, which mainly affects the students' judgment on the welding process, assembly, welding methods and other aspects, and

ultimately affects the quality requirements of welding. If the welding quality inspection cannot be carried out correctly, it will affect the students' learning effect on the final forming of welding, which will lead to the failure of the product to meet the welding requirements. Ignoring the mastery of welding posture will affect the control of weld forming and welding defects, and seriously affect the quality of weld.

## **4 Curriculum teaching reform program**

### **4.1 Clear curriculum objectives adhere to the competition to promote learning**

In the process of developing vocational skills training ( welder level 3 ) training course, teachers formulate curriculum objectives according to the actual needs of students and the needs of society for future talents. Through the course study, students can complete the technical operation of the intermediate and advanced work of this type of work, have basic process analysis ability and operation skills for products ( parts ), be skilled in using, adjusting and maintaining the main equipment of this type of work, correctly use welder machinery and tools, have a good sense of safe production and civilized production, and develop a good teaching outline of professional ethics.

In the past two years, this course combines the existing facilities and equipment of the training room and the competition concept of the Tianjin ' Haihe Craftsman Cup ' vocational skills competition welding project, constantly innovates and practices the innovative ideas of ' welder vocational skills training + competition concept ', and promotes the reform and remodeling of teaching content, the innovation of teaching mode and the diversification of assessment methods. Let the results of the skills competition be popularized to all students, so that each student has the opportunity to contact the highest level of vocational skills development in various fields, and transform high-level technical skills into technical skills that can be accepted by all students. In the process of teaching, each competition project is optimized and analyzed, and the basic modules suitable for competition and teaching are extracted. [3]The specific contents include different materials, different welding methods and different welding positions. Students' training of these techniques can not only practice their own welding specifications and ' weld pool ' standards, but also transfer the practiced specifications and standards to the welder ( Level 3 ) skill identification project, which will achieve twice the result with half the effort in training technical skills.

### **4.2 Innovate teaching organization form and reform teaching methods**

In terms of teaching organization and implementation means, " student-centered " should be taken as the basic teaching strategy, and practical training, vocational skill appraisal and vocational skill competition should be integrated into one, so that students can learn and train in the environment of engineering site, find problems, analyze problems and solve problems in the process of practice. Through various teaching methods that are close to reality, the teaching effect and teaching efficiency are improved. The specific teaching organization forms include : modular teaching, comprehensive training, and competitive assessment. [4]

#### **4.2.1 Modular teaching**

Combined with the characteristics of the welding learning process, closely linked to the actual production, analyzed the competition project, and designed eight training modules, including electrode arc welding, argon arc welding, CO<sub>2</sub> gas shielded welding and other basic welding methods. With the help of different welding methods and welding positions such as plate docking and pipe docking, modular teaching is carried out, the difficulties of welding learning are decomposed, and the teaching content is connected in series, so that the welding nouns in the book are visualized and the scattered welding knowledge is systematized, so that students can demonstrate the theory in the practical training, the theoretical knowledge guides the practical training, and the spiral rising method improves the students' technical skills and engineering literacy. [5]

#### **4.2.2 Integrated training**

According to the teacher's own training experience, combined with the actual training situation of students, effectively adjust the training content and training plan, through sensory training, cross training, closed-loop training and other comprehensive training, so that students can achieve 'peace of mind, even breath, hand stability', so that students can quickly grasp the basic skills of welding in observation, feeling and understanding, understand the key to learning welding well, promote the effective transformation of knowledge to ability, so that students are more confident to learn relevant professional knowledge, actively participate in various competitions, so as to dare to do, know how to do and be able to do. [6]

#### **4.2.3 Competition examination**

The examination adopts the competition mode, the organization form, the assessment process, the score judgment and so on draw lessons from the vocational skill competition method, the students from the sign to the submission, the teacher from the inspection to the identification of the specimen, all in accordance with the competition process. It not only cultivates teachers' ability to organize competitions, but also allows students to experience the competition atmosphere in advance and objectively examine students' learning effects. [7]

#### **4.3 Integrate the craftsman spirit into the teaching content**

In view of the single problem of ideological and political form, the course carries out reasonable and effective design and integration of teaching content, focuses on summarizing and summarizing relevant knowledge content and course projects. In the teaching of welding training course, students can independently change the welding process plan, cultivate students' spirit of excellence and stimulate students' national pride. Teaching resources develop teaching materials containing ideological and political elements, and carry out ideological and political education in combination with course content and relevant cases. [8]

From the perspective of welding specialty, appropriate cases are selected, such as growth cases from Gao Fenglin, Zeng Zhengchao, Ning Xianhai, etc., to educate students in the classroom, make full use of the new era media, vocational education cloud platform, national teaching resource library, etc., and display relevant teaching content through videos, micro-classes, and pictures, so that students can understand the story of teaching content.

Through the teaching content project, adopt independent, inquiry and communication teaching methods, while creating a good teaching environment for students, guide them to understand the country 's strategy of firmly taking the manufacturing power. It makes students deeply understand that high-tech skilled talents are an important force to support China 's manufacturing and China 's creation, and then arouses students ' subjective initiative in learning, and stimulates students to take the road of skill success and skill serving the country.

#### **4.4 Give students more training time to pay attention to the basic operation**

In the study of traditional welding training courses, teachers perform operation demonstrations and students learn on the sidelines. This teaching organization form cannot bring more help to students ' learning. The study of welding training course is mainly about the level and process of welding technology, so the basic skills and operation skills of welding are very important. The main way to practice the basic skills and operation skills is to study hard, so teachers should transfer more classroom time to the students themselves. Students should carry out sufficient specimen welding practice and reasonable allocation of time practice in practical training, which can improve the efficiency of practice and enhance the effect of students ' practice. In the process of training, students are not afraid of mistakes. Training teachers must demonstrate and guide more, and constantly correct students ' wrong operation methods, which vary from person to person and teach students in accordance with their aptitude. The course trains the training content from shallow to deep, purposeful and targeted, continuously improves the existing problems, and gradually achieves proficiency and solid mastery of basic operation essentials and skills. [9,10]

The welding course learning is carried out in a project-based and competition-based way. After the teacher explains the basic knowledge clearly, the students first carry out the process arrangement and operation practice by themselves. In the process of observing the students ' practical operation, the teacher carries out specific guidance and infiltrates the theoretical knowledge into the practical teaching. Only when students fully expose their problems in the training class can they make rapid progress in the future practice and be familiar with each process. In the process of students ' independent inquiry, teachers should encourage students to use the method of group cooperation to explore. [11]

### **5 Teaching effectiveness and its promotion value**

In order to ensure the smooth implementation of the course, the course invites teaching supervisors to listen to the class many times to improve teachers ' teaching ability ; invite welding experts to guide many times to demonstrate the curriculum implementation plan ; communicate with students from time to time, improve teaching content and training methods according to students ' feedback, and ensure the achievement of curriculum objectives. [12,13]

In the study of welding course, on the basis of imparting students ' basic knowledge and skills of welding, teachers teach students how to learn welding knowledge and how to master skills quickly, learn in exploration and development, and actively communicate with teachers and students. Experience and experience have effectively mobilized the enthusiasm of students ; the students strive to overcome the difficulties of poor welding environment and great

occupational hazards, actively train, give full play to the educational function of the course, and realize the functional transformation of the course from "transmission" to "acquisition."

Through reasonable planning of time, improve the training arrangement, the use of 16 weeks of time, students lay a good foundation for welding, effectively improve the level of skills, combined with the analysis of the results of the final examination, 100% to achieve the level of senior workers. Many students said to continue training after class to prepare for the skills competition. After 10 weeks of participating in the course, a classmate participated in the 2023 'Songyang Craftsman' Vocational Skills Competition in Songyang County, Zhejiang Province under the guidance of teachers, won the winning award, and successfully obtained the three-level vocational skill level certificate of electric welder.

## 6 Conclusion

Through the reform and exploration of the welding training course, the curriculum system is more complete. Combined with the ability requirements of future professional posts, the actual needs of students and the national skill appraisal and assessment standards, we constantly optimize and adjust the teaching content, adhere to the competition to promote learning, innovate the teaching organization form, reform the teaching method, integrate the craftsman spirit into the teaching content, give students more training time, pay attention to the basic operation, make the teaching content more in line with the needs of students, make the course more forward-looking, more in line with the requirements of personnel training, and constantly promote the training of welding technical personnel.

## References

- [1] LU H L. (2015) Analysis of the practice and exploration of welding basic training. *Journal of Higher Education*, 17: 168-169. DOI:10.19980/j.cn23-1593/g4.2015.17.082.
- [2] FAN Q F. (2023) The exploration of ideological and political education in welding professional courses under the spirit of craftsman. In: *Academic Symposium on Teacher Development Forum of Guangdong Teachers' Continuing Education Association*. Guangdong. 377-380. DOI:10.26914/c.cnkihy.2023.019669.
- [3] WANG Y, ZHANG L Y, HANG J Z. (2020) Design of competition practice course oriented by new engineering talent training. *Experimental Technology and Management*. 37(8): 167-171. DOI: 10.16791/j.cnki.sjg.2020.08.036.
- [4] ZHANG J C, LAN M S, LAI X L et.al. (2022) Project-driven Innovation class: Innovative of New Forms of Teaching Organization in Applied Universities. *Research in Higher Education of Engineering*, 03: 74-78+95.
- [5] WANG Z W. (2020) Reform and Innovation of Creative Writing Teaching—Modular Teaching Design and Personalized Process Evaluation. *Review of Educational Theory*, 3(3):49-51.
- [6] YAO J. (2023) From the perspective of innovation and entrepreneurship education and modern apprenticeship system, the design and practice of penetrating comprehensive training room for mechanical and electrical majors in higher vocational colleges. *Science Educational Culture*, 2: 158-162.



- [7] WU R T, WEI L C, HUANG A L. (2021) Discussion on the integration of skill competition into the assessment and evaluation method of nursing training. *Ke Xue Zi Xun*, 45: 168-170.
- [8] HONG T, WU W J. (2023) Cultivate the craftsman spirit of a big country in ideological and political education. *Teaching Reference of Middle School Politics*, 19:104-105.
- [9] DOU H Q, ZHAI D J, SUN X J. (2019) Design and Practice of Intelligent Welding Skilled Talents Training Program -- Taking Sichuan Engineering Vocational and Technical College as an Example. *Kejifang*, 22: 29+35. DOI:10.19392/j.cnki.1671-7341.201922024.
- [10] KLEBANOV B, MUFAZALOV A, MYASOEDOV I, et al. (2016) Use of Plant Simulation for Improvement Technological and Business Processes of Metallurgical Manufacture. In: *Proceedings of the 35th China Control Conference*. Chengdu Sichuan. 1245-1248.
- [11] CAO H X, SHAN Z B, LIU Z F et al. (2021) Consideration on Organizing International Welding Skills Competition. *Welding Technology*, 50(11): 101-104. DOI:10.13846/j.cnki.cn12-1070/tg.2021.11.030.
- [12] WAGN H D, LIU Q, GUAN X, et al. (2023) Reflect on Curriculum Reform Based on OBE Concept under New Engineering Situation. *SCIENCE & TECHNOLOGY INFORMATION*, 21(1):170-173.
- [13] BARON J, CELAYA L M, WATKINS P. (2023) *Pragmatics in Language Teaching:From Research to Practice*. Routledge, New York. DOI: <https://doi.org/10.4324/9781003180210>.