Design and Application of BOPPPS Model in Welding Practice Course Teaching in Vocational Colleges

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Abstract. In order to highlight the characteristics of vocational college students in learning professional skills and emphasize the student-centered teaching philosophy. The article analyzes the prominent problems in current welding practice teaching, and guides the welding practice teaching steps through the process of BOPPPS model. It uses the unique methods of combining virtual and real, participatory learning, and multi project evaluation in professional course construction to mobilize students' enthusiasm for mastering operational skills. At the same time, it enhances the comprehensive ability of welding practice courses through diversified application design of the model.

Keywords: BOPPPS model; Welding practice course; Application capability

1 Introduction

Welding course teaching is a professional job assignment course offered by vocational colleges, and its unique operational performance and wide applicability have become the backbone teaching course of colleges. Welding practice course is a highly professional operation job, requiring teachers to have a high level of professional skills to guide welding operations, and requiring students to have a long training time to master welding skills. Considering the current teaching situation of welding practical courses in vocational colleges, factors such as younger teachers and short training cycles have become key obstacles for students to quickly and comprehensively master welding professional skills. Therefore, analyzing the characteristics of students in learning welding practical operation skills, clarifying the key and difficult solutions, it is necessary to develop a good practical teaching group training mode. The article applies the teaching mode of BOPPPS model in welding practice courses, guiding teaching through case-based task driven approach, interactive teaching through a combination of virtual and real methods, and student-centered participatory teaching, gradually forming a group training method suitable for practical operation courses to improve teaching effectiveness.

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2 The Current Application Status of the Teaching Mode of the BOPPPS Model

The BOPPPS model is a new teaching method widely used in Canadian Teacher Skills Training (ISW)[1], which plays an important role in mobilizing students' learning enthusiasm. The model mainly includes six parts: Bridge-in, Objective or Outcome, Pre-assessment, Participatory learning, Post-assessment, and Summary. These six parts are interrelated, not only clarifying teaching objectives, but also increasing the fun of the course and improving student learning efficiency. By introducing the overall process of teaching through projects, it is fully reflected in the good communication and interaction between teachers and students, achieving the requirements of mastering knowledge, skills, and literacy goals. The BOPPPS model course currently has a good application in theoretical courses, and the classroom atmosphere is significantly enhanced. However, its application in practical courses is relatively limited, mainly in terms of classroom regulation and group training, and there is a disconnect between each link. Therefore, it is necessary to comprehensively use various teaching methods to design a good BOPPPS model teaching plan for practical courses. By leveraging the characteristics of different stages of the model, the continuity of different tasks in the training project is maintained through the transition of content [2]. The step-by-step teaching of the BOPPPS model has a great role in mastering professional skills in vocational colleges, especially for welding, which is a highly practical, difficult to observe state, and difficult to master skills course. There is an urgent need to apply and design teaching methods.

3 Teaching Plan for Welding Practice Course under BOPPPS Model

The teaching of welding practical courses is a significant feature that distinguishes vocational education from ordinary higher education, and is an indispensable and important component of the complete education and teaching system in vocational colleges [3]. Therefore, in order to cultivate students with efficient and efficient welding operation skills, universities need to reform the overall teaching mode and update teaching methods in a timely manner, gradually use the BOPPPS model to guide teaching practice, and intersperse various teaching methods to improve teaching effectiveness. The various links of the BOPPPS model are interrelated and coordinated with each other. The pre class stage mainly includes three items: Bridge-in, Objective or Outcome, Pre-assessment, mainly including subject preview before class and transitional introduction of the learning content of this class; The in class session is Participatory teaching, mainly focusing on the learning of professional skills and the interaction between teachers and students to master key operations; The after-school session mainly includes a Post-assessment and Summary, which is a test of students' learning of operational skills and a summary of their strengths and weaknesses. Using this teaching plan, gradually cultivate students to learn by doing, to do while learning,

to guide practice with theory, and to promote the understanding and mastery of theoretical knowledge through practical operations.

3.1 Case Task Driven Theory Teaching

The Bridge-in part of the BOPPPS model is the starting point of learning, with the aim of making the learning of teaching subjects more closely related to students' psychological acceptance status, which can attract students' attention, generate interest, and stimulate motivation. Bridge-in is a good opening statement that needs to be carefully designed. Therefore, during the pre class preview stage, teachers can analyze the learning situation based on the current teaching objectives, carefully design online teaching content, publish pre class learning guides and tasks on the online platform, and use high-quality audio or video auxiliary materials to lay the foundation for the in class introduction. At the same time, students can gradually become familiar with the teaching content of this lesson through online learning, thereby solving the problem of traditional classroom teaching where the introduction time is too short to stimulate students' interest in learning. This can stimulate students' interest in self-directed learning and cultivate good learning habits [4]. In the pre class learning stage, by introducing specific real fault cases, students can vividly and concretely understand the professional knowledge and technical content that needs to be learned in this class. At the same time, teachers should also keep up with the times, break through the constraints of textbooks, appropriately introduce the latest literature reports, extend the knowledge scope of the course, and broaden the horizons of students [5].

Based on the practical teaching work of welding, for the learning of professional skills, teachers cannot directly introduce them through simple training subject chapters. Instead, they need to combine practical applications and create situational models for introduction and learning. Common fault repair cases should be used to describe and explain the various professional skill operations present. The welding operation methods required in the cases should be combined with daily training course subjects, and a task driven approach should be adopted to guide the transitional learning and mastery of practical operation subjects. This case driven teaching approach enables subject learning to be no longer singular, breaking away from the limitations of classroom teaching. It cultivates students to comprehensively apply specific practical operations to master skills and better grasp the crucial importance of key operations for case maintenance. At the same time, the enthusiasm for learning operational skills is improved, and the initiative for maintenance is strengthened.

3.2 Combining Virtual and Real Interactive Skills Teaching

The introduction of good subjects will stimulate students' desire and initiative to learn, achieving an eye-catching effect. However, the implementation of practical subject operation learning is the focus that needs to be paid attention to, because whether the maintenance of fault cases can be solved depends on whether the operation of skills is mastered. For the teaching of welding operation skills, most universities currently

adopt a state where teachers teach and students learn. The level of mastery of operation skills by students is often uneven, mainly due to the dark conditions during the welding process. Teachers are unable to provide detailed guidance on the effectiveness of student operations in a quantitative manner, resulting in a state where teachers have the ability to teach but students cannot learn for a long time.

Based on the above issues, the participatory teaching approach of the BOPPPS model can comprehensively utilize the combination of virtual and real teaching methods, and achieve mastery of operational skills through coordinated practice. The specific method is to combine various virtual methods such as simulation and virtual welding with practical operations for practical operation teaching. Firstly, in the theoretical knowledge explanation section of the welding practice course, finite element simulation software can be used to dynamically demonstrate specific welding melting methods and analyze the melting and forming mechanism of welding. For example, through the SYSWELD welding simulation software, the teaching content of the course can be integrated into the three-dimensional model of the welded part, and welding parameters can be dynamically set. Based on different welding parameters, the temperature field, stress, and deformation of the welded part during the welding process can be directly simulated. Making welding operations more vivid and concrete, students can gain a better understanding of the changing effects of welding pools through videos, which plays a good role in guiding the adjustment of welding process parameters in practical operations. This way of visually displaying course content through dynamic videos and images makes it easy for students to grasp the key and difficult points of teaching, thereby making students pay more attention to learning theoretical knowledge, deepening their understanding of key knowledge points, mobilizing their learning enthusiasm, and stimulating their interest in learning [6].

Secondly, For the practical operation of welding, virtual welding and practical welding are combined to test the effectiveness of practical operations through a transitional process from simple to complex and from basic to comprehensive. In the virtual operation section, students use a welding simulation training simulator to perform virtual operations on welding subjects. They conduct welding training in a virtual scene, cooperate with corresponding sound effects, and use VR immersive experience to practice the specific process of operating the subjects. Through virtual technology, the deformation process of the weld seam is realistically presented, so as to master the key points of various welding angles and postures, gradually form muscle memory, and make the learning process of the subjects no longer unfamiliar and the practical operation no longer rigid. At the same time, the virtual welding platform can monitor the operation trajectory and information data of operators in real time, and point out its existing problems after analysis[7].

Finally, In the specific practical operation stage, it is necessary to closely combine the process skills of virtual operation learning, and conduct inspections in real practical operations. The same welding techniques and operating steps should be used to compare and analyze the differences between virtual and real welding forming effects. At this time, teachers need to provide guidance and explanation in the specific practical operation stage, combined with the principles of welding and the effect of

the molten pool, to guide students to understand the key and difficult points of welding skills. This interactive learning method that combines virtual and real learning allows students to integrate theoretical knowledge learning with practical operation mastery, and can effectively combine operational skills with daily maintenance cases. It is of great help to improve students' comprehensive practical ability and ability to analyze problems independently, and has a good effect on improving their professional skills.

3.3 Participatory Interactive Training Teaching

For participatory learning in the BOPPPS model, it is the core and key link in the entire model, and an important stage in regulating classroom teaching. There are many ways of participatory teaching, such as group teaching, split classroom, flipped classroom, etc. This is mainly manifested in common theoretical courses such as questioning and discussion. However, there are fewer participatory learning methods in conventional practical training teaching. The main reason is that students have a longer period of personal hands-on practice, and there is not much communication and sharing between them. Therefore, it is necessary to comprehensively utilize multiple teaching modes to enhance the interactivity of participatory learning. The BOPPPS model is a student-centered and teacher led teaching model based on constructivism and communicative approach. Therefore, in response to the problem of poor student interaction, researching and designing a participatory interactive training teaching method has become the core highlight of this teaching model. This requires teachers to break away from the teacher centered teaching philosophy in curriculum teaching, and to be student-centered in the learning of knowledge and skills. Teachers should become guides for students to master their skills.

For the learning of welding practical operation skills, participatory interactive teaching should be reflected throughout the entire learning stage. Firstly, in the Pre-assessment section, students can verify the preview effect of the subject by simplifying welding drawings and completing virtual welding operations. The teacher compares and analyzes the submitted assignments, focuses on how to solve several key points based on common problems, and then distributes the task objectives to students, emphasizing the need to solve them in subsequent practice. Through this hybrid BOPPPS teaching model, the Pre-assessment is combined with student preview, and micro videos, image comparisons, and other methods are used to stimulate students' interest in learning, enabling them to unleash their potential for autonomous learning and further improve learning efficiency. At the same time, teachers can timely understand the situation of student preview, better adjust teaching priorities, and design participatory learning with targeted approaches[8]. Secondly, In the formal participatory learning stage, key questions from the course are raised by the teacher, and students are grouped for practical operations. The welding pool monitoring camera is used to observe the operation process of students and teachers. Students directly observe the welding wire position, melting state, posture, etc. during the operation process of teachers and themselves, record and display the welds completed by students[9].

Finally, In the post-assessment testing stage, group discussions and analysis are used to provide solutions. After practical operations, the effectiveness of each group's solutions is shared with each other, and the teacher promptly comments on their strengths and weaknesses. This type of student solves fault repair cases through participatory practical operations, gradually improving their mastery of professional skills through competitive and comparative operations between groups, truly achieving a deep understanding of professional skills learning.

3.4 Multi Project Evaluation Guided Teaching

A good teaching model must have a good test effect. Regarding the mastery of students' professional skills, teachers must establish a good evaluation method and provide reasonable and evidence-based ratings. The post-assWessment of the BOPPPS model is the process of evaluating the completion of classroom teaching objectives. For courses with strong welding practicality, the post-assessment part is the key to evaluating the mastery of operational skills. Therefore, a basic welding design question is added to the post-assessment activity to ensure that students can complete it through hard work, which not only enhances their confidence but also stimulates their enthusiasm for struggle[10]. At the same time, teachers can comprehensively evaluate the welding effect of students, evaluate the virtual operation of students through the evaluation system built-in in the virtual welding machine, and compare and analyze the shortcomings and improvements of each value, After the practical operation is completed, in response to welding quality issues, students can access welding operation videos offline through the welding simultaneous platform system, clearly see their welding effects, and receive guidance on how to improve or learn from mistakes. Then, a welding quality scoring table is issued, and each group searches for welding defects in the workpiece and records them in a timely manner. The teacher monitors the fairness of the records in a timely manner, and finally collects the quality scoring table, compares and analyzes the scores, and evaluates the overall student's mastery of operating skills.

4 Building the Application Capability of Welding Practice Course under the BOPPPS Model

The welding practice teaching plan under the BOPPPS model plays an important guiding role in the overall teaching development of the course. Through this task-based teaching method, not only can the teaching quality and effectiveness of the course be effectively improved, but it also has good practical effects in academic research and martial arts competitions. Systematic teaching under the application and BOPPPS model can stimulate students' interest in learning in academic research, exercise their ability to analyze and solve problems, and cultivate good spatial thinking and teamwork skills by actively applying for relevant innovative patents, small inventions, and small productions. At the same time, teachers can also cultivate relevant academic research and paper achievements, solve high-order and challenging practi-

cal fault maintenance problems through the combination of teaching and research, and the integration of expertise and creativity. In addition, combined with existing manual welding teaching, advanced robot welding technology is gradually adopted to enhance the depth of teaching, closely integrating teaching and research, and enabling students to engage in practical exercises in advance[11]. In the direction of martial arts competitions, it can stimulate students' spirit of hard work and progress. By participating in various levels of welding competitions, students can combine learning methods of welding inspection with project construction, and combine them with subject competitions such as the "Challenge Cup"[12]. Through project practice, students can exercise their practical application abilities, experience the effects of high-quality welding level, enhance their spirit of striving forward courageously, and enhance their professional skills of craftsmanship. At the same time, teachers can use the BOPPPS model to innovate welding skills and methods for education, cultivate students' innovative awareness, and cultivate their innovative design abilities. By writing small papers on welding technology, comprehensive welding technology design competitions, etc., teachers can continuously exercise students' innovative design abilities and professional qualities, and enhance their professional skills and job positions.

5 Conclusions

The welding practice course teaching under the BOPPPS model utilizes a case driven approach to cultivate good learning interests, utilizes virtual integration, participatory interaction and other forms to stimulate students' learning enthusiasm, and finally enhances their sense of achievement in skill mastery through diversified evaluation mechanisms. At the same time, combined with the course application and design construction under this model, the professional construction level of the course is gradually improved. The teaching application of this mode still needs to go through multiple polishing and implementation practices, and for various group training methods and ideological and political integration, it is necessary to strengthen planning and design in the course construction process.

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