Practice and Exploration of "CDIO+PBL" Blended Teaching Concept in Professional Background Courses

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Abstract. In the curriculum system of military academies, professional background courses are the bridge between military basic courses and first-time courses, and the key to train students to use engineering thinking to solve military problems. At present, there are some problems in teaching, such as unclear requirements for docking posts and ineffective integration of advanced teaching concepts, which restrict the improvement of teaching effect to some extent. This paper attempts to explore the integration of "CDIO+PBL" mixed teaching concept into the professional background course teaching, and puts forward the "six-step method" teaching process of "judging needs-sorting out ideas-creating problems-allocating resources-strengthening practice-evaluating effects", which provides new ideas and references for the development of military education.

Keywords: CDIO+PBL "mixed teaching concept · professional background course · engineering thinking · military education

1 Introduction

In recent years, President Xi Jinping has delivered many important speeches on military academy education and military personnel training. In November, 2019, President Xi Jinping emphasized at the opening ceremony of the training for the heads of all military academies that it is necessary to fully implement the military education policy in the new era, comprehensively implement the strategy of strengthening the army with talents, comprehensively deepen the reform and innovation of military academies, and put the training of talents in a more prominent position, so as to cultivate high-quality, professional new military talents with both ability and political integrity. Therefore, combining the characteristics of courses and integrating advanced educational concepts in military colleges and universities plays a vital role in cultivating new military talents.

CDIO teaching mode is a new engineering education mode, which represents conception, Design, implementation and operation [1]. It emphasizes the whole process from component development to equipment use as the carrier, so that students can learn engineering principles by active, practical and organic connection between courses in the learning process, and cultivate students' basic engineering knowledge, practical ability and teamwork ability.

PBL (Problem-Based Learning) mode is based on problem-oriented teaching [2], which emphasizes that in the teaching process, problems are the center, tasks and projects are the main line, teachers create problem situations and guide problem learning, and students solve problems by means of independent inquiry and cooperation, which promotes students' learning and knowledge inquiry, promotes the all-round development of students' comprehensive quality, and provides a platform for cultivating independent learning, cooperative communication and problem-solving ability.

The "CDIO+PBL" mixed teaching concept [3–6] organically combines problem guidance with engineering practice, adds a large number of practical activities, organically connects all knowledge points of the course, and enables students to learn the structure and principle of professional background courses in military academies in an active, practical and organic way, so as to achieve mastery through a comprehensive study and cultivate students' ability to learn independently and solve complex military engineering problems.

2   The Main Problems in the Teaching of Professional Background Courses

The professional background course in military academies is an important part of higher education in military academies, and it is a professional course to cultivate students' ability to analyze and solve military problems by using engineering principles. The leading course is the basic course of military affairs, and the follow-up course is the first-time course, which serves as a connecting link between the preceding and the following. Therefore, the teaching effect of professional background courses plays an important role in the generation of students' abilities. After a long period of teaching practice, a mature teaching system has been formed. However, with the continuous development of teaching models and changes in the demand for post abilities, the following three outstanding problems have gradually emerged in teaching.

2.1   The Requirements of Docking Posts are not Clear Enough

Although the background course is not directly oriented to the post, it can provide engineering ideas and methods for the post, and is the technical support for the first-time course. At present, some professional background courses focus on bringing general technical knowledge and local commonly used technologies into the classroom, and lack of effective integration with the post-serving troops' equipment. It is difficult for students to understand the principle realization process from the demand level, which is not conducive to the construction of reverse link system cognition.

2.2   The Integration of Advanced Teaching Concepts is not Effective Enough

With the deepening of teaching reform, a series of advanced teaching concepts such as "problem-oriented", "people-oriented" and "practice-oriented" are gradually implemented, and intelligent teaching methods are constantly updated. However, in the actual teaching process, due to too much attention to the intelligent application of advanced

teaching concepts, there is a lack of systematic and in-depth understanding of what students really need to learn, how to learn, and how to use them well, which leads to the phenomenon that they forget after learning and do not know how to use them.

2.3 Engineering Practice Teaching Links are not Systematic Enough

According to the requirements of the talent training program, practical teaching activities have been carried out in military basic courses, professional background courses and first-time courses. However, there are some repeated teaching phenomena, and the correlation among courses, courses and undergraduate graduation projects is weakened, lacking horizontal correlation and vertical depth. It is difficult for students to connect the knowledge points of courses to form a complete system, which leads to students only mastering scattered theoretical knowledge points in textbooks, which is not conducive to improving their comprehensive quality.

3 The Construction of "CDIO+PBL" Mixed Teaching Concept in Professional Background Courses

In order to solve the problems existing in current teaching, such as unclear requirements for docking posts, ineffective integration of advanced teaching concepts, and unsystematic engineering practice teaching links, this paper integrates the "CDIO+PBL" mixed teaching concept into professional background courses, which can further improve the teaching quality and lay a solid foundation for training new military talents.

3.1 Construction Ideas

The construction of the teaching system of professional background courses based on the "CDIO+PBL" mixed teaching concept should focus on job requirements, aim at students' ability generation, and design the whole link according to the "six-step method" teaching idea of "judging needs-sorting out ideas-creating problems-allocating resources-strengthening practice-evaluating effects". Form an organic interconnected and interlocking teaching closed loop, which can effectively promote the achievement of teaching effect. The "six-step method" teaching idea based on the "CDIO+PBL" teaching idea is shown in Fig. 1.

3.2 The Construction Process

3.2.1 Judge the Needs—Why Take This Course?

According to the talent training plan, we should find out the course orientation, deeply understand the connotation of military education policy in the new era, analyze the necessity of the course setting from three aspects: the course linking function, the post demand and the personal development demand, strengthen the students' correct cognition of the course from the demand point of view, make the course play its best role, let the students master the theoretical knowledge systematically, and at the same time, be more aware of the principle, realization and application behind it, which will provide a fulcrum for the next students to use engineering knowledge to analyze and solve military problems.
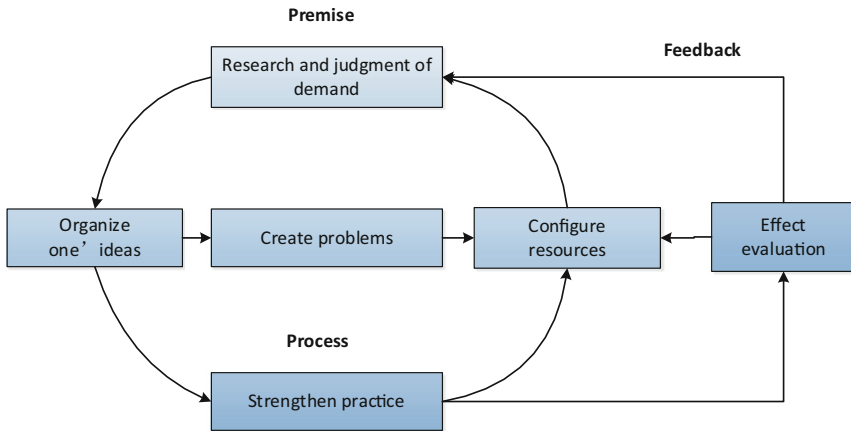
Fig. 1. The "six-step method" teaching idea based on the "CDIO+PBL" teaching idea

3.2.2 Sort Out Ideas-What Ideas to Choose for Teaching?

According to the syllabus, the expected goal and effect of students' learning through professional background courses are defined, and specific and clear course teaching ideas are established from three angles of docking follow-up course requirements, post requirements and personal development requirements, so as to realize horizontal integration and vertical penetration between courses and subjects within courses, improve the degree of connection and close integration, and cultivate students' engineering thinking.

3.2.3 Create Questions-What Questions are Designed to Guide Students?

As a connecting link between the preceding and the following courses, professional courses should be taught according to the needs of posts, pay attention to military needs and course characteristics from the perspective of combat application, and create scientific and reasonable military problems by combining combat cases and cutting-edge knowledge. The teaching contents are organically connected in series through question strings to stimulate students' interest in learning, which is helpful to realize the organic integration of principle knowledge and combat methods, and strengthen their firm confidence in winning future wars.

3.2.4 Organization and Implementation—What Method is Used to Achieve the Goal?

According to the characteristics of teaching contents and teaching objects, the teaching process should be reshaped, and the original form of classroom teaching should be changed to online and offline combination. Based on online resources, teachers can complete the independent learning of knowledge distribution. Based on offline resources, team members can complete the project learning task to the greatest extent by thinking collision, writing papers, questioning and answering questions, etc. Teachers can give

targeted guidance and explanation according to the completion situation and existing difficult problems, effectively improving students' ability to analyze and solve problems.

3.2.5 Strengthen Practice-Through What Activities Do You Strengthen Practice?.

Focusing on the generation of practical ability and engineering application ability, the practice teaching method of integrating teaching, learning and doing, such as theoretical explanation, equipment practice and experimental verification, is comprehensively adopted, and multi-level and diversified practice teaching activities are established, so that students can personally participate in the whole process of teaching conception, design, implementation and reflection, give full play to students' subjective initiative, realize the organic combination of theory and practice, simulation and installation, and effectively improve the practical innovation ability and engineering application ability of military academies.

3.2.6 Effect Evaluation—What Method is Used to Evaluate the Effect?

According to the specific objectives in the course implementation process, taking the generation of engineering application ability as the center, making full use of intelligent teaching platforms such as smart tablet and online courses, randomly testing and recording the achievement degree of the students' goals by topic, comprehensively adopting various evaluation methods such as process evaluation, after-class evaluation, mutual evaluation between teachers and students, etc., developing a diversified multi-level evaluation system, and supervising the generation of students' abilities in the whole process to ensure the effective achievement of the course teaching objectives.

4 Conclusions

Based on the professional background curriculum, this paper analyzes the theoretical knowledge of the "CDIO+PBL" mixed teaching concept, and combines with the main problems existing in the teaching of the current professional background curriculum in military academies, constructs a six-step teaching process of "judging needs-combing ideas-creating problems-allocating resources-strengthening practice-evaluating effects" based on the "CDIO+PBL" mixed teaching concept, and analyzes the implementation process in detail. Therefore, the integration of problem guidance and engineering practice can effectively improve students' learning interest, help to cultivate students' practical ability to quickly get familiar with military equipment, operate equipment, and deal with problems, maximize students' subjective initiative, and provide strong support for the integration of theory and practice teaching, so as to finally improve students' ability to apply engineering principles to solve complex military problems in teaching practice.

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