Exploration and Practice of PBL (Problem-Based Learning) Teaching Model in Post-position Course Teaching

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Abstract: Post-position courses in military academies bridge the final gap between students and their units, characterized by distinct post-position features and practical attributes. However, many practical challenges remain in fostering high-level thinking skills in students within these courses. With the continuous development of the times, traditional teaching models no longer align with the "student-centered" teaching philosophy and cannot adequately meet the training needs of modern military personnel. The PBL (Problem-Based Learning) teaching model, characterized by problem-based, student-centered, being teacher-guided, and aimed at developing students' abilities, can partially achieve a role transformation for teachers and students in the classroom, allowing students to participate more actively in classroom teaching and proactively construct knowledge. Based on the characteristics of post-position courses in military academies, this paper analyzes the advantages of applying the PBL teaching model to postposition courses from the perspectives of students, courses, and instructors. Through practice in the airport navigation lighting support course, the paper summarizes the difficulties of implementing PBL teaching in post-position courses and proposes suggestions and recommendations. providing references for educational and teaching reform in military academies and the cultivation of new military talents.

Keywords: PBL Teaching Model; Military Vocational Technical Education; Post-Position Courses; Teaching Methods

1. Introduction

The new era military education policy emphasizes that military academies should cultivate high-quality, professional, and morally competent new military talents. In the new era, new combat theories have rapidly developed, a large number of new equipment has been inducted into the troops, and the pace of updating and developing is continuously accelerating, with the form of warfare evolving towards intelligence. Sergeants are the users and maintainers of military equipment, and their capability levels impact the generation of combat power. The post-position courses in military vocational technical education serve as the "last mile" before students graduate, characterized by distinct military professionalism, job orientation, and practical dependency, aiming to cultivate vocational and technical talents with strong practical abilities. Traditional teaching methods focus on knowledge transmission, neglecting the cultivation of students' thinking abilities. Against this backdrop, this paper introduces the PBL teaching model into the post-position courses of military academies, aiming to cultivate students' application of knowledge and future professional skills, with a greater emphasis on the cultivation of comprehensive abilities such as innovative thinking and teamwork.

2. Analysis of the Connotation of PBL Teaching Model

The PBL (Problem-Based Learning) teaching model was proposed by American scholar Barrows, initially applied in medical education. Its main method is problem-based teaching, where teachers create scenarios that meet course content requirements, allowing students to conduct self-directed learning around the problems that need to be solved within these scenarios. This teaching model aligns with the widely accepted "student-centered" concept in the education community and coincides with the constructivist teaching theory, where teachers primarily create scenarios, organize interactions, and provide scaffolding during the teaching process, ultimately enabling students to construct knowledge through selfdirected learning and group collaboration. The main characteristics of this teaching model are "problem-based, student-centered, teacherguided, and aimed at cultivating students' abilities" [1]. Currently popular teaching methods such as the situational teaching method [2], case teaching method, and project teaching method [3] are essentially driven by problems or tasks to transform students' roles from passive knowledge receivers to active knowledge explorers and constructors. Of course, this process also changes the classroom positioning of students and raises higher requirements for teachers' capabilities.

3. Advantages of Applying the PBL Teaching Model in Military Academy Postposition Courses

3.1 Fully Enhance Students' Learning Initiative

Military academies differ from civilian universities in that they possess both the educational attributes of regular universities and the management attributes of the military. In addition to completing their academic studies, military academy students must also engage in physical training, collective activities, and various duties, leaving them with less self-study time compared to civilian universities. Obedience to orders is a fundamental requirement for military academy students. This sense of military discipline influences students' learning activities to a certain extent, with students' thinking and the academy's teaching activities often remaining within the realm of traditional education. The mainstream teaching model is one of classroom indoctrination, resulting in generally low learning initiative among students.

Compared to traditional teaching models, the PBL teaching model emphasizes students' proactive acceptance of knowledge, thereby enhancing their learning initiative. Teachers create scenarios, carefully select and design teaching problems, and actively guide students to participate in classroom teaching activities in groups, discuss and present their findings, and finally summarize and provide suggestions. This process cultivates students' abilities for self-directed learning and group collaboration. Driven by problem-solving, students' thinking abilities are trained, classroom participation increases, enhancing their interest in learning, and group discussions improve their teamwork and language organization skills, all of which meet the requirements for cultivating new military talents.

3.2 Effectively Improve Students' Postposition Competence

Post-position courses are core courses in the integration of higher education and vocational education in military academies, aimed at cultivating students' initial job competence. These courses are characterized by distinct military features and job orientation, with teaching content often sourced from the military, requiring quick updates and high levels of realism. The goal of military vocational technical education is to cultivate highly skilled and high-quality military personnel who are generally required to have the ability to manage and maintain equipment and facilities, operate them, and diagnose and troubleshoot faults. These abilities manifest as high-level thinking skills for solving practical military problems [4]. The traditional classroom-based teaching model is somewhat inadequate in cultivating these abilities.

Under the PBL teaching model, teachers can use actual military work and complex battlefield environments as backgrounds to create "chaotic and poorly structured" scenarios based on real cases, making problem scenarios the center of learning organization [5]. For military students, solving practical problems such as equipment malfunctions, special security situations, and sudden tasks is a key reflection of their future job competence, and these can all be set as problem scenarios and brought into the classroom. Students, as problem solvers, need to have basic knowledge for problem-solving as well as critical thinking skills, adaptability, and the ability to find and use learning resources, all of which are particularly important for future military positions in combat contexts.

3.3 Truly Achieve Mutual Teaching and Learning

With the adjustment of military structure and the continuous improvement of national education levels, the level of military students has been rising annually, and their learning foundation is generally good. The requirements for their cultivation and their learning abilities have significantly changed compared to the past. In traditional teaching models, teachers play the leading role in the classroom, transmitting knowledge to students through lectures, while students mostly play the role of listeners. This single teaching method of "teacher transmission—student reception" limits students' classroom participation and restricts teachers' proactive awareness in course development [6].

Unlike traditional teaching, the PBL teaching model assigns more tasks to teachers. Teachers are no longer limited to preparing courseware, lesson planning, and lecturing; they need to become qualified guides and organizers in the classroom. Students focus on thinking about, discussing, reporting, and evaluating problems, becoming the center of the classroom. In this kind of classroom, teachers must control the overall pace and address various questions which requires from students, higher professional quality and extensive preparation work around case problems. In this process, students improve their thinking abilities, and teachers enhance their teaching levels, truly achieving the effect of mutual teaching and learning.

4. Application of the PBL Teaching Model in the Airport Navigation Lighting Support Course

The research team explored the application of the PBL teaching model in the Airport Navigation Lighting Support course, focusing on problem presentation and problem-solving. Classroom teaching revolves entirely around problems, primarily designed around the operation and troubleshooting of the airport navigation lighting system. The teaching process is divided into "presenting the problem" \rightarrow "analyzing the problem and collecting data" \rightarrow "classroom reporting and mutual evaluation" \rightarrow "teacher commentary and summary" \rightarrow "verification and problemsolving." During this process, classroom teaching is mainly conducted in the form of cooperation and discussion.

4.1 Constructing the Teaching Content System in Modules

The "Airport Navigation Lighting Support" course is divided into six modules and 22 knowledge units based on typical tasks in military airport navigation lighting support: Overview, Low-Voltage Distribution Equipment Maintenance, Constant Current Regulator Maintenance, Navigation Lighting Monitoring System Maintenance, Navigation Lighting Circuit Maintenance, and Optical Testing of Navigation Lighting. Except for the overview, the other five modules focus on the main components of the navigation lighting system, with the theoretical foundation being the equipment's structural composition and electrical/optical knowledge, and the main teaching content being equipment operation, maintenance, and troubleshooting [7].

4.2 Presenting the Problem

Presenting the problem is a critical step for the successful implementation of the PBL teaching model. Before class, the teacher designs the problems, and each study group focuses on solving them. These problems should include the content of the airport navigation lighting system course and have a certain degree of exploration to stimulate students' learning enthusiasm. During lesson preparation, the teacher designs a series of problem topic modules based on the teaching plan, learning objectives, and teaching content, creating problem scenarios combined with actual military support and laboratory equipment [8]. They provide relevant literature and MOOC resources, encouraging students to find information and analyze problems independently. Taking Module 3 "Constant Current Regulator" as an example, the paper introduces how problems are designed. According to the composition and performance requirements of the airport navigation lighting system, the constant current regulator, its operation and maintenance, commissioning, and fault diagnosis and handling, five learning modules are set up, and several problems are presented (Table 1).

4.3 Analyzing the Problem and Collecting Data

The course team, based on the number of students and learning ability survey results, formed groups of five students, with fixed group members and rotating group leaders. Before officially starting the course, each group, using the information resources provided by the teacher, searches for data and engages in self-study both online and offline, then conducts group discussions and finally consolidates the discussion results. Given the characteristics of post-position courses, teachers need to open the laboratory to students as needed and appoint safety officers and laboratory supervisors to ensure compliant equipment operation and electrical safety.

Table 1. Learning Modules and Problems in the "Constant Current Regulator" Chapter

Chapter	Learning Module	Problem Presentation
Constant Current	Composition and	Problem 1: What is the composition of the airport navigation
		lighting system?
	Requirements of the	Problem 2: What are the performance requirements of the airport
	Airport Navigation	navigation lighting system?
	Lighting System	Problem 3: On what basis are the performance requirements of the
		airport navigation lighting system proposed?
		Problem 1: What are the main structures of the constant current
		regulator, and what are their functions?
	Constant Current	Problem 2: What is the principle of constant current dimming in the
	Regulator	regulator?
		Problem 3: What impact does sawtooth wave voltage have on the
		lighting circuit, and how to solve it?
		Problem 1: How to complete the light level adjustment and check
Regulator	Operation and	the light level, current, and voltage operation?
Maintenance	Maintenance of the	Problem 2: How to implement the light grading and accuracy check
	Constant Current	of the constant current regulator?
	Regulator	Problem 3: How does the military conduct the above work, and
		what are the specific requirements?
	Commissioning of	Problem 1: How to perform short-circuit testing and load testing?
	the Constant Current	Problem 2: Under what circumstances is it necessary to calibrate
	Regulator	the constant current regulator, and how to operate it?
	Fault Diagnosis and Handling of the Constant Current	Problem 1: What are the common faults of the constant current
		regulator?
		Problem 2: How to identify and handle fault codes of the constant
	Regulator	current regulator?
		Problem 3: Complete the handling of E01-E02 faults in groups.

4.4 Classroom Reporting and Mutual Evaluation

In the classroom, group leaders report their group's discussion results using various methods such as oral presentations, PPT demonstrations, or practical demonstrations. After the reports, groups conduct mutual evaluations. This process primarily examines students' self-study status and achieves the goal of identifying and addressing gaps through inter-group evaluations [9].

4.5 Teacher Commentary and Summary

After students complete their reports and mutual evaluations, the teacher needs to comment on and summarize the discussion results formed by the students. This process is crucial and is also a direct reflection of the teacher's teaching ability. For the reporting results and solutions proposed by the students, the teacher should appropriately supplement and deepen, systematically summarizing the learning content to help students construct a complete knowledge system.

4.6 Verification and Problem-solving

The problems in military post-position courses are primarily practical. Students not only need to understand the equipment structure and working principles but also need to master specific operational methods. Based on this, for issues like equipment operation, maintenance. troubleshooting, and after students' results reports and teacher summaries, it is necessary to verify the solutions relying on laboratory equipment. In this process, based on operational work cards, the teacher, under the premise final problem-solving that the implementation plan is operable, guides students to complete the plan's implementation and verification, ultimately solving the

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problem [10].

5. Challenges in Applying the PBL Teaching Model in Military Academy Post-position Courses

5.1 Ensuring Teaching Problems are Closely Aligned with Actual Job Requirements

Post-position courses need to be job-oriented, meeting knowledge goals while also exceeding requirements to cultivate students' job innovative thinking and problem-solving abilities, achieving competency goals. In the problem-based PBL teaching model, how problems are set determines the achievement of these goals. Firstly, thorough investigation and research are essential to ensure that teaching content is synchronized with actual military practice. Before each teaching session begins, the research team takes advantage of opportunities like soldier vocational skill identification to deeply understand the current status of navigation lighting support in the military. This includes reflecting updates in equipment and new working methods in the teaching design. Secondly, staying abreast of the latest developments in the field, integrating the latest achievements in civil aviation and international navigation lighting systems into teaching, thereby proposing advanced problems to foster students' innovative thinking abilities. Lastly, establishing a problem update mechanism is crucial. The course team refines problems based on actual military practice and various research projects, and valuable problems raised by students during the teaching process are consolidated into the problem topic modules after the course ends.

5.2 Ensuring Smooth Implementation of Students' Self-directed Learning

One major advantage of the PBL teaching model is its ability to enhance students' learning enthusiasm. However, this does not guarantee that students will necessarily engage in self-directed learning activities as arranged by the teacher, which is a critical part of the PBL teaching process. This requires teachers to intervene in various ways. Firstly, the problems designed by teachers should be targeted, practical, and exploratory, effectively stimulating students' learning enthusiasm and connecting with the cultivation of humanistic qualities to foster students' sense of job responsibility and mission. Secondly, during group formation. students should be reasonably paired based on their learning abilities and sense of responsibility, ensuring each group has an appropriate "leader" to positively drive the group's activities. Lastly, changing the course evaluation method is essential. Classroom reports, inter-group evaluations, and teacher commentary should be integral parts of formative assessments, with recognition and score rewards for students who play significant roles in the groups. Implementing a "one-vote veto" in practical assessments is also necessary. Moreover, effectively integrating teaching resources is important. Teachers should preselect and provide relevant MOOCs, microcourses, textbooks, regulations, and reference books to students, ensuring they have reliable learning resources.

5.3 Reasonably Controlling Classroom Pace

As guides and organizers in the classroom, need teachers to organize classroom discussions and reports while ensuring the entire teaching process revolves around the lesson's teaching objectives. Firstly, during pre-class teaching design, clear teaching objectives should be established, distinguishing between key and difficult points, and following the OBE (Outcome-Based Education) teaching theory, ensuring all activities are goal-oriented. Teachers must ensure classroom activities stay on topic. Secondly, during classroom teaching, teachers should timely adjust the pace, reasonably allocate time, allowing students to fully present their results while reserving time for guidance and summary, helping students strengthen and enhance their self-directed learning foundation. achieving an "enlightening" effect. Lastly, during practical sessions, reasonable task allocation is necessary. Limited laboratory resources should be used to complete plan verification, ensuring each student gets practical training. The method adopted in this paper is to select the best group plan after student reports and discussions, which is then refined by the teacher and verified by the group, while other groups conduct training during extracurricular time. A practical assessment session is set up where students randomly select problems to solve.

6. Conclusion

To adapt to the new era's military talent cultivation goals and meet the needs of the military for sergeants, this paper applies the PBL teaching model to the Airport Navigation Lighting Support course, initially establishing a new PBL teaching system for post-position courses. This model better aligns with the objective requirements of cultivating highbroad-based technical talents, quality, achieving a shift in classroom focus towards students from various aspects, including the attainment of teaching objectives, participation in the teaching process, and completeness of teaching evaluation, resulting in excellent teaching outcomes.

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