

Teaching Reform of Mechanical Design Foundation Course in Military Academy

Pei Feng^{1, a}, Ning Shan^{1, b}, Yuhua Shi^{1, c}, Rongrong Feng^{1, d}, Peng Shang^{1, 2, e}

¹ School of Equipment Management and Support, Engineering University of PAP, Xi'an 710078, China;

² School of Mechanical Engineering, Xi'an Jiaotong University, Xi'an 710048, China.

^a83101958@qq.com, ^b

ssnn3193@163.com, ^c359887953@qq.com, ^d395391315@qq.com, ^esipone@163.com

Abstract. Mechanical design foundation is a main basic course for cadets majoring in mechanical background in military academy, which lays a solid theoretical foundation for the subsequent job training courses. In view of the particularity of cadets and the problems existing in the traditional teaching process, a new teaching mode (point, ability and pattern, PAP) is given and the course teaching reform is discussed from two aspects: teaching model and teaching content. The PAP teaching mode could promote cadets' learning enthusiasm and initiative effectively and greatly improves the teaching effect of mechanical design foundation course.

Keywords: Mechanical design foundation; military academy; teaching mode.

1. Introduction

As a specialty background course in military academy, mechanical design foundation is launched to make cadets understand the common principles of mechanical transmission mechanisms. Beyond that, cadets should know the selection principle and application method of mechanical parts after learning. Combined with the problems existing in the traditional teaching process of this course, this paper proposed a teaching mode consisting of three teaching modules: point module, ability module and pattern module. The purpose is to cultivate cadets' professional knowledge and practical skills, and to focus on strengthening the training of cadets' innovation ability and skills, to develop the theoretical basis and application ability suitable for the post requirements, so as to lay a solid foundation for the military to move towards informatization and intelligentization [1, 2].

2. The PAP Teaching Mode

The PAP teaching mode is the abbreviation of "Point", "Ability" and "Pattern". It strives to logically sort out and summarize the complicated knowledge system, and continuously strengthen it by using multiple practical teaching patterns. The ultimate goal of the PAP teaching mode is to make students steadily establish their knowledge structure and self-learning ability. It promotes students to form an internal driving force for learning. The specific implementation structure of the PAP teaching mode is shown in Fig. 1.

The teaching objectives of mechanical design foundation course are promoted step by step. According to the specific situation in teaching, we apply knowledge structures, task-driven, mutual assistance discussion, diversified communication, knowledge review and other flexible cooperation in teaching process. At present, the basic goal of exploring teaching mode is to repeatedly consolidate and strengthen the foundation and finally complete the teaching task with high quality.

Based on this goal, the teaching implementation strategy of the PAP teaching mode should be mainly applied in three aspects: First, we should guide students' learning enthusiasm and initiative to form a preliminary systematic knowledge chain structure of course knowledge. Secondly, the core goal is to enhance students' autonomous learning ability and improve teaching quality and effect. Finally, we should cultivate students' spirit of combining theory with practice which completely enhance their professional ability, innovation ability and practical operation ability.

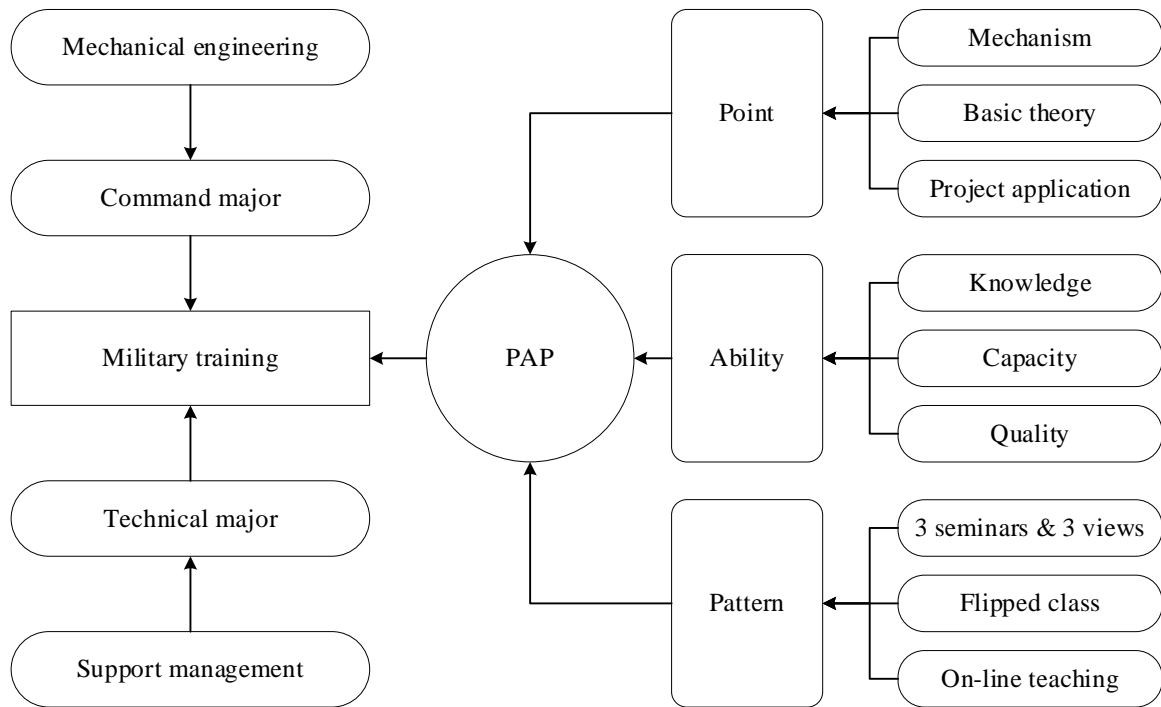


Fig. 1 Structure of the PAP teaching mode

The purpose of the PAP teaching mode is to fully integrate three teaching strategy modules: condensing knowledge points, improving professional ability and improving teaching pattern. The specific design idea is as follows: First of all, this teaching model tailor-made differentiated design plans for different backgrounds and majors offering the course mechanical design fundamentals and for different shifts of students. Secondly, the teaching mode will summarize the isolated basic knowledge points and form a logical systematic knowledge system. Among them, a variety of teaching methods are involved in the specific teaching process. Various mechanical design cases are taken as the starting point, and immersion scenarios are introduced into learning and role-changing learning modes to continuously consolidate and improve students' basic knowledge. Finally, the teaching mode subdivides students' inner professional ability consciously and runs through the whole teaching process. Through all kinds of mechanical practice innovation activities to test, and achieved a good teaching effect. To sum up, the key support for the design and implementation of the PAP teaching mode lies in the invocation and specific arrangement of various teaching means.

3. Point, Ability and Pattern

3.1 Condensing Knowledge Points

This teaching mode focuses on the mechanical principle module and the mechanical design module two categories of knowledge modules in series, which are summarized into three teaching levels: aware, know and apply. The Specific implementation structure is shown in the figure 2.

The basic idea can be implemented in the teaching process as follow. First, arouse curiosity with practical problems. Second, combine with theories and summarize the main points. Finally, explore specific solution. For technical majors, focus on explaining the connotation mechanism and basic concepts. For command majors, focus on basic concepts and engineering applications. To do this, the teacher must be extremely proficient in this course and the relevant knowledge. Then, the teacher would know exactly which knowledge points must be mastered by students, which knowledge points can be generally understood. According to this, the knowledge structure of each chapter was sorted out, and the courseware was carefully prepared.

Only by doing that, the teacher can establish a logical system of knowledge with constantly inspiration. After students feel the teachers' enthusiasm and knowledge, they can actively cooperate and resonate.

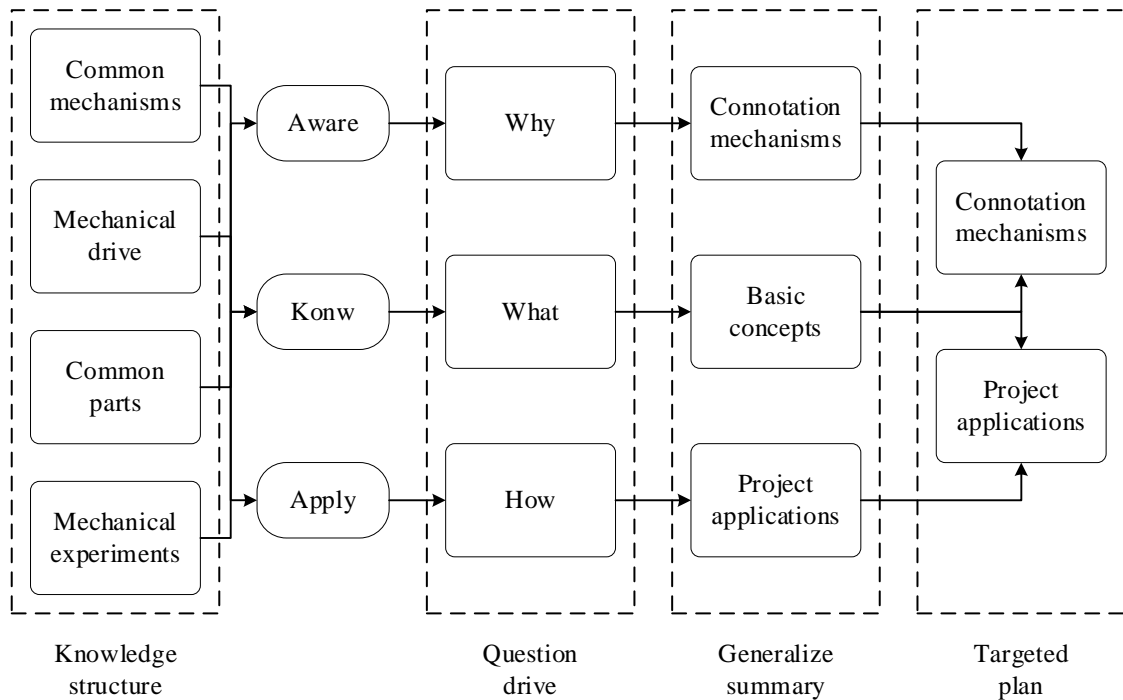


Fig. 2 Diagram of condensing knowledge points

3.2 Improving Professional Ability

In terms of improving professional ability, the cultivation of professional ability is always through the teaching of mechanical design foundation. According to interest group, innovation competition and other driving force, independent learning, hands-on operation and team cooperation ability, students could master professional knowledge, use professional skills and professional quality. And for the cultivation of professional ability, the online+offline multi-teaching platform has been built. On the one hand, a non-lethal weapons online website has been developed to facilitate students' autonomous learning. On the other hand, the equipment engineering laboratory has been built to facilitate the actual teaching. At the same time, construction of practical education base to carry out on-site teaching.

3.3 Improving Teaching Pattern

Aiming at cadets, how to improve the teaching model under the established class requirements to improve students' class learning efficiency has become the key reform object of the teaching model. The Specific implementation structure of improving teaching pattern is shown in the figure 3.

First of all, "3 seminars" and "3 views" towards teaching cycle should be coordinated well. That is, the teacher should hold the preparatory seminar before class, the discussion seminar during class and the conclusion seminar after class, so as to help students accomplish pre-class preview, during-class view and after-class review. By observing students' learning situation, teachers can adjust the teaching pace to ensure the teaching quality.

Meanwhile, for some simple content, the teaching subjects could be exchanged through the implement of flipped class. Before class, students are guided to learn independently through task driving, and then they would be preliminarily familiar with the key and difficult content of the course. During class, students are invited to be the teaching subject and the teacher is transformed to be a listener.

Furthermore, the teacher should guide the students to complete the lesson properly, record the students' logical ideas, and explain the advantages and disadvantages of the process. The benefit of this exchange pattern can mobilize students' enthusiasm to participate in class-teaching. For the less theoretical chapters, students are permitted to give the lecture as much as possible. In this mode, the teacher changes from content teaching to method teaching, while the students change from passive listening to active learning.

Additionally, students have rights to evaluate all groups involved in the class. The standards are formulated to combine group mutual evaluation, group self-evaluation and teacher evaluation. Then the final score are calculated according to a certain weight. By the end of the semester, the teacher links flipping class scores with the formative assessment, so as to stimulate the motivation and enthusiasm of students' independent learning.

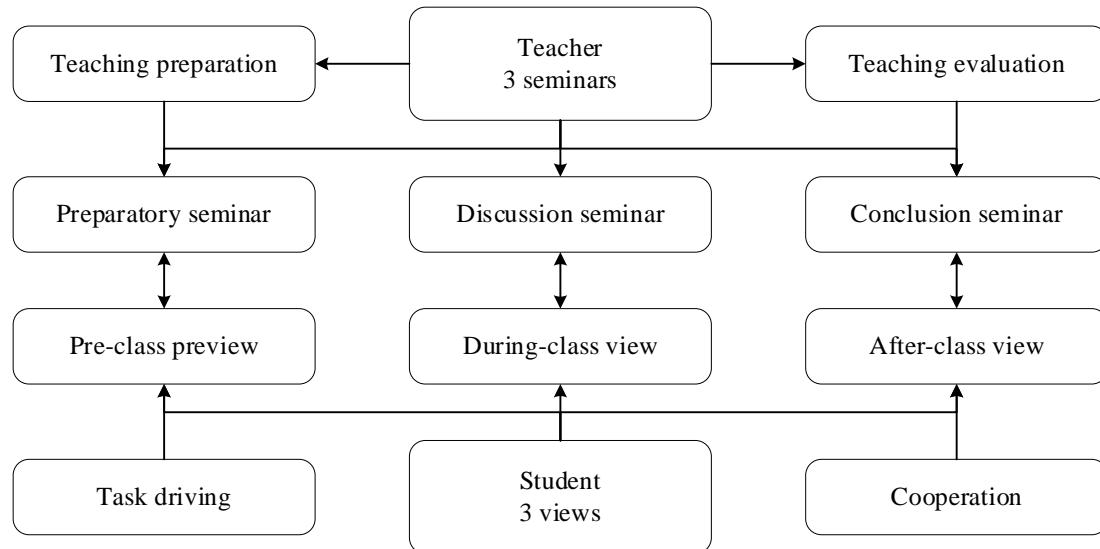


Fig. 3 Diagram of Improving Teaching Pattern

4. Summary

PAP teaching mode consists of three teaching modules: condensing knowledge points, improving teaching pattern and improving professional ability. Also, PAP is the abbreviation of People's Armed Police. From the current preliminary implementation effect, the teaching concept of the teachers' team has been updated, and the teaching effect has been improved to some extent. However, there are still some problems to be reconciled in the connection between the innovation of teaching mode and the actual teaching resources and conditions. The positive improvement and adjustment of the teaching mode is the prerequisite to improve the teaching quality of mechanical design foundation course.

References

- [1]. Jeffery A McNally, et al. Teaching leadership at the U.S. Military Academy at West Point. The journal of applied behavioral science. June (1996). p. 175-188.
- [2]. Qin Lili. Research on constructing the teaching mode of Basis of Mechanical Design based on "learning through race". Journal of Hunan Post and Telecommunication College. Vol.15 (2016) No. 4, p. 129-132.
- [3]. MIAO Hong-bin, QIAO Feng-li, BO Rui-ying, et al. Research on hybrid model of mechanical foundation courses based on lecture in large class and discussion in small class. JOURNAL OF MACHINE DESIGN. Vol.35 (2018) No. 2, p. 242-244.