

Application of Project-driven Teaching Mode in The Teaching of Pump and Pumping Station Course

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Abstract

Course of pump and pumping station is one of the most important core courses in agricultural water conservancy engineering specialty, which plays an extremely important role in cultivating applied talents in agricultural water conservancy engineering. Based on the main problems existing in the practical teaching of pump and pumping station course in application-oriented universities, this paper puts forward the suggestion of adopting project-driven teaching mode in the course teaching, analyzes the general principle of implementing project-driven teaching mode in the course of pump and pumping station, and introduces the key links of applying project-driven teaching mode in detail from the aspects of project construction, implementation and evaluation.

Keywords

Project-driven teaching mode, Pump and pumping station, Application-oriented university.

1. Introduction

In recent years, with the rapid development of industrial and agricultural production, science and technology, the construction of large-scale low-lift pumping stations in the inter-basin water transfer project of South-to-North Water Transfer Project, the improvement of urban flood control standard system, regional agricultural irrigation and drainage planning and the implementation of the renovation of large and medium-sized pumping stations nationwide, the demand for applied agricultural water conservancy engineering professionals with deep theoretical foundation, rich historical literacy, solid practical ability and ability to meet the requirements of modernization and intelligent construction has increased sharply. Therefore, the development of application-oriented undergraduate agricultural water conservancy engineering specialty is facing unprecedented strategic opportunities, and at the same time, it also puts forward new requirements and challenges for teachers in application-oriented undergraduate universities in teaching reform [1]. With the rapid development of popularization of higher education, the teaching goal of application-oriented undergraduate is to cultivate high-level professional practical talents with application, compound, skill and innovation, so as to meet the urgent need of high-quality development of economic and social wisdom empowerment.

As one of the important core courses of agricultural water conservancy engineering, pump and pumping station covers a wide range of field knowledge, emphasizes practicality and practicability, and has high professional comprehensive requirements. In the planning and

design of agricultural irrigation and drainage system, the irrigation and drainage pump station project are a key component of the water conservancy hub building, and its safe, stable and efficient operation is very important for ensuring the national food production safety and solving the problems such as flood disaster, drought and water shortage. Through the systematic study of this course, students will master the basic knowledge, basic theory, energy characteristics, cavitation characteristics, working condition determination and adjustment of pumps, and be able to independently complete the engineering design tasks of irrigation and drainage pumping stations, including the selection of pumps and motors, the structure of pumping stations, the design of water inlet buildings and water outlet buildings of pumping stations [2]. For undergraduates in application-oriented universities, because this course involves complicated theoretical knowledge, including a large number of hydraulic machinery principles and related formula derivation and deep reasoning in hydraulic engineering design, students always feel abstract and difficult in learning this course, and it is very challenging to understand and master the knowledge points of the course. However, this course is not only professional and practical, but also suitable for the design of pumping stations in agricultural irrigation and drainage systems. It can also be widely used in urban and township water supply and drainage, urban water supply and water source projects, inter-basin water transfer projects and other fields, and its teaching quality directly affects students' learning in the follow-up courses and the effect of improving their professional quality. Therefore, in the teaching of water pump and pumping station, teachers should comprehensively use a variety of innovative teaching methods to help students master the theoretical knowledge of water pump and pumping station more comprehensively and fully.

2. Teaching Status

2.1. Weak knowledge base

The course of pump and pumping station covers many disciplines, including mathematics, mechanics, machinery and so on. Students need to master advanced mathematics, engineering hydrology and hydraulic calculation, theoretical mechanics, hydraulics, material mechanics, structural mechanics, soil mechanics, reinforced concrete structure, electrotechnics and electrical equipment, hydraulic structures and hydraulic engineering construction, and integrate and construct the professional knowledge system of agricultural hydraulic engineering, so as to deeply understand and master the contents of the course of pump and pumping station. However, undergraduate students in application-oriented colleges usually lack a solid theoretical foundation, and some contents of the course of pump and pumping station lack the necessary basic knowledge, which directly affects the teaching effect of the course.

2.2. Single and outdated teaching mode

The theoretical knowledge system of pump and pumping station course is complicated, the formula derivation is monotonous and tedious, and the professional concepts and definitions are abstract, so the traditional indoctrination teaching method is often relied on in the teaching process. This method is difficult to stimulate students' interest in learning and innovative thinking, and can not effectively mobilize students' subjective initiative. Therefore, students often have resistance to learning, and their enthusiasm for learning is significantly reduced, which seriously affects the teaching quality and effect of the course.

2.3. Divorced from practice

Pump and pumping station is a course combining theory with practice, which covers the basic knowledge and theory of water pump, including the experimental content of main performance such as energy characteristics and cavitation characteristics. In the design of pumping station

engineering, students need to master practical skills such as pump selection, determination and adjustment of pump operating conditions. However, although more class hours are arranged in the course, the class hours of experimental teaching are seriously insufficient, and even there is a problem of insufficient experimental equipment configuration. This makes it difficult for students to fully consolidate and verify the theoretical knowledge they have learned in class and to form a deeper grasp and understanding of the theoretical knowledge. Although practical links are set up, due to unreasonable arrangement of observation, implementation, evaluation and summary in experimental activities, students' participation is insufficient and their subjective initiative cannot be effectively mobilized. This situation leads to poor learning effect, and students' practical ability and innovative thinking have not achieved the ideal training effect. Therefore, in order to improve the teaching quality and effect of the course, it is necessary for professional teachers to reform the traditional teaching mode to ensure that students can really apply and consolidate their theoretical knowledge in practice, so as to cultivate their practical ability and innovative thinking.

3. General Principle

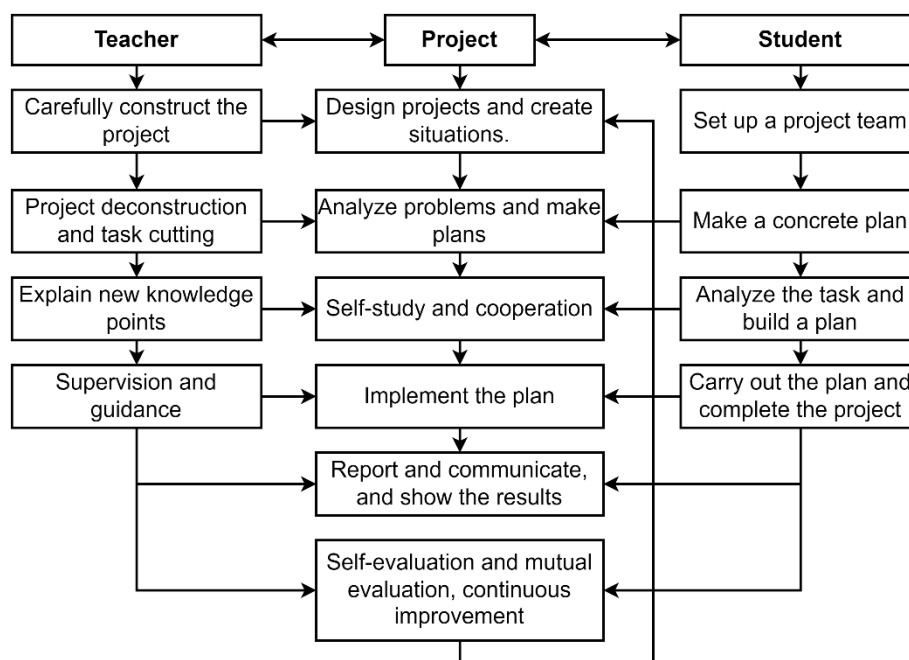


Figure 1. Key links in the implementation of project-driven teaching mode

Project-driven teaching mode is essentially a new teaching method based on constructivism teaching theory [3,4]. By guiding students to solve the “key problems” of preset projects, this teaching method enables them to master and understand new knowledge of the course and apply it flexibly in practice. At the same time, this method can stimulate students' innovative spirit and help to train their practical operation ability [5]. Fig. 1 shows the key links of the project-driven teaching model. In fact, the implementation of the project-driven teaching model requires the joint participation of teachers and students. The teachers' task is to carefully design the projects that students need to complete according to the theoretical knowledge of the curriculum; The task of students is to complete the projects assigned by teachers through independent analysis and collaborative research driven by projects, so as to improve the ability of independent learning and solving complex problems [6,7]. As a link between teachers and students, projects promote the close combination of theoretical knowledge and practical activities in the teaching process, enhance students' understanding of the knowledge they need

to master, and realize the transformation from theory to practical ability. Compared with the traditional teaching mode, the project-driven teaching mode requires students to gradually analyze, understand and master various knowledge points under the guidance of project tasks, and achieve cross-integration. Through the implementation of the project, students can study independently, analyze independently, discuss collaboratively, and finally complete the project. In this process, students' interest in learning and desire to explore are constantly stimulated, thus significantly improving the teaching effect.

4. Implementation Mode

In the project-driven teaching of pump and pumping station, the knowledge points of the course are organized into several independent projects, and students are required to complete these projects by mastering new knowledge points. In the teaching process, students can independently complete the corresponding project tasks after completing each chapter, and obtain a series of phased research results, thus stimulating their interest and enthusiasm for the follow-up projects. Through project-based learning, we can promote students' deep development of higher-order thinking, and promote their comprehensive training of theoretical knowledge and practical ability.

4.1. Project construction

The reasonable design of the project is the key link in the construction of the project-driven teaching situation of the course of pump and pumping station, which directly affects the cultivation effect of students' innovative thinking and practical ability. The goal of project design should be to help students cultivate innovative ability and professional accomplishment, closely combine with theoretical teaching content, and solve practical engineering problems to ensure that the project is both challenging and feasible. For example, in the content teaching of the chapter, "Basic knowledge of water pump", we can design and optimize a water pump system project through Solidworks software, and adjust parameters to achieve the best performance of the pump; In the content teaching of the chapter, "Energy characteristics of water pump", the design items can be as follows: compiling the corresponding program with Matlab software, drawing the basic performance curve of water pump, and calculating the flow, lift, shaft power and efficiency of water pump under design conditions; In the teaching of the chapter, "Cavitation of Water Pump and Determination of Installation Elevation", we can design the following items, using CFD (Computational Fluid Dynamics) software to simulate the flow field of pump and calculate and determine the optimal installation elevation of pump; In the teaching of the chapter, "Operation Condition and Adjustment of Water Pump", we can design the following items: compiling the corresponding program by Python software, iteratively calculating the operation condition of pump, and determining the adjustment scheme of the optimal operation condition of pump.

4.2. Project implementation

First of all, it is very important to form a suitable project team. It is necessary to pay attention to controlling the number of team members, rationally distributing the tasks and responsibilities of team members, and ensuring smooth coordination and cooperation among team members. In addition, determining the responsibility system by turns can effectively promote students' participation and learning effect in project teaching and create a good learning atmosphere and environment. Distribute the project to the project leader in the form of task book, and the project leader will organize team members to collect and sort out the data and technical information needed for project implementation according to the task requirements, so as to cultivate students' information literacy. Secondly, the team should actively carry out discussions and consultations, aiming at solving project problems, and

formulate specific implementation plans and solutions. Each team should analyze and solve the problems in the project independently. Finally, students need to write a project research report and use PPT to report and communicate the results. The completion of the project is helpful to cultivate students' awareness of independent innovation and improve their ability of independent thinking and problem solving. In the implementation stage of the project, teachers should carry out necessary supervision and guidance.

4.3. Project appraisal

Project-driven teaching evaluation of pump and pumping station should not only evaluate the team's project achievements, but also pay attention to the team's performance in the whole implementation process. The project evaluation results will be included in the final grade of the course of pump and pumping station according to the preset weights. In the evaluation of project results, the completion of the project will be mainly evaluated, including the students' understanding and mastery of knowledge points, the display of autonomous learning ability, and the strategies for analyzing and solving problems. In the process evaluation of the project, we focus on the participation and initiative of each student in the process of project completion, and record the students' cooperation and innovation ability.

5. Conclusions

In the project-driven teaching activities of pump and pumping station, students learn independently through project tasks, which embodies the application-oriented undergraduate education concept of "ability-oriented, student-centered and practice-oriented". This teaching method is helpful to cultivate students' independent thinking ability, cooperative ability, innovative thinking and practical ability. Course teaching is student-centered, and project implementation is the main means to promote students' autonomous learning and collaborative inquiry, cultivate their innovative consciousness and improve their practical ability. The teaching mode based on project-driven needs to be continuously improved in practice. At the same time, the teaching methods of the course of pump and pumping station in application-oriented undergraduate colleges should keep pace with the times, constantly explore and practice, and devote themselves to cultivating high-level practical professionals with professional characteristics to meet the needs of social development.

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