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Application of Project-Imported Task-Driven Method in Learning of GPS Measurement Technology Course

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Abstract:

According to the characteristics of the course of GPS measurement technology and the problems in the teaching process, the "project-imported task-driven" method was introduced into the teaching. The specific steps of implementing the "project-imported task-driven" teaching method in the course of GPS measurement technology are described, the problems are analyzed, and the methods for solving problems are proposed to provide a reference for the teaching reform of other courses.

Keywords:

Project-imported task-driven
GPS measurement technology
Teaching reform

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1. Introduction

China's roads, railways, and urban rail transit are in a period of continuous and significant development. The construction of these projects first involves the surveying and staking out of routes, bridges, tunnels, and more. With the widespread application of 3S technology, especially GPS surveying technology, in various projects, the demand for practical GPS surveying talents in enterprises is increasing daily [1]. However, the GPS surveying technology course is theoretically abstract, highly practical, and interdisciplinary. Vocational college students often have limited learning abilities and a weak foundation, making it difficult for them to accept much of the course content. Traditional teaching methods and approaches struggle to achieve the desired results [2].

The "Project Introduction and Task-Driven" teaching method integrates the basic characteristics of case-based teaching, task-driven teaching, and project-based teaching. It runs practical projects throughout the teaching process, introduces new knowledge through tasks and projects, and uses case-based teaching to strengthen the breakthrough of key and difficult points in knowledge during classroom organization. In practical teaching, "project introduction" and "task-driven" are the main forms, providing students with gradual and in-depth learning methods and pathways to stimulate their initiative and enthusiasm [3].

Applying the "Project Introduction and Task-Driven" teaching method to GPS surveying technology teaching is beneficial for mobilizing students' enthusiasm,

increasing their interest, strengthening their practical operation abilities, improving their professional qualities, and meeting the needs of construction enterprises for skilled and applied surveying talents.

2. Characteristics of GPS surveying technology courses and problems in teaching

2.1. Characteristics of GPS surveying technology courses

2.1.1. Multi-disciplinary integration and cross-over with a wide range of content

The GPS surveying technology course not only involves geodesy but also electromagnetics, electronics, astronomy, mathematics, physics, meteorology, and other disciplines. It is a product of multidisciplinary intersections.

2.1.2. Strong practicality of the course

This course first requires students to master basic GPS theoretical knowledge through classroom teaching. Secondly, it requires students to master the performance and usage of GPS receivers, as well as the operation methods of different positioning modes through practical links, to deepen their understanding of theoretical knowledge and cultivate their hands-on practical abilities. Additionally, students should master GPS data processing through computer experiments.

2.1.3. Many formula derivations and abstract concepts

The course involves many formula derivations, such as coordinate system transformations, the establishment and linearization of observation equations, and the establishment of single-difference, double-difference, and triple-difference observation models. Additionally, there are abstract concepts such as the GPS time system, coordinate system, and positioning principle descriptions that involve knowledge from other disciplines.

2.2. Problems in GPS surveying technology course teaching

2.2.1. Lack of integrated theory and practice textbooks

Existing GPS surveying technology textbooks for engineering surveying majors in vocational colleges generally emphasize theory over practice. There is too much content on GPS system-related knowledge and surveying principles, while there is less coverage on the specific application of GPS technology in engineering.

2.2.2. Teaching focuses on theory over practice

The GPS surveying technology course involves knowledge from multiple disciplines. It is difficult to achieve the desired teaching effect through traditional teaching methods. The emphasis on theory and the neglect of practice can easily make students lose interest in the course. Additionally, there are fewer practical class hours, the experimental content is not closely related to engineering practice, and practical assessment is absent from the final assessment.

2.2.3. Practical training conditions are detached from production reality

GPS surveying technology is at the forefront of surveying and mapping disciplines, and building a training room requires high equipment costs. For institutions with a relatively weak economic foundation, the construction of training systems lags, resulting in a disconnect between theory and practice that is difficult to meet the actual needs of production units.

3. Programming design of the project introduction and task-driven method in GPS surveying technology courses

3.1. Project design and task assignment

The design of projects and tasks is the fundamental premise of applying the “Project Introduction and Task-Driven” teaching method. Therefore, project task design must be scientific, reasonable, highly implementable, and structured, reflecting the student’s subject status. Hence, the teaching content should be determined and projects and tasks under those projects should be set based on the specific content that graduates may engage in future work, combined with the requirements of 3S technology development for surveying talents. The project and task settings for the GPS Surveying Technology course are shown in **Table 1**. **Table 1** illustrates that the design of teaching projects and tasks meets the actual engineering and social job requirements. The teaching tasks cover the knowledge points and operational skills that need to be

Table 1. The design of teaching projects and tasks

Project	Task
Project 1: GPS control network survey in Class E cities	(1) Technical design of urban GPS survey; (2) Establishment of urban GPS control network; (3) Field data collection of urban GPS control network; (4) Indoor data processing of urban GPS control network
Project 2: GPS control network survey for bridges	(1) Technical design of GPS survey for bridges; (2) Establishment of GPS control network for bridges; (3) Field data collection of GPS control network for bridges
Project 3:Third-class tunnel GPS control network survey	(1) Technical design of tunnel GPS survey; (2) Establishment of tunnel GPS control network; (3) Field data collection of tunnel GPS control network; (4) Indoor data processing of tunnel GPS control network
Project 4: GPS control network survey for lines	(1) Technical design of GPS survey for lines; (2) Establishment of GPS control network for lines; (3) Field data collection of GPS control network for lines; (4) Indoor data processing of GPS control network for lines

mastered. Through these practical training tasks, students can better grasp theoretical knowledge and develop practical skills, achieving a seamless connection between teaching and professional positions.

3.2. Implementation of projects and tasks

(1) Divide the class into groups. During grouping, students are free to combine based on their learning situation, interests, and personality. On this basis, the teacher makes appropriate adjustments based on their understanding of students' learning situations to achieve complementary advantages. Each group consists of 4–5 students playing different roles, and the entire class is divided into several groups.

(2) Each group member should review relevant theoretical knowledge beforehand to prepare for the smooth implementation of subsequent projects and task completion. When previewing theoretical knowledge, it can be implemented by designing worksheets with tasks as the carrier, summarizing the problems to be solved and the corresponding knowledge on the worksheet, allowing group members to discuss and analyze independently and finally solve the problems.

(3) Before implementing each work task, the teacher should evaluate the students' early mastery. Students are required to master basic knowledge before using the instrument for operation. The teacher should conduct full inspection and supervision during the task implementation, and discover and answer questions encountered by students in practical operations.

3.3. Achievement evaluation and course assessment

(1) Submit achievement materials after project and task implementation, including GPS surveying technology design documents, GPS operation schedules, GPS surveying notebooks, raw data, control network adjustment reports, etc. Evaluate the completion of projects and tasks through teacher evaluation, group self-evaluation, and peer evaluation.

(2) During group self-evaluation, it is necessary to evaluate not only the completion of tasks but also the work attitude of members and their ability to work together. Simultaneously, each group is required to select a representative to provide a comprehensive overview of the entire process of completing the group's tasks, and groups should exchange ideas to achieve common improvement.

(3) The teacher finally determines each student's grade based on the group's self-evaluation, peer evaluation, and various evaluation indicators. The final course assessment not only focuses on theoretical knowledge assessment but also includes the completion of each practical training task during the actual measurement process, which is included in the overall course score.

4. Problems and solutions in the teaching process of "Project Introduction and Task-Driven"

4.1. Existing problems

Through the specific practice of the "Project Introduction and Task-Driven" teaching method in GPS Surveying Technology courses, good teaching results have been achieved, and students' enthusiasm has been improved. However, through visits and surveys of students and employers, the following problems have been identified in the practical application of this teaching method:

(1) Due to the significant influence of traditional teaching models and methods, students' initiative is not very high in completing tasks, and they still rely heavily on teachers' guidance;

(2) When students form groups based on their preferences, they tend to group with those they have good relationships with, which is not conducive to complementary advantages among students. Additionally, some members have low participation and easily rely on other group members;

(3) Teachers need to further consider students' cognitive development level, the actual needs of the project, and the specific needs of employers for talents when selecting projects and tasks.

4.2. Solutions

(1) To stimulate students' initiative and enthusiasm for learning, teachers should utilize multimedia teaching tools in addition to traditional blackboard writing during the teaching process. By introducing students to scenarios where they can apply knowledge points to solve practical engineering problems, teachers can foster interest in the designed projects and motivate students to complete tasks. Meanwhile, teachers should provide timely praise after students complete each task to promote their learning enthusiasm.

(2) Regarding grouping issues, teachers should be adept at adjusting and guiding to ensure that each group includes students with different learning abilities, academic levels, and interests, making the group allocation more reasonable. Then, in assigning roles for teaching tasks, teachers should assign different students suitable roles based on their characteristics, leveraging each member's strengths and mobilizing their enthusiasm. This avoids situations where only a few members are actively involved while others reap the benefits. Additionally, teachers should encourage role exchanges to promote students' comprehensive development.

(3) The design of projects and tasks should primarily align with actual engineering needs and social job requirements. It should always be considered from the student's perspective, with targeted designs that allow tasks to progress from simple to complex and be operable. The scale of the tasks should be appropriate and generally not too large.

5. Conclusion

The "Project Introduction and Task-Driven" teaching method is a new teaching model that holds significant importance in improving teaching quality and exploring teaching models for cultivating application-oriented talents. It provides some assistance in cultivating "marketable" vocational graduates and is a teaching method suitable for vocational education.

Through the development and application of this teaching method in GPS Surveying Technology courses, an effective curriculum reform implementation plan has been obtained, greatly promoting students' initiative and enthusiasm for learning. Issues that were not fully understood in theoretical teaching have been deepened through the process of completing tasks. Practical evidence demonstrates that this method is highly suitable for teaching GPS Surveying Technology courses in vocational education.

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