

# Exploration on Improving the Teaching Quality of Soil Mechanics and Foundation Engineering Course in Polytechnic College

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## Abstract

With the needs of economic and social transformation, China pays more and more attention to the teaching quality of vocational education. Soil Mechanics and Foundation Engineering is an important course for architectural engineering majors. This paper studies the problems existing in the teaching process of Soil Mechanics and Foundation Engineering in Polytechnic College, aiming to provide reference for the teaching reform of Soil Mechanics and Foundation Engineering in Polytechnic College.

## Keywords

Soil Mechanics and Foundation Engineering; Teaching Quality; Teaching Reform.

## 1. Introduction

Soil Mechanics and Fundamental Engineering Engineering is a course for architectural engineering majors who are studying "Architectural Structure and Drawing Recognition" and "Engineering Mechanics". It integrates theory and practice is set up. Compared with other courses, this course is highly theoretical, and requires a higher reserve of physics and mathematics knowledge. However, for most students in Polytechnic College, mathematics and physics are their shortcomings in learning, and students are afraid of learning Soil Mechanics and Foundation Engineering. The teaching quality of Soil Mechanics and Foundation Engineering has been unsatisfactory. Therefore, how to improve the teaching quality of the "Soil Mechanics and Foundation Engineering" course in Polytechnic College has always been a problem that the majority of "Soil Mechanics and Foundation Engineering" teachers have been thinking and exploring.

## 2. Problems Existing in the Teaching of Soil Mechanics and Foundation Engineering in Polytechnic College

### 2.1. The Course Content of Soil Mechanics and Foundation Engineering Is Complex and the Class Hours Are Insufficient

The course Soil Mechanics and Foundation Engineering is a combination of "Soil Mechanics" and "Foundation Engineering", covering a wide range of contents, mainly involving the physical properties and classification of soil, calculation of stress in soil, calculation of foundation settlement and deformation, earth pressure and retaining wall, deep and shallow foundation, foundation treatment, etc. The logic and system of the course are particularly strong, mixing with many complex formulas, makes this course difficult to learn. Taking the major of engineering safety evaluation and supervision as an example, the class hours of this course are 54 class hours, which is relatively small, and the course needs to teach a lot of content. The class hours and content do not match.

## **2.2. Weak Teachers, Backward Teaching Methods and Teaching Methods**

The teaching process of Soil Mechanics and Fundamental Engineering involves a lot of calculations. The traditional teaching mode is often teacher-centered, that is, the teacher speaks on the podium and the students listen in their seats. Teachers are accustomed to the teaching method of "lecture + board performance", and they use indoctrination teaching. At present, the teachers in Polytechnic College in my country are relatively weak. Most of the teachers are non-normal graduates, and they lack teaching experience. They are not familiar with new teaching methods and modern teaching methods, and are affected by the undergraduate teaching mode during their studies. Overemphasis on the cultivation of students' computing ability and problem-solving ability is difficult to arouse the enthusiasm of students in class, resulting in students losing interest in learning the course.

## **2.3. The Assessment Method of Soil Mechanics and Foundation Engineering Is Single and Backward**

The traditional "Soil Mechanics and Foundation Engineering" assessment is generally obtained by weighting the final exam and the usual scores according to a certain proportion. The usual grades are based on homework and attendance. The final exam is based on a paper (closed-book written test) to assess the theoretical knowledge that students have mastered. In order to pass the test, students must memorize knowledge points by rote. This single assessment method tends to ignore the learning process among students and the assessment of practical ability, resulting in students only focusing on the final exam. It is difficult to fully reflect the true level of each student, and it is difficult to meet the requirements of higher vocational talent training programs.

## **2.4. Insufficient Training Conditions**

Due to the problem of funding shortage, most of the current higher vocational Soil Mechanics and Fundamental Engineering courses are lack of demonstration experiments. Even if a training room is prepared, it is often difficult for non-geotechnical technicians to teach students to carry out practical operations, which is not in line with the cultivation of talent goals. At the same time, there is a lack of practical training materials suitable for guiding higher vocational students to conduct geotechnical experiments.

## **3. Measures to Improve the Teaching Quality of Soil Mechanics and Foundation Engineering**

### **3.1. Reform Teaching Content and Organize Teaching Materials**

Higher vocational education focuses on cultivating technical application-oriented talents and pays attention to the cultivation of students' practical and application ability. Therefore, in the teaching process of Soil Mechanics and Foundation Engineering, the content of theoretical derivation that is difficult to understand should be weakened. Viewing from job requirement, focusing on practice, the content of teaching should make students feel useful and important, and deepen students' impression.

At present, most of the textbooks of Soil Mechanics and Fundamental Engineering are difficult. Since textbooks have a decisive, fundamental and substantive impact on teaching activities and teaching quality from different levels, choosing textbooks that conform to the actual situation of students is an important part of improving teaching quality. However, by comparing many national-level higher vocational textbooks published by Tsinghua University Press, Machinery Industry Press, Higher Education Press, etc., there are a large number of theoretical derivations related to mathematical physics. Based on this situation, teachers can compile their own teaching materials according to the actual learning situation of the school and the

characteristics of students, and delete the more difficult content. In order to stimulate students' enthusiasm for learning, in the introduction part, a large number of engineering examples and pictures can be used to make students realize the application and importance of "Soil Mechanics and Foundation Engineering" in the practice of construction engineering, such as transcon Barn in Canada, Baocheng Landslide in Hong Kong, Leaning Tower of Pisa in Italy, Tiger Hill Tower in Suzhou, Teton Dam in the United States, etc. Through these typical engineering failure cases related to soil, students have deepened soil strength and deformation penetration.

Most of the students in Polytechnic College have relatively weak foundations in physics and mathematics. Taking the major of engineering safety evaluation and supervision as an example, only a few students choose physics during the college entrance examination. Therefore, in terms of the deletion of teaching content, it is necessary to closely follow the training objectives of higher vocational professionals, adhere to the principle of sufficient theory and practicality, and choose to talk as little as possible or not to talk about difficult content with little practicality. At present, BIM technology has become an indispensable part of the modern teaching system. Based on the characteristics of BIM visibility and simulation, BIM technology can be fully integrated into the actual teaching content of Soil Mechanics and Foundation Engineering, presenting the previous two-dimensional components as three-dimensional solid graphics. For example, when explaining the problem of foundation pit and retaining wall design, the integration of BIM technology can solve the problem of students' lack of space imagination to a certain extent, and improve the progress of course teaching. In addition, it is the compilation of practical training materials. Teachers should invite enterprises and industries to cooperate and jointly compile teaching materials that are closely integrated with production practice, so as to ensure that the teaching materials are not deviated from production practice.

### 3.2. Innovative Teaching Methods

Using the combination of heuristic teaching method, group discussion method, case teaching method and other methods, the teaching form of Soil Mechanics and Foundation Engineering can be innovated, which changes the traditional cramming education model of "teachers teach knowledge points and students passively accept them". In the teaching process, students are the main body, so students should actively participate in teaching interaction, making silent courses active. For example, when teaching the physical property index of soil, after explaining the concepts of natural weight, saturated weight, dry weight and effective weight in detail, students can be required to sort the size of the four indexes through group discussion. In the process of teaching implementation, teachers should maintain patience, encourage students to use their brains, think more, and take the initiative to find answers.

Secondly, we should make full use of modern information technology means, we can use multimedia technology, combine with the psychology of modern students, make exquisite teaching courseware according to the characteristics and background of Soil Mechanics and Foundation Engineering knowledge, and record and upload micro-lectures for intuitive teaching, which enhance students' interest in learning. For example, through the online platform, you can find soil mechanics test videos, engineering construction videos, etc. related to the course content, so as to strengthen students' understanding of knowledge points. It is also possible to use mobile devices to implement "flipped classrooms", in which the traditional classrooms are flipped, and the learning tasks can be completed after class rather than during the class, this can change the students' learning methods and concepts, and continue to innovate to encourage students to conduct more in-depth learning, to improve the quality and effect of learning. In addition, we can make full use of platforms such as WeChat to increase the interaction between teachers and students. Before starting the class, teachers can use questionnaires to understand the specific conditions of students, such as study habits and interest in Soil Mechanics and Foundation Engineering, so as to adjust Teaching content in class.

After class, students' real learning experiences can also be collected through WeChat to provide reference for the next teaching arrangement and future teaching reform.

### 3.3. Establish A Multi-Assessment Evaluation System

Evaluation is an important part of the teaching process [1], which runs through every link of teaching activities. In order to improve the teaching effect of Soil Mechanics and Fundamental Engineering, the assessment method must be comprehensively reformed, and it is imperative to implement diversified teaching evaluation. Appropriate use of diversified evaluation is conducive to teaching students in accordance with their aptitude, promoting students' multi-dimensional development, and better implementing hierarchical teaching; it is also conducive to comprehensive evaluation of students' practical ability in learning attitudes, world outlook, values, and other aspects. By means of multi-directional communication and interactive evaluation, it can also reflect the subject status of students' learning. All majors and enterprises of the school jointly participate in the assessment and evaluation, and establish a whole-process, full-staff and three-dimensional assessment system. It adopts a combination of process evaluation and target evaluation, and an integrated evaluation model of theory and practice. It emphasizes the diversity of evaluation, and comprehensively evaluates students' performance in combination with students' homework, classroom questions, daily tests, students' practice, learning progress, skill competitions and test results. Teachers should pay attention to the assessment of students' ability to analyze and solve problems, encourage students to innovate in learning and practical application, insisting that the assessment of knowledge points and skills is fully open, and comprehensively evaluate students' abilities.

Specifically, it includes three aspects: first, to understand theories and concepts, and focus on assessment of thinking and skills; second, the answer to the assessment is not unique, there should be multiple standard answers, and an open-ended approach should be advocated; third, Class participation, homework completion, performance in practical teaching, etc. are comprehensively assessed, recorded in the final grade, and the proportion of daily assessment is increased, so that assessment is not only a means to test learning effects, but also a driving force for students to continue their independent learning.

### 3.4. Strengthen the Teaching Staff

The construction of teaching staff is the key to improve the quality of teaching in an all-round way. Based on the teaching requirements of Soil Mechanics and Foundation Engineering, teachers who are responsible for the teaching task of this course should have a postgraduate degree or above or an intermediate professional title in construction and civil engineering, be familiar with basic construction drawings, be proficient in the basic principles and calculation methods of soil mechanics, and have enterprise-related Design or construction experience, all these can provide students with good teaching guidance and practical training support. Polytechnic College should establish and improve the system of teachers' in-depth vocational training, and continuously improve teachers' scientific research and professional practice ability [2]. It is necessary to introduce high-quality professional talents from the front line of production and work to enrich the teachers; strengthen the connection with the enterprise's employing department, and form a relatively stable team of enterprise teachers, so that most professional teachers have the "double-qualified" quality.

In 2020, the Ministry of Education issued a notice on the issuance of the "Guidelines for Ideological and Political Construction of Colleges and Universities", which clearly stated that ideological and political education should be integrated into the talent training system, comprehensively promote the ideological and political construction of colleges and universities, and give full play to the educational role of each course, improve the quality of talent training in colleges and universities [3]. In this context, in order to improve the quality of curriculum teaching, it is necessary to enhance teachers' "moral education awareness" and cultivate and

enhance teachers' "moral education ability". Through the "same direction peers, collaborative education" among teachers ,it ensures the "same direction peers, synergistic effect" between courses [4] , and achieves the organic unity of knowledge imparting, value guidance and ability training in curriculum teaching.

#### 4. Conclusion

The quality of teaching is related to the quality of personnel training. Only by in-depth analysis of the specific situation and existing problems of the curriculum, students and teachers, can the goal and direction of the next improvement be clarified. Soil Mechanics and Foundation Engineering is one of the most critical basic courses to enter the construction industry. It is very theoretical and complicated. The subjects involved are physics, advanced mathematics, linear algebra, probability theory and other multi-subject theoretical courses. In the teaching process, it is necessary to combine the current industry and related enterprises' requirements for professional talents to reform the curriculum, improve the teaching quality, and strive to achieve a harmonious unity of basic, practical and forward-looking.

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