

## Analysis on Teaching Method of Soil Mechanics Course

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**Abstract.** Soil mechanics is an important basic course in civil engineering specialty. According to the characteristics and teaching status of the course, the course teaching contents, teaching methods, practice teaching, assessment methods and quality of teachers are analyzed in order to improve the teaching quality. It's suggested to establish a framework of the course contents from the introduction. The topic teaching method can be adopted to help cultivating the students' divergent thought, critical thought and creative thought. The comprehensive experimental program based on the single tests was designed to improve their comprehensive analysis ability. And teachers should continuously improve the level of knowledge and quality of themselves. The suggestions and ideas put forward can provide useful reference for the improvement of teaching quality of soil mechanics course.

### Introduction

**Characteristics of Course.** Soil mechanics is an important basic course of civil engineering specialty, and it's also the bridge that links basic courses and specialized courses. Its concepts, methods and conclusions are the foundation of many follow-up courses, such as the underground structure, deep foundation pit, foundation treatment and other specialized courses [1,2]. The survey shows that the working ability of students was closely related with the master degree of the course theory to some extent. The students, who have a good theoretical basis, are easy to comprehend problem. And they have a stronger ability to adapt to the changes of work environment [3].

**Teaching Status.** With years of accumulation, the soil mechanics course has made great progress in contents, teaching methods and teaching quality. This course has become an important part of knowledge structure and ability training for civil engineering students at present. With the development of this subject, the new environment puts forward new requirements and challenges to the course. Some experts put forward that the students' ability should include basic learning skills, information technology, innovative thinking, interpersonal and cooperative spirit, practical ability [4]. However, the education of civil engineering specialty in China is excessively emphasis on specialized education, while ignoring the cultivation of the comprehensive quality and innovation ability. And some students do not adapt to the work environment. The traditional course teaching methods gradually cannot meet the needs of the current education personnel training [5-7]. Therefore, how to cultivate students' creative thought and ability of using basic knowledge to solve practical engineering problems becomes an important issue that should be further studied.

### Adjustment of Course Contents

Combination with the civil engineering training target of applied undergraduate, the teaching contents of the course should be adjusted. Based on the concept and basic principles, the thought of some complicated formulas only be introduced instead of detailed derivation. Emphases should be focused on guiding students by using the basic theory to solve practical engineering problems. Avoiding duplicate content of the former courses and put the limited teaching hours on new knowledge. Furthermore, in order to enhance the age of teaching, the new edition and high quality of textbooks are necessary. Though some textbooks were published in recent years, the contents were still based on old standard. And the theoretical part of some textbooks is excess, which limits many

students' initiative, enthusiasm and innovative consciousness in a certain extent. Therefore, it is advisable to use latest version of the textbook compiled by the national civil engineering teaching and guidance committee.

### Diversity of Teaching Methods

**Establish Framework from Introduction.** College students will be of great curiosity to listen a new course. But if the first class cannot attract their attention, it will be very difficult to stimulate their interest in the following learning. Therefore, full preparation should be made in the introduction of the course. The first thing is to let the students establish a framework of the course contents in mind. The soil mechanics course mainly includes the principal concepts of soil, the strengthen problem, the deformation problem, the seepage problem and dynamic characteristics of soil [8]. Then the course contents can be divided into three parts, which is shown in Figure 1.

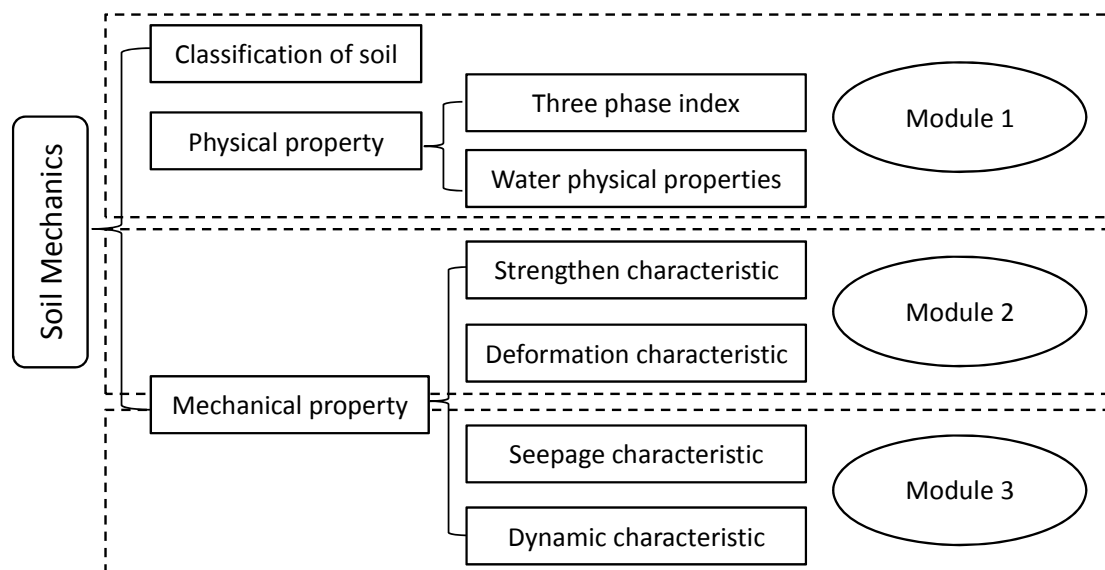


Figure 1. The core contents and modules of soil mechanics course

**Topic Teaching Method.** From traditional spoon feeding teaching method to bilateral interaction teach and learn method is a fundamental change. Topic teaching method is used in the class, with more "why to do" instead of "should to do". So students can think, response, discuss and communicate about the problem. In the guidance of teachers, students are easy to master the course content, and then the students' divergent thought, critical thought and creative thought can be cultivated gradually. Based on this, the topic teaching method is more better than the traditional teaching method in teaching style and contents[9], which is shown in Table 1.

Table 1. Difference of topic teaching method and traditional teaching method

| Comparison Items     | Traditional Teaching Method  | Topic Teaching Method   |
|----------------------|--|---|
| Teaching items       | Theoretical knowledge of teaching program                                    | Basical theoretical knowledge and methods of solve problem                        |
| Teaching form        | Teach students and classroom communication is limited                        | Lectures on special topics and classroom communication is easy                    |
| Participation degree | Students study passively and enthusiasm is poor                              | Students study initiatively and full of enthusiasm                                |
| Incentive mechanism  | Based on external supervision and lack of learning motivation                | Based on internal supervision and learning motivation is adequate                 |
| Teaching effect      | Students' understanding of theoretical knowledge is plain and easy to forget | Students have personal exprience of theoretical knowledge and innovation capacity |

**Combining Theory with Practice.** This course is a comprehensive course of integrating theory and practice. Spenting a lot of time and energy, students maybe still cannot fully understand the course because of the abstraction of theory. Then the method of site field teaching can be considered in the teaching process so that students have more intuitive understanding of textbook knowledge. At the same time, students should visit practical engineering to cultivate relatively strong sense and experience, which can better improve their learning enthusiasm and creativity.

### Strengthen Engineering Education

**Comprehensive Experimentation.** Combined with the theory of teaching, the relevant experimental content is arranged. Under the guidance of the experimental teachers, the comprehensive experimental program about the basic theory of soil mechanics and engineering problems is designed based on the single tests so as to reflect innovative teaching ideas[10], which is shown in Table 2.

Table 2. Comprehensive experimentation of soil mechanics

| Comprehensive Experimental Items                         | Integration of Single Tests   | Soil Mechanical Parameters  |
|--|---|---|
| Classification and name of soil                          | Grain-size distribution test, liquid and plastic test   | $C_u C_c W_L W_P I_L I_P$   |
| Evaluation of compression performance of soil            | Soil particle proportion test, soil density test, water content test, consolidation test, compaction test | $G_s \gamma W e$<br>$a_{1-2} C_c C_s E_s$<br>$C_v W_{op} \rho_{dmax}$ |
| Evaluation of bearing capacity of foundation soil        | Direct shear test, traditional 3-d compression test   | $c \phi$<br>$c_{cu} \phi_{cu}$<br>$c' \phi'$                          |
| Evaluation of seepage characteristics of foundation soil | Seepage test(constant water head, variable water head)  | $k$<br>Evaluation of soil flow  |

**Participation In Scientific Research Activities.** Encourage students actively participate in the teacher's scientific research and engineering practice to cultivate students' ability of integrating theory with practice. During the winter and summer vacations, students are recommended to the related engineering company to enhance their perceptual knowledge, cultivate the engineering consciousness and enhance the analysis ability of solving engineering problems.

## Improve Quality of Teachers

Professional teachers are the source of students' knowledge. To a certain extent, the level of teachers directly determines the students' learning level and knowledge. So teachers should continuously improve their level of knowledge and quality.

On one hand, teachers should master the solid theoretical knowledge and engineering practice ability, and then they can put theory into practice and bring the practice back into the classroom. Furthermore, teachers should actively participate in related scientific research activities, keep up with the development of the discipline, constantly improve their own understanding and academic level, and timely let students have access to the latest academic information. On the other hand, teachers should have a positive attitude, and keep a mentor relationship with students. Besides, team teaching method with multiple intelligences is also an effective method to improve students' learning interest and teaching quality [11,12]. Only by this way, teachers can have a good interaction with students, and a win-win result can be achieved.

## Conclusions

Based on the aboved analysis, some suggestions and ideas of teaching method of soil mechanics course were put forward. It is advisable to use latest version of the textbook compiled by the national civil engineering teaching and guidance committee. Stimulate students' learning interest from the introduction of the course. The topic teaching method should be adopted to help cultivating the students' critical thought and creative thought. The comprehensive experimental program about the basic theory of soil mechanics is designed based on the single tests to improve students' comprehensive analysis ability. And teachers must continuously improve the level of knowledge and quality of themselves.

Teaching quality is the basic of education, only that the quality of teaching is effectively guaranteed, the students have competitive power. Of course, the course teaching research and reform cannot be completed in one day, which requires continuous research and exploration in the process of teaching practice.

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