ENGINEERING GEOLOGICAL EDUCATION-PRACTICAL ASPECTS FROM CIVIL ENGINEERING DEPARTMENT AT TEI OF SERRES (GREECE)

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ABSTRACT: Geotechnical engineering plays an important role in civil engineering education. Computer systems and sophisticated software provide the tools to simulate real world geotechnical effects in civil engineering, to analyse geotechnical problems and to realize the effects geotechnical ground conditions have on structures. Within this context, teaching practices from engineering geological education provided in Civil Engineering Dept., at Serres Technological Education Institution are presented and various aspects including teaching class, laboratory exercises and e-learning support are discussed. Concluding, the outcome of educational procedures evaluation in TEI of Serres is more or less expected: more practice in "real world" conditions is needed to help students gain experience and confidence in their abilities.

1 INTRODUCTION

The high uncertainty degree in Engineering Geological problems that a professional Engineer faces due to spatially and time varying characteristics of the subsurface, impose the terms and conditions of Engineering Geological education. That high uncertainty that is not common in other courses of Civil Engineering Education makes Engineering Geological Education somewhat complex and variable. To face the problem, students during their course studies, are taught basic principles and a list of procedures in order to solve practical problems in class.

As is obvious, that procedure can not cover every aspect of any Engineering Geological problem that might occur during the professional life of a Civil Engineer and this is a reason for the lack of confidence students have in their capabilities.

For that reason, professional experience of the teaching stuff is of great importance. Teaching practices that involve case studies based on real facts must not only provide the ability to apply basic concepts on real problems but to give students the impression that applying those concepts and following a standardized procedure can lead to reliable results. As already mentioned, standardizing a procedure in Engineering Geological applications can be inadequate due to spatial and sometimes temporal variability of various subsurface parameters. Therefore, in order to face that problem, teaching practices that must provide the principles needed by the students to develop critical thinking and to make judgments are essential.

Teaching practices in general, involve lectures, laboratory based practical sessions and field work. Teaching can be supported by e-learning platforms that provide students the ability to communicate with the teaching stuff or between themselves and to have access to additional information regarding their courses (further reading material, links etc)
In the present paper, teaching procedure of Engineering Geological courses in the Civil Engineering Dept. at TEI of Serres, Greece are presented and various aspects of the teaching procedure are discussed.

2 ENGINEERING GEOLOGY COURSE OUTLINE

Engineering Geology is a course unit of the first semester whereas Engineering Geological Applications in Building Construction is an elective unit (option discipline) in the seventh semester of the Civil Engineering Department at Technological Education Institution of Serres (Northern Greece).
Knowledge basis is needed only for the seventh semester course and includes Mathematics and Engineering Geology.

2.1 *Scope*

Basic concepts of the Engineering Geology course's theoretical part is the introduction to basic geological, seismological, tectonic and hydro geological aspects with emphasis to their impact on geotechnical properties of geological formations (rocks and soils). In seismological aspect lectures for instance, special attention is given to seismic ground motion and it's parameters as well as it's resultants and their impact on structures (damage levels) while in "joints in rock masses" lectures special attention is given to the way they affect rock mass behaviour taking into consideration strain and stress distribution and groundwater circulation.

Laboratory based practical sessions (practical training) aim to provide fully understanding of the geological structure of an area and the way different geological formations interact between themselves, as well as with groundwater. Students are grouped in groups of 40 persons and are trained to construct geological cross sections in any given direction and to interpret the geological structure in terms of geotechnical ground conditions.

The second course, Engineering Geological Applications in Building Construction, aims to provide the ability to the qualitative evaluation of the geotechnical behavior of geological formations based on their physical and mechanical properties (from a theoretical point of view), their weathering status and the presence of ground water in order to indicate potential geotechnical problems, estimate excavation methods and costs and evaluate the ability to use excavated rock as construction material. Another aim is to help students develop critical thinking that can help them suggest geotechnical investigation methods and to design geotechnical field work in various cases.

The course's practical training involves the use of sophisticated software in engineering geological applications.

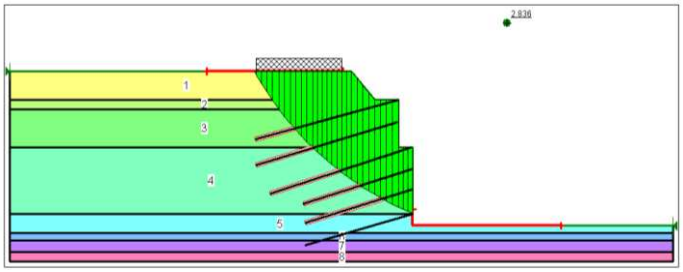

Figure 1. Engineering Geological Applications in Building Construction course, Laboratory based practical sessions. An example of slope stability analysis and the proposed solution with the calculated factor of safety (2.8).

Every semester a number of about 60 students attend this course. In Laboratory based practical sessions they are grouped in groups of 30 persons.

2.2 *Teaching methods and practices*

Both courses (Engineering Geology and Engineering Geological Applications in Building Construction) last for one semester (usually 12 to 14 weeks). Teaching in both cases, is via traditional lectures as well as self-learning while the practical aspects are covered via laboratory based practical sessions. Both lectures and practical sessions, last for two hours each. Teaching procedure in both cases is supported by an e-learning platform.

Engineering Geology course at the Civil Engineering Department aims to:

- Teach students how to learn. It is considered as an important aspect of the educational procedure because, at any given time, it gives students (and engineers at a later stage) the ability to search and find helpful information regarding their project (theoretical aspects, case studies etc) and in general the way to find and evaluate relevant info and technical bibliography in order to support their project.
- Provide information about the Engineering properties of geological formations.
- Provide information about the impact of weathering on the engineering properties of rocks.
- Present Groundwater and its impact on the geotechnical properties and the geotechnical behavior of geological formations.
- Give the ability to qualitatively evaluate the geotechnical behavior of geological formations based on their weathering status.
- Give the ability of qualitatively estimate potential geotechnical problems and suggest probable solutions in different cases (from a theoretical aspect only).

Teaching via lectures in both large and small groups is supported by multimedia presentations and topics include an introduction to geology (mineralogy, petrology, weathering of rocks, sedimentology, groundwater) with emphasis to the engineering properties of minerals, soils and rocks as well as the impact of groundwater on those properties. Course topics also include the evaluation of excavated rock as building material and potential geotechnical problems due to ground conditions and possible solutions with special attention given to project construction.

Student assessment is through final exams at the end of semester. These include examination in the course's theoretical as well as practical concepts.

Teaching is supported by the Serres TEI e-learning platform (http://elearning.teiser.gr/) which provides the students help and support to various aspects and also an easy way to communicate with the teaching stuff. Students submit questions at any time and get answers via this system, download lecture presentations, reading material, helpful links etc. (Fig.1).

Engineering Geological Applications on Building Construction course's basic concepts include:

- Qualitative evaluation of potential geotechnical problems and probable solutions in various cases.
- Theoretical aspects and training about geotechnical construction and field works, methods, construction phases and implementation.
- Geophysical investigations in building construction (GPR investigations and Rerfaction Seismics).
- Project construction and management in terms of defining geotechnical works needed (define design parameters, evaluating boring schemes, defining cross sections to be constructed and so forth).
- Using common open source and commercial geotechnical software.

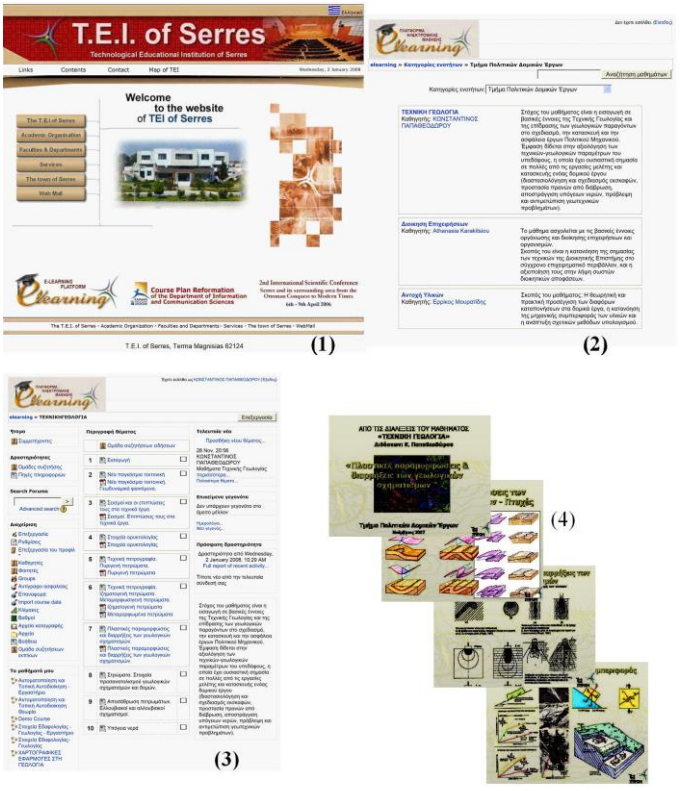

Figure 2. TEI of Serres Engineering Geology supporting e-learning platform. (1) TEI of Serres welcoming page, (2) entrance to the e-learning platform, (3) Engineering Geology lecture notes and further reading material, (4) part of the lecture regarding folds, faults and joints in rocks.

During this course only a few new theoretical concepts are taught, the main goal being to relate already known concepts to real world situations and problems.

Once again, teaching via lectures in groups is supported by multimedia presentations and topics include rock mechanics principles, geotechnical problems in soils and rock (instability parameters, in situ and laboratory tests), site geophysical investigations, project construction and management and the use of common geotechnical software.

During the course, students are assigned small projects in order to utilize concepts and methodologies taught. During these projects students have to investigate geotechnical problems (case studies), find relative bibliography and propose solutions. Student projects are presented and discussed during teaching classes.
Student assessment is through the evaluation of their project and through final exams at the end of semester. These include examination in the course's theoretical as well as practical aspects.

3 TEACHING PERSONNEL

Teaching is carried out by faculty personnel (2 persons) with more than ten years of professional and teaching experience. As already stated, one of main goals is to teach students how to learn, especially students at the first semester of their studies. Students are grouped in 30 person classes in order to attend laboratory based practical sessions.

Another aim is to stress the necessity of relating construction demands with geotechnical conditions by assigning them projects that are real world cases. Those projects must be prepared by the teaching stuff with all the information needed and a lot of time (way beyond standard contact hours) has to be dedicated to students in order to help them understand the problem, indicate instability parameters, choose the appropriate measures, propose the final solution and write their final report.

4 STUDENT FEEDBACK

Students seem to understand and accept the value of Engineering Geology course in both its scientific and practical aspects like the help they get in learning how to search, find, evaluate and use relative to their (geotechnical) problem bibliography. As the course addresses to students at the first semester, problems arise when subjects like strain or stress distribution have to be discussed.

The Engineering Geological Applications on Building Construction course is widely accepted by the

students because it gives them the ability to apply the theoretical background they created in both courses to real world problems using modern techniques and software. But even though the projects they are assigned correspond to real world problems (most of them are case studies) students don't seem to have a relative confidence in themselves (they don't believe that in a real world situation they would do as good as they did during their project).

5 CONCLUDING REMARKS AND DISCUSSION

A fact that is widely accepted stands also for the Civil Engineering Department at Serres TEI, Greece. Engineering Geological courses in a Civil Engineering department contribute significantly to engineering education as they provide the theoretical and practical aspects that can help the Engineer prevent and solve usual geotechnical problems. The qualitative perspective that Engineering Geological education provides to students along with the ability to quantitavely analyze geotechnical problems through the use of specific software, gives them the ability to overcome usual problems occurring during construction.

Use of e-learning provides an easy way for the students to communicate with the teaching personnel and to have access to further reading material and additional information. Teaching procedure effectiveness is therefore greatly enhanced by the use of an e-learning platform as it allows students to keep up with the pace of a rapidly evolving field of geosciences and relative software and technology.

The same conclusion could be generalized to also stand for geo-engineers. As science and especially technology evolve continuously, a life learning system would greatly help professional engineers to keep up with the pace.

Laboratory practical training and project assignment can help students develop critical thinking and at least theoretically, the ability to solve "real world" geotechnical problems. A closer contact to professional geo- engineering is needed though, in order to improve their self confidence.

Lessons learned indicate that, project assignment helps the students develop initiatives and apply their geotechnical theoretical background using modern software but two persons are very few to keep up with the continuously increasing requirements due to the number of students. So, project assignment seems to have a very positive impact on the Engineering Geology teaching procedure at the TEI of Serres Civil Engineering Dept., but more personnel has to be involved in order to keep up with the increasing number of students.

Finally, as a general problem, students don't feel confident in their capabilities despite the fact that they face and solve "real world" geotechnical problems during their courses. That could be due to the fact that in real world situations there is a lot of responsibility they have to take and they don't feel ready to take that responsibility which is a normal reaction considering their present status. The same problem stands for other aspects (courses) of civil engineering education and the way students could overcome this problem is to work in real world conditions at least for one semester during their study cycles.

A convenient and effective way of overcoming that problem is therefore by having a close contact with the professional field through visiting construction sites, lectures given by professionals and finally by working in real world conditions during their practical course at their last semester of studies.

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