

A Review on WEB Resources in Teaching of Geotechnical Engineering

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Abstract—The use of computer hardware and software in education and training dates to the early 1940s, when American researchers developed flight simulators which used analog computers to generate simulated onboard instrument data. Computer software is widely used to help engineers and undergraduate student solve their problems quickly and more accurately. This paper presents the list of computer software in geotechnical engineering.

Keywords—Geotechnical, Teaching, Courseware

I. INTRODUCTION

USAGE of computer software is not new and back to 1960s. There are several research project which recently addressed the effect of software in geotechnical engineering.

Jaksa et al (2010) investigated the effect of software in teaching outcomes. In one of their paper they conclude that: "Computer aided learning (CAL) offers many advantages over traditional forms of learning. These include: [1], [2], [7]

1. The ability to run simulations of laboratory experiments and design scenarios that allow the student to see the effect on some behaviour by modifying various parameter(s);
2. The material can be delivered in an exciting and challenging manner;
3. Students are able to learn at their own pace, rather than fitting into a schedule set by the course timetable;
4. Student progress and areas of difficulty can be automatically monitored;
5. Scarce teacher, technician and equipment resources can be diverted to other areas, e.g. research."

There are several resources available to improve the teaching methodology [8], [10], [18], [19], [20], [21], [21] such as paper, URL, CDs and software. For geotechnical engineering, there is an excellent internet site, which lists an extensive source [15], [16] of links to geotechnical engineering software, is provided the Geotechnical and Geo environmental Software Directory which also provides a list of educational links.

"Courseware is a term that combines the words 'course' with 'software'. Its meaning originally was used to describe additional educational material intended as kits for teachers or trainers or as tutorials for students, usually packaged for use with a computer.

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The term's meaning and usage has expanded and can refer to the entire course and any additional material when used in reference an online or 'computer formatted' classroom. Many companies are using the term to describe the entire "package" consisting of one 'class' or 'course' bundled together with the various lessons, tests, and other material needed. The courseware itself can be in different formats, some are only available online such as html pages, while others can be downloaded in pdf files or other types of document files. Many forms of e-learning are now being blended with term courseware. Most leading educational companies solicit or include courseware with their training packages. In 1992 a company called SCORE! Educational Centers formed to deliver to individual consumers courseware based on personalization technology that was previously only available to select schools and the Education Program for Gifted Youth. This study will focus on different Web Resources." [24]

II. WEB RESOURCES

A. Bolton Institute CAL Courseware [28]

This online courseware is designed to accommodate the MSc program in Environmental Technology at the Bolton Institute, UK. This web source include materials relate to contaminated land and address: history and political initiatives; soil assessment; water assessment and reclamation, including innovative treatment methods.

B. CIVCAL

CIVCAL, is a web-based source of geotechnical engineering projects in the Hong Kong area. The collection includes of descriptions, diagrams and photographs. The user may access CIVCAL material through any of university gateways at CIVCAL opening page and use the navigational facilities designed to suit the material within each university domain. Figure 1 shows the primary interface of CIVCAL.

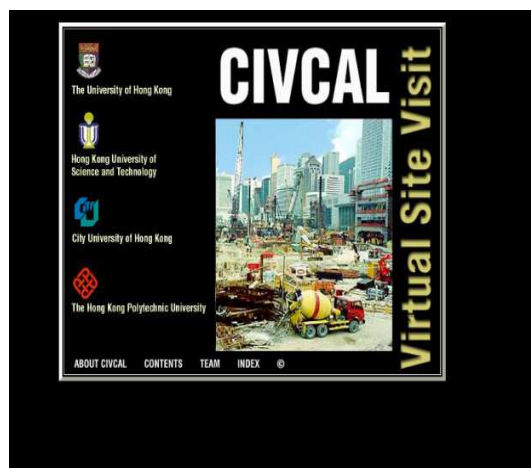


Fig. 1 CIVCAL (civcal.media.hku.hk)

C. GeoMeca (geomeca.ecp.fr)

GeoMeca is the web site of KSO (Knowledge Synthesis Organisation). The aim of this web source is to provide a better understanding of the in situ characteristic of the soils and rock for tunnels, foundations, dams and roads. There are different types of material available through the website such as photos, video clips related to soil mechanics, etc...

D. Arizona Geotechnical Courseware [25]

GROW (Geotechnical, Rock and Water Resources Digital Library) is phase I of a National Civil Engineering Digital Library (NCERL) that is being developed in the Department of Civil Engineering & Engineering Mechanics of the University of Arizona. One of the collections in GROW is a Virtual Geotechnical lab created by the author. These virtual labs allow not only for the virtual testing of soils as if the user were in a real lab but allow the user to explore other test situations that are often difficult to conduct in real labs. [3],[4]

Geotechnical Courseware, [3],[4] offers different concepts in geotechnical engineering which can be listed as:

Consolidation Concept is an interactive simulation of the process of consolidation specifically for fine-grained soils. Students can get good understanding while interacting with the software.

Virtual Consolidation Test provides an interactive simulation of the oedometer test

Virtual Triaxial Test is a multimedia web-based resource that is intended to replicate all the procedures that a student will perform in a real laboratory setting. Figure 2 shows the general interface of Arizona Courseware.

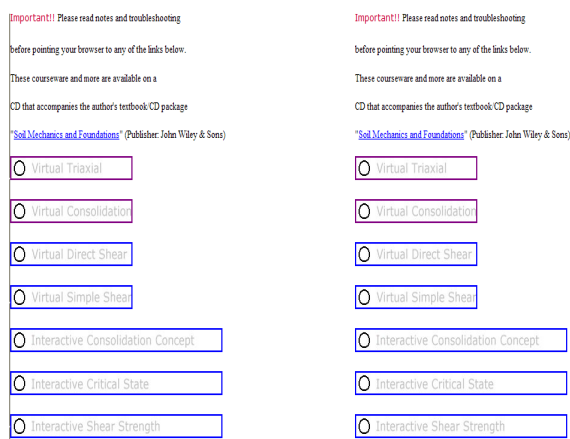


Fig. 2 Geotechnical Courseware
(<http://www.ic.arizona.edu/~ce544/ce544labs.htm>)

E. University of Melbourne Courseware [27]

The project aimed at developing multimedia learning modules to be used by lecturers and students. Specific modules developed included videos in DVD format and self-learning programs in CD or web-based format. The topics included deep excavation (construction of a multi-level basement in the city of Melbourne) and laboratory direct shear test.

In a climate where student field excursions are becoming increasingly difficult owing to large class sizes and extensive occupational health and safety requirements, the former provides opportunities for students to gain a detailed understanding of a complex construction activity undertaken in an urban setting. On the other hand, the laboratory module supplements limited hands-on laboratory experiments undertaken by students. The modules have been incorporated in elective subjects in geotechnical engineering and also presented as additional information in some other subjects. This paper describes the basis, project execution, and lessons learnt from the collaborative project. Finally, it gives a summary of an evaluation of the deep excavation module based on feedbacks received from a cohort of students. It is evident that students appreciate the availability of the modules, and perform arguably better in the respective subjects.

F. University of Durham CAL Courseware [26]

As it can be seen in figure 3, the University of Durham, UK, offers 3 sets of web-based courseware:



Fig. 3 Durham Courseware [26]

Dam Design [11] is a series of webpages that provides comprehensive information on concrete and embankment dams. There are sections on loading, site investigation, geology, hydrogeology, foundations, spillways, and construction of dams. *Dam Design* includes some limited self-assessment questions and worked examples, a glossary and reference lists. (Figure 4)



Fig. 4 Dam Design of Durham Courseware [26]

Road Design is a series of webpages that contain material to design roads based on UK standards.(Figure 5)

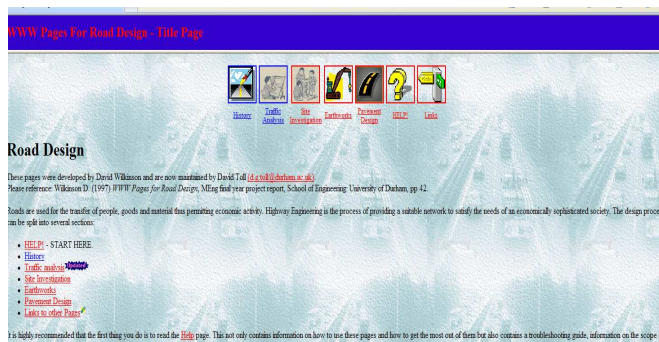


Fig. 5 Road Design of Durham Courseware[26]

Slope Design [6] is a series of websources that covers the slope design procedure.(Figure 6)

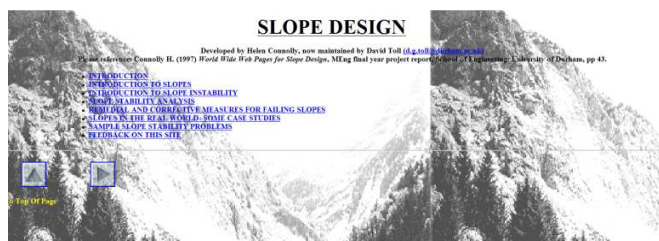


Fig. 6 Slope Design of Durham Courseware[26]

III. CONCLUSION

This paper focused on investigation on existing courseware and virtual labs in geotechnical engineering. It is likely that, in near future, CAL will achieve a significant role in teaching and learning practices than at present. Use of CAL is very cost effective and easy to handle specially with high speed internet and ease of internet usage seems to be a reliable solution in teaching.

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