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A Review on WEB Resources in Teaching of Geotechnical Engineering

Amin Chegenizadeh, Hamid Nikraz

***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 advantagesover traditional forms of learning. These include:[1],[2],[7]

1. The ability to run simulations of laboratory experimentsand design scenarios that allow the studentto see the effect on some behaviour by modifyingvarious parameter(s);
2. The material can be delivered in an exciting andchallenging manner;
3. Students are able to learn at their own pace, rather than fitting into a schedule set by the coursetimetable;
4. Student progress and areas of difficulty can be automatically monitored;
5. Scarce teacher, technician and equipment resourcescan 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 linksto geotechnical engineering software, is provided the Geotechnical and Geo environmental SoftwareDirectory which also provides a listof 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.

Amin Chegenizadeh is with the Curtin University of Technology, Perth, Australia Tel: +61-413165961;Email: amin.chegenizadeh@postgrad.curtin.edu.au

Hamid Nikraz is with Head of the Department of Civil Engineering, Curtin University of Technology, Perth, Australia; Tel: +61 8 9266 7573; Fax: +61 8 9266 2681;Email: H.Nikraz@curtin.edu.au

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 accommodatethe MSc program in Environmental Technology atthe Bolton Institute, UK. This web source include materials relate tocontaminated land and address: history and politicalinitiatives; soil assessment; water assessment andreclamation, including innovative treatment methods.

B. CIVCAL

CIVCAL, is a web-based source of geotechnical engineeringprojects in theHong Kong area. The collectionincludes ofdescriptions, 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.Figure1 shows the primary interface of CIVCAL.

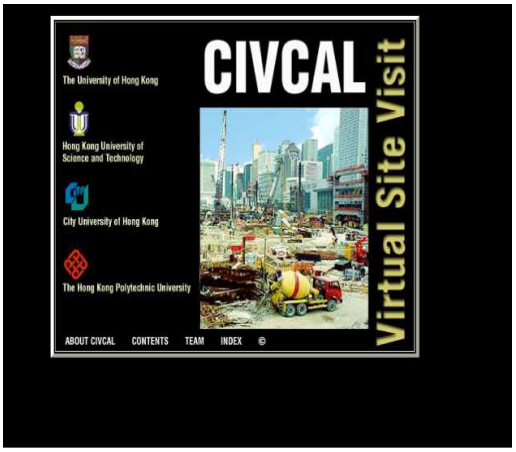

Fig. 1 CIVCAL (civcal.media.hku.hk)

C. GeoMeca (geomeca.ecp.fr)

*GeoMeca*is the web site of KSO (Knowledge SynthesisOrganisation). The aim of this web source is to provide a betterunderstanding of the in situ characteristic of the soilsand 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 mechanic, 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 simulationof the process of consolidation specifically for fine-grainedsoils. Students can get good understanding while interacting with the software.

Virtual Consolidation Test provides an interactivesimulation of the oedometer test

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

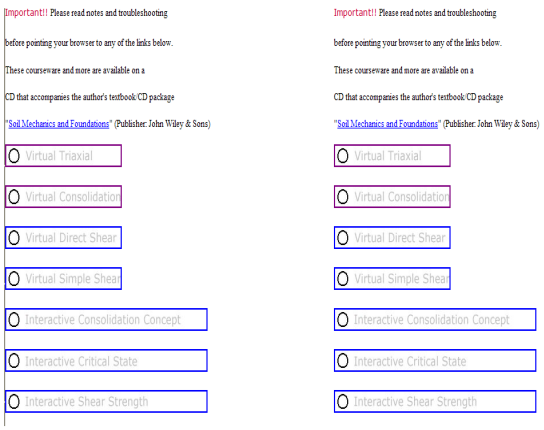

Fig. 2 Geotechnical Courseware
(http://www.ic.arizona.edu/~ce544/ce544labs.htm)

E. University of Melbourne Coursware[27]

The projectaimed at developing multimedia learning modules to be used by lecturers and students. Specificmodules developed included videos in DVD format and self- learning programs in CD or webbasedformat. The topics included deep excavation (construction of a multi- level basement in thecity 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 figure3, the University of Durham, UK, offers 3 sets of webbasedcourseware:

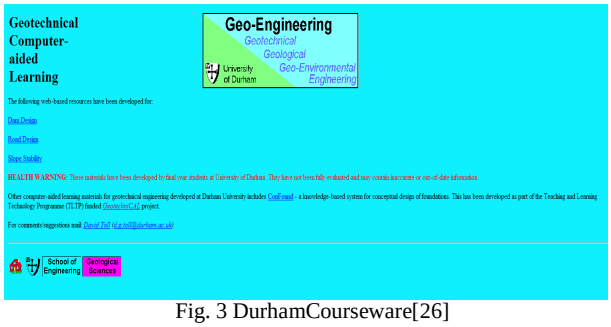

Fig. 3 DurhamCourseware[26]

Dam Design [11] is a series of webpages that provides comprehensive information onconcrete and embankment dams. There are sectionson loading, site investigation, geology, hydrogeology,foundations, spillways, and construction ofdams. *Dam Design* includes some limited selfassessmentquestions and worked examples, a glossaryand reference lists.(Figure4)

Fig. 4 Dam Design of DurhamCourseware[26]

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

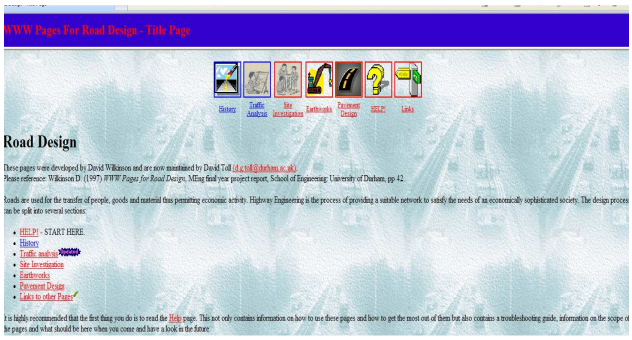

Fig. 5 Road Design of DurhamCourseware[26]

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

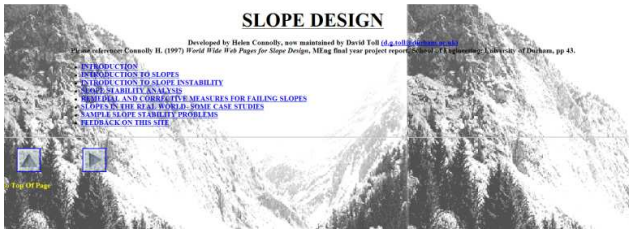

Fig. 6Slope Design of DurhamCourseware[26]

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.

References

[1] Alani, M. and Barnes, R. (1999). "A multimedia soil mechanics laboratory software development for teaching and learning purposes." Proceedings of the Int. Conf. in Engineering Education ICEE 99, Ostrava, Czech Republic, August.

[2] Budhu, M. (1999a). "A simulated soils laboratory test."Proceedings of the Int. Conf. on Simulation and Multimedia in Engineering Education, ICSEE'99, H. Tharp and L. Huelsman Eds., pp. 3–6.

[3] Budhu, M. (1999b). "Multimedia geotechnical laboratory testcourseware." Proceedings of the 1999 ASCE Annual Conference& Exposition, Charlotte, June.

[4] Budhu, M. (2000). Soil Mechanics and Foundations, Wiley.

[5] Byron, D. and Sowerbutts, W. (1996). "Courseware: Rock deformation and Geological Structures." In Structural Geology and Personal Computers, De Paor, D.G. Ed., Elsevier Science, pp. 39–42.

[6] Connolly, H. (1997). "World wide web pages for slope design", MEng final year project report, School of Engineering, Uni. of Durham.

[7] Davison, L.R. (1996). "GeotechniCAL – Computer assisted learning in geotechnical engineering." Proceedings of the 7th Australia New Zealand Conf. on Geomechanics, Adelaide, July, M.B. Jaksa, W.S. Kaggwa and D.A. Cameron Eds., pp. 957–963.

[8] Davison, L.R. and Porritt, N. (1999)."Using computers to teach."Proceedings of the Institution of Civil Engineers, Vol. 132 (Feb.), pp. 24–30.

[9] De Paor, D.G. and Simpson, C. (1996)."Visualization of basic structural geometries with Structure Lab 1." In Structural Geology & Personal Computers, De Paor, D.G. Ed., Elsevier Science, pp. 51–56.

[10] Ferreira, R.S. (1998). "Learning stress distribution in soils using a digital multimedia tool." Proceedings of the Int. Congress of Engineering Education, Rio de Janeiro, www.ctc.puc-rio.br/icee-98.

[11] Graham, A. (1997). "The development of world wide web pages for dam design", MEng final year project report, School of Engineering, Uni. of Durham.

[12] Jaksa, M.B., Kaggwa, W.S. and Gamble, S.K. (1996)."CATIGE for windows – Teaching basic concepts of geomechanicsby computer." Proceedings 7th Australia New Zealand Conf. on Geomechanics, Adelaide, July, M.B. Jaksa, W.S. Kaggwa and D.A. Cameron Eds., pp. 976–980.

[13] Jaksa, M.B ,L.R.Davison,D.G.Toll,Computer aided learning in geotechnical engineering education

[14] Moran, J.A., Langdon, N.J. and Giles, D.P. (1997). "Can siteinvestigation be taught?" Proceedings of the Institution of Civil Engineers, Vol. 120(3), pp. 111–118.

[15] Oliver, A.W. and Oliphant, J. (1999)."A computer-aided learning program for teaching effective stress to undergraduates."Geotechnical and Geological Engineering, Vol.17Paul, M.A. (1997) TALiSMANSpecialist Seminar on Copyright and the Web, Moray House Institute of Education, Edinburgh, June, www.talisman.hw.ac.uk.

[16] Robinson, D. (1995). "The Virtual Microscope."Terra Nova –Geologic, pp. 638–641.

[17] Sharma, S. and Hardcastle, J.H. (1999a)."Using Multimedia to Teach Geotechnical Engineering Laboratory Procedures."Proceedings of the 34th Engineering Geology &GeotechnicalEngineeringSymp., Utah State Uni., Logan, April.

[18] Sharma, S. and Hardcastle, J.H. (1999b)."A Multimedia Approach for Teaching Geotechnical Engineering Laboratory Testing." Proceedings of the 11th Panamerican Conf. on Soil Mechanics & Geotechnical Engrg., Iguasu Falls, Brasil, August.

[19] Sproull, J.D. and Orzach, M. (eds) (1991). "JedI teacher activities book." US Geological Society Open File Report 91-14.

[20] Toll, D.G. (1999)."Information technology applications ingeotechnical education and vocational training."In Geotechnical Engineering for Transportation Infrastructure,Proceedings 12th European Conf. on Soil Mech. and Geotech.Engrg., Amsterdam, June, F.B.J. Baraends, J. Lindberg, H.J. Luger, L. de Quelerij and A. Veruit Eds. (In press).

[21] Toll, D.G. and Barr, R.J. (1996)."Computer-aided learning forgeotechnical engineering", Deliberations on teaching andlearning in higher education, JISC Electronic LibrariesProgramme,www.lgu.ac.uk/iem/engineering/eng_comp.html.

[22] Toll, D.G. and Barr, R.J. (1998)."A computer-aided learningsystem for the design of foundations."Advances in Engineering Software, Vol. 29(3), pp. 637–643.

[23] Wilkinson, D. (1997). "WWW pages for road design", MEngfinal year project report, School of Engineering, Uni. of Durham.

[24] Wikipedia,2012sigthed at feb 2012

[25] http://www.ic.arizona.edu/~ce544/ce544labs.htmsigthed at feb 2012

[26] (www.dur.ac.uk/~des0www4/cal)sigthed at feb 2012

[27] http://eshowcase.unimelb.edu.au/files/showcase/excavate.pdf,sighted at feb 2012

[28] (www.technology.bolton.ac.uk/civils/mscenvgeo), sigthed at feb 2012