

## Improving student interaction using an e-learning tool for engineering design and construction

Craig Willis and Lindsay Doherty.  
The University of Adelaide, Australia

Corresponding Author Email: [craig.willis@adelaide.edu.au](mailto:craig.willis@adelaide.edu.au)

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### BACKGROUND

One of the most important attributes required for the successful transition from engineering student to professional engineer is a strong understanding of the relationships between theoretical design and practical construction. In other words, ensuring that the output from design calculations can be built in real life. For some engineering graduates, however, there can be a gap in this knowledge, which can lead to consequences ranging from inefficient professional development to dangerous practice, if incorrect designs are proposed.

### PURPOSE

The objective of this study was to improve student understanding of the links between engineering design and construction. Rather than use a traditional (and often ineffective due to a lack of student engagement) didactic lecture format, this study proposes an alternative teaching strategy with a focus on developing an interactive learning experience for students.

### DESIGN/METHOD

An electronic learning (e-learning) tool was developed using the computer aided drawing package *QikLink* (QikDraw Systems, 2010) to create a comprehensive documentation record of the construction of a multi-storey reinforced concrete building at the University of Adelaide. An interactive 'tour' of the building and construction phase was developed that was based around the professional engineering drawings of the structure. Using *QikLink* allowed the selection of different structural components of the building such as beams and columns, to display corresponding photographs, descriptions of details and challenges associated with their design and construction.

In addition, it demonstrated multi-disciplinary design requirements, such as the accommodation of mechanical and electrical services that affect the arrangement and type of structural elements possible in a building. Such practical examples were demonstrated in the virtual building tour and gave students the freedom to explore the entire construction process of the building.

Students were required to review the e-learning tool as part of their independent study prior to the face-to-face teaching session. By engaging with the course content prior to contact with the lecturer, the format of the learning environment was able to be changed from the passive didactic lecture to include active learning strategies such as situational learning (Gamboa *et al.*, 2009).

### INTERIM FINDINGS

The results of qualitative surveys showed that students felt that the teaching strategy of using the e-learning tool improved their understanding of the complex relationships between engineering design and construction. Also, students indicated that the e-learning tool improved their appreciation of the multi-disciplinary requirements in engineering practice. The understanding of the links between the elements of design demonstrated higher order learning and a holistic approach to design whereby several conflicting objectives were accommodated.

As it allowed students to independently study the course material at their own pace, they appreciated the opportunity for flexibility of learning. Students felt that using the e-learning tool built their confidence in the curriculum, and having the subsequent active learning strategies in the face-to-face session was more engaging than a traditional lecture format. This is supported by the findings of Goldberg *et al.* (2006) that concluded if the course material is delivered electronically, students believed that they had more time to contemplate the information and that the allocated lecture time could be used more interactively and effectively, rather than to simply recite the course material.

### **FURTHER RESEARCH**

With the *QikLink* package having the potential to be used in a variety of applications and disciplines, including engineering and beyond, there is scope for research to further develop its educational use. In this way, new learning resources can be created and viewed in a much more intuitive and navigational manner, rather than the relatively linear viewing (i.e. delivered as a succession of slides) of more commonly used presentation packages such as *Microsoft PowerPoint*. Like traditional slide presentations, *QikLink* can also be projected to a classroom or lecture theatre, but it has the additional capability to develop concepts and ideas interactively on the projected image in a sophisticated way. The effectiveness of its use in these proposed applications must be evaluated with respect to the student learning experience.

### **CONCLUSIONS & CHALLENGES**

The integration of the e-learning tool into the learning space resulted in improved student interaction. This was achieved in two ways: 1) by engaging students in a pre-lecture setting through the study of course material; and, 2) utilising active learning strategies in the face-to-face teaching sessions. While the development of the e-learning tool was initially time consuming, the overall academic workload for teaching staff has been reduced. This is due to the repeat use of the learning materials for several years and for multiple courses.

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### **KEYWORDS**

e-learning, interaction, design, construction.

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