Information Technology in the Building Design Engineering Studio

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This paper reports on the activities of CADET in the design studio environment and in a variety of community contexts with the objective of developing a strategy for teaching design within the context of design, art, architecture and engineering. It begins with an outline of earlier design projects, in a variety of traditional media and in CAAD at several levels within the Undergraduate programme at the University of Strathclyde together with community organisations. It then outlines a model with a number of strands that explore the principles of visual communication which are fundamental to both the development and communication of design ideas. The report will place these activities in the context of developments in education and the wider sphere of cultural heritage, which ultimately inform understanding and knowledge of our architectural and design heritage. It will highlight and explore some important ideas that inform our judgment of aesthetic forms and refer students to relevant texts and precedents in art, design, engineering and architecture.

Introduction

Architecture and design, together with our social and ethical principles, define our cultural heritage. The study of design, architecture and engineering are therefore central to the education of future generations – the value we place on these is reflected in the quality of the built environment that is our collective responsibility and the legacy we bequeath to future generations.

This project, while dealing with practical problems in teaching design, is informed by established theories of design and visual communication. It is not simply practice, nor theory bound, but a creative praxis that focuses on the potential that exists in the use of CAAD as a dialogic tool.

In the Memorandum of Understanding, Multi-media access to Europe's Cultural Heritage, Val Herman identifies in his final report important issues in developing multi-media uses in education :

- "Examination of the use of cultural & heritage material in the educational sector, including school/museum linkages."

- "Examination of how multimedia cultural heritage material can be introduced into the curriculum."

- "Stocktaking of IT resources & multimedia cultural heritage initiatives in schools."

- "Monitor and evaluate pilot approaches to the use of multimedia cultural heritage materials as educational tools, their generalisation & transferability.

- "Identification of specialised applications (e.g. for the disabled) & different levels of education (e.g. higher education)."

If these aspirations are to be realised, education, at all levels, must harness the increasing enthusiasm for IT rather than allow it simply to be background noise in recreational environments

Objectives & Context

The objective is to use Information Technology at all levels within the Building Design Engineering Course in order to increase the students understanding of the potential of multi-media in the development and communication of ideas an integral part of the design studio.

Building on the experience of the earlier stages that involved pupils in primary and secondary sectors as well as adults, the present project will similarly involve secondary school pupils and adults as part of the wider community.

As Paul H Hirst has stated, «To acquire knowledge is to become aware of experience as structured, organised and made meaningful in some quite specific way, and the varieties of human knowledge constitute the highly developed forms in which man has found this possible. »

Increasingly, Multi-media functions as a means of presenting information not only about our cultural heritage but also the environments in which that culture exists. Understanding the structuring, organisation and meaning of common experience will be determined by ones ability to read and decipher that which is encoded in multi-media presentation. An understanding of the principles of conventional design languages is the key to participating in the discourses of the design, architecture and engineering that shape our built environment. The conventions of visual communication are a core part of the educational curricula at all levels of education.

The Project

By integrating computer based 3D modelling into the design studio students inadequacies in manipulating 3D space and in particular their use of colour and light as a modelling tool were highlighted. This increased the awareness of the need for conventional teaching of the visual elements within pictorial conventions. This project identifies as crucial the introduction of computer assisted learning at the earliest stage of the undergraduate programme, and by implication to an even earlier stage in secondary education.

This took the form of formal teaching utilising information technology to illustrate the principles of design with particular reference to precedents, as well as reviewing the elements of a visual language and colour theory. In developing an IT database of teaching material we have created a more effective and flexible resource which complements the traditional slide library resources.

By the complete integration of CAAD to the design studio the most able students are able to think and express complex ideas directly in 3D Studio without the use of any conventional media. We have found that when CAAD is taught at a later stage in the course students with ability in conventional skills can utilise CAAD effectively, whereas the weaker student tends to expose their deficiency in design. However, experience demonstrates that there are those who are perceived as weak in design but are in fact merely limited by their lack of ability in conventional presentation techniques. These students are enabled by IT to demonstrate their true design ability and to participate effectively in the design process.

Encouraged by these specific findings we have integrated this form of teaching into the first year syllabus of the Building Design Engineering Course. This approach, far from limiting the learning experience, has actually had the opposite effect. E.g. one of the students who commenced the course with limited conventional pictorial skills has been enabled by the technology to successfully complete the year with the major part of his design submissions conceived, developed and presented as purely digital images. The outcomes of this study are illustrated by some images of this work.

Outcomes

The Building Engineering Course is a multi-disciplinary course focused around the activities in the design studio. For the first two years the students follow a broadly based curriculum. At the end of second year students choose which of the options, (architecture, civil engineering, environmental engineering or construction management), they are going to specialise in. Even though they are specialising in a particular area the students continue to participate in the design studio and work as multi disciplinary teams in their final year.

This multi-disciplinary approach means that the incoming students have a very diverse range of skills and abilities especially in their pictorial skills. The outcomes described in this section are based on the experiences gained with this current cohort of first year students.

The design studio curriculum that makes up 33% of the first year syllabus has four design credits one of which is Design & Information Technology (D&IT). As part of this course students are taught IT skills including word processing, desk top publishing, photoshop, and 3D Studio. This is complemented the by formal teaching of art, design, architecture and presentation techniques. It must be emphasised that all this takes place in an integrated studio environment with students having access to both conventional drawing boards and computers. All the software used is on a networked p.c. platform including peripherals - A4 colour inkjet, A3 black and white laser jet, A0 colour inkjet downgraded to black and white, and a colour scanner.

To introduce students to the design of the built environment they are required to produce a bibliography for a famous designer from an approved list. It is worth noting that prior to this exercise many students would find it impossible to list more than three architects or engineers. This introduces the students to examples of quality design and allows them to practice their word processing, desk top publishing and presentation skills.

Later in the year students are required to produce a poster for their chosen architect. This involves the analysis of the architecture and experimentation in presenting their findings using a variety of media. The studies are supported by seminars and tutorials in communication techniques. Making judgments as to the value of a design is based, not only on an intuitive grasp but also on an understanding of the conventions and context of the work. An important aspect of the design studio is access and use of precedents of good practice. The results include work in oil pastel, water colors, computer manipulated images and computer models (see figure 1).
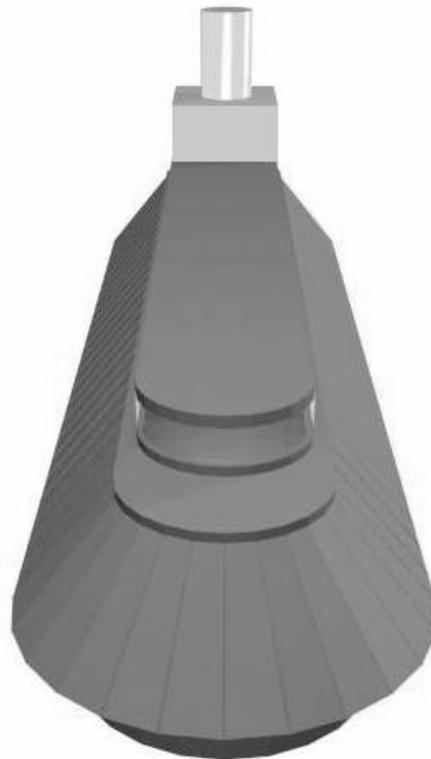

Figure 1.   Computer model of the Bookshop in Venice by James Stirling included in one of the student poster designs.

The concept that underpins much of this teaching is 'value added learning'. It is important that in an overcrowded curriculum students gain as much from each learning experience as possible. Information technology must be taught in an integrated manner by design studio staff and not by 'specialists' divorced from the studio.

Students are encouraged but not forced to utilise the IT facilities in executing their other design projects and associated supporting exercises (see figures 2 - 3).
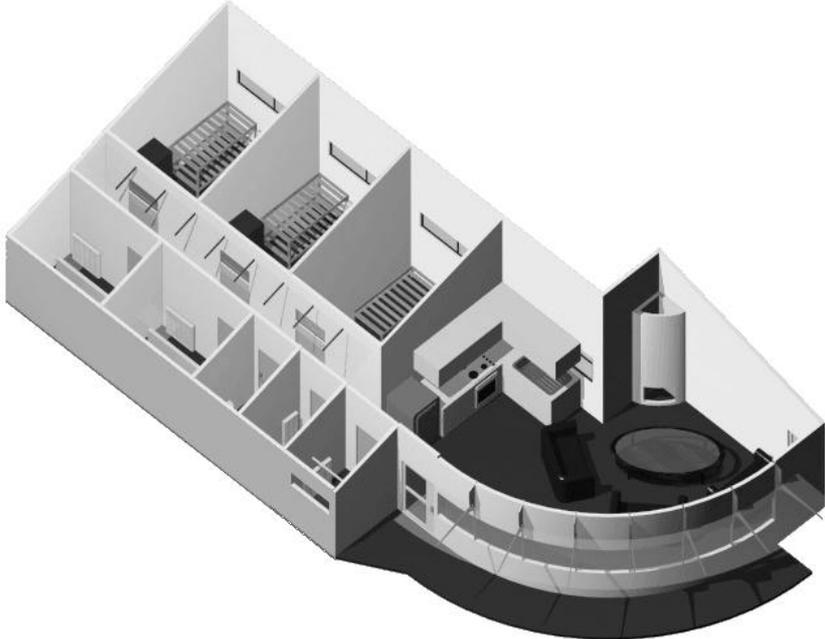

Figure 2.   Axonometric of a team building retreat.

Figure 3.   Perspective of team building retreat in site context.

The important feature of the project featured in figures 2 and 3 is that the author of the scheme worked exclusively in 3D Studio. There were absolutely no conventional drawings. Tutorials took place around the computer and the final presentation was executed in Power Point. The discipline of organising the images for an electronic presentation enabled the student to communicate the design process undertaken more effectively than many who presented their concepts conventionally.

Conclusions

This study highlights the potential of the effective use of information technology in both the teaching of design skills and in the development and communication of design concepts. Its effectiveness is dependent upon those leading the design studio being not only computer literate, but also committed to the creative application of the technology.

Initially this method was introduced at third and fourth year levels. We then introduced it into second year and this year into first year. Earlier workshops with younger students have indicated the potential for success at an even younger age. We are currently developing course material for use in a pilot scheme that will integrate the teaching of art, design and technology by the use of information technology and computer aided learning in Govan High School, Glasgow.

There are identifiable differences in the reasons why students use computer modelling. It depends at what level it is introduced and whether it is a compulsory part of the course or an elective. When introduced at a senior level as an elective students broadly fall into two main categories - strong students who perceive it as another technique to enhance their work and less able students who hope that it will improve their work. Unfortunately computer modelling tends to highlight the design weaknesses of the latter group. There are also some students who are perceived to be weak designers, due to their lack of conventional pictorial skills, who are enabled by their acquisition of computer modelling and animation skills to demonstrate their latent design ability.

When computer modelling is introduced as a compulsory part of the course at an early stage in the curriculum, the weaker students are the first to give up and not try to utilise its potential within their design studio work. This is seen as a positive advantage as there is a lot of damage done to the perception of CAAD by weak designers using it ineffectively.

This case study highlights the effectiveness of an integrated approach to design teaching through the use of information technology. Our experience demonstrates that this approach enhances the learning experience and the understanding of design.

References

Hirst, Paul H. 1974. *Knowledge and the Curriculum*, London: Routledge & Kegan Paul.

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