Value Added Learning: The Cadet Experience

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Abstract: This paper reports on the integration of Information Technology in the Building Design Engineering Studio. It is based on the work carried out by the CADET Unit (CAD Education and Training), which promotes a better understanding of the built environment through an integrated approach to design studio teaching. This is achieved through a dynamic studio environment guided by a Building Design Engineering ethos that adopts a holistic approach to design; recognising that design in engineering, architecture and the visual arts demands an understanding of the challenges of a multidisciplinary approach that acknowledges a broader cultural dimension.

There are increasing demands placed on students of architecture and engineering. They require skills in making physical as well as computer models, they must be able to draw in 18th & 19th century conventional media (paper, pen and pencil) as well as CAD and they must be proficient in rendering in full colour both conventionally and in the electronic media including animations. The creative use of the computer at the point of analysis and conceptualisation, as important as technical proficiency, is a necessary part of the design process.

In recognition of the demands that we currently make of university students we are exploring two critical responses. In the first case we demonstrate an integrated approach to design studio practice, achieving a value added learning experience in the University Sector, and with a view to the longer term we are exploring the application of a similar design approach within the Secondary School Sector in order to raise the awareness of design at an earlier stage.

1. Introduction

The Building Design Engineering course was created over 10 years in response to the perceived need by government, industry and construction professionals who have a greater understanding of the various design disciplines. It was therefore developed as a multidisciplinary course where students do not normally specialise in the design field of their choice until the end of their second year. At that point students choose from professionally accredited streams in structural engineering, environmental engineering or architecture. They can also elect to follow a construction management stream or a non-specific general stream. Students in 3rd and 4th years, no matter what stream they are following, continue to participate in the Building Design Engineering studio projects. In 4th year this involves working in multi-disciplinary teams. As integration is a key element of the design methodology CAD was considered as one of a number educational strands of the design studio.

With the need to satisfy the course requirements of the three professional bodies the first two years of the course are highly prescriptive. This leaves very little space within the curriculum for the teaching of information technology in a traditional way, as 11 of the 12 classes taken are compulsory and it is acknowledged that students already carry a very heavy work load. We believe that information technology should be seen as another tool to be used in the design process and not be assessed as a separate skill. With the amount of software currently being used within the school it would be possible for CAD classes to account for over 15% of an undergraduate degree which could clearly distort the degree classification.

It was therefore necessary to incorporate the teaching of IT skills into the various design tasks of the Building Design Engineering studio projects. This integration was achieved by Design and Information Technology 1 - which has taken the place of one of the four design credits. As well as being a pragmatic approach, it is also pedagogically sound in that while the course contains a lot of information technology teaching the emphasis is on its application. The assessment is of the creative outcomes of the exercises - no marks are awarded for learning the software.

In following this route we have had to consider IT in relation to the other traditional media and in particular its role in the design process.

2. IT in the Design Process (a creative tool?)

A course concerned with art, science and technology should strive to integrate those aspects that contribute both to our understanding of the built environment and to the shaping of it. The Design and Information Technology 1 course, and in particular the design studio workshop, is the point at which the principles of these specific disciplines are interwoven.

IT underpins the relationship between theory and practice by requiring the student to research particular precedents in drawing, design and methods of presentation. Of equal importance is identifying how these conventions relate to other modes of signification – in particular the language of a critical discourse. In this paper it is proposed that the strength of feeling against computer aided design is 'devious and confused' [Benj92:220], based on a blind prejudice, a lack of historical perspective, a narrow minded classicism and, at worse, a cynical elitism that seeks to exclude rather than embrace a wider constituency. In the lectures on design the aim is to achieve a more balanced perspective.

Analysis of precedents in Design, Architecture and Engineering explore a common pictorial language. Within these disciplines pictorial conventions demonstrate that 'traditional drawing' is one of a number of conventions applicable to the design process. CAD is then but one of a number of tools that presents a possibility to represent events in time as well as objects.

In the design studio students are required to consider the following points covered in lectures and tutorials within the Design and Information Technology 1 Course.

1. The issues around drawing expose a 'style' that has evolved within a particular academic tradition with a strong emphasis on specific conventions within Fine Art.

2. This 'traditional' drawing, narrowly defined, would exclude a wealth of techniques characterised as 'work on paper', including collage and photo-realism that lend themselves to software such as 3D Studio, Photoshop and PageMaker.

3. As with the 19th century debate about painting and photography, the issue is not between a traditional drawing medium and computer drawing, but the appropriate use of a medium which clarifies ideas, organize and present possibilities as they arise, explore potential developments in briefing a concept and a programme of work. What is required is a medium that facilitates an intuitive and creative response to design problems developed in the student's Building Design Project.

Lectures and projects explore:

The historical roots of 'drawing' from its appearance in the 16th – 18th century, and in particular the promotion of drawing as a personal style. Failure to recognise this encourages a mystification of the design process that inhibits sound inquiry and research.

The 18th century canons had to adjust to the Salon des Refusés but, while the Ecole des Beaux-Arts, that resisted the innovative drawing techniques of Viollet-le-Duc, appropriated the concepts of Modern Art and Architecture, the obsession with 18th century pictorial conventions would appear to be alive and well.

In literature, and in current assessment practices, we are reminded of the strength of that influence on those trained before the advent of computers. It should be remembered that those who represent that first dawn of the Modern Style exert an inordinate influence on contemporary teaching practice as they represent the bench mark of good design practice.

Understanding good practice is achieved by a careful analysis of exemplary precedents and a systematic review of design texts. Students are required to review texts and extrapolate the guiding principles of current design processes. Bryan Lawson's Design in Mind is a useful example in highlighting the relationship between current practice and

historical precedent.

Lawson remarks that "Calatrava reveals a dazzling array of influences and interests." [Laws97:22] In this artist-architect we can see a tension between traditional approach to drawing and the use of CAD. According to Lawson, Calatrava "freely acknowledges the historical influence of Viollet-le-Duc." [Laws97:22] In particular in his exploration of the qualities and properties of different materials – which he explores in a sculptural form both for itself and as part of the design process. In this approach Calatrava conforms to the academic tradition. He shares with Viollet-le-Duc a preference for structural drawings and sections in keeping with the attitudes of the structural rationalists that emerged in the 19th century and in contrast to the prescriptive style of the Ecole des Beaux-Arts. While his graphic style differed, Viollet-le-Duc shared with the academic tradition the notion that "drawing was a way of seeing an essential truth not immediately apparent to the eye." [Viol90:4] With Calatrava the search is for an essential form which he will often explore directly from the abstract, "sometimes it is just a gesture or an idea perhaps about equilibrium". In other cases he identifies that "technical advances usually come when we try to solve specific problems rather than from generalized or abstract thought." [Laws97:22] For Calatrava, therefore, the design process represents a flow between inspirational and intuitive responses to a place and an analytical approach to particular technical problems. While he "likes to work rapidly and intensively at certain stages of the design process…(achieving a design with)…freshness and spontaneity" [Laws97:30] he acknowledges that, in the case of CAD, he "very much likes the unbelievable precision…'maybe sometimes you want an arc between two points which you want to see immediately and you could not do this by hand'…". However compared to the 'hyper-realistic models' (of computers) he prefers "the abstraction of black and white models." [Laws97:28]

Calatrava provides a good reference for students of art, design, architecture and engineering in that he demonstrates a transition from the traditional approach to contemporary practice, a consciousness of the value of historical precedent, reference to nature and art history together with an open, if qualified, approach to CAD.

The question remains which medium can express the modern condition? Without doubt the 17th century drawing has that capacity in the hands of those with that particular feeling for traditional medium. However, the sensibility and imagination can also be expressed in collage, montage and in filmic terms. In particular, where 'event', rather than 'object' is the issue – "the traditional architectural drawing cannot describe multiple points of view, change of light over time or the motion of bodies…" [Tsch97:123] Tschumi raises an issue that cannot be resolved not even by a contemporary Tiepolo or by Baroque machinations at their best. We have moved beyond the limited vision of the Impressionist to a new era. As such we must address the expressive potential of new media. This does not mean turning against the conventions of Leonardo, Raphael, Durer but extending the means of expression to accommodate different sensibilities. "The mode of human sense perception changes with humanity's entire mode of existence. The manner in which it is accomplished, is determined not only by nature but by historical circumstances…" would demand that we are forever critical of the tendency to accept existing canons of taste. "…technology has subjected the human sensorium to a complex kind of training." [Benj92:216,171]

As long as the precedents are sought in those wedded to an 18th century tradition, with all of its splendid visual and architectural effects, each new generation will be marginalised. The history of art and design would indicate that, strong as institutional pressures to conformity are, new technology will steadily transform our methods of working and therefore our mode of perception.

When Richard Burton, according to Lawson "considers that the directness with which he can alter a drawing is missing when mediated by a computer and thus the feeling is lost" [Laws97:14] he is talking from a particular experience of education and within a particular historical context. He is quoted as believing "I know now that if I can't visualize a thing clearly in my mind I'm not going to be able to draw it very well." [Laws97:14] Lawson goes on to emphasise that drawing it well is important to Burton, "an artist as well as an architect". [Laws97:14] Lawson thought it important to stress the distinction "Being an artist, it clearly offends Richard Burton to draw 'not very well'…Thus the urge to produce better drawings drives forward the need to resolve and clarify ideas in the mind." [Laws97:14] This tradition is one in which the medium of drawing and other conventional pictorial modes of representation have resisted an effective use of CAD. As with traditional approaches certain values are attached to particular ways of doing things. Specialism, in both education and the professions, tends to exclude the general public from that specialist language and discourse, and therefore the knowledge that comes from that practice. In such a fractured society "knowledge is and will be produced

in order to be sold" [Lyot91:4] The consumer or client is therefore at a disadvantage.

But Burton underlines the importance of developing ideas and sharing these with the client. He "sees his relationship with the client as critical in the design process. In particular, he stresses the interactive nature of brief making." [Laws97:14] In Burton's own words "clients are beginning to understand that briefing is an absolutely crucial element." [Laws97:14] Now clearly clarity of ideas are essential in this process and therefore the medium of drawing is crucial. To assume that the client has the knowledge to understand the medium is an assumption too far.

In contrast to the reservations of Calatrava and Burton, Ian Ritchie "uses his computer very much like a sketchbook". [Laws97:90] Decisions are not made "solely on drawings; models are always made and displayed and now the computer operates in that field as well" [Laws97:90]. Ritchie uses the computer to get "simple and quick views of emerging designs to aid design decision making…'What we are looking for might be only 10% of all the lines on the screen. A particular proportion, a particular view'. Consequently he never lets clients see these drawings since they would 'see 100% of the lines' and thus miss the point." [Laws97:90]

Here Lawson, through Ritchie, raises important issues with regard to both the relationship of designer/client and accessibility of pictorial conventions.

The changing role of the designer (or one more recently acknowledged) in a participatory process requires an extension to the traditional modes of representation. In stressing this important issue in the design studio a brief review of drawing and the language of criticism is explored in lectures, assignments and criticism in order to emphasise the 'conventional' nature of these modes of representation and production.

As part of Design Project 1A the students are required to draw a well designed object. This exercise is supported by a series of short lectures which highlight both the development of drawing techniques and the language of criticism. As noted with Lawson some of the language below appeared in the interviews in which the designer described the qualities looked for in their drawing process.

A summary of some attitudes to drawing are outlined in order to show how this 'knowledge' has developed within a particular social and historical context. Giorgio Castelfranco descriptions of the Drawings of Leonardo da Vinci provide a useful example of the 'traditional' concept of drawing which, sadly, became institutionalized through the Ecole des Beaux-Arts and other 'Royal' Academies. Following this academic tradition artists would follow a prescribed process in the study of precedent and in the study of nature. These conventions are illustrated in the lectures which highlight attitudes to drawing and ways of describing drawings.

Castelfranco highlights the following:

"a tendency is to condense the external realities of colour by subjectively and selectively interpreting the colours of any given object in terms of their visual impact; that is according to the degree of light or darkness involved in what is seen."

(the artist) "must choose, or rather fashion, a combination of colours which fundamentally he has invented"

"that intrinsically non-chromatic image which is commonly called the 'form' of things."

"man is more apt to remember form than colour (form being more persistent in changing conditions), and because they provide things with those fundamental structural attributes which no one can possibly ignore if he hopes to live and function in the world."

"given the great rapidity and convenience of drawing…it has always lent itself admirably (to the artist's) first attempts at setting down their ideas, testing structural values, adapting elements from previous works to new compositions or experimenting with typical, generic forms before trying to individualize them and gradually absorb them into a personal

style." [Cast71:1-4]

These ideas are very much in the academic tradition. We read in Reynolds' Discourse of the importance of studying the great masters (the established code). He distinguishes between study and "the drudgery of copying" in which one "falls into the dangerous habit of imitating without selecting, and of labouring without any determinate object". He would recommend one "to make slight sketches of the machinery and general management of the picture." If this method is followed the student will find that "ideas (are) thus fixed by sensible objects, will be certain and definitive; and sinking deep into the mind, will not only be more just, but more lasting than those presented to you by percepts only; which will always be fleeting, variable, and undetermined." [Reyn66:33-34]

We find the directness, abstraction, spontaneity reflected in Lawson and his interviewees (above). But the strength of traditional 'values' becomes elitist and counterproductive as education moves acts against intuition and imagination and towards "prescriptivism, standardization and codification" [Batt94:22] becoming set in a narrowly defined practice. The example of language developing in a 'court' system demonstrates an ideological strategy that cannot last (as history demonstrates) and certainly must not be encouraged in an educational environment. By opening up the range of media and presentational techniques, and emphasising communication, the client of the future will be able to read, like Ritchie, the 10% lines. It has long been the belief that drawing is the art of leaving out, of reduction.

The interaction with the client is recognized as a crucial part of the design process. In the design studio it is important to stress how a visual language evolves, and the way in which 'style' and technology, old and new, give form to language and change our perception of the world.

Research reveals that our European pictorial conventions are part of "a historical process in which the changing world of material goods conditioned the modes of perception of an entire population (Italy)" [Gold95:148] In reviewing the emerging conventions of drawing, the academic style should be seen in the context of the language of criticism and other codes of behaviour. Drawing should be perceived as part of a number of presentational modes. The example of 17th century France provides an example. France sought a period of stability, consolidation and ultimately expansion. Culture was an instrument and strategy equal to the institutional control provided by the armed forces.

The Academic institutions set out the canons of taste and behaviour – marks of distinction that established an elite. Art and Architecture adopted the same principles perceived to have been successful in Italy. In the pictorial arts "painting allied itself with literature, and once painting was admitted to this rhetorical culture of the imitative arts deeply steeped in the classical tradition, the first claims were made for it as a higher intellectual activity that separated it from the mechanical arts and placed it as a sister art alongside poetry." [Gold95:146]

Drawing is one, crucially important, convention that has developed within a particular historical context. It is not a gift endowed from above. It is a tool that fashions ideas. It has appropriated, in its association with luxury goods, a very special place in the codification of a particular visual language. It is a product of the 17th and 18th century that witnessed a period of rapid change – what we now recognise as the modern age. A significant innovation of that period was the institutionalisation of knowledge, of language, behaviour. The visual arts were but one of a rich system of signification. This material is given as background information to assist the students in their application of their DTP skills.

In their 'linguistic perspective' of France in the 17th century, Battye and Hintze recognised that the "ruling elite needed a badge of identity and the grammarians, who codified the standard variety of French, helped them to find one." [Batt94:22]

They also describe a relationship between city (Paris) and Court that gave birth to institutions and attitudes that are ingrained in our present cultural institutions. Their image is worth considering in more detail. "The new sense of the need for order and regimentation in society (often referred to classical values) made itself felt, not only in the political, but also in the social sphere, where the concept of 'honnêtes hommes' grew up. The honnêtes hommes were individuals who in their conduct displayed the virtues, the social graces and intellegence which were desirable attributes of those who were to be counted as members of the ruling elite." [Batt94:22] Creatures of the salons, the type of which survived

the Revolution and sought to shape the structures of cultural institutions through their control of education and the arts.

3. Course Structure and Outcomes

The Design Information and Technology 1 course runs throughout both semesters and is made up of three components:

- Bibliography
- Design Analysis and Poster Design
- Long Span Structure: Model and Analysis

The bibliography is to acquaint the students with information gathering and preparing a report including the design of a title page and illustrations. In order to assist with this the students are taught word processing (word), desk top publishing (PageMaker) and scanning images. The exercise also familiarises students with the work of some architectural icons. There is a short series of lectures on graphic design and colour to support this exercise. Students are assessed on the content of their bibliography and its design and layout.

On completion of the bibliography the students are then taught 3D Studio for the remainder of the semester. In order to practice their skills students are required to model some features of a building by the subject of their bibliographies. This work is not directly assessed.

At the start of semester two, students are given a series of tutorials and lectures to help them to analyse and understand the architecture of "their architect". They are also encouraged to experiment with different presentation media. They are then required to design a poster for "their architect" which must include one of their 3D studio images. Students are assessed on their understanding of the architects design philosophy and the design of the poster.

The final exercise involves the construction of a physical model (or computer model) of a long span structure. In order to help them understand the forces acting within the structures the students are helped to produce some graphical output using "lusas" a structural analysis package. Students are assessed on their understanding of the structure and the quality of the model.

While the students are learning and applying several IT packages they are only assessed on the final design output and not on their technical expertise.

Students are however encouraged to utilise their new IT skills in the other design projects that they participate in. This has produced mixed results with some students producing all their design presentations manually and some using IT to a great extent. There was even one student who produced his entire design and presentation electronically with absolutely no sketches or drawings being produced throughout the entire design process. This is an example of CAD as a design tool.

4. Future Directions

From our experience of working with undergraduate students and post graduate students of all levels and through workshops in the community with primary and secondary pupils and adults we believe that this integrated approach to the design process makes a valuable contribution to the formal curriculum and general understanding of the creative potential of CAD. We are currently establishing a collaborative research project in conjunction with Govan High School, Glasgow involving artists, designers and client bodies representing organisations in a social context forming part of Glasgow’s Year of Architecture and Design 1999.

5. Conclusions

We can learn from A.N. Whitehead that "when you analyse in the light of experience the central task of education, you find that its successful accomplishment depends on a delicate adjustment of many variable factors. The reason is that we are dealing with human minds, and not dead matter. The evocation of curiosity, of judgement, of the power of mastering a complicated tangle of circumstances, the use of theory in giving foresight in special cases – all these powers are not imparted by a set rule…". [Whit70:8]

In the context of the design studio what is required is a means of organising and presenting ideas. "Organised thought is the basis of organised action. Organisation is the adjustment of diverse elements so that their mutual relations may exhibit some predetermined quality." [Whit70:153] Computer aided design is one such medium. As soon as we extend our notion of 'appropriate' content, such as the relation of environmental qualities to the movement of bodies, should we limit ourselves to a 4B pencil, or the radically new rapido-graph, fine line pen or marker?

CAD does not restrict or diminish the pictorial form. Images in 17th century Italy, prior to the fashion for simplicity, was populist, ubiquitous yet contributed to the development of a sensibility that was unique in human history. We are not about to erase it from existence, simply extend its possibilities and embrace other ways of seeing and expressing ideas.

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