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MEDIA USE IN THE DESIGN STUDIO: A CASE STUDY OF SECOND YEAR ARCHITECTURE

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ABSTRACT
This paper outlines a case study of media use within a second year design studio at Deakin University in Victoria, Australia. The case study involves an active cohort of students working on four design projects, each staged to address specific aspects of tectonics and conceptual design. The research is based on three questionnaires, a focus group discussion and analysis of assessment and digital folios to explore the way students use digital, analogue and hybrid media within their design projects. Relationships are drawn between media use within projects and student perceptions of the benefits of using particular media within projects of a conceptual or tectonic nature.

Keywords: media, design studio, architecture, case study

INTRODUCTION
This paper discusses an exploratory study of making with digital and physical media within the second year design studio. The paper represents a small part of a wider research project being conducted by the author. Ethnographic case study methodology is used to address two key research questions:

What is the relationship, for students in this case study, between media use and demonstrated ability to resolve design and tectonic issues? What are the key issues brought up by students relating to the use of media as learning tools for the understanding of design and tectonics?

Two fundamental issues in the education of young architects for practice are represented here: tectonic design education and representation media. 'Tectonics' is defined by Webster's dictionary as 'the art or science of construction' (Porter 1996) but is brought into the realm of design by (Frampton 1996), and referred to as 'the poetics of construction'. Understanding tectonics is fundamental to the practice of architecture, as it is the nexus between the concept and 'real' architecture. The practicing architect, as 'a person skilled in the art of building' (Porter 1996), is required to have developed understandings of tectonics as a basic requirement for architectural competency, as dictated by the National Competency Standards in Architecture (AACA 2001). Registered architects are required to have the requisite skills to enable the 'resolution of design, integrated technology and methods of procurement in complex buildings'. The early years of architectural education are seen as a pivotal time for the teaching of tectonic principles: the manner in which tectonics is taught in these early years is likely to influence the potential for understanding tectonics in future design processes.

Just as tectonics is a means of translating ideas into a built reality, representation is the nexus between the idea as conceived in the mind and the communication of ideas to a third party. Representations of design concepts are recorded through the use of media (e.g. paper) using tools (e.g. pencils, computer) within certain procedures (e.g. drawings) (Dave 2000). The learning and refinement of representational techniques throughout the architecture course is essential as it enables students to communicate their ideas to studio 'masters', reviewers and colleagues. Representational media explored here are principally 3D CAD, physical models, drawings and hybrid combinations of these.

MAKING TECTONICS: THE CUTSD PROJECT
The Committee for University Teaching and Staff Development project, 'Reflective Making' addressed the issue of teaching tectonics with a particular focus on 3D CAD. Between 1999 and 2002, Deakin University, the University of Adelaide and Victoria University of Wellington developed a large body of resources (Ham 2002a) and curriculum that utilised information technology to facilitate the integration of tectonics within the design processes of first and second year students. The project aimed for students to achieve a 'broad inclusion of designing construction in architectural design' and 'ability to adapt computer-aided design and related computer systems within a design process' (Radford et al. 1999). A founding premise of CUTSD was that 3D CAD could be used as a learning technology (Oliver 2001) to assist in understanding tectonics within design processes.

Projects developed at this institution to facilitate this symbiotic relationship between computing, making and tectonics include a digital construction course incorporating digital case studies, IT-integrated collaborative-constructivist projects (Ham 2001, Ham 2002b). The subject of this case study (Architecture 2b) has been developed with the assistance of CUTSD in 2001 and developed further in 2002 to include online delivery and electronic and physical submission of project work.
The methodology of the case study

The case study is of a cohort of 89 active second year students enrolled in the Architecture 2b (SRD264) unit of the Bachelor of Arts in Architecture course in the second semester of 2002. Four architectural design projects were analysed, each designed to explore a different aspect of the founding question behind the unit, being 'what is the relationship between tectonics and architectural design?'

Project 1, 'Discovering Architecture' occupied four weeks and is worth 30% of unit marks and involved the design of a Coastal Discovery Centre on a sensitive site off Dells Beach. Project 2, 'Discovering Tectonics,' occupied two weeks and was worth 10%, involved the development of detailed understandings of a tectonic assembly of the Coastal Discovery Centre (figure 1 right). Questionnaire 1, delivered immediately after project submission, related to student experiences in undertaking Project 2.

Project 3, 'Composing Architecture', occupying four weeks and worth 30%, involved the design of a small-scaled 'masterpiece' for the contemplation and composition of music, a Music Room (refer figure 1 left and centre). Questionnaire 2 relates to student experiences in undertaking Project 3. Project 4 required students to actually construct a selection of Music Rooms in teams of 12 students over a period of 3 weeks. Questionnaire 3 relates to Project 4 and an overview of the unit.

Quantitative data was obtained through 3 point Likert scale responses from the three questionnaires, a sample of which are listed below:

- This medium made it easy for me to understand the tectonics of my design.
- I feel that this medium was the easiest for me to demonstrate my understanding of tectonics.
- Using this medium forced me to think about tectonics in three dimensions.
- This medium produced the best outcome.
- List, in order, the media you will most likely use to understand tectonics in future design projects? (1,2,3).
- List, in order, your preferred media for design projects (1,2,3).

In addition to the gathering of student's perceptions of media use within their projects, analysis of assessment for the unit and student's reflective folios was undertaken. This analysis involved the examination of media use within student's presentations in all marking categories (High Distinction, Distinction, Credit, Pass and Fail). Combined High Distinction/Distinction (70%-100%) categories have been related to the Pass (50%-55%) category for purposes of this paper.

Students had some basic skills developed through exposure to 3D CAD, physical modelling and drawing. Throughout the four projects, students were encouraged to explore media use as a means of understanding and communicating their understanding of tectonics and design. Assessment for projects was performance-based and moderated amongst the unit chair and three studio staff involved.

Figure 1: Student work: Project 3 3D CAD conceptual model (left); Project 1 physical form model (centre); Project 2 tectonic drawing (right)
RESULTS AND DISCUSSION

Analysis of assessment reveals that media used by students appears to be related to the type and duration of project. The type of media used, and the proportion of hybrid media instances relative to sole media, varies considerably between Projects 1, 2 and 3. Projects 1 and 3 experienced higher instances of hybrid media use, whilst the shorter, tectonic design project experienced higher instances of sole media use. Students appear to be evolving their own individual media strategies, based on predispositions, perceptions of benefits and established skills. High performing students have a tendency to use a wider range of media, whilst low performing students used a less diverse range of media in their projects.

INSTANCES OF MEDIA USE IN PRESENTATION: DISTINCTION AND HIGH DISTINCTION

Distinction (70-79%) and High Distinction (80-100%) marks have been combined for this research due to the relatively small number of students obtaining high distinctions (refer figure 2). Hybrid media was used by 55.6% of D/DH students for Project 1 and 70.4% for Project 3, however was significantly less for Project 2 (8.8%). This reduction in hybrid media use for Project 2 is attributed to the higher proportion of 3D CAD (47.0%) use in this category. Drawing use as a sole medium in the D/DH category was low, but relatively constant across Project 1 (11.1%), Project 2 (11.8%) and Project 2 (7.4%). Physical models use as a sole medium was non-existent across all projects. In summary, hybrid media use is most likely to obtain a D or HD result for conceptual design projects, however 3D CAD is most likely to obtain D or HD result for the tectonic design project.

Figure 2: Media use for distinction and high distinction results in Projects 1, 2 and 3

INSTANCES OF MEDIA USE IN PRESENTATION: PASS

A mark of pass (50-59%) indicates a barely competent resolution of the project requirements. Hybrid media use in this category varied widely, from Project 1 (46.7%) to Project 2 (6.3%) and Project 3 (63.8%). Drawings used as a sole medium in the Pass category recorded the highest percentage for Project 2 (68.8%), significantly higher than for Project 1 (6.7%) and Project 3 (4.6% each). Physical model use as a sole medium was non-existent for all projects. Students in all marking categories have not realised the potential of physical models to communicate a broad range of design information and they are used primarily in form-making as a complement to plans, sections and elevations (see figure 1 centre). 3D CAD usage in this category experienced little variation, from 13.3% in Project 1, to 12.5% in Project 2 to 9.1% in Project 3. Hybrid media use is most likely to obtain a Pass result for conceptual design projects; however drawings are most likely to obtain a Pass result for the tectonic design project. There is a similar probability of 3D CAD obtaining a Pass for all projects (refer figure 3). Student's folios provide evidence of a correlation between design skills and media skills, with a general tendency towards poorly designed projects being also represented poorly.

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STUDENT PERCEPTIONS OF MEDIA AS TOOLS FOR UNDERSTANDING TECTONICS

Questionnaires were used as a means of gauging student's perceptions of the ability of each medium to help understand, and to demonstrate their understanding of tectonics. The questionnaires received response rates of 39.9% (Questionnaire 1), 44.5% (Questionnaire 2) and 46.0% (Questionnaire 3) of the active cohort (89 students). Results were experiential in nature, with perceptions based on use within design projects. These surveys indicate that, for Project 2, physical models and drawings were perceived as the easiest tools to help understand tectonics (with a 70.6% and 69.0% positive response respectively), followed by 3D CAD (58.3%). This contrasts with responses for Project 3, wherein 81.8% of respondents agreed or strongly agreed that 3D CAD was easiest to help understand the tectonics of their design for that project, compared to 72.0% for drawings and 68.2% for physical models.

Drawings were perceived by survey respondents as being the easiest medium to demonstrate understandings of tectonics for Project 2, with the highest combined agree and strongly agree response of 66.7%. 3D CAD and physical models received similarly high combined positive responses, of 56.7% and 55% respectively, however 3D CAD received the highest combined negative response of 38.7%. A shift in opinion occurred between projects 2 and 3. 3D CAD was the medium perceived to be the easiest to demonstrate understandings of tectonics for Project 3. This is evidenced by the highest combined “agree” and “strongly agree” responses for 3D CAD (82.6%), 9.9% higher than physical models and 14.6% higher than drawings, although physical models obtained 1.8% higher “strongly agree” responses than 3D CAD.

3D CAD and physical models were rated as the media that forced students to think about tectonics in three dimensions for both Projects 2 and 3. Combined “agree” and “strongly agree” responses for Project 2 were relatively even for 3D CAD (66.7%) and physical models (64.7%) with drawings receiving 56.5%. For Project 3 however, physical models and 3D CAD were perceived to force students to think about tectonics in 3D (86.4% and 78.3% respectively), 34.4% higher than drawings.

3D CAD and physical models were perceived relatively equally to have produced the best outcome for Project 3. This is evidenced by the highest “agree” and “strongly agree” responses for 3D CAD (78.3%), 5.6% higher than physical models and 20.0% higher than drawings. 3D CAD was considered to be more time consuming relative to outcome than physical models and drawings, with 59.1% of respondents providing “agree” or “strongly agree” responses, compared to 56.5% for physical models and 29.2% for drawings.

There is a clear indication that, after the completion of the SRI262 programme, 3D CAD is the media most likely to be used by respondents to understand tectonics in future design projects, with 60% of respondents indicating 3D CAD as first preference. This was 33.5% higher than physical models (26.5%) and 44.8% higher than drawings (15.2%). 3D CAD obtained a slightly higher percentage of responses as preferred medium for use in conceptual design projects, at 37.8%. This result however is close to physical models and drawings, each
recording 33.3% response as first preference. 3D CAD obtained the highest percentage of “least likely” responses, at 40.5%, compared to 33.3% for drawings and 22.2% for physical models.

Text-based responses provided by students in the questionnaire may help to illuminate the key issues brought up by the qualitative data. There was awareness, amongst some, that understanding tectonics requires more than just modelling with media; ‘Tectonics needs to be understood on many levels to through models, experience and trade literature’. The advantages of 3D CAD for this project are highlighted by one student’s comment; ‘Microstation is great less you create anything you need so you can build it up in 3D to make sure it works’. There was, however some negative perception towards 3D CAD, perhaps based on skills; ‘3D CAD modelling is time consuming and software tends to limit what you design’.

One student commented on physical models; ‘The physical model making is hard to find materials, but when I overcome the problem I was more confident’. Another related physical models to drawings; ‘Physical model helped but drawings not particularly helpful’. The way in which student used drawings was also discussed, with one student relying on ‘Mainly perspectives, sections, 2D plans’, and another student; ‘Probably rely on CAD too much for some things. Time spent on form model is worth it but some drawings for details are helpful’.

Availability of computers and software was also an issue for many, with one student stating; ‘Not enough exposure to computer software & availability of program’ and another finding work-around solutions when resources weren’t available; ‘My Rhino (3D CAD programme) evaluation ran out so it restricted me to making a physical model. The use of “second choice” media paid off for this student; ‘I do have a weakness in model making and prefer CAD models. The physical model gave me a better understanding I believe in the way it went together’.

Learning representational media in conjunction with undertaking projects is a persistent issue within the design studio, with comments reinforcing the questionnaire data showing less use of hybrid media in shorter projects. As one student stated; ‘I’m not strong with either of the other methods and become frustrated trying to learn while sticking to project timelines’. It appears that the ‘comfort zone where the designer tends to flee when faced with high performance expectations under stressful conditions’ proposed by Bermudez and King (2000), appears widely visited, particularly for students in the lower marking categories.

CONCLUSIONS

Students enrolled in the unit that is the focus of this case study utilized a range of media to fulfill the specific requirements of each project. The use of hybrid media was more evident for longer projects of a conceptual nature with a greater marking incentive than for the short-duration, tectonically oriented project worth fewer marks. The benefit of using hybrid media in these situations was dispersed, with relatively even presence in both the Distinction/High Distinction and Pass marking categories. Students of lesser ability tended to use only one or two media throughout the semester, whereas high performing students experimented more across the media repertoire. The use of 3D CAD brought some dividends, leading to a significantly higher probability of receiving a Distinction or High Distinction for tectonic design projects. The three dimensional virtual environment of 3D CAD offers great potential for use by skilled students as a ‘learning technology’ (Oliver 2001) for the understanding of tectonics. 3D CAD, however advantageous for understanding tectonics through digital making, denies students the fundamental application of physics or as one student commented: ‘computers don’t understand gravity’.

3D CAD appears also easier to use as a sole medium for tectonic projects, through the manipulation of viewpoints, reconstruction of the model into constituent components and easy transfer of images (with appropriate notation) into digital presentations. Physical models appear to have lesser capabilities for use as a sole medium within these projects, however are rated highly for their ability to help students understand and communicate tectonic understandings. Actual construction of buildings perhaps helped students understand tectonics most, although the nature of the structure under construction, cost and programmatic issues make this more difficult.

The traditional medium of manual drawings still has a role in the design studio, however is perhaps more useful in conceptual projects. The use of drawings within this case study provided less dividends for the tectonic design project (Project 2), however performed well in conceptual projects. Students, perhaps due to insignificant skill development, had a generally poor ability to construct drawings such as exploded axonometric and isometric drawings that are useful to demonstrate three-dimensional understandings of tectonic assemblies. This ‘perspectival hinge’ is an issue intrinsic in the use of two-dimensional media to describe three dimensional objects (Perez-Gomez and Pelletier 1997).
The research raises important issues in both design education and skill development for early year students and highlights the need for more research into the area. Clearly the capabilities and learning strategies of the students are central to the degree of tectonic understandings achieved, with good students understanding tectonics regardless of media used. The experience of making, through actual construction, 3D CAD and physical modeling (perhaps in that order) appear to bring students to a closer understanding of tectonics.

REFERENCES


