THE PERCEIVED EFFECT OF DIGITAL DESIGN TECHNOLOGY ON STUDENT LEARNING IN ARCHITECTURAL TECHNOLOGY

A Preliminary Analysis

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Abstract. This paper explores some of the issues facing architectural education in relation to digital design and student learning. The paper, which reports on a section of a larger PhD study, presents a preliminary analysis of interviews with lecturers, tutors and studio group leaders at two Australian universities. The paper focuses on the perceptions of the key individuals intimately involved in the students' learning process. It focuses particularly on the issues of perceptions of digital design technology, with specific attention on culture, and the approach and delivery of digital media as design tools. Through comparative analysis of 14 one-on-one semi-structured interviews with educators involved in the design and delivery of the architectural studio, we explore educational responses, including curriculum design and course delivery, to the evolvement of digital design and student needs. The semi-structured nature of the interviews encouraged participants to explore and question the effect of digital design on student learning, leading to a greater awareness and understanding of this evolving phenomenon. The purpose of the paper is to provide insight and understanding of driving forces responsible for shaping the learning experience of architectural students.

Keywords. Digital design technology; student learning; course delivery; perception; phenomenology.

1. Introduction

The fabric of modern day life and business is exposed to a constant stream of technological innovations. As such, fields of design education and research
are in a dynamic state of response to the driving forces behind this technological shift (Boulton-Lewis et al 2006; Milne, 2007; Buchan, 2008; Brill and Park 2008). Over the past two decades, the growing popularity and gradual acceptance of emerging digital technology has produced a challenge; not only in architectural practice, but also for educators in the design faculty (Kennedy et al 2007, 2008; Oliver and Goerke, 2007; Waycott et al 2008). Schools and faculties of design and architecture are thus developing and upgrading a curriculum that aims to produce graduates that possess high competency in digital technologies (Mitgang, 1999; Yanik and Hewett, 2000; Savage, 2005; Crowther, 2010). Accordingly, educators are engaging in an on-going debate surrounding digital technologies’ role in the curriculum. Some educators emphasise the importance of developing design skills and build a strong foundation in conceptual investigation. This is an area of key importance in the traditional core values imbued in the study of architecture, which focuses on the need to cultivate life-long learning skills and instruct students to develop strong technical resolution (Karloff, 1996).

This paper explores educational responses, including curriculum design and course delivery, to the evolution of digital design and students needs. The paper forms part of a larger study, which aims to develop contemporary understandings of the factors that encourage students to, or prevent them from, using digital technology. Existing research in this area, such as that conducted by Kennedy et al (2008), argues for the importance of investigating students’ digital behaviour and their experience of digital tools. They claim that:

’an investigation of students current technological experiences will have implications for ways in which technology could potentially be harnessed in pedagogically sound ways to improve teaching and learning’ (Kennedy et al 2008, p.109).

In accordance with this, we aim in our research to provide a critical understanding of the field, offering the participants and the participating universities an opportunity to understand and question their use of digital technology. With this research we aim to promote dialogue and establish links between the research community, industry, students and academics who in different ways are involved in the architectural education process.

This paper only reports on one element of the overriding study, namely the perspectives and experiences of educators. We present a preliminary analysis of data collected through semi-structured interviews with 14 educators at two Australian universities who are engaged in the delivery of the design studio. Through comparative analysis of the interview material, we aim to provide insight into some of the driving forces that shape the learning ex-
periences of architectural students as they relate to digital technology and digital design.

2. Moving from analogue to digital

This paper is underpinned by the observation that there has been a shift in design education and practice, moving from analogue to digital methods and mediums. ‘Analogue’ refers to the exploratory (as apposed to absolute) nature of the hand drawn pen or pencil sketch. This keystone skill has been taught, and in most cases nurtured, to students studying architecture from its inception. In recent years however, analogue skills and their teaching have lost their prominent position. It has been questioned whether this form of visual communication can maintain its standing in the current educational setting. This has been primarily due to an increase in digital design methods.

Whilst emerging digital design technologies are a key factor in the reconsideration of the position of analogue methods in design education, existing research suggests that digital design cannot completely replace analogue design. There is a level of subjectivity embedded in analogue design methods; indeed, a key factor that separates digital and analogue mediums is that related to implicit and explicit representation (Chastain et al 2002; Johnson, 1998). The distinction between implicit and explicit representations suggests that, whilst analogue methods may form part of all stages of the design process, digital design methods may be an unsuitable form of visual communication for the early phases of design where the focus should be placed on the intangible qualities achievable with a hand drawn medium.

Johnson (2005) argues that freehand sketching conveys more substance than final presentation drawing, identifying that sketches have the potential to present the designer with more than one interpretation of the design problem, making the sketch an important investigative tool throughout the designer’s process. In a similar way, Won (2001) suggests that computer generated representations can be scrutinised for missing the ambiguous qualities that are required to deliver:

> multiple interpretations and visual shifts in perception associated with design exploration in design processes (as cited in Guidera and MacPherson, 2008).

Using the ‘draw then modify’ principle to describe the process of computer driven software applications, research conducted by Bilda and Demirken (2003) concludes that, during a design focused study, subjects were more efficient in managing their time, perceiving the design issue, generating a range of solutions and distinguishing spatial components of design using an analogue method of media as opposed to using a digital method.
Limitations in the digital medium have also been noted in other disciplines, such as graphic design. In a study of the strengths and weaknesses of both sketching and digital design, Stones and Cassidy (2007), for example, found that student designers using a drawing process on analogue methods had greater confidence than students using a computer when it came to producing a range of design alternatives.

While many authors have addressed digital design technology as an inappropriate means for conceptualisation (e.g. Lawson and Loke, 1997; Verstijnen et al 1998), contemporary studies in the field of design have likened the process of digitally based sketching to the process of free hand sketching (Plimmer and Apperley, 2002). Within this classification, many promising digital design methods have been prototyped to demonstrate the users concepts effectively, with a majority of them based on a digital sketching environment that imitates free-hand sketching performances (Gross and Do, 2004). Herbert (1993) argues that sketch design in general requires more manual effort to repeat and refine the design process and frequently results in a loss of data and information, an inherent feature of digital technology not possessed by hand drawn methods.

Another drawback to freehand drawing and sketching identified by Bailey (2003) points to issues associated with the transfer of sketch design to a digital format for processing. Bailey observes that designers have to possess a certain level of experience in order to recognise and respond efficiently to many of the numerous design concerns embedded in analogue methods.

3. Research design

The study of which this paper forms part, seeks to explore the shift from analogue to digital design technology as it is experienced by students and educators of architecture at two Australian universities. The study, which is based on qualitative inquiry, aims to explore student’s and educator’s personal experience of the digital design paradigm through the collection of rich data that explores depth, rather than breadth, of the field. The study is guided by three key themes: (1) students’ knowledge and experience of design technologies and their perceptions of the role of technology in the profession of design; (2) students’ use of digital technology in the design process and its influence on the various stages of the design process; and, (3) educational responses including curriculum design and course delivery, to technological advancement and the changing needs of students (pre and post studies). The paper is primarily concerned with the last research theme, whereby various educational responses relevant to the field of study were targeted. Educators were engaged in semi-structured interview sessions, which revolved around
the topics - culture, curriculum and delivery; approach; and response. The research was designed as a comparative qualitative study that combines the techniques of interviews, focus groups and participant observation. Data was collected from two distinct field sites in Australian tertiary architectural education, each with an accredited undergraduate program (recognised by the Architects Accreditation Council of Australia). The two universities were chosen following an Internet-base preliminary analysis of the architectural curriculums of Australian tertiary institutions. This analysis found that Australian architectural education institutions can be categorised into two general groups, distinguished by their approach to technology in design education. Group One contains schools or faculties that are more technically aligned with the use of digital technology or with a specific focus on digital design. Group Two contains schools or faculties that follow design process largely informed by analogue design methods and computers are predominantly used for documentation and presentation purposes. One school was chosen for participation from each of these groups.

4. Preliminary analysis: educational responses to the technological shift

The interviews were digitally recorded, transcribed and analysed according to common and contrasting themes. The preliminary analysis reveals several key themes that relate to the main research goals, including: Institutional Perception and Change, Visual Culture and the Ecology of Tools.

4.1. INSTITUTIONAL PERCEPTION AND CHANGE

The design education tradition is in a state of dissonance; a period defined in the literature as a shift from the ‘Information Age’ to ‘Interaction Age’ (Milne 2007; Buchan 2008; Brill and Park 2008). It is a period of technological characterisation that focuses on digital content, understood in terms of ‘delivering’ and ‘accessing’, and on interaction and interactive relationships (Milne, 2007).

Rarely has this notion been applied to the field of design and architecture, begging the question – how is this ‘Interaction Age’ impacting the students of architecture and how should we as designers and educators react? The theme of change in culture and perception of digital technology was explored at length in the interviews with the key informants, each providing a unique perspective on their respective cultural environments. Although these individuals responded separately to one another, they did provide an excellent overview of their corresponding institutions. Based on our inclusion and exclusion criteria discussed above under research design, School One falls under ‘Group One’, and School Two under ‘Group Two’ respectively.
The preliminary analysis of the key informant data has allowed us to reassess and interpret our standing on key research questions; providing us with an initial profile of each school to carry through in the next stage. Initial profiling has indicated that the separation between ‘digital’ and ‘analogue’ schools is not as straightforward as initially anticipated. Whilst the key informants form School One largely conformed to our original précis, participants identified that the school is currently going through a state of transition, moving back towards a holistic approach that incorporates analogue methods after a period of emphasis on digital modes and methods. According to the School One key informants, their institution is ‘very forward looking’ in the way that is adapting to societies changing pace. As Sarah stated:

I think [School One] has a program that is concerned about these topics, and that it's updated in the ways that it's producing the knowledge… in other Universities I find there's still a Modernist approach (Sarah).

Mark reiterates this sentiment, however, he asserted that the school appears to be going through a ‘reverse shift’, having already encountered the digital zeitgeist in earlier curriculum manifestations:

I think people are starting to realise there's actually richness in the culture of architecture, and that's what we're more interested in engaging with, in parallel with a more nuanced understanding of what digital environments are capable of in a design sense (Mark).

Regarding the perceived role of digital design tools in the university design culture, School One seems to indicate more of a holistic understanding of the digital medium. Matt outlined an approach that is centred on a dynamic interchange between digital media and student exploration, citing digital design technologies popularised conditions as the main driving force behind this change in perception and focus:

Right now to actually focus on that is not as interesting to actually focus on cross platforms and the abilities of the students to look for the software that is needed to solve a specific problem (Matt).

Preliminary analysis of data collected at School Two has provided renewed insight of digital technologies role and perception amongst the staff cohort. Backed by observations recorded during the fieldwork, our original expectation of a largely analogue-based student design approach was validated. However, through the semi-structured interview process we found a catalyst of interest and appreciation of the digital medium permeating a well-established foundation of architectural instruction.
One of the main contributors and advocates of this digital resurgence is Benny, who belonged to a generation that was faced with a similar difficulty and challenge to transition from analogue to digital design methods. When asked how the new media is perceived in his current institution he said:

I think there is a stronger resistance in general, because it is something new... It involves something that is very challenging, but also some sort of shift from traditional ways and routines. Which means that it requires more work from the students and from the tutors, and the professors as well (Benny).

This position adequately represents the school’s spur of interest in digital media and of adopting new approaches to the architectural design discipline. However it also illustrates School Two’s perceived resistance to change, as confirmed by Anna:

I think it's frowned upon... I think particularly in early stages, and particularly earlier years... there are certain schools of thought that are very strong about the fact that the computer is bad, and that you should be hiding any attempt at working on the computer (Anna).

Andy supports this observation when he was asked about digital design technologies perceptions in the school:

For the undergrad degree then it's almost seen as the enemy... that's how I think it seems to be perceived... a lot of it is being picked up as fly away comments, rather than seeming to be a deliberate strategy (Andy).

One final issue worthy noting regarding the theme of institutional change and perception is highlighted in a comment made by Harry concerning the perception on new media:

I don't know whether it's a hangover from the old days... I think some of [the students] perceive it as just CAD... so if we don't understand it, how are they going to understand it (Harry).

This statement returns back to Benny’s line of thinking, emphasising the importance of creating a culture that breaks from the deeply embedded institutional construct. Essentially, the data suggest that for new approaches of design to be established in this particular school, a strong and conscious effort must be made by academics to facilitate the curriculums evolution. A response must be made strategically, rather than apprehensively, towards digital technology application in architectural design education.
4.2 VISUAL CULTURE

One of the main themes in the key informants’ responses was the concept of Visual Culture; in particular, the importance of creating an awareness and appreciation of visual culture in the students’ design learning. Visual culture is largely concerned with actions of a visual nature through which the user pursues desire, knowledge or significance through an interaction with visual technology. This can be defined as a method, ‘or apparatus designed either to be looked at or enhance natural vision’ (Mirzoeff, 2002, p.3).

This definition covers a multitude of enablers that have the potential to influence a students design process, especially access to information via the Internet. Participants were asked how the university is responding to the increasing availability and prevalence of digital technology. Responding to this question, Sarah remarked that with immediate access to information most commonly sourced via the Internet, students and designers could be very easily seduced by images:

There's a lot of culture of the image I think... we are developing very big eyes, but very small brains… we are able to process a lot of images, and we have the sense of what is cool, what is good, what is bad, but sometimes we don't go far enough… (Sarah).

This view highlights an interesting line of questioning regarding the pedagogical response in architectural design, to how visual information is being received. Are students adequately trained to disseminate a potentially overwhelming flood of image-based content when searching for design ideas and precedents? When asked what her approach was to tutorial sessions, Anna exposed that although she quite often discusses architectural precedents related to individual student designs, she did not believe students were exposed to enough examples of relevant architecture:

I don’t think they’re shown enough precedents, I don’t think they look properly at precedents (Anna).

A consequence of this, Anna explained, was a danger of uninformed design ideations being reached by not understanding how to interpret and dissect a precedent. When asked how visual strategies for design communication were incorporated in the curriculum, Matt echoed this sentiment related to the ‘culture of the image’ in the context of a students design presentation:

Images are not natural or innocent…they have a precedent, they have meanings that are there...images end up telling much more about [the student] that puts them up there than [the student] would like to… (Matt).
Matt’s position on understanding images in terms of their precedent heritage reflects an emphasis on students being conscious of the visual strategies they are using during design process. In addition to this idea, Sarah suggests that students should take ownership and go beyond the superficial layer of ‘the image’ to develop strategies that could better cultivate their understanding and digestion through the many lenses of visual technology, with the goal to understand more about the primitive idea:

We have all this access to quick information, even unrelated to architecture, that we stop looking at projects in terms of what’s behind them…we just go on how it looks…(Sarah).

Given the focus of this paper on understanding the role and effect of digital design technology in architectural education, the issues raised by the participants surrounding this theme question how this new condition of visual culture and visual experience requires rediscovery and reinvention of the established traditions.

4.3 ECOLOGY OF TOOLS

The third dominant theme that we will discuss is that of The Ecology of Tools. We loosely define this complex theme as the interaction between multiple instruments of design (both digital and analogue) functioning within the system of the design process. Given Mirzoeff’s (2002) definition of visual technology, we can perceive the combination of tools used by students for design development as important instruments for accelerating visual competency in this realm.

Discussion of this theme includes an overview of student working methods, as observed by the key informants. These working methods were deemed successful or unsuccessful via the students design outcome. It was a widely accepted by all the key informants that the more design tools a student used in their process, the better the outcome in terms of creativity, resolution and integrity would be. An example of this can be seen when Mark was asked how he would define a creative design solution to the given design brief:

The most successful students are the ones who use all the tools at the same time, not that well though... so they're not that great at 3D modelling, not that great at sketching, so there's no dominant method of working and that's actually an advantage, because they sort of test something out in one environment and reach a limit, and that forces them to go through another environment… (Mark).
It is interesting to note here in Mark’s response that having no ‘dominant method of working’ was seen as a successful strategy to employ during a students design process. This statement challenges the notion of ‘mastery’ and ‘digital literacy’ by speculating on a working method change in pedagogy that promotes using multiple tools simultaneously to broaden and enrich design outcomes. This notion is somewhat echoed in a comment made by Benny regarding how visual strategies for design communication are incorporated into his school curriculum:

A radically different comprehension of the digital medium, one that can work in parallel and along with analogue means. This is how I strongly believe we have to view the new media (Benny).

Another successful instance of applying a well-rounded use of design tools was noted in Andy’s response, however there was still some bias towards the use of analogue methods, likely due to contrasting institutional characteristics:

Maybe the ones that just do it by hand and model-make can manage to make it work... but I think the people who manage to go between all the modes that are available are more successful (Andy).

The preliminary analysis also suggests that those student’s who used a single design tool, whether it be a digital or analogue tool, were more likely to deliver an unsuccessful design as perceived by the key informants:

The least successful students are actually the ones that only use a single tool (Mark).

Interestingly, students only using digital methods in their design process are perceived as somewhat limited or one track minded in regards to their design thinking process. This is demonstrated in Mark’s response about how digital technology is perceived at his university. He suggests that:

My problem is that students that only use digital technology can only think in a very certain way (Mark).

Conversely, when students are only using analogue methods in their design process, some of the key informants perceived that students can demonstrate a greater attention to detail and level of understanding. When asked about whether there is a resolved understanding of the design in either digital or analogue medium, Cindy suggested:

I’m finding that those who are resolving things on paper, appears as if they’re thinking things in greater depth...and quite often their drawings get deeper, rather than more of them... (Cindy)
5. Conclusion

The preliminary analysis of the key informant data has setup a strong framework for future progression into interpreting the student participant data collected from the field sites. The initial findings present an exploration into the phenomenon of digital technology in architectural education, uncovering key themes that inform the cultural perspective and differentiation of the institutions surveyed.

Initial discoveries have confirmed our original conjecture regarding the definition and perception of digital design technology held by the two schools. However, we infer that there is evidence of a much more integrated approach that conveys the development of a holistic understanding of the new media, which further signifies a shift to a post digital understanding of design technologies in education. From this move to a post digital understanding, we observe a renewed interest in visual culture, leading to questions of how this new condition requires reassessment of the established design education tradition. With this more nuanced understanding of digital design technologies role in architectural education, key informants suggest an important trend emerging that reflects a multi instrumental approach taken by students during their design process. Findings in this area highlight a focus on developing strategies to address this in future curriculum designs.

In our future research we aim to test these preliminary results against students findings to provide a more inclusive description of the phenomenon and to relate them to existing scholarship from the fields of architecture and beyond. The overall aim is to collect a rich data set that explores depth, rather than breadth in the field; we now seek to explore the student participants’ own experience of the digital design paradigm within the defined cultural group, rather than prove these extrinsic ideas and categories. This paper will contribute to the larger PhD Study by enhancing the understanding for academics and researchers of the student perspective in architectural design, allowing for more informed conclusions to be reached regarding the implementation of digital design technologies in today’s higher education institutions.

5. References