Back to Basics...
An Intervention based on the dilemma of CAD vs Manual Drawing

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Introduction

Over the past twenty years there has been an increase in use of digital media in design education and practice. Computer aided design (CAD) tools are seen as a means for creating drawings accurately and quickly. Proficient use of this technology is considered as an essential skill that improves employability and efficiency. However, it is also important for students and professional to be able to express their ideas using manual sketching and drawing. This evaluation critically assesses the value of having manual and digital drawing skills and investigates the need to retain traditional manual drawing methods within design education and practice as a way of understanding, developing and improving the design process and outcomes.

Literature Review

The wide use of digital technology in design disciplines has led to the idea that CAD is more important than traditional manual drawing and modelling methods. However, literature and personal observations have highlighted that traditional skills are essential for understanding scale and organisation of space and are more effective at the early, conceptual stages of design development. As mentioned by Kara (2015), they are seen as the basis for development of design skills and have been considered as important elements in the foundation year and minimum first two years of studies. Manual sketching and drawing methods are also seen as more intuitive, flexible and allow the designer to retain their design ideas during the process as they can constantly compare and overview what they produce. These are suitable for the conceptual parts of the design process (Ibrahim and Rahimian 2010).

In the past few years more sophisticated CAD tools have been developed and are now capable of being used at all stages of design development – even at concept stages. The expressive and geometric power of CAD modelling can in theory replace traditional methods of sketching and drawing from the beginning to the end of a design project (Shih, Sher and Taylor 2017). The development of technologies such as CAD and Building Information Modelling (BIM) can also incorporate detailed information about materials and construction systems that can be used as a platform for easily sharing information with other professionals.

However, current CAD and BIM software demand too much precision too soon. When these are used at early stages of design they can stifle creativity as they tend to demand exact dimensional and geometric information which tends to limit experimentation CAD is an excellent tool for describing and presenting proposals and designs. However, it is just a tool and does not generate a solution on its own - computers cannot think for themselves (Marx 2000, Pipes 2007).

It has been observed that designers who freely switch from manual sketching and drawing to digital tools tend to be more creative because the change in media causes them to re-think previous ideas and improve the quality of their solutions (Chen 2005).

Hypothesis and Methodology

Students produce better designs and detailed drawings when they go through a manual drawing process before embarking on CAD practices.

- Students were actively observed over two modules that include extensive drafting and elements of design (BSc Architectural Design and Technology 'Design Technology' and 'Building Surveying and Adaption' in Semesters 1 and 2 AY 2018-2019).
- Students were given a chance to choose how they would carry out their design and drawing work i.e. manually, digitally or using a combination of methods.
- Different outputs were compared to establish which ones were more successful.
- Students were asked to reflect upon their learning and mainly how manual drafting impacted on their performance.

References

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Evaluation and Findings

Looking at the different outputs of projects, it was observed that students engaging with both manual and digital drawings had a better understanding of their proposals in terms of scale and detail resolution. It is believed that this was because they acquired a more thorough understanding of what they were drawing. The transition from manual drawings to CAD clarified their solutions and reinforced ideas. The ability to switch from manual to digital practices gave them more flexibility and allowed them to implement the 'right tool at the right time' (Do 2005).

It was also observed that the limited knowledge and experience of software limited the students' design output. They tended to avoid trying to experiment with forms and materials because they did not feel confident in reproducing their ideas using the software available. This highlighted the need for further training and practice using specialist software.

Student quotes and testing the 'dilemma'

"I normally draw my proposals and details manually first and then translate them to CAD or BIM. This helps me understand scale and how different spaces relate to each other" (switching from manual to digital)
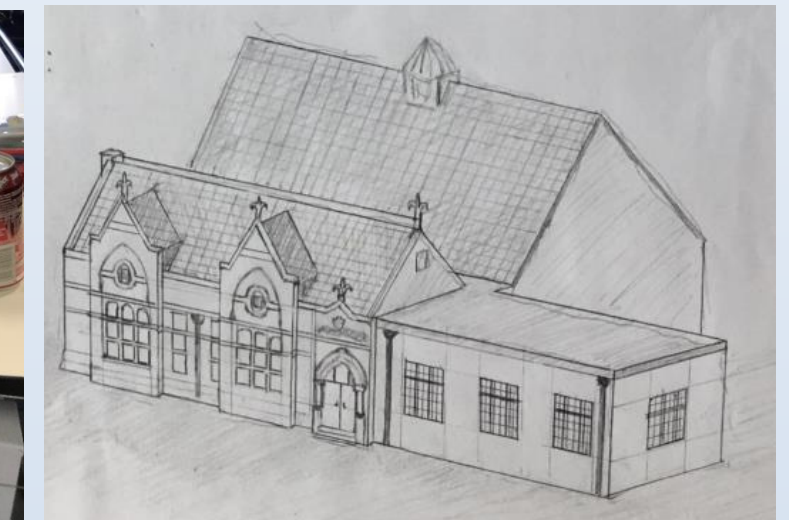
"I generated the drawing using BIM but it needed further detail. I used that drawing as a base to create a manual drawing where I added the necessary detail. I then confidently added this to the BIM drawing as I had understood each part" (blending the two practices)
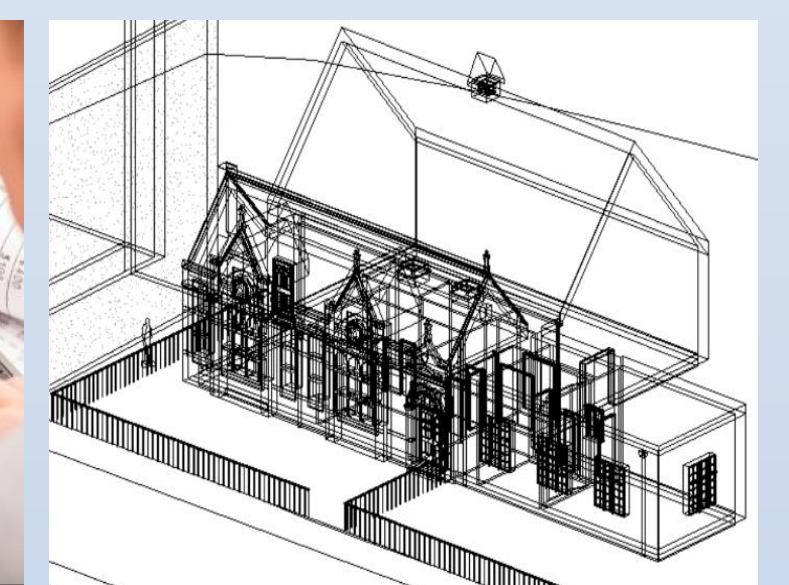
Conclusions

When students are trained to design and produce drawings and details, the main focus should be in learning the process, knowing exactly what they are asked to draw, and understand issues involving scale and functionality of their design. Using a combination of manual and digital design practices seems to increase their creativity and give the students more skills and understanding of these processes. It is thus recommended that manual design skills are retained within design education and used in **combination** with digital CAD and BIM tools to give students a better understanding of processes and more skills to use in their future careers.