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# WIP: The Importance of Freehand Sketching and Technical Drawing

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Dr. Assadollahi is a native Memphian and a 2005 graduate of Christian Brothers High School. Dr. Assadollahi earned a B.S. in Civil Engineering with a concentration in structural engineering from Christian Brothers University in 2009. He also earned a B.S. in Mathematics from Christian Brothers University in 2009, concentrating in applied differential equations. He earned a M.S. in Civil Engineering from The University of Memphis in 2010 with a concentration in structural seismic engineering. Dr. Assadollahi completed his Ph.D. in Engineering from The University of Memphis with a concentration in geo-structures in 2013. He currently an Associate Professor and Department Chair of Civil & Environmental Engineering at Christian Brothers University. He is a registered professional engineer in the State of Tennessee.

# WIP: The Importance of Freehand Sketching and Technical Drawing Techniques

## Introduction

This Work in Progress Paper discusses the importance of freehand sketching and technical drawing skills for students studying computer aided drawing. Freehand sketching involves drawing without any measuring instruments and is accomplished using only pencil and paper. Technical drawing uses drafting equipment including T-squares, drawing triangles, and a compass. Freehand sketching has been shown to be important because it connects students' hand movements and their mental thinking ability. Freehand sketching is also a quick and easy method of communicating ideas via graphics. Freehand sketching has been shown to be helpful in providing quality design solutions [1]. With the advancement of computer technology, many universities have deemphasized freehand sketching and technical drawing skills over computer-aided drawing programs. The objective of this research is to determine the students' perception of the helpfulness of freehand and technical drawing assignments and correlate these perceptions of understanding computer-aided drawing programs. Students who completed a first-year civil engineering graphics course in the Fall of 2021 and former students who had previously taken the class will be surveyed as to the effectiveness of this process.

## Transition to CAD

The author has taught civil engineering graphics for thirty-four years and has experienced the benefits of having students complete drawings using freehand sketching techniques and technical drawing methods in his classes. In the Civil Engineering Graphics course at the author's university, the students begin the semester with a quick introduction to CAD via tutorials developed by the instructor. Once the students have been introduced to CAD, the use of architectural and engineering scales is introduced whereby the students learn how to select a proper scale for a drawing. The next topic is geometric constructions, and the students first learn how to complete them using traditional mechanical drafting equipment. Once these exercises are completed, the students are then assigned similar if not identical drawing assignments to be completed via CAD.
Later in the semester when conventional topics such as orthographic views, isometric views, and section views are discussed, the instructor will assign drawings to be completed using freehand sketching techniques followed by similar drawing assignments to be completed in CAD.

## Constituency Surveys

The first group of students surveyed were the students who took the Civil Engineering Graphics course in the Fall of 2021. This survey was sent to seventeen students in the class. Fourteen students responded to the survey. A second survey was sent to former students who had previously taken the Civil Engineering Graphics course. This survey contained the same questions and comment section as the class survey and was conducted in the Spring of 2022. This survey was sent to forty students and twenty-one students completed the survey. Table 1 summarizes the results from both surveys and Table 2 summarizes the comments collected.

**Table 1. Results from Survey Questions.**

| Survey Question | Results |
|---|---|
| "Preparation provided by the Mechanical Drawing (MD-1) assignment for the following assignments: Geometric Constructions (DR-5), Highway (DR-6), and the Interchange (DR-7):" | Very Prepared: 20%<br>Well Prepared: 34%<br>Adequately Prepared: 32%<br>Somewhat Prepared: 11%<br>Not Prepared: 3% |
| "Preparation provided by the Freehand Sketching Techniques (DR-8) assignment for the Orthographic Views (DR-9) assignment:" | Very Prepared: 29%<br>Well Prepared: 40%<br>Adequately Prepared: 23%<br>Somewhat Prepared: 8%<br>Not Prepared: 0% |
| "Preparation provided by the Isometric Sketching (DR-10) assignment for the Isometrics (DR-11) assignment:" | Very Prepared: 34%<br>Well Prepared: 34%<br>Adequately Prepared: 18%<br>Somewhat Prepared: 14%<br>Not Prepared: 0% |
| "Preparation provided by the Freehand Sketching Views (DR-12) assignment for the Computer Section Views (DR-13) assignment:" | Very Prepared: 23%<br>Well Prepared: 29%<br>Adequately Prepared: 37%<br>Somewhat Prepared: 11%<br>Not Prepared: 0% |

**Table 2. Comments Regarding Survey.**

| Student | Comments |
|---|---|
| 1 | "I enjoyed freehand sketching, more assignments would have improved my skills." |
| 2 | "I feel that more freehand sketching assignments in class would better prepare to do it." |
| 3 | "I enjoyed the freehand sketch assignments, as I like to draw things by hand for assignments and as a hobby." |
| 4 | "I feel that the concepts for freehand sketching were taught well, although a few more practice assignments would help students grasp the process. I also feel that the class should start with mechanical drawings and then gradually transition into CAD." |
| 5 | "Freehand sketching helps explain how CAD works." |
| 6 | "They are good to visualize what is going on." |
| 7 | "They were useful in learning how to visualize a 3D object from 2D views." |
| 8 | "I would like more freehand sketching assignments." |

## Conclusion

The preliminary findings of this research are of value to the students and instructor of the course as to the future direction of the first-year Civil Engineering Graphics course. The findings may also benefit other first-year engineering courses to help determine if freehand sketching and mechanical drawing should be added to their curriculum. Preliminary results confirm that the freehand sketching and mechanical drawing exercises are of benefit to most students. Several students indicated they would like more assignments using freehand sketching. Students indicated that freehand sketching helped them in terms of visualization and understanding how a CAD program operates. As a result of the research for this paper, the instructor will consider adding more assignments using technical sketching beginning in the Fall of 2022.

## References

[1] Schutze M, Romer A, and Sachse P., "Support value of sketching in the design process" *Research in Engineering Design.* 89-97 2003. [Online]. Available: http://doi.org/10.1007/S00163-002-0028-7. [Accessed July 5, 2022].