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The CAD Conundrum

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Work in Progress Paper: The CAD Conundrum

Introduction

This research discusses the incorporation and possible transition from Bentley software to Autodesk software in a first-year civil engineering course. The topic of which software package is "best" has long been debated. Ultimately, the choice of which system to use depends on the designer [1]. Historically, the instructor teaching CE 111 (Civil Engineering Graphics) has used Bentley's software MicroStation in the course. Upon review of survey data from department constituents, the instructor teaching the CE 111 (Civil Engineering Graphics) course began implementing AutoCAD Civil 3D into the course.

Software Transition

In the Fall of 2019, the instructor developed tutorial exercises for the students to help them transition from MicroStation to AutoCAD Civil 3D. The instructor's experience has been that it is easier for the students to learn MicroStation at the beginning of the semester and then introduce AutoCAD Civil 3D to the students in the latter portion of the semester. During the first two weeks of the semester, the instructor provided three tutorials exercises for the students to complete in MicroStation. Then, the instructor asked the students to complete the same tutorials using AutoCAD Civil 3D. In the Fall of 2019, the first group of students was given these tutorial exercises towards the end of the semester and they were asked to complete the tutorials for extra credit. The majority of the students completed the AutoCAD Civil 3D tutorials and performed very well. A second group of students was given the same tutorials in the Fall of 2020, and the instructor's experience was essentially the same as what occurred in the Fall of 2019.

Constituency Surveys

A survey was developed and sent to the civil engineering undergraduate students who had already completed CE 111 (Civil Engineering Graphics). This student survey was sent to sixty-one students, with fifteen responses collected. The survey contained three questions and a comment section. Table 1 summarizes the results from the student survey questions and Table 2 summarizes the comments collected from the student survey.

Table 1. Results from Student Survey Questions.

Survey Question	Results
"If you were going to work on a school project and it required CAD software, what program would you use: MicroStation, AutoCAD, Both MicroStation and AutoCAD, Other?"	MicroStation: 47%
	AutoCAD: 47%
	Both MicroStation and AutoCAD: 0%
	Other: 7%
"If you were required to take an additional CAD course, which program would you prefer to be taught: MicroStation, AutoCAD, Both MicroStation and AutoCAD, Other?"	MicroStation: 0%
	AutoCAD: 80%
	Both MicroStation and AutoCAD: 20%
	Other: 0%
"If you have an internship, what CAD program do you use at work: MicroStation, AutoCAD, Both MicroStation and AutoCAD, Other, None?"	MicroStation: 13%
	AutoCAD: 47%
	Both MicroStation and AutoCAD: 7%
	Other: 7%
	None: 27%

Table 2. Comments from Student Survey.

Student	Comments
1	"Revit is a decent piece of software."
3	"MicroStation is starting to be removed from the transportation industry. They are switching to Open Roads, which is a MicroStation like program."
2	"MicroStation seems to be outdated and not as widely used in professional practice. Most jobs that I have looked at applying to look for experience in AutoCAD 3D specifically. It would have been nice to have had more experience with this software."
4	"MicroStation is being phased out of use at least in transportation and land surveying use. However, I have talked with people in the past who are still using MicroStation in their engineering work so perhaps having two different courses, one for each program could be an option."
5	"I think that MicroStation is good as a course that prepares students to learn how to problem solve and figure out software on their own but in general it does not translate to the real world. Most internships will use CAD software for projects and it would be beneficial for students to learn it in school rather than to figure it out once hired for a job or as an intern."

A second survey was developed and sent to the Department of Civil and Environmental Engineering Advisory Board, which consists of eighteen professional engineers and two professional land surveyors. This constituency was surveyed since they are subject matter practitioners who use CAD software regularly. Eleven advisory board members responded to the survey. The survey contained three questions and a comment section. Table 3 summarizes the results from the three survey questions and Table 4 summarizes the comments collected from the student survey.

Table 3. Results from Advisory Board Survey Questions.

Survey Question	Results
"Which software is used by your company to complete projects: AutoCAD, Both MicroStation and AutoCAD, Other?"	MicroStation: 0%
	AutoCAD: 45%
	Both MicroStation and AutoCAD: 55%
	Other: 0%
"Which software should be taught in the CBU CE curriculum: AutoCAD, Both MicroStation and AutoCAD, Other?"	MicroStation: 0%
	AutoCAD: 82%
	Both MicroStation and AutoCAD: 18%
	Other: 0%
"Which software do you want your hires to know before they begin work at your company: MicroStation, AutoCAD, Both MicroStation and AutoCAD, Other?"	MicroStation: 9%
	AutoCAD: 82%
	Both MicroStation and AutoCAD: 9%
	Other: 0%

Table 4. Comments from Advisory Board Survey.

Advisory Board Member	Comments
1	"We prefer to work in AutoCAD. We only work in MicroStation when our clients require us to do so."
2	"I think the practice on either software generally translates to the other software."
3	"It would be really helpful for graduates to have a basic knowledge of land grading and hydraulic tools."
4	"Revit/BIM packages should also be taught. It is becoming the standard for A/E firms (most private firms use it extensively)."
5	"Most all companies, architects, and engineers we work with and use AutoCAD as their primary design tool."
6	"Revit is becoming more popular and needed. You may add it to the survey questions so that we differentiate it from AutoCAD.
7	"It depends upon which client it is. In transportation, MicroStation is almost exclusive. Architectural work will mostly be AutoCAD."
8	"For the most part, firms that perform DOT work use MicroStation. Those firms doing heavy civil design for private customers and municipal water resources utilizes AutoCAD. If you can only teach one, my suggestion is to expose students to AutoCAD."

Conclusion

The preliminary findings of this research are valuable to the students and practitioners as they indicate the direction the CE 111 course can be driven. These findings are also beneficial for other first-year engineering courses to gain insight on what software package may be more beneficial to their programs. Preliminary survey results have indicated that AutoCAD should be incorporated into the CE 111 course. The instructor will continue surveying the CE 111 students, upperclassmen, and advisory board members during subsequent fall semesters to collect additional data. In the short-term, MicroStation will continue to be used in CE 111 with additional assignments to be completed using AutoCAD Civil 3D. The instructor will encourage other faculty members to assign drawings using both MicroStation and AutoCAD Civil 3D in their civil engineering disciplines. The instructor will develop additional exercises in using AutoCAD Civil 3D in transportation engineering and construction engineering applications. It is also noted that Revit was mentioned three times in the surveys, which seems to warrant further exploration.

References

[1] "CAD Software Comparison- Autocad, Microstation and Smartplant." (2012) *EnggCylopedia*, <https://www.enggcyclopedia.com/2012/09/comparison-cad-software-autocad-microstation-smartplant/> (May 30, 2020).