

Effects of Cal Poly Construction Management Software Curriculum on Graduate Employment Choices

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Abstract

As technology continues to advance at an accelerated pace, the construction industry struggles to keep up with these rapid changes. Understanding and adopting new technologies, specifically software, are key to the future of the construction industry. Studies have shown that the slow adoption of software in the industry has more to do with a lack of training than the limitations of the software. New hires out of universities with experience and training in these software are the linchpin to adapting this industry to new technology. The Construction Management Department at Cal Poly is renowned for putting out new hires with the practical understanding and creative thinking necessary to thrive in this ever-changing industry. The hypothesis of this paper is that the software taught in the Cal Poly Construction Management Department affects which companies graduates choose to work for. Through a survey comprised of graduates from the Cal Poly Construction Management Department, this paper will attempt to discover a correlation between software used in graduate's jobs and the software they learned in school, and analyze what gaps exist between Cal Poly and the industry in terms of valued software programs.

Key Words: Software, Curriculum, Employment, BIM, Survey

Introduction

Software has changed both the way construction projects function and how construction is taught in the Cal Poly Construction Management Department. As more construction companies adopt software to different functions of their business the CM Department has added new software to its curriculum and influenced students' perspective of software in construction before they enter into the industry. Courses that include new construction software have been strategically spread throughout a student's coursework to help them gain competency in these software and link them to specific parts of the construction industry. There are two classes taught in the CM department that focus solely on construction software. The first is CM 280 which gives students a general overview and introductory experience with a variety of construction software from BIM to project management. This class is required for all CM students and is scheduled to be taken during a student's second year at Cal Poly. The second software-focused class is CM 421, titled Emerging Trends, and gives students a chance to dive deeper into BIM software with a focus on Revit modeling. These two classes along with the CM labs give students a broad understanding of the software used in construction today.

Literature Review

Industry review

Many construction companies have taken steps towards adopting new software, but the industry overall has fallen behind other industries technologically. Geno Armstrong from KPMG writes that “Engineering and construction companies and project owners who invest in disruptive technologies should enjoy a step change in performance”. (Armstrong, 2016, p. 2) Armstrong backs up that claim with a survey of the construction industry and reasons that much of the lack of development is due to the owners that treat construction as a business enabler instead of a core driver. Construction projects require coordination between many different groups to create a successful project. The division between these different interest groups increases the need to be coordinated in software as well as on the job site.

In a study about the perceived barriers to adopting mobile technology on job sites Dr. Khalid Siddiqi found that “The leading perceived barrier was attributed to training (31%), followed by access to project drawings at site (22%), and software capacity limitations (16%)”. (Siddiqi, 2019, p. 381) This study gives a better understanding of what has led to the slow adoption of technology in the construction industry, and it is not the capabilities of the technology, but often a lack of understanding that causes the issue. Many construction software companies have created mobile apps to make their service more accessible on the jobsite and many job sites have Wifi and reliable internet connection. In Siddiqi’s study, 72% of respondents to his survey agreed that documents were always available to access via mobile devices regardless of internet connectivity. Software seems to be prepared to overcome the difficulties of job sites, but construction professionals are reluctant to adapt to the software.

Software can provide new ways of using and analyzing existing construction plans, but errors in the existing plans cannot be overcome solely based on the software. In a case study about student experiences with VDC at Colorado State University, the students found that “the quality of the material quantities produced from the VDC applications were highly dependent on the model’s quality, the level of detail embedded in the model, ... and the accuracy of the components selected for inclusion in the model”. (Eberhardt, 2018, p.80) In this study, the students found the model given to them lacked critical detail needed to make it effective and decided to create their own model with “contractor specific outputs”. (Eberhardt, 80) The quality of the base materials has a great effect on the value of the software used to analyze it and problems with software can be connected to the components instead of the software.

Software in the classroom

In Wei Wu and Raja Issa’s paper, *BIM Education and Recruiting: Survey-Based Comparative Analysis of Issues, Perceptions, and Collaboration Opportunities*, they found that only 30% of the respondents to their survey “indicated that their companies had ever considered college students (undergraduate, graduate, and doctoral) for staffing their BIM positions”. (Wu, 2013, p. 5) Companies rely on established employees to learn and adopt BIM to their projects, instead of recruiting new graduates for those positions. In their study, Wu and Issa found “a nontrivial gap between college BIM education and the expectations from the AEC industry”. (Wu, 2013, p. 6) Understanding why

that gap exists, and how to shrink it, could be an important factor in advancing the technological progress of the construction industry.

In an article about the need to integrate BIM into the teaching curriculum for Pakistani Engineering universities, author Ali Abbas claims that, “The challenge is that most of the universities lack understandings of what skills are needed in the industry”. (Abbas, 2016, p. 152) Differences between what universities are teaching, and what the industry requires of graduates, can affect what companies a graduate chose to work for and affect the graduate’s integration into the construction industry.

Research Goals and Objectives/Research Methodology

This project is aimed at understanding which software the graduates of Cal Poly Construction Management Department are using in their work environments, as well as researching if there is a correlation between the software taught in the CM Department and the software they are using in their current jobs. Through a survey created with Microsoft forms and emailed to graduates of the Cal Poly CM Department the data used in this paper was gathered. Then with that understanding, the survey will help gauge if a correlation exists between the software used in graduates' jobs and software taught at Cal Poly. The survey will focus on individual software that graduates find more important and through this approach the correlation or lack thereof between software taught at Cal Poly and graduate jobs will become clear.

This research project will use quantitative methods to collect the necessary data to discover if a correlation exists between software and employment choices. The recipients of this survey will be limited to only graduates of the Cal Poly Construction Management Department to focus on the software taught at Cal Poly and the influence of those on graduates' choices of employment. The survey will also differentiate responses based on time since graduation and current jobs to learn how great the effect of software learned has on graduates’ years after graduation. Having a greater understanding of the employment experiences of the respondents will lead to a better overall understanding of the data and any existing correlation.

Methodology

Interview Questions for Cal Poly CM Graduates

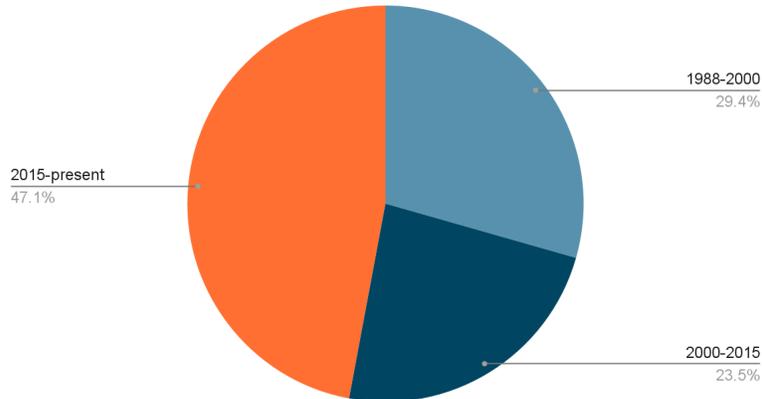
1. What year did you graduate from Cal Poly?
2. Are you currently working in the construction industry?
3. What is your job title?
4. Does your company use software you learned at Cal Poly?
5. Which construction software(s) do you currently use?
6. What construction software have you found to be most valuable for your job?
7. Did you learn that software program at Cal Poly?
8. Did the software programs you learned at Cal Poly play a role in choosing the company at which you chose to work?
9. Please list any software you are currently using that you would recommend being added to the Cal Poly curriculum?

Results

Interview Question summary

1. What year did you graduate from Cal Poly?

Graduation Year



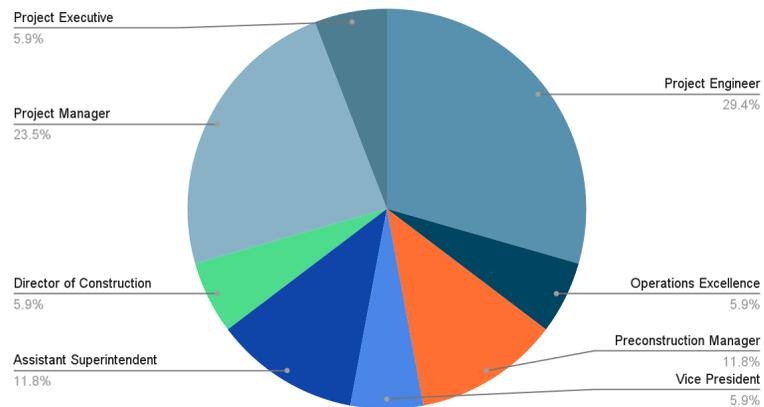
Of the seventeen respondents to the survey 5 graduated before 2000, 4 graduated between 2000 and 2015, and 8 of them graduated after 2015.

2. Are you currently working in the construction industry?

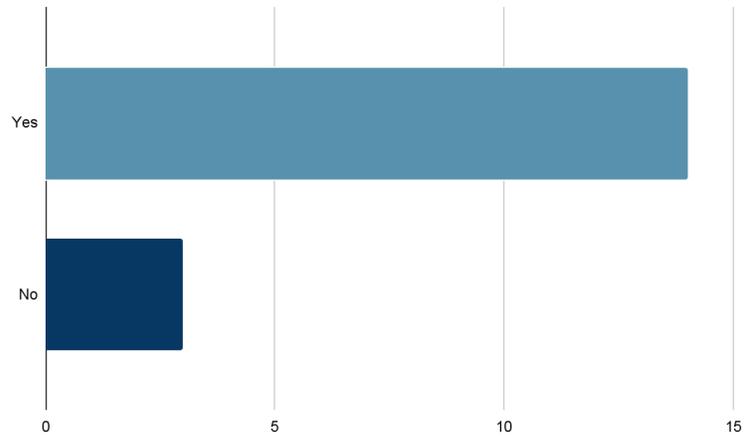
All of the people who responded to the survey are currently working in the construction industry.

3. What is your job title?

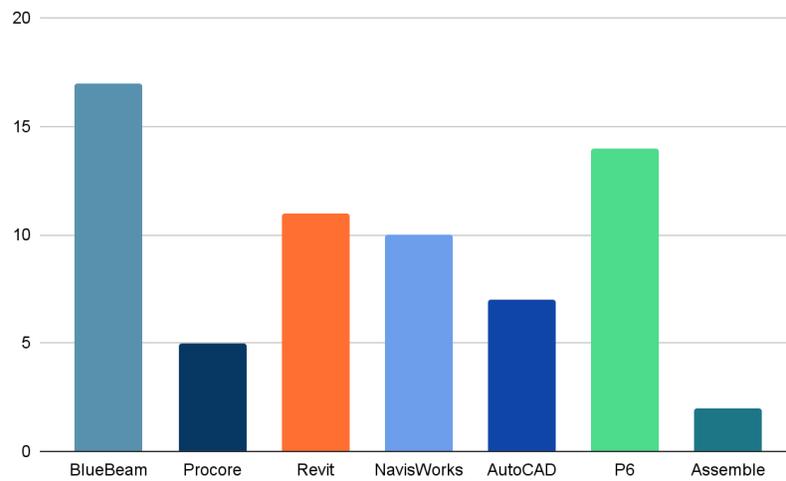
Job Title



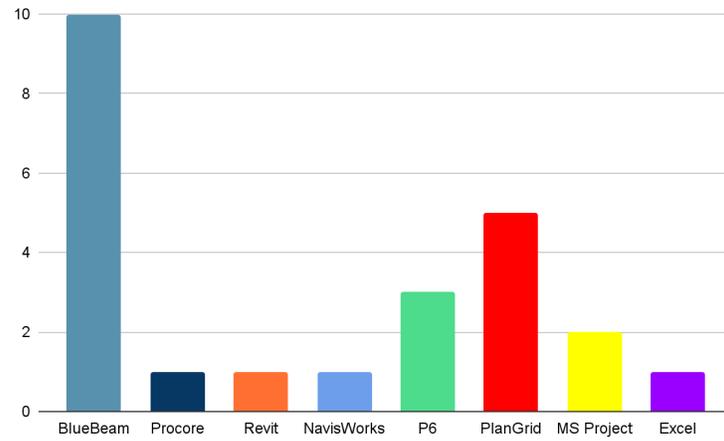
4. Does your company use software you learned at Cal Poly?



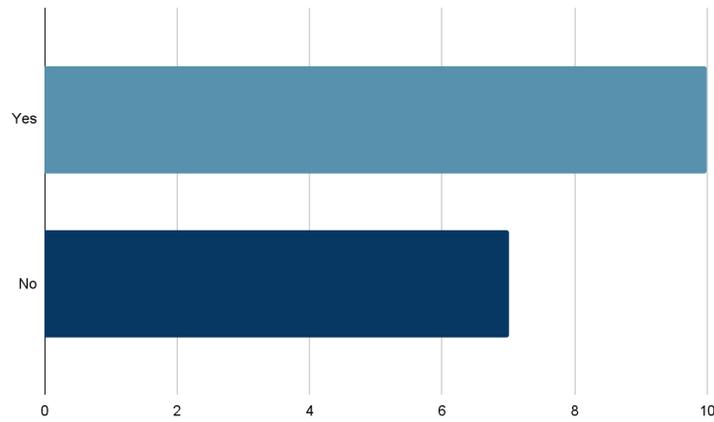
5. Which construction software(s) do you currently use?



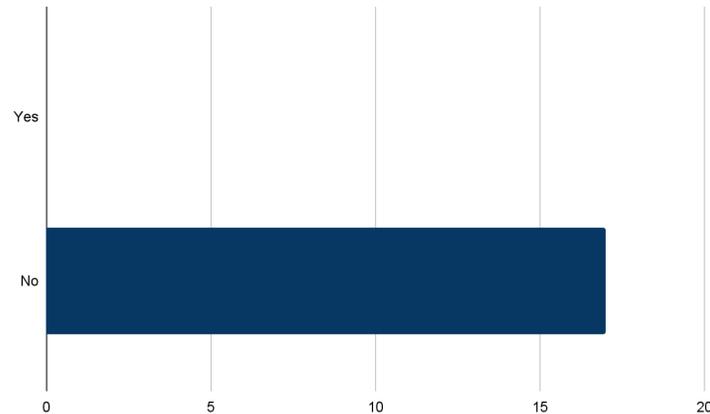
6. What construction software have you found to be most valuable for your job?



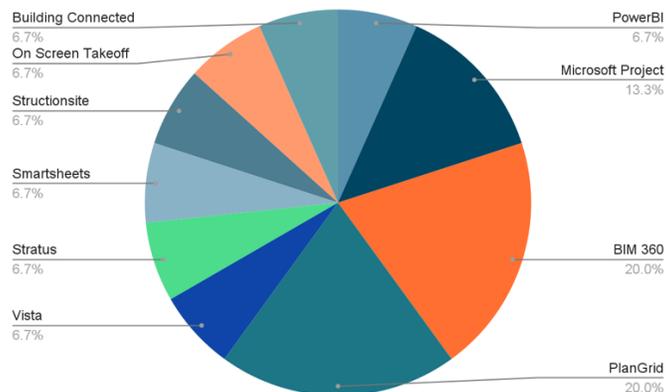
7. Did you learn that software program at Cal Poly?



8. Did the software programs you learned at Cal Poly play a role in choosing the company at which you chose to work?



9. Please list any software you are currently using that you would recommend being added to the Cal Poly curriculum?



Analysis

Grouping the Respondents

The survey sent out to alumni from the Cal Poly CM Department gathered a variety of responses from graduates of the program between 1988 and 2021. Technology and software in particular have changed drastically in the last thirty years. Microsoft Excel, released in 1987, was only one year old when the oldest respondent to the survey graduated from Cal Poly. To better understand the data gathered from the survey, the responses were divided into three groups based on their answers to the first survey question. The first group consisted of five alumni who graduated before 2000. The second group of four alumni graduated from Cal Poly between 2000 and 2015. The last group of eight alumni all graduated after 2015. This separates the respondents into groups that are based on the accessibility

of software in construction when they graduated. The first group entered the workforce when many of the software programs used today had not been created or were still relatively new. The second group covers the time period when many of the software taught at Cal Poly were created and became more accessible in the construction industry, and the last group includes recent graduates who were taught many of the same software programs that are included in the current curriculum at Cal Poly

All seventeen respondents to the survey answered that their choice to work for their specific company was not impacted by the software they learned at Cal Poly. The answers to this question show that software was clearly not a determining factor in their choice of employment. While this answer shows a lack of explicit connection between software learned and company choice, by analyzing which software these graduates use, the potential for a subtler connection can be determined.

Most Used Software

All seventeen respondents indicated that they use Bluebeam in their company. Bluebeam, having a 100% usage rate for the respondents to the survey shows a clear connection between one of the common software taught at Cal Poly and the industry. Students in the CM Department will learn how to use Bluebeam in the first or second year of school and it is necessary for many of their classes. Bluebeam is the software used most often by a majority of CM students at Cal Poly.

The next most common software used by graduates were P6, Revit, and Navisworks at 14, 11, and 10 respondents each. P6 is available to CM students and can be used in some classes but is not heavily prioritized by the CM department. In comparison, Revit is the main BIM program taught at Cal Poly and students are exposed to it in many of their CM classes. Navisworks is another software that is emphasized as a complement to Revit at Cal Poly and by graduation students have had plenty of opportunities to learn how to manage the software. While P6 may be given less focus at Cal Poly due to its nature as a scheduling software, Revit and Navisworks are both common BIM software taught at Cal Poly and about 60% of respondents use them in their companies.

The three software used least among the alumni in the survey are Procore, AutoCAD and Assemble. Procore is very popular at Cal Poly, but that may be due to the school's proximity to the company's headquarters and as one person in the survey stated "Procore is very good, my company just uses a different project management software." Procore has competitors as a project management software and is newer to the market than other software on this list. AutoCAD and Assemble only saw use among members of the survey who graduated before 2015. This can be attributed to competition in the BIM market and companies such as Revit being viewed as more valuable among newer graduates.

Most Valued Software

When asked which software they found most valuable for their job, ten alumni chose Bluebeam and five chose PlanGrid. No other software earned more than two mentions. With all seventeen alumni using Bluebeam in their companies, and ten choosing it as their most valuable software, there is a clear preference for a quality PDF editing software. PlanGrid's five votes and one vote for Procore, highlight the growth of project management software in changing the way construction companies do business. The alumni who chose PlanGrid as their most valuable software were from all three age groupings of the survey and did not show tendencies towards any age group in particular.

When asked which software should be added to the Cal Poly curriculum, the most common answers were PlanGrid and BIM 360 with three mentions apiece. PlanGrid continues to be one of the more valued software options among survey participants and emphasizes the value of project management

software which Cal Poly covers though Procore. BIM 360 is another software in the VDC environment and can be seen as complementary to software like Revit.

Conclusion

Software has changed the way in which the construction industry operates. This survey was used to help understand the way software has affected the company choices of individual graduates from Cal Poly. The results of the survey showed that software did not play a direct role in which company an individual chose to work for, but trends did appear that led to some interesting conclusions. Bluebeam is by far the most prevalent software used by graduates of the CM department and the participants valued it over any other software in the industry. Other common software were scheduling and project management software. A majority of graduates both use and highly value software in these specific categories. Revit and other BIM and VDC software were less popular among participants yet saw more use among recent graduates. This study found a limited correlation between software and the jobs of graduates. The limited number of participants in this survey leads to the potential for response bias and more studies would be needed to validate any finds from this study. The software curriculum at Cal Poly lines up well with the software graduates find valuable in the field with the largest difference in the scheduling department. In summary, the results of the survey appear to show that Cal Poly is validated in its choice of software in its construction management curriculum.

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