

Status of Technology Use among Construction Management Students: A Pilot Study

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To expedite the adaption of technology in the construction industry, it is crucial to understand the perception of construction management students towards the use of technology. To this end, a questionnaire survey was conducted in a university classroom setting to analyze the level of competency and willingness of construction management students towards the use of technology. The intent was to understand the status of technology usage in construction management students. The survey was conducted in both graduate and undergraduate level construction management courses in a university setting. This paper presents the descriptive statistics obtained from the survey. The survey will act as a pilot study to conduct a longitudinal study in construction management students to understand how and at which stage of their degree do the students learn about different technologies and how they make advancement towards technology adaptation while pursuing their degrees. Such a survey will reveal possibilities and challenges of implementing technologies in universities to increase overall technological competency of the students. The results presented in this paper will serve as a baseline for questionnaire development for the longitudinal study.

Keywords: Technology use in students, Classroom survey, Technology status

Introduction

The recent advancement in the field of technology is tremendous. Computers and electronic gadgets like tablets, smartphones have become an integrated part of human life. It would be virtually impossible for a human being to think of a life without technology aids. Technology has been widely implemented across many economic and industrial sectors to improve overall performance and reducing cost (Flanagan & Marsh 2000). Several types of research have already been performed to validate the viability of cutting-edge technology in the construction domain (Flanagan & Marsh 2000). The challenges and benefits of implementation of technology like global positioning system (GPS) (Pradhananga & Teizer 2013), ultra-wide band (UWB) (Teizer et al., 2007), robotic total station (RTS) (Cheng et al., 2011), and building information modeling (BIM) based modeling (Costin et al., 2014) in construction domain for tracking construction personnel, equipment, and materials, quality control, creating as-built drawings, etc. has already been endorsed by researchers. Yet, the implementation of technology in the construction domain has always been limited causing negative consequences in productivity and innovation (Becerik-gerber 2010). For instance, BIM has been in a market for several years, but it has not been adopted by the construction industry to its full capacity (Becerik-gerber 2010). The conflict of interest between young people who have grown up with the technology and an older generation who struggles to cope with emerging technology (Bennett & Maton 2010) could be one of the major reason for construction industry lagging in technology.

The advancement in technology is creating societal changes demanding innovative approaches and practices (Bennett & Maton 2010) which can be achieved by education. So, it is important to focus on what education are the newer generation getting from universities before they go to the real world and what will be its impact afterward. Several studies have been conducted to analyze the impact and challenges of introducing the BIM course to graduate and undergraduate level courses (Peterson et al., 2011). The advantage of BIM-based modeling compared to traditional CAD-based modeling have been already ratified by researchers via students' training and surveys (Woo 2006). The difficulty to learn many of the BIM-based software functions as a beginner was found to be the major challenge for its flourishment (Woo 2006). A survey conducted on the Canadian construction industry showed the willingness of construction industry to invest more on technology to increase the quality and speed of work, better communication, and better financial control (Rivard 2000).

The gradual shift towards the implementation of technology in a construction site for overall management and control of cost, quality, schedule, and safety is inevitable. The identification of competency level and perception of the construction domain students towards the rapidly advancing technology is a most to ensure the technological advancement within the construction industry. Recent graduates from construction management domain can play a bridge role between higher management, sub-contractors, vendors, and workers. They could encourage higher management to implement different technology in the construction process by illustrating its overall benefits. Similarly, they could assist sub-contractors, vendors, and workers who might be struggling to adapt the emerging technology. So, the identification of willingness of the construction management students towards the implementation of technology in a construction site is a must. This study tries to capture the perception and competency level of these students with different level of education (graduate and undergraduate) towards the technology by conducting a qualitative survey.

Goal and Objective

The long-term goal of this research is to track students' development and competency in technology throughout their degree via longitudinal survey. The questions would be related to the curricular learnings, employment status of students, learning processes for new things (including different technology), reasons for perspective change towards technology if any, etc. The analysis is expected to reveal how students are currently being exposed to technology, how effective or ineffective the applied methodologies are, and what impact can this learning system make in changing overall attitude of these students towards the implementation of technology in the real world.

To achieve our goal, it is essential to know the current willingness and competency level of the students towards the implementation of technology to solve real-world problems. For this, a pilot study was conducted with general questions about technology adaptation. The analysis result from this survey will form a baseline for the questionnaire development for future research towards achieving our goal. This paper will present results pertaining to the pilot study.

Methodology and Preliminary Result

The study relies on the survey data collection and descriptive analysis of the obtained data. The use of survey for studying the perception of respondents towards the implementation of technology has already been validated by many researchers (Sabongi 2009) The overall framework consists of:

1. Questionnaire preparation
2. Respondents selection
3. Data collection
4. Data analysis

Questionnaire Preparation

A questionnaire was created for qualitative analysis of respondents' attitude towards the technology and Institutional Review Board (IRB) approval was obtained to conduct the voluntary survey in the classrooms. Each participant was asked to enter his/her mail id at the beginning of the questionnaire to ensure unique entry, followed by 14 questions. The questions were multiple choice with some questions having the flexibility to select more than one option. Since there was a possibility of the same student taking both courses and participating in multiple surveys, mail id was used as the measure to delete duplicates and segregate the unique responses for further analysis. The questionnaire was segmented into five different sections (respondents' info, accessibility to technology, use of technology, perception towards technology, and technical competency).

Respondents' Info

- ***Age*** (16-20, 21-25, 26-30, and 30 above)
- ***Level of study currently enrolled in*** (graduate and undergraduate)
- ***Employment status*** (full-time employed, part-time employed, self-employed, not employed)

Accessibility to technology (computers, cell phones, internet)

- ***Number of laptops or desktops owned*** (none, one, and two or more)
- ***Number of smartphones or tablets owned*** (none, one, and two or more)
- ***Accessibility to the internet*** (24 hours, at university and work/home via Wi-Fi, at university via Wi-Fi, and only via university lab computer)

Use of technology

- ***For what purpose do you use technology?*** (study, internet, e-banking, entertainment, work, and communication)
- ***How often do you find the use of technology in your classroom for learning?*** (extensively, often, sometimes, less likely, rarely, and never)
- ***How often do you use a computer for your homework?*** (extensively, often, sometimes, less likely, rarely, and never)
- ***Total hours you spend with technology in a day*** (using computers, cell phones, etc.) (less than 1 hour, 1-2 hours, 2-4 hours, 4-6 hours, 6-12 hours, and 12 hours or more)

Perception of technology

- ***Preference in reading materials*** *(hard copy and e-copy)*
- ***"Technology helps you in better and realistic learning." Rate your feeling regarding this statement*** (Strongly disagree, disagree, somewhat disagree, somewhat agree, agree, and strongly agree)

Competency in Technology

- ***Rate yourself regarding the level of your technical skill*** (very poor, fair, good, very good, and excellent)
- ***Level of comfort while switching to the latest technology? (Like switching from AutoCAD to Revit, Windows 8 to Windows 10, etc.)*** (very comfortable, comfortable, difficult, and very difficult)

Respondents Selection

The graduate and undergraduate students from a university, located in South Florida region were chosen as the participants. For making the analysis unbiased, the students taking two different level courses were requested to participate in a survey at the end of the semester. The survey was conducted for 6 different semesters.

Data Collection

The survey was carried out with graduate and undergraduate students taking different courses at the end of the semester. The total of 216 responses was collected from 6 semesters (Fall 2016, Spring 2017, Summer 2017, Fall 2018, Spring 2018, and Summer 2018) and 137 unique responses were identified for further analysis. Seventy-nine duplicates were identified and removed from the analysis by using university mail id as uniqueness identifier. The duplicates in the survey were due to some students being enrolled in different courses selected for the survey as well as some students repeating the same course. Figure 1 shows the distribution of students participating in the survey.

Throughout the paper, the data inside the bar represents the actual number of graduate or undergraduate student whereas the horizontal axis represents the percentage distribution among the provided categories.

Out of 137 unique respondents, 36 were graduate students and 101 were undergraduate students were from 21 to 25 years age group whereas the graduate students were uniformly distributed among 21-25, 26-30, and above 30 groups. This indicates that the analysis result would represent a bigger portion of these students.

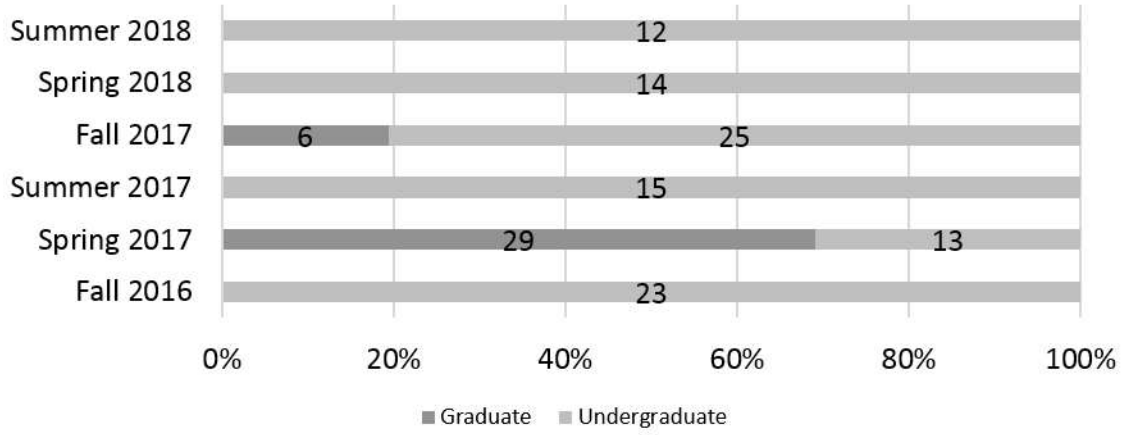

Figure 1: Graduate and undergraduate students participating in the survey in a different semester

Data Analysis

Employment status. The employment status for both graduate and undergraduate students was found to be similar. Twenty percent of both graduate and undergraduate students were unemployed. Fifty-five percent of undergraduate and 80% of graduate students were either partially or fully employed. Twenty-three percent of undergraduate students didn't respond to this question. Figure 2 shows the statistics of employment for both graduate and undergraduate students.

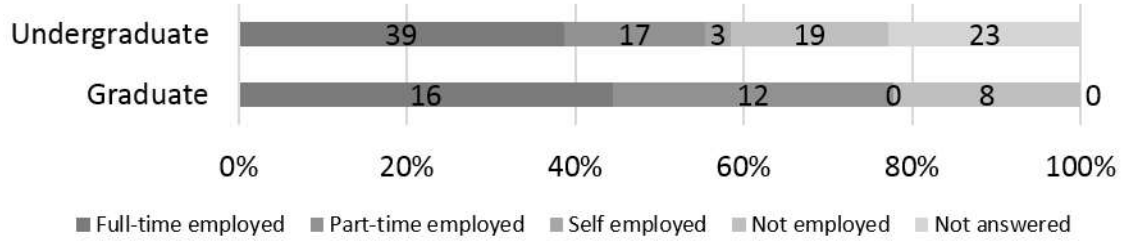

Figure 2: Employment status of graduate and undergraduate students

Technical Skills. The level of technical skills was categorized into 5 different categories as shown in Figure 3. All the students seem to have a certain level of technical skills as there was no respondent for very poor technical skill. More than fifty percent of both graduate and undergraduate students perceived themselves to be technically competent. This shows that these students can actually adapt with technology to deal with real-world issues.

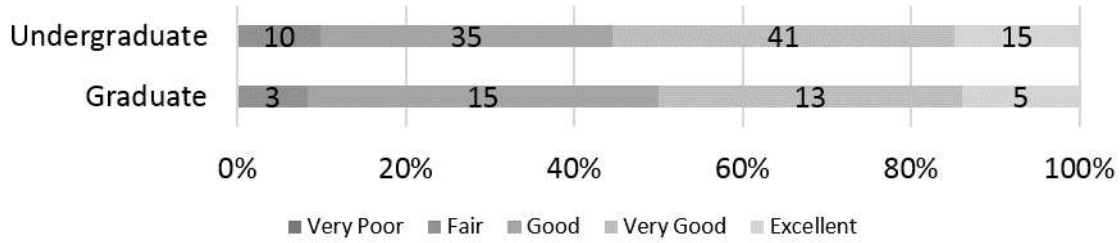

Figure 3: Level of Technical Skill

Purpose of technology use. There is a wide range of purpose for the technology to be used. For this survey, some major purposes were identified and the respondents were allowed to choose multiple options. For both graduate and undergraduate students, more than 90% used it for communication, work, entertainment, internet surfing and studying purposes. The e-banking was used by less (80%) students for both graduate and undergraduate level. This shows that almost all respondents are willing to use the technology in their day to day life for different purposes. Figure 4 shows the number of graduate (n=36) and undergraduate (n=101) students using technology for different purposes. One interesting finding was, not a single purpose was used by all students.

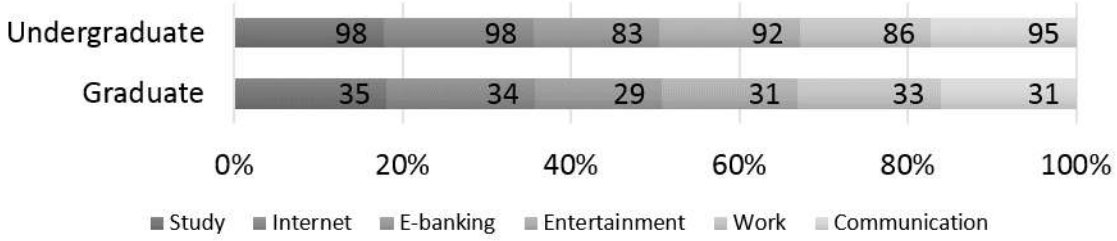

Figure 4 Purpose of technology use

Availability of Technology. The availability of technology plays a vital role in deciding the perception of a respondent towards technology. For this research, the availability of computers and cell phones were used as the measure to quantify the availability of technology. Figure 5 shows the availability of computers for both graduate and undergraduate students. Only one respondent (graduate student) didn't have his personal computer and all the respondents had at least one cellphone. From this, it could be inferred that the perception of respondents towards the technology would not be biased based on the unavailability of technology to use.

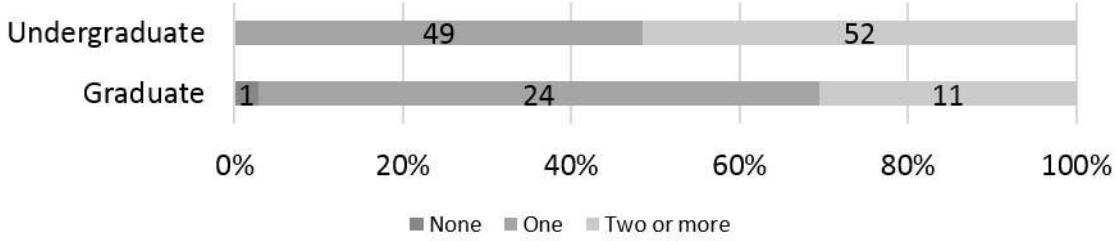

Figure 5 Availability of Computers

Preference in reading materials. Both graduate and undergraduate students were found to prefer hard-copy for reading materials than e-copy for all age group. Around 70% of the students preferred hard-copy vs 30% of e-copy. This shows that although the respondents are willing to use the technology for study purpose (inferred from

Figure 4), they are more comfortable reading hard-copy. Figure 6 shows the preference of both graduate and undergraduate students for reading materials.

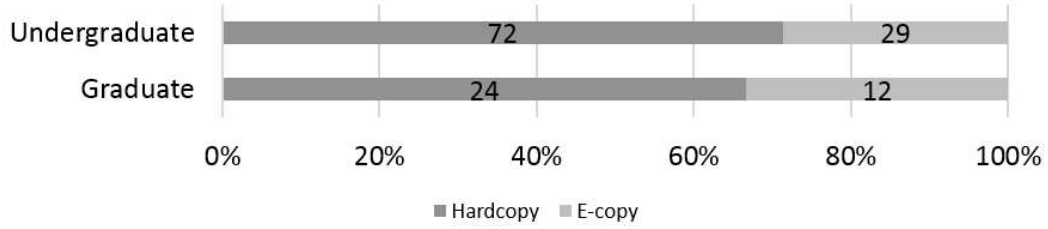

Figure 6: Preference for reading material

Use of technology in class. The response from the survey showed that the technology was used in class frequently for both graduate and undergraduate levels (more than 95%). Since the Building Informatics course was a mandatory requirement as per university rule, the students get chance to experience and explore the BIM-based modeling technology. Figure 7 shows the use of technology in graduate and undergraduate class.

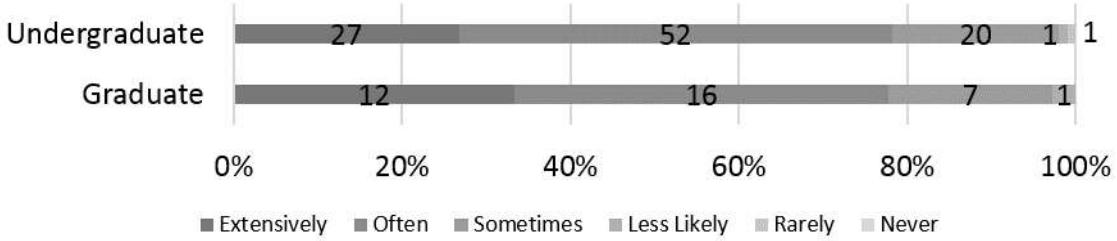

Figure 7: Use of technology in graduate and undergraduate class

Use of computer for homework. The computer was found to be frequently used by most of the students for doing homework. This also shows both the necessity and willingness of respondents towards using the technology. Either way, this experience of using different software in a computer while solving homework could encourage the construction domain students to use learned tools in the real world. Figure 8 shows the number of graduate and undergraduate students using the computer for doing homework.

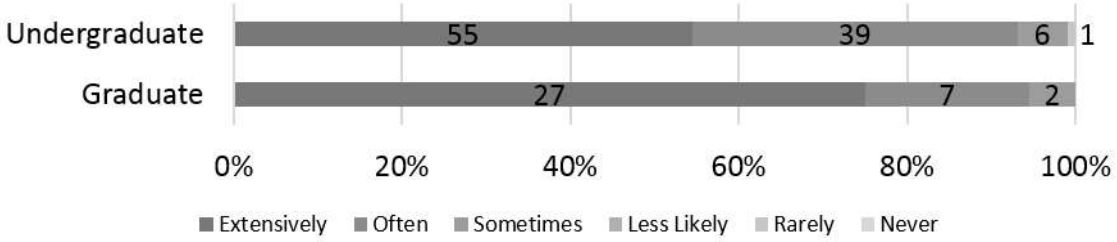

Figure 8: Use of a computer for homework

Total hours spent on technology in a day. Graduate students spent more time with technology compared to the undergraduate students. But for both graduate and undergraduate students, the time spent with technology was at least more than six hours. This shows that they are willing to be engaged with technology for longer duration every day which indicate that they are open to implementing technology in their career. Figure 9 shows the total hours spent by graduate and undergraduate students on technology in a day.

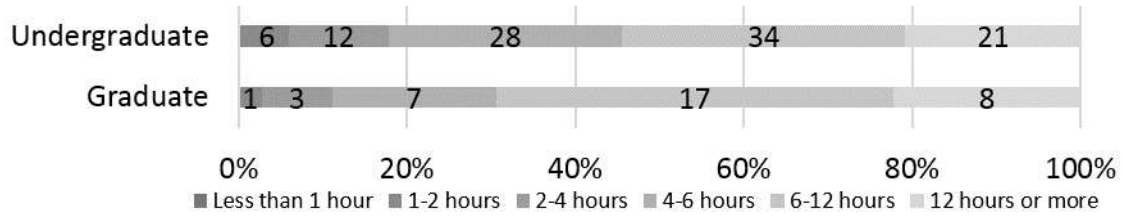

Figure 9: Total hours spent on technology in a day

Perception of Technology. Although the previous questions show the competency level of most of the graduate and undergraduate students to be above average, approximately 17% of the undergraduate students felt in some way that the technology would not help them in better and realistic learning. With the longitudinal survey planned to be carried out later, it would be interesting to track how this perception changes with time and education level. Figure 10 shows the perception of graduate and undergraduate students towards technology.

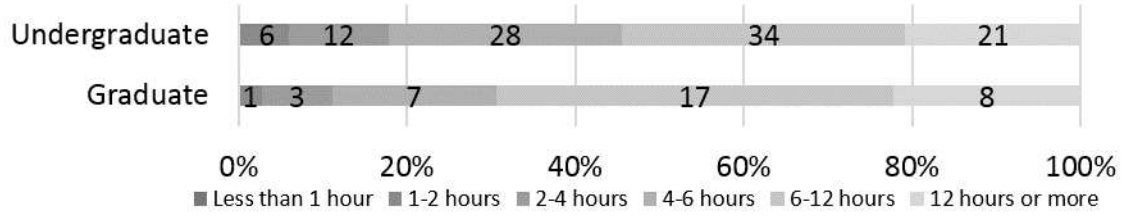

Figure 10: Perception of technology

Level of comfort while switching to the latest technology. Majority of both graduate and undergraduate students were comfortable with switching to the latest technology. An example of switching from CAD to Revit or Windows 8 to Windows 10 was provided for reference. This shows that they should have a minimal problem coping with ever-changing technology while working in the real world. Figure 11 shows the level of comfort for graduate and undergraduate students while switching to the latest technology.

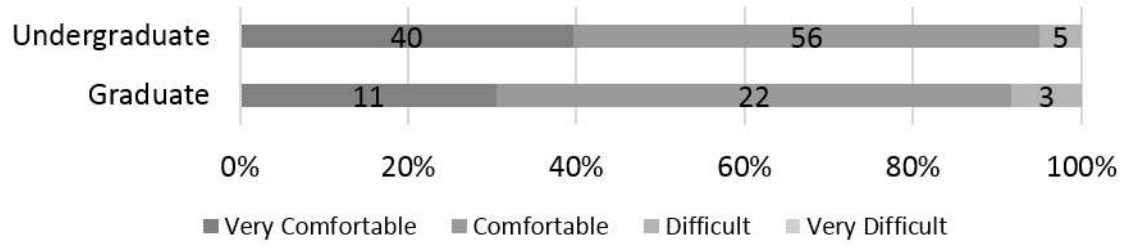

Figure 11: Level of comfort while switching to the latest technology

Conclusion and Future Research

From this pilot study, the overall perception and willingness of both the graduate and undergraduate students were found to be positive towards adopting a technology. Majority of the students were connected to technology for different purposes such as studying, social networking, working, etc. In addition, they felt that they were benefitted by technology in better and realistic learning.

Future research includes conducting a similar pilot study at multiple universities. Based on the result of the pilot study, a questionnaire will be prepared to track the technological competitiveness of construction management students both, qualitatively and quantitatively. For instance, the qualitative perception of students from the survey could be cross verified in reality by taking grades for a technology-related course (BIM-based modeling course) as a comparative measure. Moreover, the change in perception of a student towards the technology could be tracked during their university period by this longitudinal survey.

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