

Students' Perceived Knowledge Acquired During Construction Management Internships

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Many studies have shown the value of an internship or co-operative experience for young professionals to gain experience. For students, internships historically have been a way to gain valuable hands-on knowledge within their chosen degree and career path. Sponsoring companies see this as a way to groom future employees whom they hope to hire as full-time employees after graduation. This paper is the analysis of a pilot study in an attempt to identify the perceived construction management knowledge acquired by students during their internship utilizing an evidence-based documentation approach. The study analyzes students' knowledge acquired through the submission of documented evidence using weekly reports, intern documents or artifacts, jobsite photos, and a final report. In addition to the documented student work, a survey was used to identify the students' perceived knowledge gained during the internship. Knowledge areas were organized using the 20 American Council for Construction Education (ACCE) student learning outcomes (SLO's). The most significant areas of perceived knowledge included plan reading skills, understanding of how to apply electronic-based technology to a construction project and understanding of site layout and utilization.

Keywords: Internships, Cooperative Experience, Student Learning Outcomes, ACCE

Introduction

Internships or cooperative-learning experiences offer a valuable way for students to engage with industry in their chosen career choice. Typically, the goals of this experience are to allow the student to take their knowledge acquired in academia and apply their knowledge in a real-world scenario or to allow a student who has no experience in their chosen career path to gain experience or "test the waters" to really identify whether the chosen career path is "the right choice." For students, the internship has its purpose, employers have found the internship experience to be a place where they can test and review future employees who may wish to join their companies. Many employers will put the student in multiple situations to test the student within their company to identify if the student would be "the right fit" for their company culture (Hagar, Pryor & Bryant, 2003). This requires the employer to expose the student to many different people and job scenarios that occur within the construction company ("A Brief History," 2014).

Literature Review

Historically the idea of an internship stemmed from the trades people of Europe in the 11th and 12th centuries where the master craftsman and tradesman would take young tradesman to work alongside them to learn their chosen trade. With this in mind and through some very specific training came the idea of an apprenticeship system that would train young unskilled boys to skilled tradesman in many different areas of work (Bray, 2012). As time progressed through the industrial revolution the apprenticeship concept briefly went away or was reduced and led to vocational training to equip workers needed for factory work. During the vocational training apprentices were machinists and carpenters who would receive payment on a predetermined pay scale and at the completion of their apprenticeship would then join their chosen trade or labor union. The idea of an intern first was applied to medical students in the 1920's and in the 1960's internship or co-op programs were offered on college campuses as a way to integrate the college bound student into the mainstream workforce ("A Brief History," 2014). The literature has also suggested the terms of service learning, cooperative education, cooperative learning and internships have all been defined to

“designate the student experiential learning outside the university setting, with the goal of preparing students for successful entrance into their chosen field” (Tovey, 2001 & Wasserman, 2008).

For construction management, the concept of an internship is the process of providing the student exposure to the professional side of the construction industry while utilizing their education. This process has become a very important component within many construction management programs (Adcox, 2000, Moore & Plugge, 2006). Construction management internships are a three-way partnership with the university, industry and student (Tovey, 2001, Moore & Plugge, 2006, Moore & Plugge, 2008). Previous research on internships studied the perceptions in the benefits of employers sponsoring a student construction management intern and their expectations of intern performance within the internship program structure. What was identified in this research was that “careful attention must be made in balancing the needs of academia with those of industry to build lasting partnerships and provide for on-going internship placements” (Moore & Plugge, 2006, Moore & Plugge, 2008).

Adcox (2000) provided a framework for the identification of internship expectations and specific competencies that would be acquired during an internship. His research provided a framework for the collection, analysis and synthesis of information a student would perform during the internship as a structured course. His collection of information in the course was categorized in six main areas of observation, participation, managing, self-analysis of work effort, outside work activities and a professional development plan. Adcox (2000) developed a system where the specified tasks and artifacts could be measured to gain an understanding on construction concepts that were acquired by the students in an applied construction management setting using the internship as the course. This approach helps provide an example on how activity based, evidence-based or problem-based learning can be used in construction management as a rigorous structured approach to acquire structured knowledge based on research and experience as a means to learn (Barrows & Tamblyn, 1980). For students to engage in an internship, this allows the student to research construction management related concept and learn construction management competencies and concepts through experiential learning during the internship.

Wasserman (2008) developed a study linking the American Council for Construction Education (ACCE) outcomes to measure students’ opinion of their own readiness to enter the industry. Results from the 34 survey responses suggested that students had a high level of confidence in safety, construction graphics and estimating, and low levels of understanding in scheduling, cost accounting and design theory during their internships. He also suggested that the participants found the most significant useful construction skills that applied to the students’ career included safety, project management and construction graphics as career skills necessary to enter the construction industry by the respondents’.

Internship Programs

In academia, there are many different approaches to providing an internship experience for the students. There are some construction management programs that have a formalized internship program where students are required to intern at a company for a specified number of hours. Other universities may offer an un-structured internship program where the students intern with a company as an elective class. At Central Washington

University, the internship program is un-structured, but, students are required to have some type of “construction related experience” for entry into the professional side of the program.

American Council for Construction Education (ACCE) Student Learning Outcomes (SLOs)

All construction management programs accredited under the American Council for Construction Education (ACCE) must assess their programs using an outcomes-based approach utilizing 20 student learning outcomes (SLOs). Each SLO is evaluated based on a minimum of two assessment methods, at least one of which must be a direct assessment showing evidence of student learning in the form of a student product or performance that can be evaluated. A second method of evaluation for each SLO is through an indirect assessment, which must be evidence of student learning where the learning is a perception, opinion, or attitude of the student or others. Table 1 below shows each of the twenty SLOs and their definitions (ACCE, 2016):

Table 1 ACCE Student Learning Outcomes (SLOs)

SLO #	Student Learning Outcome
1.	Create written communications appropriate to the construction discipline.
2.	Create oral presentations appropriate to the construction discipline.
3.	Create a construction project safety plan.
4.	Create construction project cost estimates.
5.	Create construction project schedules.
6.	Analyze professional decisions based on ethical principles.
7.	Analyze construction documents for planning and management of construction processes.
8.	Analyze methods, materials, and equipment used to construct projects.
9.	Apply construction management skills as a member of a multi-disciplinary team.
10.	Apply electronic-based technology to manage the construction process.
11.	Apply basic surveying techniques for construction layout and control.
12.	Understand different methods of project delivery and the roles and responsibilities of all constituencies involved in the design and construction process.
13.	Understand construction risk management.
14.	Understand construction accounting and cost control.
15.	Understand construction quality assurance and control.
16.	Understand construction project control processes.
17.	Understand the legal implications of contract, common, and regulatory law to manage a construction project.
18.	Understand the basic principles of sustainable construction.
19.	Understand the basic principles of structural behavior.
20.	Understand the basic principles of mechanical, electrical and piping systems.

Student Internship Expectations

At Central Washington University students can earn credit to be applied to their construction management degree through a cooperative experience class. In order for a student to register for their cooperative experience, each student must complete a cooperative learning agreement. This agreement is a form acknowledges the completion of sexual harassment training and purchase of liability insurance. The form also acquires the necessary student, employer, emergency contact and faculty information with signatures for approval. In addition to basic information, an academic learning plan is established with each student and employer which includes the internship description, learning objectives and activities. This form serves as the formal contract and syllabus for the cooperative experience. Below are examples of learning objectives and activities that are tied to the internship description and goals:

- Develop an understanding of *drawings and specifications* related to the interns assigned project(s). Write a report (5-10 pages, double spaced) explaining how the intern used drawings, specifications and what the intern learned during the internship. Be sure to discuss daily activities, accomplishments and attendance at company trainings during the internship.
- Submit a *weekly log* of activities to Canvas which include tracking of construction quantities, engineering duties, labor, material, and equipment. This can be in the form of a word document each week, include pictures into the document to be uploaded to the learning management software for the week.
- Take *daily photos* of various critical activities occurring on the project and submit to Canvas.
- Acquire internship documents (Internship Artifacts) to demonstrate the different types of documentation used during the construction process and submit to Canvas.
- *Presentation* of experience acquired during the internship to a class. A complete power point presentation will be uploaded to Canvas prior to the end of the internship.

- Canvas will serve as the professional portfolio. All items including the daily log of activities, samples of internship documents (Internship Artifacts), daily photos, written shall be uploaded for review by the internship faculty member.

Research Methodology

The methodology of this pilot study research uses a mixed-method approach to identify the perceived knowledge acquired by students during their construction management internship utilizing an evidence-based approach for the acquisition and analysis of data. Therefore, both qualitative and quantitative data was acquired to identify the types of knowledge students acquired. Qualitatively students were asked to provide documents, pictures, written weekly and summative reports about their internships (Creswell, 1998). Quantitatively, a survey was distributed to the students electronically that tied their perceived knowledge acquired to the ACCE SLO's. The survey questions were also grouped to focus on the acquisition of both hard and soft skill knowledge. At the completion of the student internship, students were provided a link to an electronic survey developed in Qualtrics and distributed through the learning management software Canvas within the last week of the internship by the professor of record.

Data Acquisition

Data for this research was collected through qualitative and quantitative methods. The researcher utilized Canvas as an online submission platform where all students uploaded documents and communicated with the professor. Within Canvas assignments were created as individual submissions for students to upload their documents for review. The assignment included the following items used for data in this research:

- Weekly Reports – each student submitted weekly reports. Report formats were provided using two different forms depending on if the student performed work in the field or the office.
- Intern Artifacts – this assignment instructed students to upload examples of documents the students either developed or used during their everyday work. Documents could include items such as requests for information (RFI), cost reports, drawings, submittals, as-builds etc.
- Jobsite photos – included a photo documentary of what the student observed during their internship.
- Presentation PowerPoint – included an annotated PowerPoint presentation the student would make to underclassman about their internship to include descriptions of work and photos of significant items the intern found during the internship.
- Construction Action Photo – a self-portrait of the student with their company logos within the photo.
- Final Written Report – a 5-10 page written report which summarizes the student's internship experience.

Results

The results provided one of the limiting factors of this study in the fact that there were only 17 students that participated in the survey. Overall there were 21 students involved in the class, the survey yielded a response rate of 81%. Demographic results of the study indicated that the majority of the students who participated in the study were students focused in the heavy/civil area (82%, n = 14). The other areas of construction included commercial (12%, n = 2) and mixed-use (6%, n = 1). Geographically, students were in the state of Washington (88%, n = 15), the other two students interned with companies in Hawaii and Florida. The majority of the students were seniors (59%, n = 10), with some juniors (35%, n = 6) and sophomores (6%, n = 1). Shown in Table 2 are the results of the perceived construction management knowledge concepts acquired during the internship as the concepts are mapped to the 20 ACCE SLO's. Additional information provided with this table is an assessment of perceived knowledge of hard and soft skills acquired during the internship.

Table 2 Results of Perceived Construction Management Knowledge Concepts Acquired During the Internship

Question	ACCE SLO number	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)	Mean
1. The internship enhanced my written communication skills (HS)	1	4	11	2	0	0	4.12
2. The internship enhanced my oral communication and presentation skills (SS)	2	6	11	0	0	0	4.35
3. The internship enhanced my understanding of safety applications on a construction project (HS)	3	7	10	0	0	0	4.12
4. The internship enhanced my understanding of site layout and utilization (HS)		10	7	0	0	0	4.59
5. The internship enhanced my understanding of cost estimating (HS)	4	9	5	3	0	0	4.35
6. The internship enhanced my understanding of submittal documentation (HS)	7	10	5	2	0	0	4.47
7. The internship enhanced my understanding of bid preparation (HS)	4	8	4	4	1	0	4.12
8. The internship enhanced my scheduling skills (HS)	5	4	7	6	0	0	3.88
9. The internship enhanced my understanding of how to make decisions based on ethical principles (HS)	6	3	10	4	0	0	3.94
10. The internship enhanced my plan reading skills (HS)	7	12	4	1	0	0	4.65
11. The internship enhanced my understanding of contract documents (HS)	7	8	9	0	0	0	4.47
12. The internship enhanced my understanding of how to analyze construction methods, materials and equipment (HS)	8	8	8	1	0	0	4.47
13. The internship enhanced my ability to apply construction management skills as a member of a multidisciplinary team (HS)	9	8	7	2	0	0	4.35
14. The internship enhanced my understanding of how to apply electronic-based technology to a construction project (HS)	10	11	6	0	0	0	4.65

15. The internship enhanced my surveying techniques for construction layout and control (HS)	11	4	6	6	1	0	3.76
16. The internship enhanced my understanding of project delivery systems and roles and responsibilities of those involved in the construction process (HS)	12	9	5	3	0	0	4.35
17. The internship enhanced my understanding of how to manage project risks (HS)	13	6	7	4	0	0	4.35
18. The internship enhanced my understanding of construction risk management (HS)	14	6	7	4	0	0	4.12
19. The internship enhanced my understanding of construction quality assurance and control on a project (HS)	15	7	9	1	0	0	4.35
20. The internship enhanced my understanding of the construction project control process (HS)	16	6	7	4	0	0	4.12
21. The internship enhanced my understanding of the legal implications of contract, common and regulatory law to manage a construction project (HS)	17	6	8	3	0	0	4.18
22. The internship enhanced my understanding of the basic principles of sustainable construction (HS)	18	6	6	5	0	0	4.06
23. The internship enhanced my understanding of the basic principles of structural behavior (HS)	19	7	7	3	0	0	4.0
24. The internship enhanced my understanding of the basic principles of mechanical, electrical, utility and piping systems (HS)	20	5	10	2	0	0	4.18
25. The internship enhanced my understanding of specialty contracting (HS)	20	4	7	6	0	0	3.88
26. The internship enhanced my ability to work as a team member (SS)	12	5	0	0	0	0	4.71
27. The internship enhanced my leadership skills (SS)	7	10	0	0	0	0	4.42
28. The internship improved my self-confidence (SS)	7	10	0	0	0	0	4.42

29. The internship has assisted me in securing an offer with my current internship company (SS)	5	5	7	0	0	3.88
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Note: N = 17, HS = Hard Skills, SS = Soft Skills

Overall, the results identified the students' perceived knowledge acquired in all elements of the ACCE SLO's during the internship are relatively high at a rating of $M > 3.76$. Significant results of this study indicated that the greatest perceived knowledge acquired during the internship included plan reading skills ($M = 4.65$), application of electronic-based technology ($M = 4.65$), site layout and utilization ($M = 4.59$), understanding contract documents ($M = 4.47$) and understanding of submittal documentation ($M = 4.47$). Some of the lower perceived knowledge areas that were exposed included the application of surveying techniques for construction layout and control ($M = 3.76$), understanding of specialty contracting ($M = 3.88$), scheduling skills ($M = 3.88$) and understanding of how to make decisions based on ethical principles ($M = 3.94$).

Qualitative data was collected in addition to the survey data included written reports, jobsite photos, PowerPoint slide presentations, intern artifacts and weekly reports (Creswell, 1998). All 21 students submitted written reports and PowerPoint presentations reflecting on their internship experience, there were over 750 jobsite photos submitted showing many different aspects of the work and most students submitted weekly reports for their 10-week summer internship. Most importantly, the students provided a broad range of intern artifacts which included drawings, requests for information (RFI), submittal logs, hand-drawn and electronically drawn sketches, tracking logs and contracts. Many of the intern artifacts were developed by the students as part of their internship tasks for the management of the project. The best means of capturing the student experiences came from the weekly reports where students provided a snapshot of their weekly experiences over their ten (10) week internship. There were two structured weekly report types which included the office and field report depending on where the student spent their time during the internship for that week. In some cases two reports were submitted for one week. Significant self-reflective statements acquired from the qualitative section of the survey were centered on the understanding of the construction process and are shown below:

- There are some things the classroom is meant for and other things you can only learn out in the real-world, an internship gives you the opportunity to see the real-life construction process and if you're lucky and intern with a good company you will be part of the construction process.
- It has given me an appreciation for the intricacies of basic communication between different members in a team.
- Allowed me to be able to take the stuff I learned from a text book and apply it in real life or see how things in the field are altered from things in the classroom.

Conclusions and Future Work

This study provides a method for educators and students to document their work experience during a summer internship. What the documentation process provides is an avenue for the student to share the valuable information they are receiving during the internship process. This study has also provided the educator insight to the activities students are engaged in during the class on a real-time basis through the weekly reports, artifacts and photos. Information that can be gleaned from this internship can also be used to inform educators on the structure of their curriculum within their construction management program. The data suggests the fact that employers are utilizing interns for their technological skills and there is a great need to make sure construction curricula is aligned in the technology area to provide the maximum benefit to the intern and employer that allows the intern the ability to integrate within a construction team of professionals at a high level.

It was interesting to find that one of the perceived knowledge areas that was enhanced through the internship experience included construction plan reading skills ($M = 4.65$). This information was also similar to Wasserman's (2008) study where the respondents had a high level of confidence during their internship in their abilities to work with construction graphics.

Future research in this area of work could involve tracking the students after their internships during their careers within ACCE SLO's to compare the significant perceived knowledge areas and to identify how these knowledge areas change with respect to the experience gained after graduation. It would also be interesting to see how technology has influenced the confidence level of the intern's ability to understand the construction process graphically through electronic construction documents.

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