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Graduate Construction Management Education: A Senior-level, Industry-Based Delphi Study

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Graduate education can be utilized by working professionals as an advancement to their careers. This paper presents the results of a Delphi survey sent to 31 experts in the construction industry. A survey questionnaire was developed to ask the participants about their perceptions of the relevance of the current graduate-level construction management courses in developing senior-level construction managers. A curriculum analysis of 34 graduate CM programs in the United States was conducted. The resulting data from the curriculum analysis is utilized in developing the survey questionnaire. The study is part of a larger research Delphi study that aimed at identifying the Knowledge, Skills, and Abilities required for senior-level managers in the construction industry. Two phases of the survey were sent to participants in this Delphi study. The results of the study indicate that the current graduate programs in construction management across the United States of America are not adequately focused on developing senior-level construction managers.

Key Words: Construction Executives, Delphi Study, Construction Management Education, Senior-level management

Introduction

The construction industry is quick-paced and constantly evolving (Arditi & Polat, 2010). To address the emerging issues in construction, senior-level managers are continuously required to develop new strategies for effective decision making. The increasing complexity of the construction projects, advances in project management strategies, and the evolution of new technologies increased the demand for construction managers who are well-trained and well-educated in the knowledge of building and business management (Atalah & Muchemedzi, 2006). Due to the increased demand for construction managers, many engineering professionals are enrolling in graduate construction management programs to further their education (Atalah & Muchemedzi, 2006). The current graduate programs in construction management are not adequately focused on developing advanced

management and leadership skills. The study conducted by (Goodman & Chinowsky, 1997) found that professionals who received advanced degrees in traditional Construction Management (CM) programs are clearly not meeting the demands of the industry. The authors define senior-level construction management focused programs as the programs which help and prepare mid-level construction managers in advancing their skill-sets to reach a senior-level position. Graduate education can be utilized by working professionals as an advancement to their careers. Recognizing that limited research had been reported which identified the relevance of the current graduate construction management curriculums in developing senior-level construction management leaders, the current research was undertaken. This study is a part of a larger research study that aims at identifying the Knowledge, Skills, and Abilities (KSAs) required for senior-level managers in the construction industry. The long-term research objective of the authors was to influence curriculum development for programs serving senior-level managers in the construction industry.

Construction Education: History and Trends

Construction education in the United States derives its history from the 1920s. Until the 1920s, there were very few Civil Engineering programs in the United States which offered a specialization in Construction, particularly Construction Management. Universities started developing CM graduate programs during the mid-1970s (Arditi & Polat, 2010; Atalah & Muchemedzi, 2006). By the start of the 1980s, there were more than 40 graduate CM programs in existence across the United States. Some masters-level programs focused on developing qualified professionals for CM consulting firms, while most focused on developing research faculty (Arditi & Polat, 2010).

To understand the emphasis of the current graduate CM programs, this study examined a majority of the construction management graduate programs in the United States. Currently, there are 76 undergraduate CM programs and four graduate CM programs in the United States, which have been accredited by the American Council for Construction Education (ACCE). Looking at just those four graduate programs would not be a sufficient sample size to reach any conclusions regarding the focus of current graduate CM programs. Therefore, this study also considered the non-accredited CM graduate programs offered by the universities with accredited CM undergraduate programs for curriculum analysis. The official websites of these universities were accessed, and the authors found that 34 universities of the selected programs have been offering a graduate program in construction. This translates to 45% of the US universities offering ACCE accredited undergraduate CM programs.

These 34 graduate CM programs offer a total of 463 courses. Research work or thesis was excluded from the curriculum analysis. The average number of courses per program is 13.62. The course data for all the programs was obtained through the course catalog descriptions in the respective program websites. The 20 most frequently offered courses in these programs were evaluated for content and are listed in Table 1. The courses having similar content were grouped into a single course or topic category. The frequency represents the percentage of programs offering that course. The ranking is based on the frequency of the course offerings.

Note that only two of the 20 frequent courses were offered in more than 50% of the programs. Not a single course or topic is offered in more than 70% of the programs. This supports the findings of (Popescu, 1987) that there is a greater variation within the graduate-level CM curriculums. The 34 graduate programs differ in the types of degree offered. The different types of degrees offered include Master of Science in Construction Management or Construction Engineering Management, Master of Construction Management, and MBA in CM.

Table 1

Courses offered at the graduate level Construction Management programs in the U.S.

Courses/ Topics	Frequency (%)	Ranking
Sustainability and Green Construction	62	1
Construction Project Management	56	2
Construction Cost Estimation/Bidding Strategy	44	3
Construction Management Research	44	4
Construction Scheduling	44	5
Construction Accounting & Finance	41	6
Construction Law	41	7
Construction Contracts Administration/Business	32	8
Construction Planning and Cost Control/Analysis	29	9
Construction Safety Management	26	10
Construction Project Delivery Systems	24	11
Graduate Internship	24	12
Independent Study	24	13
Seminar	24	14
Advanced Computer Applications in Construction	18	15
Construction Management Special Topics	21	16
Leadership in Construction	21	17
Building Information Modeling	18	18
Construction Visualization and Simulation	18	19
Legal Issues in Construction	18	20

Since the purpose of the current study was to find the relevance of the graduate-level CM courses in developing senior-level construction managers, the authors looked for the programs which had a focus on developing leaders. First, the authors categorized the 34 programs into two categories. The two categories are i) programs with Leadership and Upper-level construction management focus and ii) programs with Research and Technical skills focus. To categorize the programs, the authors looked at the purpose statements of those programs. The purpose statements were inspected by accessing the websites of the 34 programs. Out of the 34 universities, 16 universities mentioned that their program had an emphasis on developing leaders and upper-level construction managers, while 14 universities mentioned that their program is more research-oriented and focuses on technical skills of construction. The remaining four universities did not have any purpose statement and are excluded from the curriculum analysis. Table 2 represents the 20 most frequent courses offered by the two categories (Leadership Focused or Research Focused). The ranking in Table 2 is based on the frequency of the course offerings. There is very little difference in the courses offered, between the two categories; in fact, they have 14 courses in common. It is generally acknowledged that a Master of Science program is more research-based, which explains the apparent lack of senior management level courses.

Table 2

Courses offered in the two categories

Ranking	Courses/Topics in the Leadership focus programs	Courses/Topics in the Research and Technical skills focus programs
1	Sustainability and Green Construction	Construction Management Research
2	Construction Project Management	Sustainability and Green Construction
3	Construction Cost Estimation/Bidding Strategy	Construction Project Management
4	Construction Scheduling	Construction Accounting & Finance
5	Construction Law	Construction Cost Estimation/Bidding Strategy
6	Construction Accounting & Finance	Construction Contracts Administration/Business
7	Construction Planning and Cost Control/Analysis	Facility Planning and Management
8	Construction Safety Management	Construction Law
9	Legal Issues in Construction	Construction Project Delivery Systems Seminar
10	Construction Management Research	Risk Management
11	Construction Project Delivery Systems Seminar	Innovation in Construction
12	Advanced Computer Applications in Construction	Construction Scheduling
13	Leadership in Construction	Construction Planning and Cost Control/Analysis
14	Codes & Regulations	Graduate Internship
15	Construction Contracts Administration/Business	Independent Study
16	Graduate Internship	Construction Management Special Topics
17	Independent Study	Leadership in Construction
18	Construction Information Systems	Construction Visualization and Simulation
19	Construction Delays and Claims	Construction Professional Competencies
20		

However, the programs with leadership and upper-level management focus offer similar courses offered by the research-oriented programs. The evaluation of current CM-graduate programs across the country (as demonstrated in Table 2) supports the argument for the lack of senior management level content in construction management graduate education, even in the programs which have purpose statements with a focus on developing construction management leaders.

Research Methodology

To further determine if the findings of the curriculum analysis were consistent with industry demand, the authors distributed a survey to construction industry professionals. The focus of the survey was to identify if the courses listed in Leadership focused programs (Category 1 from Table 2) would help in developing senior-level construction management leaders. Delphi methodology was utilized in this study. The Delphi Technique is a systematic and iterative process used to collect the opinion of

experts on a specific topic. The goal of the Delphi technique is to achieve consensus among a selected panel of experts. Delphi study is conducted in an anonymous environment. This will assist the participants in changing their previous opinions. The current study uses the classical Delphi approach, which has minimal impact on the reliability and validity of the data obtained.

Selection of Expert panel The participants in the Delphi study were considered content experts who have knowledge and experience about the issue being investigated (Skulmoski, Hartman, & Krahn, 2007). Purposeful sampling was performed to ensure that the sample consists of individuals who are knowledgeable and experienced about the topic of senior-level or executive-level issues in the construction industry. Potential experts were selected from the contacts the research team has access to through national and regional associations and networks. Also, the snowball sampling technique helped the authors to find a few more experts. Three categories of experts were selected for this study i) Senior-level Managers or Construction Executives who have more than 15 years of experience in the industry, ii) Mid-Level Managers who have at least 5 years of experience in the construction industry, and iii) External industry members such as CPAs, Bankers, Sureties, Insurance Brokers who work closely with the construction industry. The reason for selecting this heterogeneous group of experts was to identify the perceptions of different stakeholders. This heterogeneity also assures the validity of the results (Hallowell & Gambatese, 2009).

Delphi Survey The design of the study included a three-phased survey with the industry expert panel. The questionnaire for the demographic survey and phase one of the survey was developed by the research team prior to the beginning of the survey. The survey was conducted through an online-based survey program called Qualtrics. Participants were contacted through an e-mail from the Qualtrics. The demographic survey was sent in June 2019, and Phase 1 of the study was sent in September 2019. The questionnaire for Phase 2 was developed based on the responses from Phase 1, as is typical methodology for Delphi studies. Phase 2 was sent in October 2019. Previous research suggests that two rounds are adequate in a Delphi study when a structured instrument is used.

Consensus Criteria Consensus is defined as the collective opinion arrived by the research participants (Gough, 1987). Many of the previous Delphi studies set the consensus criteria as at least 75% of the participants responding to either agree or strongly agree on a 5-point Likert Scale. Few Delphi studies defined consensus as a 51% agreement among the participants (Loughlin & Moore, 1979). Selecting the consensus criteria is arbitrary in most of the previous studies (Flanders, 1988). Utilizing a 5-point scale is popular, but it restricts the participants' responses to just those 5 choices. To account for this problem, the authors utilized the 100-point scale where 100 represents strongly agree, and 0 represents strongly disagree. In selecting the consensus criteria for the 100-point scale, the authors carefully analyzed the previous criterion and set a higher standard for consensus. The authors defined consensus on agreement on an item as responding greater than or equal to 80 on a 100-point scale. Once each respondent completed each phase, the mean and median were established for each response category. The median was reported in the results section as it measures more accurate central tendency of the data. The mean was not used as limited respondents (n=29), and the nature of a Delphi study does not allow for eliminating outliers without adversely impacting the results.

Consensus was achieved on an item in this study if at least 75% of the respondents were in agreement or responded with a score of 80 or greater than 80 on the 100-point scale. This condition also ensures that median would be greater than 80.

Results and Discussion

Phase 1 The 20 frequently offered courses in the leadership category identified from the literature were compiled and sent. Twenty-nine out of the 31 experts responded to the Phase 1 survey resulting in a 94% response rate. The demographic distribution of the participants is presented in Table 3. Demographic Data indicated that 93% of the participants possess a bachelor's degree or higher. More than 50% of the participants work at a Director, Vice President, or a President role in their companies.

Three courses met the consensus criteria in Phase 1, indicating that these courses were relevant in developing senior-level managers in the construction industry. The remaining 17 courses did not meet the consensus criteria and were further pursued in Phase 2. The results from Phase 1 of the survey are presented in Table 4.

Table 3

Participants Demographic Data Table

	Phase 1 (n=29)	Phase 2 (n=28)
Position/ Job Category		
Executives/ Senior-level	76%	75%
Mid-level Manager	14%	14%
External Industry	10%	11%
Education		
Bachelor's Degree	65%	64%
Master's Degree	28%	29%
No Degree	7%	7%
Years of experience in the Current role		
1-5 Years	42%	39%
6-10 Years	31%	32%
11-15 Years	10%	11%
>15 Years	17%	18%

Phase 2 Phase 2 questionnaire was sent to the 29 experts who responded to Phase 1. Delphi study allows for controlled feedback by informing the participants about the results of the previous phase. The results of the Phase 1 of the Delphi study was sent to the participants. This helped the participants to reflect on their answers in relation to the entire panel. The participants reconsidered or changed their responses during Phase 2 based on the collective group response from Phase 1.

As an addition to the current study, the authors were interested in identifying the most effective course delivery methods for teaching senior-level construction content. Delivery methods were not included in the Delphi study and thus excluded from Phase 2. Participants were asked to rate the effectiveness of 10 types of delivery methods, which the authors came up with after a brainstorming session. The results regarding the effectiveness of delivery methods were presented in Figure 1. Data for the delivery methods can be found in Appendix.

Table 4

Results

Sl. No	Course	Agreement	Median	Consensus Status (Phase)
1	Construction Project Management	86%	90	Achieved (1)
2	Leadership in Construction	86%	90	Achieved (1)
3	Construction Scheduling	82%	85	Achieved (2)
4	Construction Accounting & Finance	79%	85	Achieved (2)
5	Construction Planning and Cost Control/Analysis	76%	90	Achieved (1)
6	Legal issues in Construction	75%	80	Achieved (2)
7	Construction Contracts Administration/Business	75%	80	Achieved (2)
8	Construction Delays and Claims	75%	85	Achieved (2)
9	Construction Cost Estimation/Bidding Strategy	71%	85	No Consensus
10	Construction Safety Management	71%	80	No Consensus
11	Construction Project Delivery Systems	64%	80	No Consensus
12	Graduate Internship	61%	85	No Consensus
13	Construction Law	57%	80	No Consensus
14	Codes & Regulations	21%	65.5	No Consensus
15	Construction Information Systems	21%	60	No Consensus
16	Advanced Computer Applications in Construction	14%	53	No Consensus
17	Sustainability and Green Construction	11%	50	No Consensus
18	Construction Management Research	7%	51	No Consensus
19	Seminar	4%	49	No Consensus
20	Independent Study	4%	30	No Consensus

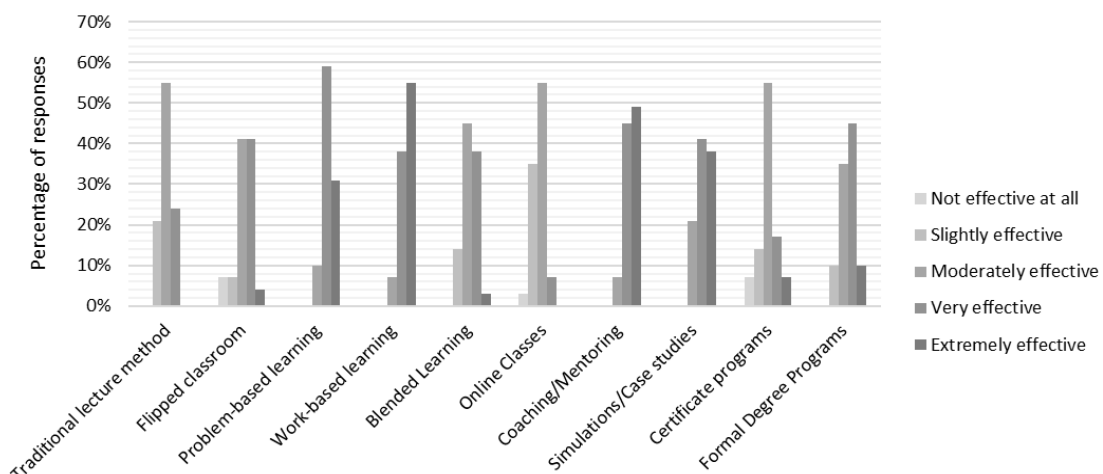


Figure 1: Delivery Methods

Conclusions

Construction management graduate curriculums in the United States still have a more significant variation in the course-offerings when compared to undergraduate CM curriculums. Sustainability and Green Construction, and Building Information Modeling are two topics that have gained momentum in recent years and are reflected in the course offerings in Table 1. Also, it is surprising to see that Sustainability, which is the most frequently offered course across the 34 graduate programs to be one of the lowest preferences by the industry professionals. Work-based learning, Problem-based learning, and Coaching or Mentoring were perceived as the most effective delivery methods by the panel for senior-level education. It is interesting to note that Online Classes, which is one of the most popular choices for senior-level education to be perceived as the least effective delivery method by the panel.

In the present study, through a two-round Delphi study, the courses which are relevant to producing leaders in the construction industry are identified. The results of the study indicate that Construction Project Management, Leadership in Construction, Construction Scheduling, Construction Accounting and Finance, Construction Planning and Cost Control Analysis, Legal issues in Construction, Construction Contracts Administration, and Construction Delays and Claims met the consensus criteria. The results indicate that the current graduate-level construction management curriculums are not adequately focused on developing senior-level construction managers. The results reinforce the previous research findings that industry perceptions differ from what is being offered in academia (Lee, Ponton, Jeffreys, & Cohn, 2011).

There is a need for collaboration between educators and construction industry professionals in developing master's programs that align with the needs of the construction industry. Forming an industry advisory committee is a smart way of incorporating industry's suggestions into the curriculum based on the evolving trends in the construction industry. Continuous curriculum revisions in response to the industry trends ensure graduating students to be equipped with the right skills for a successful career in construction.

Limitations

The results of the Delphi study are based on the subjective judgment of the expert panel, which might be prone to several biases. The authors mitigated this to some extent, by having a higher number of participants (n=29) compared to the minimum panel requirement of 8 experts (Hallowell & Gambatese, 2009). Also, anonymity is maintained to mitigate the dominance effect. The curriculum analysis was conducted on a reasonable sample of 34 graduate programs in this study. This was not inclusive of all CM graduate programs in the United States. However, all efforts were made to have a reasonable level of representation of program types, geographical locales, and curricula emphasis areas.

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Appendix

Data for Delivery Methods: The percentages represents the number of participants who rated that particular effectiveness.

	Not effective at all	Slightly effective	Moderately effective	Very effective	Extremely effective
Traditional lecture method	0%	21%	55%	24%	0%
Flipped classroom	7%	7%	41%	41%	4%
Problem-based learning	0%	0%	10%	59%	31%
Work-based learning	0%	0%	7%	38%	55%
Blended Learning	0%	14%	45%	38%	3%
Online Classes	3%	35%	55%	7%	0%
Coaching/Mentoring	0%	0%	7%	45%	49%
Simulations/Case studies	0%	0%	21%	41%	38%
Certificate programs	7%	14%	55%	17%	7%
Formal Degree Programs	0%	10%	35%	45%	10%