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What 21st Century CM Graduates Need to Know and Be Able to Do: Results of a Needs Assessment Study Using Industry Focus Groups

Tom Leathem, PhD and Richard Burt, PhD
Auburn University
Auburn, AL

The need for construction management programs to maintain a curriculum that is relevant to current and future industry needs is a regular challenge. The most accessible option for conducting a curriculum needs assessment is to do it within the program among the faculty and administration. While it is essential for these stakeholders to be key participants, their view includes only a portion of the critical perspective. A holistic evaluation should include multiple perspectives from key stakeholders, namely faculty, students, and industry. However, little literature on needs assessment incorporates the student perspective. This paper reports on results of employing a focus group approach to gain insight from recent graduates of a CM program to determine the essential knowledge and skills required of new graduates in the construction management industry. Results from two different focus group sessions indicate recent CM graduates should possess a suite of technical skills but more importantly a strong set of soft skills.

Key Words: Needs Assessment, Focus Groups, Knowledge, Skills, Curriculum Development

Introduction

In today's rapidly changing world it can be hard for higher education to know if they are appropriately preparing their students for the future working world. Construction education programs around the world are guided by various accreditation agencies and professional organizations in developing their academic curriculum. In the United Kingdom the Chartered Institute of Building (CIOB) (2018) has an established Educational Framework with core standards for construction education for those institutions seeking to become an approved centre of learning for the CIOB. In the United States the American Council for Construction Education (ACCE) (2022) establishes and maintains standards for construction education. In both the CIOB Educational Framework for Undergraduate Programmes and ACCE Document 104 - Standards and Criteria, learning outcomes are used to guide institutions in the development of their curriculum. Learning outcomes are defined by the ACCE (2021) as "the set of knowledge, skills, and abilities to be attained by students upon completion of an event.

Although both the CIOB & ACCE set learning outcomes for students to achieve by graduation, they do not specify the specific curriculum, content, nor operational definitions for each outcome. Leathem

(2014) points out the ACCE learning outcomes, by design are ambiguous, to allow for varying types of construction programs. Institutions are empowered to develop their own operational definitions underpinned by specific knowledge, skills, and abilities that are translated into a curriculum to meet the standards. Previous work in construction education related to curriculum development, presented below, shows several different approaches to obtaining stakeholder input. Surveys and interviews are a popular method for obtaining information to aid curriculum development. Most studies have focused on identifying skills and knowledge construction graduates should acquire for more specific subject matter.

Following a revision of Bloom's defining work on categorizing educational objectives, four general types of knowledge were identified: Factual, Conceptual, Procedural and Metacognitive. Although construction communication involves elements of all four types of knowledge it is primarily concerned with procedural knowledge which is how to do something, including methods of inquiry, as well as criteria for using skills, techniques, and methods (Anderson & Krathwohl, 2014). Biggs & Tang (2011) define "intended learning outcomes" as statements that define what a student should know at the end of an instruction period. The kind of knowledge and the level of student understanding are key points to consider in crafting these outcomes. Key to defining the intended level of expected student performance is to identify the appropriate outcome action verb. Moon (2002) suggests well written learning outcomes contain three components; a verb that indicates what the learner is expected to be able to do, words that indicate on what or with what the learner is acting and word or words that indicate the nature of the performance required as evidence that the learning was achieved.

The most important skills the construction industry requires from graduating construction management students was the focus of a study using a structured survey administered to construction professionals. Respondents were requested to evaluate 93 skills across seven attribute/skill areas deemed significant for graduating construction management students (Ahmed, Yaris, Farooqui, & Saqib, 2014). Several studies focus on specific skills and knowledge. A questionnaire-based survey was used to gather information from general and electrical contractors in the United States regarding the desired skills of construction management students upon graduation in the area of electrical systems (Tatum & Conradi, 2019). In another study, a list of Heating, Ventilating and Cooling (HVAC) curriculum topics grouped into six subject areas was developed and the importance of each topic evaluated using a 5-point Likert scale by construction industry professionals (Burgett, Perrenoud & Smith, 2018).

Another approach used in construction education to obtain stakeholder input on curriculum development is the use of consultation with individuals or groups of individuals. In an effort to identify construction superintendent competencies and develop curricula to support superintendent education and training, Gunderson (2008) held interviews to identify and rank the skill sets required by project superintendents. Tatum (2013) used interviews with general contractors, construction managers and electrical contractors, together with literature reviews to develop a survey to gain feedback regarding electrical curriculum content. A similar approach was used to develop a BIM curriculum for a construction program (Lucas, 2014).

As part of a comprehensive review at Purdue University, faculty used industry input to establish undergraduate educational competencies and revise the curriculum within guidelines. An industry panel was used to develop and rank competencies that students should acquire prior to graduation (Benhart & Shaurette, 2014). As part of an Australian government sponsored national endeavor, a series of 14 workshops and follow-up questionnaires was convened to examine the preferences of a building discipline group to develop "Threshold Learning Outcomes." Many of the workshops were

for academic staff of construction programs, while others were for industry practitioners and employers, current students and recent graduates (Newton & Goldsmith, 2011).

In a study to identify the competencies that construction companies expect from construction graduates (Attallah, Mahfouz & Jones, 2019) used semantic analysis to analyze job descriptions and identify the most significant competencies expected for certain jobs. In similar studies outside the field of construction education, Hartmann & Jahren (2015) analyzed seven years of job posting data from engineering companies to first understand the frequency and use of the word "leadership" in job descriptions. A content analytic approach was used to examine active job postings for entry-level business analytics positions to offer insights for those seeking to develop academic programs in this area (Cegielski & Jones-Farmer, 2016).

Most of these studies have been focused on a specific topic within construction education, and many are nearly 10 years old or more. This study looked to gain new insights on the entire curriculum from alumni of the program that are currently working in the construction profession. This provides input from not only the industry perspective, but also the student perspective. The aim of the research was to identify the knowledge and skills graduates need upon entering the construction industry to successfully complete tasks required during their first three years post-graduation.

Method

This qualitative study used focus groups and the Nominal Group Technique (NGT) to identify themes of knowledge and skills most frequently required among recent graduates (within the last 3 years) of a construction management program in the southeast United States. Focus groups are small, structured groups that have a specific purpose, used to explore individuals' views and experiences through group interaction (Krueger & Casey, 2000; Litosseliti, 2003). Widely used within social sciences as a tool to inform policy and practice, focus groups are effective in program evaluation (Hennink, 2007). However, on their own, they have limitations related to participation and information generated. Nominal Group Technique (NGT) can be used to alleviate these challenges by using a more structured approach, working from individual participant responses toward a group consensus (Ven & Delbecq, 1972). Figure 1 illustrates the NGT structure and process.

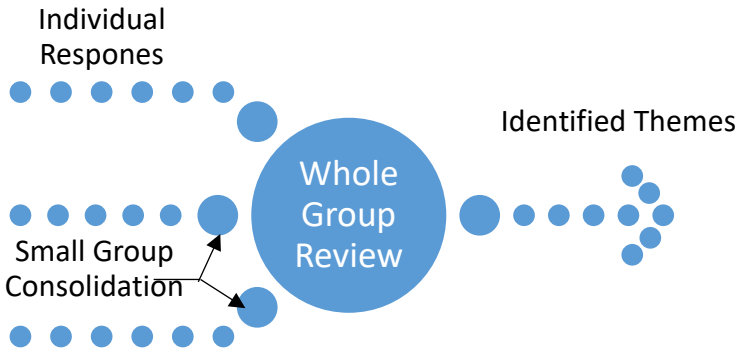

Figure 1. Nominal Group Technique Process

Prior to arriving at group discussions, participants are given the opportunity to develop individual responses to each question, problem, or topic posed. All individual responses are then used to drive subsequent discussions that advance from small groups to the whole group. This approach allows all

participants thoughts to be considered with reduced potential for bias from other participants. It also reduces potential for researcher bias when the researchers serve as the focus group facilitators.

Alumni of the program that currently work in the construction management profession who graduated within the last 10 years were the preferred target population. To solicit this group, the researchers utilized the program's Industry Advisory Board (IAB). Most IABs include executives of construction firms. The program in this study has an Industry Executive Council (IEC) that serves that role. The program's IAB group is focused on early career alumni who graduated from the program within the last 10 years. This group was formed by the program in response to growing demand from young alumni for a resource to stay involved in the program. Emails were sent to potential participants approximately 6 weeks prior to the scheduled focus group with RSVPs requested. Participation was completely voluntary but did include lunch.

Two focus groups were held in different cities. Each session lasted approximately 6 hours with a 1-hour lunch break. The authors served as facilitators for the focus groups. Participants were first asked to individually identify tasks most performed during their first three years of work after graduation.

Following the individual answer session, participants were asked to work in small groups of 3 to 4 and discuss their answers. The goal of this session was to identify the range and frequency of tasks. Each small group was provided post-it-notes to document the task and how many in the group identified the particular task. When all groups were done, the facilitators guided the groups in posting the notes to common areas around the room so that all identified tasks were noted (Figure 3). During this process the participants also identified themes for the common tasks identified.

After all tasks and related themes were identified, the groups were then assigned the different themes and asked to develop a list of knowledge and skills required to successfully complete the tasks within each of them. Groups documented the related knowledge and skills on large post-it-notes and displayed them on the wall with their related theme (Figure 4).

Figure 3. Group Task Identification

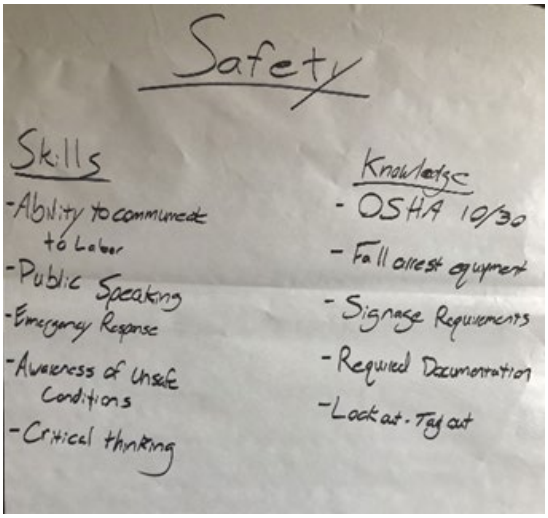

Figure 4. Skills and Knowledge Incorporated to Themes

When all groups were done the facilitators led participants through a discussion of the identified knowledge and skills associated with each theme. This process was intended to establish consensus among the participants that all tasks and their associated knowledge and skills had been accurately identified.

Results

Focus groups were conducted in Atlanta, GA and Birmingham, AL over the summer of 2023. Prior to each session, the accessible sample population was contacted via email to solicit participation. A general description of the event and agenda were provided in the email. Participants were asked to RSVP. Two reminder emails were sent leading up to the event to encourage participation. The goal was to have 15-20 participants for each focus group. Alumni within the 10-year window were preferred but participants with more work experience were not prohibited. In total, 33 people representing 20 different companies participated. Job titles for participants ranged from Executive level, such as President or Director, to entry level, such as Field Engineer or Assistant Project Manager. Table 1 provides descriptive statistics of the participants.

Table 1

Participant Descriptive Statistics by Focus Group

Focus Group	Male	Female	Avg. Years	Companies	Position Level	(n)
Atlanta	15	1	10	12	Entry	4
					Mid-Level	4
					Mid-Management	5
					Executive	3
Birmingham	14	3	8.5	8	Entry	7
					Mid-Level	4
					Mid-Management	3
					Executive	3

That Atlanta and Birmingham groups identified 15 and 18 original content themes, respectively. After collating results from both groups, 15 common themes were determined. These themes are shown as the top row of tables 3 and 4 below. A total of 60 different tasks made up the different themes. The Atlanta group identified 46 tasks and the Birmingham group identified 55 tasks. Both groups indicated 42 similar tasks. The most frequent of these were Quantity Takeoff (94%), Prepare Meeting Agendas and Minutes (91%), Review Submittals (88%), Review/Develop/Negotiate Subcontractor Scopes (82%), and Write RFIs (76%). Both groups identified the use of various types of software as a common task. The Birmingham group identified five construction software platforms as specific tasks. Other tasks specific to the Birmingham group included OSHA Enforcement, Promoting Safety Culture, Subcontractor Walkthru's, Negotiating Subcontractor Pricing, Prequalifying Subcontractors.

After compiling the specific tasks and organizing them into content themes, the facilitators guided the participant groups through selecting themes to identify essential knowledge and skills for each. Participants worked in their small groups to list on large post-it notes, knowledge and skills required to complete the tasks associated with each theme. Once complete, the list was posted on the wall with the related theme and tasks for the entire group to review and agree upon. Changes were made as necessary to incorporate comments from the whole group. Table 3 illustrates the skill domains identified within each theme.

As indicated, the most frequently sited skills were related to soft skills. The ability to communicate using multiple mediums and varying contexts and purposes was most frequently identified. Utilization of appropriate software and technology was cited as part of one's ability to effectively communicate; participants discussed various aspects of how they needed to learn the appropriate tools to use in their communications. This ranged from simple software like email, to industry specific platforms like Procore, Bluebeam, and 3D Visualization tools. Other soft skills aspects included the ability to work in teams, build relationships with varying types of project participants, and the overall ability to listen and understand your audience and their needs. Commonly identified technical skills included ability to read and interpret drawings, specs, and other project related documents to effectively execute other common tasks related to the job.

Table 3

Identified Skills by Theme

	Themes																
Skills	Estimating	Meetings	Submittals	Subcontracts	Communications	Scheduling	Sub Relations	Project Coord.	Field Operations	Cost Mgt.	Closeout	Project Docs	Quality	Safety	Technology	Design	**Total**
Oral & Written Communication	x	x	x	B	B	x	x	x	B		x		B	x		x	17
Competently Use Software / Technology	B	x	x		x	B		B	x	x	x	x	x		B	x	17
Collaboration / Teamwork	x	x			x	B	x	x	B		B		B				13
Analyze Related Documents	B		x	B				x	B		B		B			x	13
Interpret Documents	B	x	x					B	B		B		B			x	13
Organization / Time Mgt.	x	x	x		x			x	x	B	B	B					12
Soft Skills /Build Relationships	x	x			x	x	x	x			B		B				10
Critical Thinking / Understanding Why		x			x	x			x			x	x	x			7
Ability to Obtain Clarity / Buy-In	x	x			x	x	x		x								6
Attention to Detail	x						x				B	B					6
Public Speaking		x			x									x	x		4
Situational Awareness		x							x					x			3
Confidence							x				x			x			3
Integrity/Trust		x					x										2
Multi-Task				x					x								2

Note: Themes identified by both focus groups ("B") are counted twice.

The participants indicated key pieces of knowledge needed to support the identified skills (Table 4). These included terms and symbols, relationships of documents to each other, how information is organized and communicated, types of project documentation processes, building materials, methods, and equipment, and various standards and regulations associated with construction projects.

Table 4

Identified Knowledge by Theme

	Themes																
Knowledge	Estimating	Meetings	Submittals	Subcontracts	Communications	Scheduling	Sub Relations	Project Coord.	Field Operations	Cost Mgt.	Closeout	Project Docs	Quality	Safety	Technology	Design	**Total**
Terms & Symbols	x			B				B	x	B	x	B	B			x	14
Document Makeup/Relationships	x			B				B	x		x	B	B			x	12
Materials, Methods, & Equipment	B					B		B	B	x		B		X			12
Computer Software Platforms	B	x	x			B		x		x			x		B	x	12
Understand SOW	x			B		x	x	B	x			B					10
Contract Structures / Requirements				B		x	x			B	B		B				10
Trades & Trade Organization	x				x	B		x	B			B					9
Types of Logs & Project Tracking Systems	x					x		x		x	x	x	B				8
Workflow b/w Parties	x		x		x	B		x				B					8
Required Documentation				B						x		x	B	x			7
Regulations, Codes, Standards				B					x				B	B			7
Math & Measurements	B							x	B								5
Legal Parameters / Documents				B			x					x					4
Phases of Design	x						x									x	3
Construction Site Makeup								x	B								3
Surveying									B								2
Prequalification Requirements							x										1

Note: Themes identified by both focus groups (“B”) are counted twice.

Analysis and Conclusions

This study used alumni from a construction management program to identify essential knowledge and skills required to complete tasks commonly executed by CM graduates within their first three years of work. Overall, the identified themes were relatively common to what most programs address. The most prominent skills were focused on soft skills rather than technical skills. During discussions with both groups, they emphasized the importance of being able to communicate effectively with various types of people in a wide variety of situations and contexts. This discussion also brought other aspects of soft skills that are regularly required as part of executing daily activities. As one participant put it, possessing "emotional intelligence" is key. The ability to listen to others, understand their needs, and recognize how they are reacting to situations is key. These skills aid in the ability to build good relationships with the variety of individuals that construction managers – even new graduates – communicate with every day. The most important technical skills centered on the ability to read and interpret the varying types of documents associated with construction projects. This ranged from plans and specs to contract documents, codes and standards, and guidelines. Ability to use varying forms of technology was also high on the list. However, the participants emphasized that new graduates should understand that technology is a tool, and it is just as important to know when to use it as it is how to use it. There were varying pieces of knowledge recognized, but again, most of it centered on knowledge pertaining to various types of documents, how they relate to each other, and the impacts they can have on a project.

The results of this study may appear somewhat obvious on the surface. However, it provides an updated look at essential knowledge and skills required by CM graduates from the perspective of those that are actively doing the job. Different from other studies, the results indicate a greater emphasis on non-technical skills as key to a construction managers' daily activities. The study also provides an approach to incorporating alumni and industry into executing a curricular needs assessment. Given the limited sample size, the authors intend to expand the research as a validation measure. Future research will incorporate larger sets of professionals in the region and incorporate other data sources – namely entry-level job postings. Considering the increased emphasis on soft skills, further research should take a deeper look at specific aspects of soft skills in the CM discipline that support success and how CM programs can better integrate them into their curriculum.

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