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Identifying Knowledge and Skills at the "Create" Cognitive Process Dimension for Construction Management Graduates

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In developing an academic curriculum, a range of methods for identifying the knowledge and skills of graduates are used. Several approaches rely on the subjective perception of future employers using panels, focus groups, or surveys. However, a more objective method involves the analysis of entry-level job postings. An analysis of 125 entry-level job postings obtained from 58 companies recruiting from a large construction management program in the southeast USA was conducted. Results from a textual analysis of position announcements identified lists of job duties. A total of 1689 job duties were analyzed using qualitative data analysis to identify duties that included Bloom's action verbs at the "create" level. The most frequently used were prepare, develop, create, and plan. The most frequently used phenomena that entry-level graduates are expected to create are reports, schedules, costs, logs, estimates, change orders, and meeting minutes. The results provide helpful information for identifying the knowledge and skills construction management graduates need upon graduation.

Keywords: Education, Human Resource Management, Personnel, Recruitment, Training

Introduction

Construction education programs worldwide are guided by various accreditation agencies and professional organizations in developing their academic curricula. For construction education programs, the American Council for Construction Education (ACCE) (2025) establishes and maintains standards for construction education. In both the ACCE Document 103 - Standards and Criteria, learning outcomes are used to guide institutions in developing their curricula. Learning outcomes are defined by the ACCE (2025) as "the set of knowledge, skills, and abilities to be attained by students upon completion of an event."

The ACCE framework emphasizes learning outcomes that align with higher-order thinking skills described in the Revised Bloom's Taxonomy (RBT), a foundational model in curriculum development (Anderson & Krathwohl, 2001; Forehand, 2010). At its highest level, *Create*, Bloom's Taxonomy encourages students to generate new ideas, design processes, and construct original work, an essential cognitive skill in construction education where students are expected to synthesize technical knowledge into real-world applications. This aligns with the intention of preparing graduates who are technically competent and capable of working in complex construction environments. At this level,

the ACCE standards require students to create oral and written communications, a safety plan, a project estimate, and a project schedule.

Literature Review

Researchers have been attempting to identify the competencies required of construction graduates for some time, recognizing the ever-changing and complex nature of the industry. Industry expectations for construction management (CM) graduates increasingly emphasize not only technical proficiency but also higher-order cognitive and interpersonal skills. Ahn, Pearce, and Kwon (2012) conducted a survey of representatives from over 100 U.S. construction companies (n=148) and asked them to rate 14 core competencies expected from graduates of four-year CM programs. Among these, ethical decision-making, complex problem-solving, and interpersonal leadership were rated critical. The competencies were categorized into general, affective, cognitive, and technical domains, with the cognitive category aligning with the upper levels of RBT, specifically the ability to analyse and synthesize knowledge to solve novel problems. While this study emphasizes key competencies, it does not directly suggest skills in the creative cognitive domain, which is the aim of this paper.
A balanced mix of technical and managerial competencies is essential for construction management graduates entering the workforce. Ahmed, Yaris, Farooqui, and Saqib (2014) conducted a detailed survey of industry professionals to identify the most critical attributes for improving CM curricula. A survey of 46 industry professionals in South Florida (U.S.) revealed that some of the top competencies prioritized by the respondents were knowledge of health and safety regulations, the ability to interpret contract documents, attention to detail, knowledge of building codes, and time management. These competencies are more closely aligned with other domains of the RBT positioned below the 'create' domain.

Even recently, researchers have continued their efforts to identify key competencies for construction management graduates. As construction processes evolve in the digital age, industry expectations increasingly demand innovative thinking from graduates of construction management (CM) programs. Toyin and Mewomo (2023) investigated the innovative and creative competencies required of CM graduates in the context of Industry 4.0 by conducting a systematic literature review to identify 13 core competencies and 27 essential skills. They used these findings to obtain 330 survey responses from industry professionals. Notably, the study explicitly highlights the need for graduates to possess teamwork skills and critical thinking, and that they must embrace innovative skills and competencies; however, it does not explicitly target the 'create' domain.

Bridging the gap between academic preparation and industry expectations is a growing priority in construction management (CM) education, which forms the basis of this paper. McCord et al. (2023) conducted a dual-perspective study analysing five years of industry internship performance evaluations and academic research to identify competency needs for CM graduates. Their findings revealed alignment between academia and industry on the importance of experiential learning and software proficiency. Still, they highlighted gaps in areas such as soft skills, adaptability, and project-level accountability. Although the paper alludes to the ACCE SLOs at the 'create' level, the paper doesn't explicitly focus on this domain.

Additionally, several prior studies in construction education, as discussed by Burt, Redden, & Yantis (2022), have investigated the specific skills and knowledge that graduates need to be effective in the industry. One such area of focus has been technical subject matter, such as electrical systems. For instance, Tatum and Conradi (2019) employed a questionnaire-based survey targeting general and electrical contractors in the United States to determine the knowledge that construction management

students should acquire before entering the workforce. Other research has focused on mechanical systems; Burgett, Perrenoud, and Smith (2018) developed a list of heating, ventilation, and air conditioning (HVAC) topics organized into six content areas and had construction professionals rate their importance using a Likert scale. These studies provide insight into how specialized technical competencies can inform curriculum priorities, but nothing specifically focuses on the 'create' domain.

In addition to survey-based studies, some researchers have gathered input through interviews and group consultations. Gunderson (2008) interviewed industry professionals to identify and rank the skill sets needed for construction superintendents, which informed curriculum development for that role. Similarly, Tatum (2013) conducted interviews with general contractors, construction managers, and electrical contractors, supplemented by a literature review, to develop a targeted survey aimed at refining the content of electrical curriculum. Broader efforts to define educational outcomes have also taken place. For example, Benhart and Shaurette (2014) worked with an industry panel at Purdue University to establish and prioritize undergraduate competencies that shaped the restructuring of their construction management curriculum. In Australia, Newton and Goldsmith (2011) led a national initiative involving 14 workshops and follow-up surveys with academic staff, students, and employers to define "Threshold Learning Outcomes" for the building discipline.

Burt, Redden, & Yantis (2022) have identified specific communication skills and tools required of entry-level construction management graduates based on a content analysis of 53 job descriptions from the southeastern U.S., using keyword and context analysis (Burt, Redden, & Yantis, 2022). Results indicate that the most valuable activities are related to drawings, meetings, and submittals. In context, it suggests that students need to produce work products, but it is not the explicit intention of the paper. This paper also discussed several other studies that have applied content analysis to job descriptions to identify required graduate competencies. For example, Attallah, Mahfouz, and Jones (2019) employed semantic analysis to examine job postings and identify the skills most frequently expected of construction management graduates. Outside the construction field, similar methods have been used in engineering and business disciplines; Hartmann and Jahren (2015) analyzed seven years of job postings in engineering to understand how often and in what context the term "leadership" appeared, while Cegielski and Jones-Farmer (2016) applied content analysis to business analytics job postings to help guide academic program development in that field.

Even with the variety of attempts and methods used to understand the competencies of construction management graduates, few have explicitly focused on the "create" cognitive process dimensions using content analysis of entry-level job postings and Burt, Redden, & Yantis (2022) assert, "analysis of entry-level job postings is a proven method used to identify the skills and knowledge a graduate will need when developing academic curriculum." To address this, this research aims to use entry-level job descriptions from companies recruiting from a large construction management program in the southeast United States (U.S.) to identify those duties that an entry-level graduate would need to perform at the "create" cognitive dimension level and the phenomena they would be "creating" using the content analysis approach similarly employed by Burt, Redden, & Yantis (2022).

Method

Companies that regularly recruit students from the program in question were contacted, requesting job postings for their entry-level positions. The request indicated that job postings for all entry-level construction management job types were sought. Purposive sampling was conducted based on companies' relationships with a specific construction program; however, the sample included many companies with a national footprint that recruit from construction programs nationwide.

These entry-level job descriptions typically include the following elements: a position name or title, a general description of the role, detailed job duties or requirements, and specific qualifications. The job descriptions were analyzed to obtain specific information on the position name or title and the job duties or requirements. MAXQDA (VERBI Software, 2024), qualitative analysis software, was used for content analysis of the position name or title and the job duties or requirements. Content analysis was employed to determine not only the frequency of specific words but also the context in which they were used. Content analysis is a long-established research method for making replicable and valid inferences from written texts, such as job postings, to the contexts in which they are used (Krippendorff, 1980).

To provide some context for the position names or titles, these were analyzed to identify the frequency of nouns, pronouns, and adjectives, as well as the context in which certain pronouns and adjectives were used in relation to nouns. The detailed job duties or responsibilities were broken into single sentences. A total of 1689 individual job duties were identified. Table 1 provides examples of job duties identified.

Table 1. Examples of text included in job duties and/or responsibilities

Job Duty and/or Responsibility
Communicate persistently with subcontractors regarding involvement/interest in preconstruction pursuits and diligently follow up to review project scope and pricing prior to bid day.
Evaluates the adequacy of all construction allowances, contingencies, and general conditions.
Perform quantity and material take-offs.

Results

A total of 125 entry-level job position names or titles were analyzed. Table 2 shows the frequencies of nouns, compound noun components (CNCs), and adjectives used in job position titles, and maps the responsibility to the noun/title. The table illustrates the frequency of having the adjective "Assistant" plus a single CNC, such as "Project," and the corresponding noun, such as "Engineer," so that one job title may have been "Assistant Project Engineer." In the case where there are fewer CNCs than the noun, the title was the noun. "Engineer" is the most used noun, and "Project" is the most common CNC. The adjective "Assistant" is used in 26 of the position titles, but interestingly, not in any position that uses the noun "Engineer." The most common titles were "Project Engineer," followed by "Field Engineer" and "Assistant Project Manager."

Table 2. Frequency of words used in job position names or titles

Noun (freq.)	**Adjective**	**Compound Noun Component (CNC)**		
	Assistant	***Preconstruction***	***Field***	***Project***
Engineer (64)	0	4	19	39
Manager (27)	17	4	2	19
Superintendent (12)	9	0	2	1

The results in Table 2 show significant diversity in the job titles of the sample group, indicating that graduates are filling multiple roles.

Create cognitive process dimension-level action verbs

A total of 1689 individual job duties were analyzed using qualitative data analysis to identify duties that included Bloom's action verbs at the "create" level. To identify the action verbs at the "create" cognitive process dimension level, a list of 56 potential verbs was used in the Lexical search function

in the MAXQDA software. This process identified 243 individual job duties that included a verb identified as being at the "create" cognitive process dimension level. These 243 individual job duties were then analyzed using the word frequency function to identify the most frequently used "create" level action verbs. Table 3 below gives the result of this analysis. The most frequently observed action verbs were Prepare(s)/Preparing, Develop(s)/Development, Create(s)/Creating, and Plan(s)/Planning.

Table 3. Most frequently used "create" level action verbs

Action Verb	**Frequency**
Prepare(s)/Preparing	64
Develop(s)/Development	49
Create(s)/Creating	31
Plan(s)/Planning	16

Phenomena that entry-level graduates are expected to create

Further analysis was conducted to identify what phenomena entry-level graduates were expected to create. Keyword in-context analysis was used on each of the four action verbs identified in Table 3 above. Once the create-level action verb was identified, the text following the verb was analyzed, and the phenomena that entry-level graduates are expected to create were identified.

Table 4. Most frequently identified phenomena following the create level action verbs

Action Verb	**Phenomena**	**Frequency**
Prepare(s)/Preparing	Reports	19
	Schedule(s)/Scheduling	11
	Cost(s)	11
	Estimate(s)	8
	Change-Orders	6
	Meeting Minutes	6
Develop(s)/Development	Schedule(s)/Scheduling	15
	Log(s)	11
	Documents	6
Create(s)/Creating	Schedule(s)/Scheduling	7
	Log(s)	4
	Reports	3
Plan(s)/Planning	Schedule(s)/Scheduling	7

The most frequently used phenomena that entry-level graduates are expected to create are set out in Table 4 above. These are reports, schedules, costs, logs, estimates, change orders, and meeting minutes.

Conclusion

The findings from this study reinforce and extend previous research on the competencies expected of construction management (CM) graduates, particularly as they relate to the "create" level of RBT. While earlier studies by Ahn, Pearce, and Kwon (2012) and Ahmed, Yaris, Farooqui, and Saqib (2014) emphasized critical thinking, problem-solving, and the integration of contract and safety information, this paper advances the conversation by specifically identifying action verbs and tangible outputs associated with the creative process dimension. For instance, this study found that verbs such as prepare, develop, create, and plan were frequently used in entry-level job descriptions, reinforcing

the need for graduates to demonstrate applied competencies through the production of reports, schedules, estimates, cost breakdowns, and meeting minutes.

These expectations mirror those outlined in ACCE's (2025) Document 103, which emphasizes the ability to create written and oral communications, project safety plans, cost estimates, and schedules. However, among these, oral presentations and project safety plans were not strongly emphasized in the analyzed industry feedback, which may suggest a potential gap in the perception of key competencies required of new graduates as they relate to student learning outcomes; further exploration will be needed to confirm this.

Compared to the prior work by Burt, Redden, and Yantis (2022), which categorized communication tools such as meetings, submittals, and drawings, this study provides greater specificity regarding the 'create' RBT domain expectations of early-career professionals. It complements the content analysis approaches used by Attallah et al. (2019) and Hartmann and Jahren (2015), who also examined job descriptions for graduate competencies, but with a more targeted emphasis here on higher-order tasks. By explicitly linking job expectations to the “create” cognitive process, this study provides additional evidence for integrating more structured creative tasks, such as developing schedules or preparing project reports, into CM curricula.

The implications for construction education are significant. Academic programs should ensure that students can understand and apply knowledge, as well as synthesize and generate professional deliverables, such as those expected in the workplace. The frequency of deliverables such as cost estimates, change orders, and scheduling documents underscores the need for assignments and assessments that reflect these real-world outputs. Moreover, incorporating project-based learning that requires students to produce, iterate, and refine such documents can help bridge the gap between academic instruction and professional readiness. These findings also validate institutions aligning their learning outcomes with accreditation standards that highlight the importance of creation-level tasks.

However, this study has limitations that warrant consideration. The dataset was limited to 125 entry-level job postings from companies recruiting from a single construction management program in the southeastern United States. As such, results may reflect regional or institutional trends and not fully represent national or international expectations. Additionally, while MAXQDA allowed for the systematic identification of verbs and contextual phenomena, the analysis is still limited by the clarity and consistency of job posting language. Companies may describe similar tasks in varied ways, which could affect frequency counts or skew the identification of phenomena. Finally, while this study identifies the products graduates are expected to create, it does not yet assess how well current academic programs are equipping students to meet these demands, an area that would benefit from future research on curriculum assessment. Future work should also explore how construction management programs across diverse geographic regions within the U.S. and internationally align with demands identified in job postings specific to the intended location of hire, using the content analysis method employed within this research.

This study highlights the types of tasks and outputs that entry-level construction management graduates are expected to create, demonstrating a clear alignment between job expectations and higher-order learning outcomes. The frequent appearance of "create"-level action verbs in job descriptions suggests that graduates must be ready to generate professional documentation, coordinate technical workflows, and synthesize data into actionable project insights. As such, CM programs should continue to emphasize curriculum design that fosters these competencies through hands-on,

product-driven assessments. Future work should aim to explore how effectively such curricular strategies are being implemented across institutions and how graduates perceive their preparedness for these expectations in real-world settings.

Generative AI Statement

To enhance writing clarity, generative AI tools were used during the preparation of this manuscript. ChatGPT-4o (OpenAI) was employed to support sentence restructuring, grammar refinement, and readability improvements. Grammarly was additionally used to check for grammar, spelling, punctuation, and stylistic consistency. These tools helped improve the clarity and flow of the writing but did not contribute to the intellectual content, analysis, or interpretation of the research. Full responsibility for the accuracy, originality, and interpretation of the work remains with the authors.

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