

IDENTIFYING COMMUNICATION KNOWLEDGE AND SKILLS FOR CONSTRUCTION MANAGEMENT GRADUATES USING CONTENT ANALYSIS OF ENTRY LEVEL JOB DESCRIPTIONS FROM THE SOUTHEAST UNITED STATES

Richard Burt¹, Lauren Redden and Andrew Yantis

McWhorter School of Building Science, Auburn University, Miller Gorrie Center, Auburn, AL 36849, USA

An analysis of 53 entry level job postings from companies recruiting from a large construction management program in the southeast United States was conducted to identify the communication knowledge and skills required of graduates. Content analysis was used to determine not only the frequency of certain words, but also the context in which words were used. Results identified the most frequently used words related to communication tools were meetings, drawings, submittals, documents, contracts, and reports. Selected results for the type of "meeting" identified "project" and "weekly" as the most frequent types of meeting, with "minutes" being mentioned after meeting in a third of the observations. "Attending" or "participating" in meetings were the most frequently observed action verbs. Additional results of the keyword-in-context analysis of the remaining communication phenomenon provide useful information for identifying the knowledge and skills construction management graduates need as they transition into industry.

Keywords: communication; recruitment; education; graduate attributes; HRM

INTRODUCTION

Construction education programs around the world are guided by various accreditation agencies and professional organisations in developing their academic curriculum. In the United Kingdom the Quality Assurance Agency for Higher Education (QAAHE) in its Frameworks for Higher Education Qualifications (FHEQ) of UK Degree-Awarding Bodies (2014) establishes descriptors that define the generic characteristics of learning outcomes for a higher education qualification at bachelor's degree (level 6 on the FHEQ). Among several other descriptors there is a requirement for graduates with a bachelor's degree to "communicate information, ideas, problems and solutions to both specialist and non-specialist audiences".

At the professional level 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

¹ rab0011@auburn.edu

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." Effective communication is identified by both the CIOB and the ACCE as an important outcome of undergraduate construction education. The location and specific outcomes related to communication are set out in Table 1.

Table 1: Communication related learning outcomes in accreditation standards

Location	Outcome
CIOB Education Framework - Section 2.8 Work-Based Learning	Present information effectively to audiences Demonstrate effective meeting skills
Developing Transferable and Management Skills Communication	Demonstrate effective interpersonal skills and informal communication
ACCE Document 104 - Standards and Criteria Section 3. Curriculum for the Bachelor's Degree	Create written communications appropriate to the construction discipline.
Section 3.5 Student Learning Outcomes	Create oral presentations appropriate to the construction discipline.

Although both the CIOB and ACCE set learning outcomes for students to achieve by graduation, they do not specify the curriculum or topical content. Institutions are empowered to develop their own 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 are a popular method for obtaining information to aid curriculum development. Studies have focused on identifying not only general and comprehensive skills and knowledge construction graduates should acquire, but also more specific skills or subject matter knowledge.

The Aim of the research is to identify those activities related to communications skills that graduates need upon entering the construction industry, to inform decisions regarding curriculum content and assessment. The specific objectives will focus on identifying communication tools such as meetings, drawings, submittals, documents, contracts, reports etc. and the action verbs used in the context of these tools.

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 and Krathwohl, 2014). Biggs and 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, and 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 and 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 and 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. 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.

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 and Shaurette, 2014). As part of an Australian government sponsored national endeavour, 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 and Goldsmith, 2011).

In a study to identify the competencies that construction companies expect from construction graduates (Attallah, Mahfouz and Jones, 2019) used semantic analysis to analyse job descriptions and identify the most significant competencies expected for certain jobs. In similar studies outside the field of construction education, Hartmann and Jahren (2015) analysed 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 and Jones-Farmer, 2016).

METHOD

An analysis of 53 entry level job postings obtained from companies recruiting from a large, established construction management program in the southeast United States was conducted. In general, entry level job descriptions contain the following elements: position name or title; a general description of the position; detailed job duties or requirements and qualifications. The job descriptions were analysed to obtain specific information on the position name or title and the job duties or requirements. MAXQDA (<https://www.maxqda.com/>) qualitative analysis software was

used for content analysis of the position name or title and the job duties or requirements. Content analysis was used to determine not only the frequency of certain words, but also the context in which that word was 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 of their use (Krippendorff, 1980).

To provide some context of the position names or titles, these were analysed to identify the frequency of nouns, pronouns and adjectives and the context certain pronouns and adjectives were used in relation to nouns. The detailed job duties or responsibilities were analysed to identify those words that had a relationship to the communication process. For example, "meetings" was included because this is an activity that involves a communication process and "minutes" was included because this a communication tool. The frequency and overall ranking of each type of communication were recorded and for those words with the highest frequency, a context analysis was conducted to identify additional words that provide greater information on the context in which the word was used. For example, when analysing the communication tool drawings, there is interest in knowing the type of drawing and what graduates are expected to do with the drawings. The context analysis identified certain words of interest up to 15 words before or after certain keywords located in the same sentence. For example, in the sentence "Write meetings agendas and meetings minutes", if the keyword "meetings" was analysed, the word "write" would be identified as an action verb providing information on what a graduate is to do in relation to meetings. The words "agenda" and "minutes" would also be identified as communication tools.

FINDINGS

A total of 53 entry level job position name or titles were analysed. Table 2 shows the frequencies of the nouns, pronouns and adjectives used in job position titles.

"Engineer" is the most used noun with "Project" being the most common pronoun. The adjective "Assistant" is used in 15 of the position titles, but interestingly not in any of the positions using the noun "Engineer". The most common title was "Project Engineer", followed by "Field Engineer". Other positions not mentioned in the table below include "Virtual Design and Construction (VDC) Engineer".

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

Adjective - Freq	Pronoun - Freq.	Pronoun - Freq.	Pronoun - Freq.	Noun - Freq.
	Preconstruction 3	Field 9	Project 20	Engineer 36
Assistant 8		Field 2	Project 9	Manager 11
Assistant 5		Field 2		Superintendent 5
Assistant 2				Estimator 5

The results in table 2. Show there is significant diversity in job titles of the sample group, indicating graduates are filling multiple roles.

Communication Content in Job Duties or Responsibilities

The analysis of the 53 separate job duties or responsibilities identified the frequency of specific individual words related to communication activities. A total of 910 paragraphs each containing a individual job duty or responsibility were analysed for a total of 8157 words. The highest ranked individual word was predictably "Project" with 348 individual mentions. The frequency and overall rank of top 15 ranked communication related words are set out in Table 3. The results in table 3 show most of the words relate to "communication" products such as drawings and documents.

However, the most highly ranked communication word is "meetings", which is an activity involving participation, from which communication products are generated. This high ranking would confirm the need for inclusion of "effective meeting skills" in the CIOB accreditation requirements. The requirement to create written communications and oral presentations as a requirement of ACCE accreditation also has significant application to meetings.

Table 3: Frequency and overall ranking of "communication" words used in job duties or responsibilities

Word	F	R	Word	F	R	Word	F	R
Meetings	88	6th	Reports	42	23rd	Request-for- Information	38	31st
Drawings	81	8th	Scope	41	24th	Logs	31	42nd
Submittals	63	11th	Bid	39	28th	Schedules	30	43rd
Documents	60	12th	Specifications	39	28th	Requirements	27	47th
Contract	56	13th	Change-Orders	38	31st	Estimate	26	49th

A keyword-in-context analysis was conducted to further identify types of communication tools, and the most frequently used words used in context providing additional useful information on the critical skills and knowledge for a construction graduate.

Meetings

Context analysis was conducted to identify the type of meeting, any action verb that described what a graduate was to do regarding meetings and any word that indicated a communication product connected with meetings. Table 4 shows the results of the analysis of the 88 instances the words "meeting" or "meetings" are used. The types of meeting, action verbs and communication products are all documented.

Table 4: Frequency and overall ranking of words used in context related to meetings

Type of Meeting			Action Verb			Communication Product		
Word	F	R	Word	F	R	Word	F	R
Project	39	1st	Attend	23	2nd	Minutes	18	5th
Weekly	14	6th	Participate	20	4th	Agenda	7	12th
Coordination	13	8th	Assist	12	7th	Notes	4	20th
Subcontractors	13	8th	Review	7	12th			
Team	11	10th	Distribute	6	15th			
Safety	10	11th	Maintain	4	22nd			

Further analysis of the 18 instances where "minutes" was mentioned identified that in 12 cases, it was implied a responsibility of the job is to create, prepare or develop meeting minutes. Examples of text included in the descriptions of job duties and/or responsibilities that illustrate the type of meeting, action verb and communication product are set out in Table 5.

Table 5: Examples of text included in job duties and/or responsibilities that illustrate the type of meeting, action verb and communication product

Job Duty and/or Responsibility
Attends and takes notes for project team meetings, including weekly Owner/Architect meetings and subcontractors' coordination meetings.
Assist weekly site OAC (and all other onsite meetings), take clear and concise notes, and maintain meetings minutes.
Prepare all project meetings agendas and associated attachments as directed by the PM

The results in table 4 shows graduates are involved in a variety of meetings. This would indicate the need for graduates to communicate with diverse audiences. This was a requirement for graduates set out in the FHEQ descriptors to communicate to both specialist and non-specialist audiences. The results also suggest multiple

activities connected to meetings, not only attendance and participation. There are also three specific products produced in relation to meetings.

The high ranking of meetings set out in table 2. and the alignment with accreditation requirements mentioned earlier has implications for construction educators. In defining what Biggs and Tang (2011) define as course-level "intended learning outcomes", educators would need to create outcomes to cover not only the factual, conceptual, and procedural knowledge related to meetings and communication products but also the skills needed to actively participate in meetings. Group projects that include structured periodic meetings with meeting agenda, notes and minutes, may be an effective form of assessment for this type of outcome.

Drawings

Context analysis was conducted to identify the type of drawing and any action verb that described what a graduate was to do regarding drawings. Table 6 shows the results of the analysis of the 81 instances the word drawings is used. The types of drawing and action verbs are all documented.

Table 6: Frequency and overall ranking of words used in context related to drawings

Type of Drawings	F	R	Action Verb	F	R
Shop	30	1st	Review(s)	25	2nd
Contract	11	3rd	Maintain(s)	11	3rd
Project	11	3rd	Assist	6	7th
As Built	6	7th	Record	6	7th
Design	6	7th			

Examples of text included in the descriptions of job duties and/or responsibilities that illustrate the type of drawing and action verb are set out in Table 7.

Table 7: Examples of text included in job duties and/or responsibilities that illustrate the type of drawings and action verb used

Job Duty and/or Responsibility
Effectively review and expedite shop drawings and coordinates, and exercises functional authority for project correspondence on shop drawings
Maintains as-built drawings
Review contract drawings, specifications, and shop drawings to ensure proper coordination and installation

In creating curriculum content and assessment strategies, construction educators should design course learning outcomes that not only address the different types of drawing including shop drawings, but also the skills involved to conduct reviews for specific tasks such as dimensional control or quality assurance.

Submittals

Context analysis was conducted to identify any action verb that described what a graduate was to do regarding submittals. Table 8 shows the results of the analysis of the 63 instances the word submittals is used.

Table 8: Frequency and overall ranking of action verbs used in context related to submittals

Action Verb	F	R
Review(s)(ing)	17	1st
Manage(s)(ing)	6	6th
Assist	4	8th
Create	3	12th
Update	3	12th

Examples of text included in the descriptions of job duties and/or responsibilities that illustrate the type of action verb used in relation to submittals are set out in table 9. The most common words used to describe the type of submittals are project and subcontractors. The most mentioned communication tool related to the submittal process is "log(s)" as can be seen in two of the examples below.

Table 9: Examples of text included in job duties and/or responsibilities that illustrate the action verb used in relation to submittals

Job Duty and/or Responsibility
Assist with the development a project submittals log and obtain approvals in a timely fashion
Review shop drawings and submittals for conformance with project specifications
Create, update and maintain project submittals logs and all other project specific QAQC reports

In creating curriculum content and assessment strategies, construction educators should design course learning outcomes that not only address the factual and procedural knowledge related to submittals, but also the skills involved to conduct reviews and even create submittal logs for specific tasks. There may be options to combine both the review of submittals and drawings into a combined assessment package.

CONCLUSIONS

Professional accreditation agencies such as CIOB in the UK and ACCE in the US set academic standards requiring graduates from construction programs to demonstrate they have developed communication skills to succeed in the industry. Analysis of entry level job postings are a proven method used to identify the skills and knowledge a graduate will need, when developing academic curriculum. An analysis of 53 entry level job postings identified significant variety in the job title or position name. The most common titles or names were "Project and Field Engineer" followed by "Assistant Project Manager" and "Field or Assistant Superintendent". The term "Assistant" was only applied to non-Engineer positions indicating those positions are supporting a more senior-level person. It is interesting to note the significant variety in job titles and names indicating graduates are pursuing multiple career tracks within the construction industry. However, it may be companies are using different titles to describe what is essentially the same position with similar job duties and responsibilities and further research is recommended in this area.

The aim of the research was to identify those activities related to communications skills that graduates need upon entering the construction industry. The results suggest the most important activities are related to meetings, drawings, and submittals.

The highest ranked communication phenomenon was "meeting". There is some variation in the names or types of meeting. There is a possibility the words used to describe the meetings might be different ways for describing what is essentially the same meeting. However, the results provide us with some indication of the purpose of

these meetings. A more focused approach such as using individual interviews or focus groups would provide valuable information about these meetings. It is clear from the action verbs used in context with meetings that graduates are expected to attend and participate in meetings.

There is strong alignment here with CIOB's Education Framework where graduates need to demonstrate effective meeting skills and effective interpersonal skills and informal communication. The research objectives sought to identify communication tools and the action verbs used in the context of these tools. The results show that meetings require three primary tools: agendas, meeting notes and meeting minutes. Analysis of the context of the use of "minutes" indicated in some instances it was a responsibility of the job to create, prepare or develop meeting minutes. In defining the expected procedural knowledge expected, the results suggest graduates need the skills to actively participate in meetings through actively listening and communicating. There may also be a need to acquire specific techniques for taking notes during a meeting and creating minutes from notes. The conceptual knowledge of how agenda and minutes relate to one another is also very important.

The second highest ranked communication tool is "drawings". The most common types of drawing were shop, contract, or project, as built and design. The most common action verbs indicate the main function is either to review or maintain drawings. Drawings are not specifically mentioned in the CIOB and ACCE accreditation standards. However, ACCE (2022) does have a student learning outcome requiring graduates to "analyse construction documents for planning and management of construction processes." Commentary on this standard identifies drawings as a contract document. The results suggest a need to acquire the factual and conceptual knowledge to review drawings. This would include knowledge of the various types of drawings and the related terminology and graphic symbols used. Students would also need to develop the techniques and methods to review different types of drawings for specific functions.

The next ranked communication tool is "submittals". In building construction, submittals are the documents provided by a contractor to an architect for approval of use of certain materials, components, or equipment. The action verbs identified in the context analysis indicate that the review of submittals is the main function followed by management of the submittal process via tools such as a submittal log or register. Therefore, it is important to have knowledge of the procedural processes regarding submittals and the specific elements involved in this process.

Ultimately decisions regarding curriculum content and assessment are made by academic faculty. However, informed decisions cannot be made in ignorance of national accreditation standards and stakeholders needs. There is a thin line between where academic education ends, and where specific industry training begins. There is a strong case to be made for developing curriculum and assessment measures to best prepare graduates to be successful communicators in the construction industry. This study has identified some of the factual, conceptual, and procedural knowledge that needs to be addressed in the curriculum. This study has used professional accreditation standards from both the UK and USA to justify the need for inclusion of communication content in a construction curriculum. However, one of the limitations of this study is that the data for this study came exclusively from the USA and future research should include and analysis of entry level positions in the UK. Additional research will use certain strategies addressed in the introduction, such as the use of

industry focus groups to centre on delineating where the teaching and learning in academic environment ends and where industry training begins. The aim of this ongoing research seeks to identify suitable assessment strategies for measuring student learning.

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