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# Analysis of Distribution of Courses in Associate Degree Programs in Construction Management

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This study analyzes the range of subjects offered in the associate's degree programs in Construction Management accredited by the American Council of Construction Education (ACCE). An associate's degree in construction management is a two-year program that equips students with essential skills and knowledge for entering the construction industry. The titles of the required courses in the accredited programs were analyzed to identify the distribution of credit hours among mathematics, science, communication, business management, and construction core subjects. The analysis showed that the hours dedicated to mathematics-related subjects vary from 3 to 8, with a median of 3 credit hours. The hours in science-related subjects range from 3 to 6, with a median of 4 credit hours. This constitutes an average of 12% of the total credit hours required in the programs. As the ACCE has removed the minimum required hours for mathematics and science and does not have a specific learning outcome related to these subjects in the current standard, these results provide a meaningful baseline for studying future trends. Additionally, the findings indicate that, outside of construction core subjects, the programs also emphasize oral and written communication, with an average of 6 credit hours devoted to these areas.

Keywords: Construction management, Associate's degree, Curriculum, Education, ACCE

## Introduction

The National Center for Education Statistics (NCES, 2002) defines an “associate's degree” as “an award that requires the completion of at least two but less than four full-time equivalent academic years of college-level work in an academic or occupationally specific field of study, and which meets institutional standards for otherwise satisfying the requirements for this degree level” (p. A-63). Hanson (2024) reports that out of an estimated 4.21 million college students who graduated in 2023 in the US, 24.06% received associate's degrees. Although the number of graduates with an associate's degree has been declining over the years - a trend common at other levels of education - significant numbers of students still pursue these degrees. An associate's degree in construction management is a two-year program designed to equip students with the foundational skills and knowledge needed to enter the construction industry. Although the exact date of the first associate's degree program in construction management cannot be pinpointed, these programs began to gain popularity in the United States during the late 20th century, particularly in the 1970s and 1980s. This shift was a response to

the growing complexity of construction projects and the need for skilled professionals to manage them effectively.

The construction industry has experienced a long-standing shortage of labor, as reported in studies such as those by Allen (1985) and Ofori (1990). According to Allen (1985), the shortage of skilled labor has been one of the biggest factors contributing to the decline in construction industry productivity. A recent article published in August 2024 by McKinsey & Company reports that "the average number of vacancies in construction almost doubled between 2017 and 2023, increasing from 200,000 to 380,000 across the industry" (Mischke et al., 2024). In addition to the labor shortage, the construction industry is also facing challenges in attracting a skilled workforce. Gilbert (2012) argues that "there is some support for the idea that there is a decline in skill level among the construction labor force. Average normalized years of education for men in construction at age 30 seem to decrease over time" (p. xviii). Mischke et al. (2024) highlight that "in addition to shortages in the workforce, retirement, shorter job cycles, and competition for talent have caused a decline in the construction workforce's skill and experience levels." A two-year associate's degree in construction management can serve as a bridge to fill the gap between the demand and supply of skilled labor in construction. This degree can also provide an avenue for new recruits to enter the industry and help train the existing workforce to advance their career paths.

The American Council for Construction Education (ACCE) accredited its first associate degree program in construction in 1992 after being recognized as the accrediting agency for such programs in late 1989 (Weidman, 1992). As of June 1, 2024, ACCE has accredited 16 such programs. A current list of the programs is available from the ACCE website (American Council for Construction Education [ACCE], 2024). Although the number of accredited programs dropped to 15 by August 2024, this study uses data from the 16 colleges that were captured on June 1, 2024. The fraction of ACCE-accredited two-year programs is very small compared to the total number currently offered in the US. Weidman (1992) reports that there were more than 300 two-year construction programs in 1989. However, data from the US Department of Education College Scorecard website lists only 86 institutions offering an associate's degree in construction management as of September 2024 (U.S. Department of Education, n.d.). Of these 86 institutions, 68 are public, 8 are not-for-profit private, and 10 are private.

Dietz and Litle (1976), McDaniel (2005), and Subedi (2023) observe that bachelor's degree programs in construction have shifted their emphasis from basic science, mathematics, and design to a greater focus on construction technology and management. This trend of reduced emphasis on mathematics and science is also reflected in the ACCE accreditation requirements for associate's degrees. The ACCE standards currently require a minimum of 3 Semester Hours (SHs) in Business & Management and 33 SHs in Construction subjects (ACCE, 2023), but do not specify required minimum hours in mathematics and science. Prior to 2016, the requirements included a minimum of 8 SHs in mathematics and science, along with 33 SHs in construction subjects, and 8 and 6 SHs for general education and business and management, respectively, as noted in ACCE (2012). Before 2016, the ACCE standards listed prescribed subjects in various categories. Effective from 2016, the ACCE standards shifted from a suggested list of subjects to a list of 13 Student Learning Outcomes (SLOs) that students must achieve to receive an associate's degree.

Although the current ACCE standards do not specify a minimum credit hour requirement, an associate's degree program typically requires 60 SHs. The previous ACCE standards, until 2014, mandated a minimum of 60 SHs for the accreditation of associate's degree programs. Since the current standard prescribes a total of only 36 SHs in business and management and construction, there

is considerable flexibility for individual programs to include or exclude subjects based on the needs of their constituency. Furthermore, programs can select subjects to create a balance between fundamental knowledge, technical skills, and practical application. Additionally, they can adopt new subjects aligned with the latest advancements in information and technology. Against this background, this research study analyzes the variation in subjects offered by ACCE-accredited associate's degree programs. The main research questions this study addresses are as follows:

- What is the variation in mathematics, science, and business-related subjects in the programs?
- What are the most commonly offered construction subjects in the programs?
- What is the status of subjects related to 'current technology' learning outcome?

Furthermore, as the requirements of the ACCE standard have evolved over time, this study provides a baseline of the main subjects offered in ACCE-accredited associate's degree programs. The findings will be instrumental not only for tracking the future evolution of these programs but also for developing new programs and comparing associate's degree programs accredited by other agencies.

**Table 1.** Student learning outcomes for two-year Associate Degree programs

<b>SLO</b>	<b>Description of SLO</b>	<b>Core subject area</b>
1	Apply effective communication, both orally and in writing	
2	Apply the Skills to Estimate quantities and cost for the building process in a construction project	Estimating
3	Apply the aptitude to schedule a basic construction project	Scheduling
4	Apply current technology related to the construction process	Technology
5	Apply the interpretation of construction documents (contracts, specifications, and drawings) used in managing a construction project	Documents and drawing
6	Apply basic principles of construction accounting	Construction accounting
7	Apply basic surveying techniques used in building layout	Surveying
8	Understand basic principles of ethics in the construction industry	Ethics
9	Understand the fundamentals of contracts, codes, and regulations that govern a construction project	Contracts
10	Understand basic construction methods, materials, and equipment	Methods and materials
11	Understand basic safety hazards on a construction site and standard prevention measures	Safety
12	Understand the basic principles of structural design	Structures
13	Understand the basic principles of mechanical, electrical, and piping systems	MEP

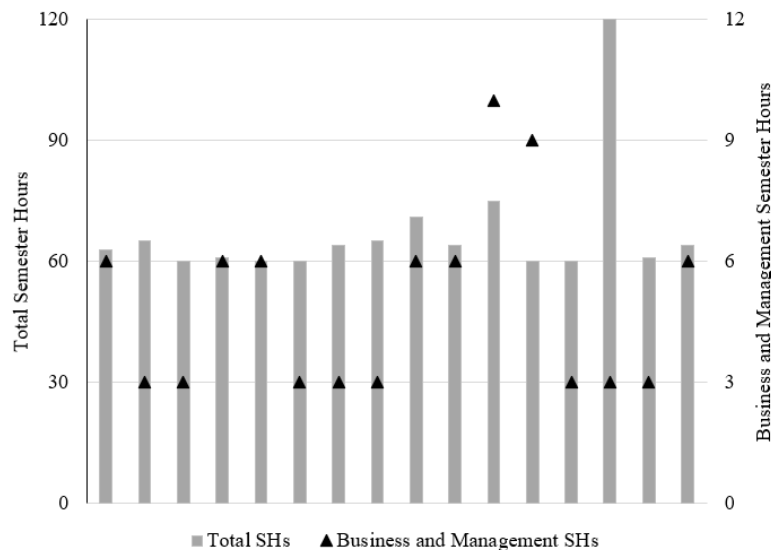
### ACCE Accreditation Requirements

The current ACCE standards and criteria for the accreditation of construction education programs require a minimum of 33 semester hours in the construction core subject area and 3 semester hours in business and management, respectively. In addition to these minimum course requirements, ACCE mandates that learners achieve 13 learning outcomes, as shown in Table 1. Out of the 13 outcomes, 12 are related to construction areas, while one outcome—specifically the first outcome in the table—relates to communication skills. It is important to note that the communication-related learning outcome (SLO 1 in Table 1) should be achieved through construction core subjects. Although not specifically mentioned in the ACCE standard, the commentary on the standard states that all learning

outcomes “are to be measured within the context of construction courses. They are not to be measured external to the Degree Program” (ACCE, 2021, p. 46).

### Courses in the Accredited Programs

The total credit hours required for graduates in the associate degree programs accredited by ACCE vary from 60 to 120 Semester Hours (SHs), with the majority of programs requiring a minimum of 60 hours for graduation (Figure 1). The single program requiring 120 SHs offers dual degrees in Architecture and Construction Management. Among the remaining programs, the range is from 60 to 75 SHs, with a median of 63 and a mode of 60. The current ACCE accreditation requires courses in two categories: Business and Management and Construction. According to the standard, the Business and Management category requires a minimum of 3 SHs, while the Construction category requires a minimum of 33 SHs.



**Figure 1.** Total Semester Hours and Business and Management Semester Hours in the ACCE accredited associate’s degree programs.

#### *Business and Management*

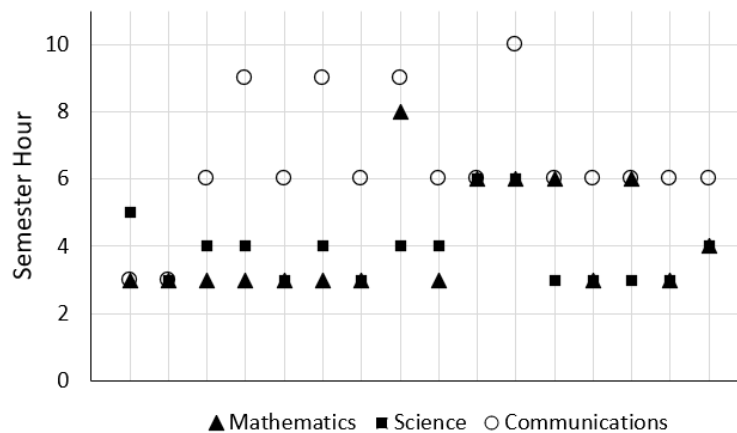
As stated above, a minimum of 3 semester hours (4 quarter hours) is required in the business and management core subject area. This 3-hour requirement for business and management is intended to ensure that graduates have an understanding of the fundamentals of Accounting, Economics, Business Law, or Principles of Management (ACCE, 2023, p. 26). The courses offered in the Business and Management category should be separate and distinct from construction business and management topics and should preferably be taught outside of the degree program. Therefore, it is important to emphasize that Learning Outcome 6 (“Apply basic principles of construction accounting”) in Table 1 is expected to be achieved through a construction core subject. Although foundational principles may be learned in a Business and Management course, the application of construction accounting knowledge must come from a construction core subject.

The standard states that “only general and fundamental business topics can be used” in the business and management core subject area, and these topics shall be taught outside of the degree program.

Furthermore, the standard emphasizes that business and management topics should not be intermingled or confused with construction business and management topics. It specifies that business and management topics “shall be taught outside of the Degree Program unless the courses are unavailable at the Institution.” The commentary further explains this requirement, stating that if these topics are not taught outside of the Construction Program, an explanation is required to justify how the topics taught are separate and distinct from those contained in the construction business and management courses. For example, a faculty member external to the program, such as a business faculty member, teaching the subject to a mixed group of construction and non-construction students can meet this requirement. The business and management course requires an understanding of the fundamentals of Accounting, Economics, Business Law, or Principles of Management. Figure 1 shows SHs of Business and Management courses in the Associate Degree programs. The hours in these subjects vary from 3, which is the requirement of the standard, to 10 SHs. Mode and median hours are 3 and 4.5, respectively.

*Mathematics, Science and Communication Subjects*

The current ACCE standard for associate degree programs does not specify any requirements for mathematics, science, and communication courses. In the last version of the standard, however, a minimum of 3 SHs was required for each of these subjects (rev 2020.09.20). The requirement prior to the 2020 edition was 8 SHs for each of the general education subjects, which included oral and written communication, as well as mathematics and science courses combined (rev 2013.05).



**Figure 2.** Hours of Mathematics, Science, Communication and Business courses

The programs, as expected, complement the required construction core and business courses with courses in Mathematics, Science, and Communication. Figure 2 shows the hours allocated to Mathematics, Science, and Communication courses in the programs. The hours in mathematics-related subjects vary from 3 to 8, with an average of 4.1 SH and a mode of 3 SH. The hours in science-related subjects range from 3 to 6, with an average of 3.9 SH and a mode of 3 SH. Similarly, the hours in communication courses vary from 3 to 10, with an average of 6.4 SH and a mode value of 6 SH. The results indicate that most programs emphasize communication-related subjects, with 14 out of 16 programs offering at least two courses (6 SHs) in oral and written communication.

*Construction core subjects*

Table 2 provides an overview of how various subject areas related to Student Learning Outcomes (SLOs) are distributed across 16 programs. The table shows the minimum, maximum, mode, and median semester hours in the core construction subject areas corresponding directly to the student learning outcomes. The data for this table is based on the presence of the core subject area or closely related fields in the titles of the subjects required for graduation from the programs. For example, SLO 2 (Estimating) requires between 3 and 8 semester hours, with the most common value being 3 semester hours (mode), and the middle value (median) also being 3. One program doesn't have subjects with the word 'estimating' in the subject title. Moreover, for SLO 5, all 16 ACCE-accredited programs have at least one subject that includes terms like "documents," "drawings," or related words such as "drafting" in the title of the required subjects. The minimum, maximum, mode, and median columns are calculated by counting the semester hours (SHs) from the list of required subjects in the program. For instance, the 'Minimum' column indicates that at least one program requires graduates to complete 1 SH of a course with "Safety" in its title. Similarly, at least one program requires graduates to complete 4 SHs in "Safety." The SHs for SLO 4 and SLO 8 are not shown as these subjects are offered in only one program.

The first learning outcome (SLO 1) is not included in Table 2, as communication is not one of the construction core subjects. Although communication is not a construction core subject, the learning outcome must be measured within the context of construction courses and not from courses external to the degree programs (ACCE, 2023). This means that the communication subjects shown in Figure 1 above, which are usually offered by departments outside of the degree program, cannot be directly considered to measure SLO 1. However, these courses equip students with essential skills in oral and written communication, which should be demonstrated in construction core subjects.

**Table 2.** Semester hours in Associate Degree programs based on course titles directly related to the SLOs.

SLO	Core subject area	Minimum SHs	Maximum SHs	Mode SHs	Median SHs	Number of programs with no Semester Hours
SLO 2	Estimating	3	8	3	3	1
SLO 3	Scheduling	3	4	3	3	6
SLO 4	Technology	x	x	x	x	15
SLO 5	Documents/Drawing Construction	3	20	6	6	0
SLO 6	Accounting	3	4	-	3.5	14
SLO 7	Surveying	1	4	3	3	1
SLO 8	Ethics	x	x	x	x	15
SLO 9	Contracts	3	5	3	3	8
SLO 10	Methods/Materials	3	16	3	4	1
SLO 11	Safety	1	4	3	3	1
SLO 12	Structures	3	8	3	3	8
SLO 13	MEP	3	4	3	3	5

Out of the 16 associate's degree programs, "Technology" (related to SLO 4) and "Ethics" (related to SLO 8) appear in the titles of the core subjects in only one program each, meaning 15 programs (as shown in the last column) do not have subjects with titles directly related to these SLOs. Similarly, "Construction Accounting" (related to SLO 6) is offered in only 2 programs, and 14 programs do not have subjects with titles directly related to construction accounting. It should be noted that the absence of these terms in the titles does not imply that graduates of these programs are not achieving the respective SLOs. Since this study was limited to mapping the distribution of subjects based solely on the list of courses found on each program's webpage, it cannot identify subjects that may cover these SLOs. The following section provides further discussion on the technology-related content of SLO 4 and details on how some programs are assessing this outcome.

### *Current technology*

SLO 4 is related to the application of "current technology related to the construction process." Out of the 16 programs, only one includes a subject with "technology" in the title. While other learning outcomes clearly specify the course-level outcomes required to achieve a particular SLO in accordance with the standard, the requirements for the application of "current technology" lack such clarity. The commentary on this learning outcome does not provide further clarification on what exactly the phrase "current technology" means. This term can imply either electronic-based technology, equipment-based technology, or both. A similar SLO for the bachelor's degree states the outcome as "apply electronic-based technology to manage the construction process," which indicates a focus on the application of electronic-based technology. The expected outcome is further clarified in the commentary of the standard, which explains that "such use of scheduling software, estimating packages, BIM, project management software, electronic surveying solutions, drone technology, etc. may be considered" (ACCE, 2021, p. 16).

Although SLO 4 for the associate degree does not specifically define what current technology entails, a brief scan of the program assessment outcomes of some programs reveals that they utilize a range of subjects, including software-related topics, to meet the requirements of this objective. This information was compiled from publicly available data on the respective program webpages.

**Table 3.** Samples of the subjects used to cover the SLO 4

<b>Program/year</b>	<b>Subject(s) used</b>	<b>Information source</b>
Program 1/ Spring 2020	CMGT 1103 - Blueprint reading and graphics CMGT 2413 - Planning and scheduling CMGT 2513 - Commercial and industrial estimating	Baton Rouge (2020)
Program 2 /2019-20	CNST 110 - Residential building systems CNST 295 - Design building management	SUNY College (n.d.)
Program 3 /2022-23	CNBT-2335 – Computer Aided Construction Scheduling	Tarrant County College (n.d.)

### **Discussion and conclusions**

One quarter of post-secondary students in the US graduate with an associate's degree. An associate degree not only serves as a foundation for further education but also provides a major avenue for career preparation, entry-level employment, skill development, and skill upgrading. Gittel, Samuels, and Tebaldi (2017) found that hiring workers with associate's degrees has boosted overall labor

quality, earnings, and productivity in the health care, trade, and government sectors. Their study implies that "workers without a college degree moving to associate's degree completion could boost growth and productivity, potentially without more time spent in school" (p. 623). As the construction industry has long faced acute shortages of skilled workers and has struggled to attract a new pool of individuals to replace the retiring workforce, associate's degrees can help fill these gaps. As Cheung, Fidan, and Fuentes (2022) note regarding the ABET accreditation, students attending ABET-accredited associate degree programs benefit greatly, and programs pursuing accreditation also gain considerable advantages. A similar argument can be made for ACCE accreditation as well.

Out of more than 100 associate's degree programs in Construction Management in the US, only 16 programs currently hold ACCE accreditation. A review of the subjects offered in these programs revealed that all have at least 3 credit hours in mathematics and 3 credit hours in science. Although the current ACCE standard does not require any credit hours in mathematics and science and does not specify a student learning outcome directly related to these subjects, the programs dedicate 8-19% of their total credit hours to these areas. Mathematics and science are essential, as these subjects help bridge the knowledge students gained in high school with what is necessary for success in construction courses. Additionally, mathematics and science courses equip graduates to adapt to rapidly changing technology and to appreciate the diversity and interconnectedness of the natural world. The ACCE standard should also introduce at least one learning outcome for associate degree graduates to address the minimum requirements in mathematics and science.

Furthermore, since these programs aim to meet the needs of the local construction industry and do not necessarily emphasize the same construction subjects, a range of construction subjects was also reviewed. The analysis showed that the programs incorporate software and computer-related subjects to fulfill the requirements of SLO 4. This learning outcome of the ACCE standard requires graduates to demonstrate competency in applying "current technology related to the construction process." Unlike the related SLO for the baccalaureate degree, the ACCE standard and its accompanying commentary are not clear about whether "current technology" refers solely to computer-based technology. In construction, "current technology" may or may not be directly related to computers. While many modern advancements, such as Building Information Modeling (BIM), drones, and project management software, heavily rely on computer-based technology, there are also significant innovations that do not involve computers, such as new construction materials and methods like prefabrication or modular construction. The ACCE standard and commentary should provide greater clarity regarding the expectations for this SLO.

One of the limitations of this study is that only ACCE-accredited programs are analyzed. Further research is required to analyze trends in programs outside of ACCE accreditation. By including a broader range of programs, future studies could provide a more comprehensive understanding of the overall landscape and the impact of different accreditation regimes on mathematics and science requirements. Additionally, such research could identify gaps in the current accreditation system and suggest improvements that could benefit educational outcomes across a wider spectrum of programs.

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