

Case Study on the Development and Implementation of a Construction Management Program

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The construction industry in the United States has faced several challenges over the last decade, one of which is the shortage of a well-trained workforce. This challenge has placed increasing importance upon higher education institutions to supply bright and motivated individuals who are capable of entering the construction arena upon graduation. This demand calls upon higher education institutions to develop new programs or expand upon their current curricula in support of preparing students to enter the construction workforce with the skills required by the industry. Limited information exists on the design and implementation of new programs in this field. This case study documents the development and implementation sequences associated with a new Bachelor of Science in Construction Management degree program at a four year university. A proposed program framework by the American Council for Construction Education (ACCE) is available; however, the framework does not address aspects associated with the design and sequential implementation of a new program as it relates to benchmarking, program accreditation, university general education requirements, articulation, and assessment measures. Lessons learned from the case study are generalizable in nature and can be applied across disciplines in support of developing new programs at university level or to improve current program curriculum outlines.

Key Words: Program Design, Benchmarking, General Education Requirements, Articulation, Assessment, Accreditation

Introduction

The construction industry will enjoy one of the highest occupational growth rates over the next 10 years as forecasted by the Department of Business Statistics. The industry is expected to grow 10% per year by the year 2016. Employment of construction workers is expected to grow by 9.5%, adding 785,000 new jobs by 2016 (BLS, 2009). In support of this statistical data, employment of construction managers is expected to grow as a result of increasing complexity of construction work that needs to be managed, including the need to deal with the proliferation of laws dealing with building construction, worker safety, and environmental issues (BLS, 2009). This promising forecast will demand training towards a qualified workforce. A need for educated talent in the industry calls upon higher education institutions to supply bright and motivated individuals capable of entering the construction arena upon graduation. An extensive literature review on the need for a skilled workforce in construction was conducted and is summarized as follows:

- The National Center for Public Policy and Higher Education, (2003): Workforce requirements and civic responsibilities combine to demand ever-increasing individual knowledge and skills.
- The National Association of Manufacturers (2008): Forecasted a shortage of approximately 13 million to 15 million skilled workers in the construction industry by 2020. Furthermore, the number of workers aged 35 to 44 will decrease, likely causing a widespread shortage of middle managers within the industry (Wang, Goodram, & Haas, 2008).
- U.S. Census data administered by Hudson Institute: An analysis projected a net increase of people with less than a high school education through 2020 (Toft, 2002). The analysis further projected modest increases in the number of those who are college-educated, and the major finding predicted a severe mismatch between educational attainment of young workers and the escalating knowledge and skill requirements of the new economy.

- Goyette & Mullen (2006): Young people who are concerned about having a steady job and high income are more likely to choose majors linked to occupations, such as engineering, business, or education.
- Pruett (2009): The job demands for college graduates have increased, and the value of a degree will translate into long-term, sustainable careers.

Based on supported evidences, a need for educated talent in the construction sector exists; therefore, higher education institutions have an obligation to offer training in this field. While a number of academic institutions have offered a variety of degrees in construction, little information exists on the design of new programs. A proposed program framework on how to structure such programs is available by the American Council for Construction Education (ACCE); however, the ACCE proposed framework does not offer a sequential approach for the development of new programs. This case study describes the development sequences associated with the design and implementation of a new Bachelor of Science in Construction Management program at the university level. The case study is generalizable in nature and can be applied across disciplines during the development of new academic programs. The composition of the case study is organized by extrapolating on five components associated with the design and implementation of a new construction management program as stipulated in figure 1.

Design and Implementation Components Associated with a New CM Program

This case study introduces five components associated with the design and implementation of a new construction management program as stipulated in figure 1: namely benchmark, additional university requirements (e.g. GE), articulation, assessment, and accreditation, which will be extrapolated upon following.

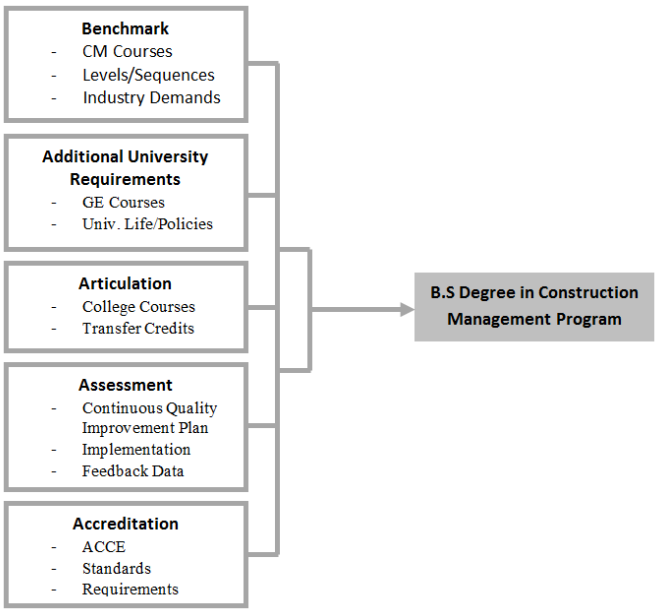


Figure 1: Components associated with the design and implementation of a new construction management program at the university level.

- Benchmark is defined as "A continuous, systematic process for evaluating work processes of organizations that are recognized as representing best practices for the purpose of organizational improvement" (Alstete, 1996). Construction management programs at different universities have different requirements in terms of class sequences and concentrations; therefore, a benchmark on courses to be taught should be established early in the program design phase. The benchmark approach not only provides a listing of courses to be taught but also provides a linear sequence of course at the 100, 200, 300, and 400 levels.
- Additional university requirements such as general education (GE) and university life/policies must be considered in support of curriculum design. Reviewing additional university requirements regarding general education is a necessary step in the development of a new program. Currently, more than 85% of

colleges and universities in the United States require all of their students to complete some general education requirements (Hachtmann, 2010). General education is rooted in the European model of classic education and includes the study of classic literary works, philosophy, foreign language, rhetoric, and logic. The U.S. education model is characterized by an additional layer of practicality, as found in applied curricula like construction management. General education must maintain a balance between the expectations of society and industry and the learning needs of young people (Hachtmann, 2010).

- Articulation is a process and relationship involving the vertical and lateral movement of students through a formal education system, regardless of age and area of study. Articulation is an agreement between two or more educational systems based upon guidelines, policies, and accreditation principles put in place by the institutions (Tenbergen, 2002). The successful progression of students from the lower-division level to completion of the baccalaureate degree and on to advanced degree programs is a basic tenet of every four-year institution (Tenbergen, 2002). Therefore, early engineering of transfer capability as part of a program design is crucial. The most pressing issue for students at the point of transfer is discovering how many course credits the senior institution will accept toward their graduation requirements (Rice, 2008). Based on the various enrollment patterns of transfer students, it is important that institutional policies and practices monitor educational expectations of those students in a non-simplistic fashion (Rice, 2008). Articulation should be a principal step in the early development stage of a new program.
- Assessment is defined as a process of measuring learning and teaching performance that will help an institution gauge whether students and or instructors are achieving their educational goals (League of Innovation in the Community College, 2004). Therefore, developing a continuous quality assessment plan for a new program is essential. The continuous quality plan should be implemented to ensure the following: 1) Student learning is actually taking place, 2) Colleges and universities document the learning process, 3) Decision makers are using outcomes assessment data to make informed decisions in the curriculum management process (Fleishman, 2009).
- Accreditation is a rigorous and formal peer reviewed process conducted by an accrediting organization such as American Council for Construction Education (ACCE) which involves the full range of construction industry stakeholders. Accreditation can be an essential task in the development of a new program. ACCE is a global advocate for construction programs of post-secondary construction higher education, who develops, periodically updates, and promulgates comprehensive standards for programs of construction higher education. (American Council of Construction Education, 2010).

The case study can be viewed as an empirical inquiry in the design of a four-year program at the university level as viewed from a real-life context. These components were implemented during the development of a new Bachelor of Science Degree in Construction Management at a university. Each component has played a predominant role during the development of the program since the program's inception. All components were objectively analyzed, with interconnectedness to the larger scope associated with a typical Bachelor of Science in Construction Management program at the university level. The case study draws attention to each component in support of their interconnectedness and role in the development of a new program regardless if it is housed in a College of Engineering, Architecture or School of Business.

Benchmark

In support of establishing a course benchmark on what courses to be taught in the program, 20 Bachelor of Science construction management programs were randomly selected from the ACCE accredited membership database. Standalone classes taught at the selected programs were grouped in first-, second-, third-, and fourth-year categories according to their catalog outlines as illustrated in Table 1. These courses were grouped according to catalogue descriptions only.

Table 1: Benchmark compilation of courses taught at 20 randomly selected accredited ACCE higher education institutions.

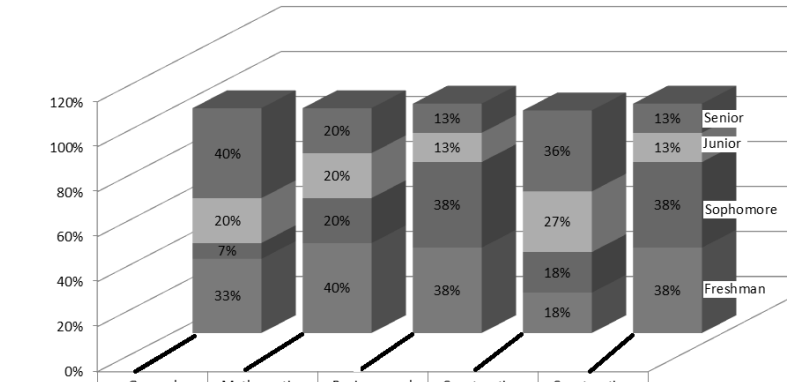
Course	First Year	Second Year	Third Year	Fourth Year
Plan Reading & Estimating	37%	27%	15%	8%
Mechanical & Electrical	3%	6%	15%	22%
Codes	3%	9%	4%	15%
Survey	3%	27%	2%	3%
Structures	3%	24%	13%	8%
Soils	6%	6%	9%	5%
Building Techniques	11%	11%	4%	5%
Materials	0%	11%	4%	5%
Intro to CM	25%	0%	0%	0%
Scheduling	0%	3%	4%	33%
Graphics	28%	3%	2%	0%
Contracts	0%	9%	2%	5%
Safety	0%	9%	4%	8%
Surveying	0%	27%	20%	3%
CM Law	0%	0%	4%	10%
Project Management	0%	0%	23%	24%
Building Equipment	0%	14%	4%	5%

The benchmark approach not only provided an outline of courses to be offered but also provided a linear sequence of courses to be offered at the 100, 200, 300, and 400 levels. The benchmark approach further supported the design team in grouping courses together by year based on their respective sequences at selected universities. Plan reading & estimating and introduction to construction management were offered (37% and 25%, respectively) during the first year. This is in contrast to contracts, safety, surveying, law, and project management (all 0%) during the first year.

Additional University Requirements

The general education framework of the university involved in the case study aims to provide a foundation of knowledge, skills and values that are consistent with a liberal arts tradition. While a liberal arts program is not designed to train students for applied or specialized fields, it does promote employability skills, including the ability to think for oneself, communication and analytical skills, and the capacity for lifelong learning. It is important in a changing world to develop these skills, which are very resistant to obsolescence, in tandem with the specific knowledge and applied training in construction management. The alignment of university general education requirements to the ACCE matrix required a cunning approach in terms of finding a balance between required general education (GE) and the required ACCE curriculum breakdown not to exceed more than a 124 credit hours before graduation per university standards. Table 2 represents the (ACCE) curriculum requirements as it relates to construction management accreditation. Such alignment calls for the substitution of some GE courses with that of CM courses within the 124 credit limit. An example of such a substitution was the course EGR 122 "*Visualization Language,"* a construction course that substituted COM 134 "*Communication Art,"* a required (GE) course. Substitutions were strictly based on comparable content frameworks that could be used to satisfy both university as well as ACCE requirements. Construction Management programs include courses from supporting disciplines essential to the general education of students, which provides basic concepts and skills that are important to the

construction industry and student training. ACCE curriculum categories should share an integrated platform as stipulated in in Figure (2) in support of CM course pre-requisite and sequences over a four year period.



	General Education	Mathematics and Science	Business and Management	Construction Management	Construction Science
Senior	40%	20%	13%	36%	13%
Junior	20%	20%	13%	27%	13%
Sophomore	7%	20%	38%	18%	38%
Freshman	33%	40%	38%	18%	38%

Figure 2: Integration of (ACCE) curriculum categories over a four year period.

Articulation

Articulation agreements are designed to build strong partnerships between community colleges and four-year institutions; these partnerships become a binding agreement between a two-year and four-year institution. The agreement outlines specific courses and letter grades completed at the community college that will transfer to the university. Therefore community colleges and four-year institutions must streamline their transfer processes to better support the bachelor degree aspirations of community college students and to be viewed as an additional population advantage to university programs. Early engineering of transfer capability as part of a program design is crucial. Table (3) is representative of an articulation agreement between a community college and the university.

Table (3). Example of an articulation agreement between a university and community college.

University Courses	**Units**	**Comparable Community College Courses**
(GE) Communication Arts	3	SPC 1A
(GE) Philosophy	3	PHIL 1 C Ethics
(CON) Construction Visualization	3	(DRA 8 & 9) Auto CAD Level 1& 2
(CON) Plan Reading & Estimating	3	(ARC 11) Architectural Blueprint Reading
(CON) Introduction to CM	3	(CM 2) Intro to Urban Planning
(CON) Construction Building Codes	3	(BIT 1) California Building Codes
(CON) Construction Materials & Methods	3	(ARCH 2) Materials of Construction

The most pressing issue for students at the point of transfer is discovering how many course credits the senior institution will accept toward graduation requirements (Rice, 2008). Based on the various enrollment patterns of transfer students, it is important that institutional policies and practices monitor educational expectations of transfer students (Rice, 2008).

Assessment

Assessment should be viewed as part of a program's design. An (ACCE) requirement is to develop and implement a program quality assessment framework, which describes the academic quality plan in terms of both inputs and outcomes, as it relates to program delivery, teaching, research, and service. For this particular case study, a quality assessment framework, named "Continuous Quality Improvement (CQI) Process" (Fig 3), was established and implemented to demonstrate how outcome assessment results are correlated with the program mission, goals, educational objectives, and outcomes. The CQI process is comprised of four principal tasks whose activities are discussed following.

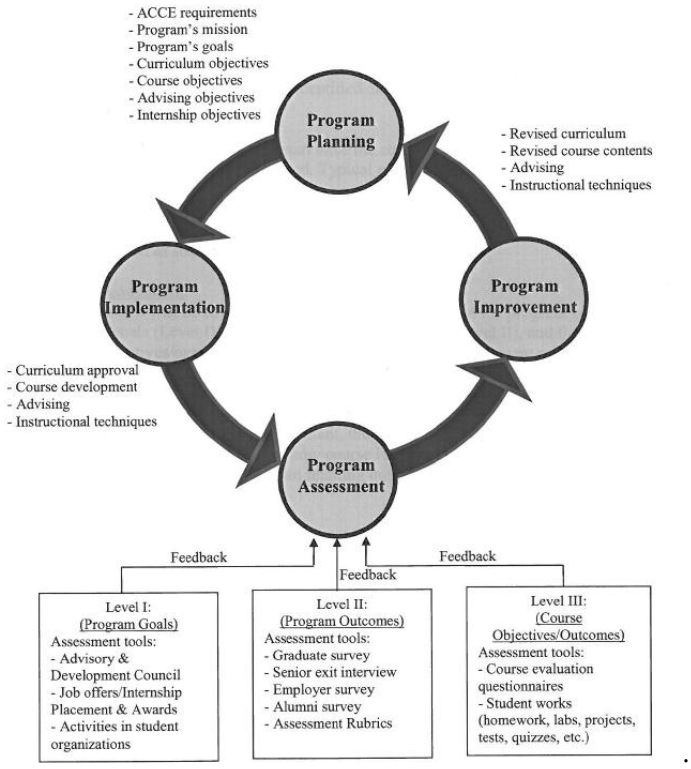


Figure 3: Continuous Quality Improvement (CQI) Process Framework

Program Planning:

Program planning is aimed at evaluating the need to revise the overall educational objectives of a program. The program planning activities assist in evaluating coursework to determine how well the courses are meeting ACCE requirements, program mission, goals, educational objectives, and course objectives.

Program Implementation:

Program Implementation starts once curriculum changes have been approved by a curriculum committee. Typical activities of program implementation include developing new courses where necessary and revising existing courses to accommodate suggested recommendations.

Program Assessment:

Program assessment is conducted at three levels to assure that the program educational objectives/goals (Level I), the program learning outcomes (Level II), and the course learning objectives/outcomes (Level III) are achieved. Assessment results should be used to continuously improve the quality of the program curriculum by updating

and/or revising course syllabi/contents as well as instructional methods. The program assessment levels are stipulated following.

Level I – Educational Objectives/Program Goals.

At this level, the assessment process draws on information from the following:

- Advisory & Development Council Reports
- Job offers/Internship (Placement/Awards)
- Student Organization Activities

Level II – Program Outcomes.

At this level program outcomes are measured by the following assessment instruments:

- Graduating senior surveys: All graduating CM senior students are asked to complete a formal survey based on their education experience.
- Employer surveys: designed to collect feedback on each outcome of the CM program. Surveys are to be sent to the construction companies where CM graduates have been employed for the past three years.
- CM alumni surveys: These are sent to graduates who have been employed for the past three years.
- Assessment rubrics: should be developed to measure the achievement of Program Outcomes.

Level III – Course Learning Objectives/Outcomes - Course Level.

Assessment mechanisms at this level include the following:

- Course evaluations using questionnaires/rubrics: These evaluations provide feedback on areas needing improvement for courses as well as instructional techniques.
- Homework/Tests/Quizzes/Lab Reports: the scores of these student works demonstrate the level of achievement of students with respect to learning objectives/outcomes.

Program Improvement:

Program improvement tasks should be developed and planned in order to accommodate the recommendations and feedback obtained from the various surveys. The feedback data should indicate where significant changes are needed towards program improvement.

Accreditation

There can be little doubt as to the standing and implementation of assessment in education. It is a legitimate concern of those who learn, those who teach and those who are responsible for the development and accreditation of courses; in a sense, "assessment is the cash nexus of learning" (Brown, Bull & Pendlebury 1997. p7). In the implementation of the proposed development framework, the new construction management program has been developed according to the accreditation requirements and standards designed by the American Council for Construction Education (ACCE). The need for construction higher education institutions to embrace the ACCE matrix towards achieving and maintaining accreditation is imperative. The ACCE matrix is an integrated framework with listed topical content to be covered in accredited schools; therefore, the ACCE matrix should be viewed as a preliminary outline in program design based on its prescribed format which is disconnected to university practices at large.

Conclusion

A demand exists to develop new construction management training programs in higher education institutions and to expand upon current program curricula in support of preparing students to enter the construction workforce with desired skills. This demand leads to the need for a proposed development framework. The proposed framework integrates aspects including benchmark, additional university requirements, articulation, assessment, and accreditation. Benchmarking is useful in identifying a list of CM courses to be taught at different levels including freshman, sophomore, junior, and senior. Additional university requirements include general education courses that

need to be aligned with required ACCE courses. An articulation process is necessary for identifying the course credits that are transferrable from community colleges to the university. Assessment is one of the most important tasks in the development of a new program as it helps the program ensure its mission, goals, and educational objectives are achieved and identify program weaknesses. Finally, most accreditation of new construction management programs are granted by the ACCE, whose requirements/criteria are available online. The curriculum of a new construction management program should align itself to the ACCE matrix; however, the matrix should be used as a guideline to determine the total number of instructional hours for each area of knowledge. The ACCE matrix classifies program requirements into the following categories, courses required by major, technical electives, business courses, and general education courses. The proposed development framework provides a platform for the development of new construction management programs as well as a guideline to improve existing programs as drawn from the ACCE framework.

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