

Restructuring Purdue University's Construction Management Curriculum Utilizing Graduate Competencies and American Council for Construction Education Standards

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In 2009 Purdue University recognized that their Building Construction Management undergraduate program was due for a curriculum review. The culmination of many influences necessitated the need for a formal review. These influences included: aging faculty, economic pressure to increase delivery efficiencies, accreditation requirements, and a newly introduced university core curriculum. In 2010 the faculty reached out to the construction industry to establish graduate competencies to help lead the construction management (CM) curriculum analysis. This process was the subject of an ASC paper and presentation by the same authors at the ASC International Conference in Omaha, NE (Benhart & Shaurette, 2011). Armed with these competencies, the American Council for Construction Education accreditation standards, and Purdue's current course objectives, the BCM curriculum committee set out to rebuild the curriculum from the bottom up. This paper serves as a follow-up to the progress paper published in 2011. Through a detailed account of the overall curriculum review process the paper describes the course of action used to restructure the curriculum to ensure that each stakeholder's objectives were met. Described in detail in the paper are the manner in which the revisions were communicated by the curriculum committee to the BCM faculty to helped maintain transparency throughout the process, tools used to aid in the decision making process, the timing and milestones that were met during the final review, as well as the college and university level reviews required prior to implementation. In addition, procedures developed during the curriculum review to support faculty preparation for the necessary course adjustments as well as an upcoming ACCE accreditation review are presented.

Key Words: curriculum, accreditation, industry, educational competencies, curriculum review

Introduction

Purdue University's Department of Building Construction Management (BCM) curriculum has been built on a solid foundation and has been successful at delivering the fundamental skills required for the market for over 40 years. Many of the longstanding faculty of the program are close to retirement and are anxious to ensure that this program remains solid and is not haphazardly altered because of short-sighted reactions. More so, the program needs to evolve with thought, deliberation, and research as the basis for change rather than mere economic pressures or simple opinions. Unfortunately, the retirement of these scholars will leave open teaching positions that will not be replaced in today's economy. This CM program will have to deliver the same curriculum with less staff.

In addition, Purdue University has been charged with the task of building a fundamental core curriculum that will apply to all students within the college. This involves the use of three courses totaling 9 credit hours. Members of the CM faculty are on the task forces responsible for developing these core courses. This direction is not only shared by the university administration, but by the state task force for higher education of Indiana. The state task force is responsible for funding allocations to land grant institutions. Simply put, there is no alternative; the CM program must introduce these core courses.

For the reasons previously mentioned, and the constant need to be conscious of accreditation, the program has progressed through the lengthy process of analyzing the curriculum. It was determined at the start that the architecture of this process should be easily repeated in the future. Pressures to adapt and update the curriculum are going to continue and the ability to systematically review the curriculum will be crucial to maintaining a nimble program.

Literature Review

Contemporary literature covering undergraduate construction education reflects an ongoing concern with curriculum review and maintenance. It covers a range of concerns including the outside influences impacting Purdue University. Allan Hauck noted that curriculum review needs to be driven by a desire to align CM curriculum with core course requirements within a college of technology (Hauck, 1997) and Shima Clarke described the influences of accreditation on curriculum development (Clarke, 2003). Even without outside influences, annual curriculum review is advocated (Thacker, 2000) and regular implementation of curriculum updates are expected as part of the ACCE required Quality Plan (ACCE, 2010). A tool for curriculum evaluation referred to as the Learning Outcome Template (LOT) is described by Auchey et al. in 1997. The LOT is used to perform detailed curriculum-wide course assessment. The LOT is a matrix of outcomes by course that displays both course outcome content and degree of emphasis. By having faculty complete the LOT, a dynamic, graphic depiction of the curriculum is available for communication about the curriculum as well as for continuous improvement.

Learning outcomes are cited as a starting point for curriculum reform for both ACCE and ABET accredited programs (Hauck, 1998; Meyer & Jacobs, 2000). In the general education literature countless theories and initiatives have promoted educational constructs for instructional design and assessment. The use of learning outcomes is frequently advocated for evaluation of education and training activities (Bloom, Hastings, & Madaus, 1971). In the second half of the 20th century the concept of competency-based education (CBE) added educational competencies to the list of learning outcomes by which instructional design and evaluation could be guided. CBE is learner centered and promotes acquisition of the skills needed for survival in the work environment (Collins, 1987). Thomas Gilbert describes competence as a social construct based on the proficiency of an exemplar. Through the systematic examination of exemplars he suggests that instructional designers can identify what accomplishments the instructional system should be designed to create (Gilbert, 1978). Competencies to guide and measure the performance of construction project management have also been advocated (Patil, 2005).

Ultimately construction management faculty must utilize performance outcomes driven by industry needs for program evaluation (Andersen and Andersen, (1995). In 1992 Jerald Rounds made the following prediction: *"The next major change, just starting to be felt in university construction education, but by no means new to the academic and professional arenas, is establishment of competency based standards … focus(ing) upon the competencies desired in our graduates, rather than educational packages we create to produce those competencies."* A competency is something that a person can do well and that meets and even exceeds his or her job requirements (Badger, Bonanno, Sullivan, Wiezel and Bopp, 2009). The most used definitions include:

- A written description of measurable work habits and personal skills used to achieve objectives at work (Green, 1999).
- A knowledge, skill, ability, or characteristic associated with high performance on a job (Mirabile, 1997).
- A combination of motives, traits, self-concepts, attitudes, values, content knowledge, cognitive skills, or other characteristic that can be measured and differentiate superior to average performance (Spencer, McClelland, & Spencer, 1994).

The competency-based literature strongly supports a systematic approach to instructional design (Gilbert, 1978; McAshan 1979; Rothwell & Kazanas, 2004). The most common suggestions for competency identification are to examine what experienced performers know (Rothwell & Kazanas, 2004) or to base competencies on the skills, knowledge and abilities of exemplars (Gilbert, 1978). A systematic approach to use of competency-based instructional design should be a formal planning process that allows stakeholders to fully participate (Gilbert, 1978; Jones, &.Voorhees, 2002; Rothwell & Kazanas, 2004) and will produce locally derived competencies appropriate to the learners' needs (McAshan 1979). By including stakeholders in the formal planning process they are more likely to accept the value of the competencies as part of the instructional design (Jones, &.Voorhees, 2002).

Construction management educators have recognized many of the same issues in CM curriculum review as have been noted in the general education literature. In 1998 Hauck advocates that comprehensive CM education reform should begin with outcomes obtained from external sources that drive curriculum revision as a whole, avoiding piecemeal changes. Some advocate a wide base for input from any stakeholder with an interest in the department (Ferguson, 2004). The input should provide sufficient depth and breadth for meaningful input (Meyer & Jacobs, 2000), but many questions arise when trying to obtain input from industry framed within the constraints of accreditation and university guidelines. A task force of industry and faculty representatives may be employed as long as all involved are willing to discard past practices (Thacker, 2000). General discussions are frequently employed, but leave too much room for interpretation (Olsen & Burt, 2010).

Once a list of competencies is ascertained, priorities must be established. No educational program is capable of covering every area of knowledge and skill equally. Methods for establishing priorities include numerical ranking of skills (Mead & Gehrig, 1995; Souder & Gier, 2006) or attempting to quantify the credit hours of study devoted to topic areas (ACCE, 2010; Olsen & Burt, 2010). The results from these prioritization efforts revealed a differential between the time devoted to areas of competency as desired by industry and faculty and the current curriculum emphasis (Olsen & Burt, 2010) or areas of competency with inadequate coverage (Souder & Gier, 2006).

Communication

Communicating a plan and schedule were crucial to the curriculum review project's success and acceptance. The committee determined that the process needed to be transparent and allow for faculty to share insight and recommendations. Curriculum review can often be controversial and needs to be openly understood. When the committee determined that rebuilding was more appropriate than minor modifications, it was decided to loop back to the faculty. During the creation of the new graduate competencies, the committee had seen the benefit of transparent communication. Each monthly faculty meeting included a detailed explanation of where the committee was in relation to the curriculum review milestones and everyone was invited to attend and participate. This consistent communication allowed everyone to play a role in the architecture of the process and the results.

The Curriculum Review Process

The first curriculum meeting of the 2010-11 school year was one that was full of debate about how to address the upcoming changes. Several participants wanted to make minor modifications and eliminate construction electives to allow for the newly added core courses as required by Purdue administrative decisions. Their voice reflected that our program had been successful for over 40 years. It was built on years of solid research and proven success. They questioned the need to meddle with success. It was hard for others to disagree. This was the process that had been used since the program inception. In the past changes were minor and there was never any need, desire, or purpose that required a complete rebuilding.

There were other members of the committee, including both authors, who felt the need to start with a clean slate. It took several failed attempts to incorporate the core courses for the team to collectively agree that the curriculum should be rebuilt completely. The mission was clear. Completely restructure the curriculum and if the result mirrors the current curriculum, then the review process will have justified and reinforced the contention that the current curriculum is the best that can be delivered. If the committee comes up with something new, this bottom up process was justified.

The fourth meeting was when the structure needed for the curriculum review came to light, giving the committee direction. The process would start from zero and build to 128 (the number of maximum credit hours Purdue would allow). The curriculum committee created what came to be called the thermometer (Figure 1). The thermometer was an excel spreadsheet that included 128 same sized cells, each representing a credit hour. It allowed the committee to quickly communicate the level of emphasis in each subject area by credit hour. Each area was then highlighted with different colors for ease in viewing. When complete, the faculty and advisory council were able to see the emphasis in each subject areas. The subject categories were based on faculty expertise and allowed sub-committee work in

each of these areas. Several faculty were part of more than one sub-committee. The curriculum committee utilized the American Council for Construction Education (ACCE) standards as the first filter. Upon this starting point the requirements of Purdue to include three college level core courses were then incorporated. The last filter dovetailed the graduate competencies that were developed in the 2009-10 academic year and described by Benhart & Shaurette in 2011. In effect, a three-legged process had been developed.

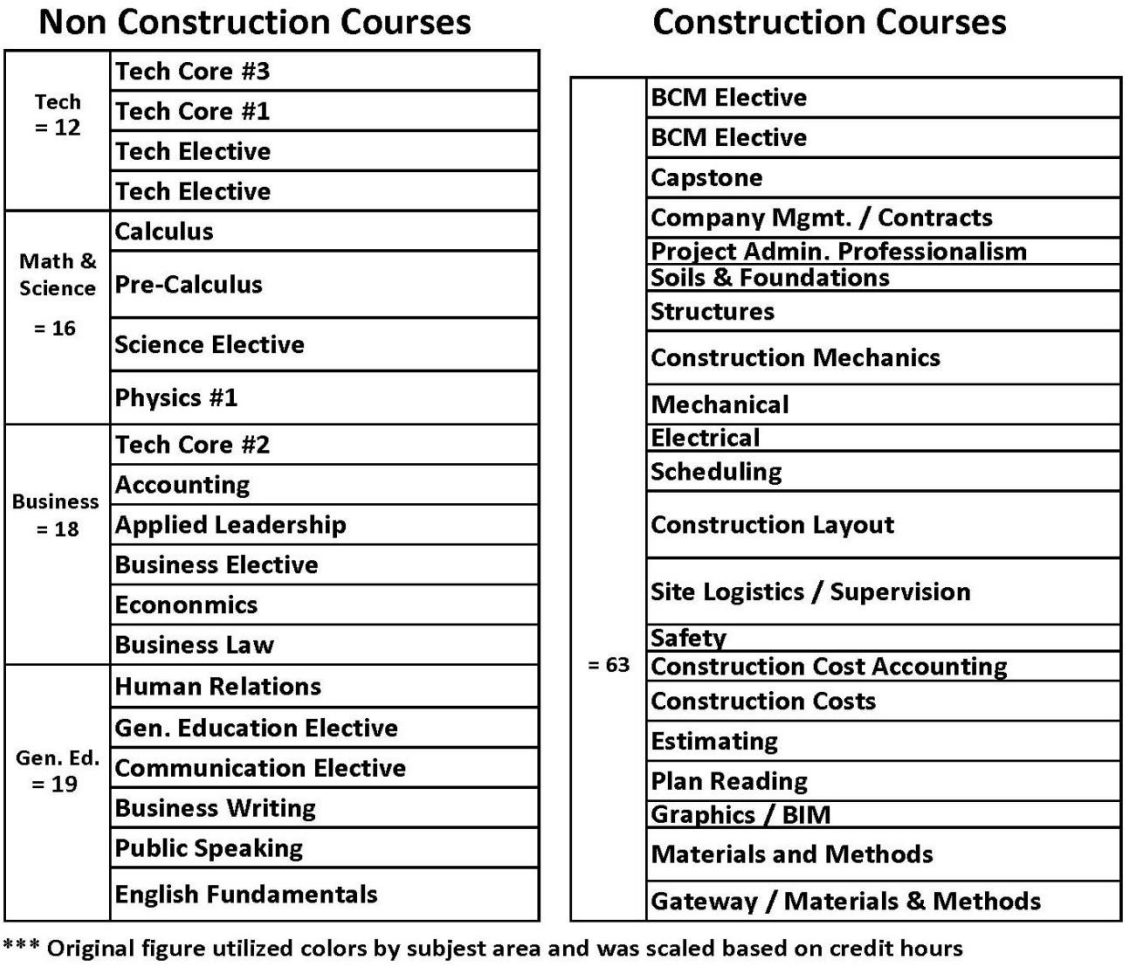

Figure 1

The BCM curriculum committee met weekly through the entire 2010-11 school year. Each meeting picked up where the last left off and continued to build the "thermometer". The first meetings worked with sections starting with General Education, Math, and Science. These blocks allowed the committee to define the process so that when Construction Management and Construction Science came up the system helped lead the dialogue. Many flipcharts were used to tackle each credit hour one by one.

During the curriculum review the committee discovered "weak" spots that were not apparent before. For example, the curriculum had utilized the same two physics courses since the start of the program. It was taken for granted that these two courses had to be taken. In this situation, history and tradition proved to be a weakness. By examining courses offered across campus that met the ACCE requirements it was determined that there were more options that would be a better match for our students. The committee also discovered that by looking at our program from a

macro level, BCM would be better equipped to provide minors and study abroad programs for our students without adding time to their college career.

By late November 2010, a draft had been completed to take back to the entire faculty. The thermometer turned out to be the most widely referenced document. A comments section was added so that each course included notes and rationale as to why it was part of the program. The construction courses were also divided into smaller areas that might include multiple courses that built upon each other. This allowed everyone to see how their specialty areas affected the overall program. Some construction topic area credit hours were reduced while other areas increased. The draft was approved by the entire faculty and the committee went back to work further defining each course and the necessary paperwork for College level and ultimately university level approval.

Milestones and Schedule

As discussed earlier, there were many influences requiring the curriculum to be restructured. Only one of these had a specific deadline. The introduction of Purdue University's core courses was set for 2012. Other programs within the Purdue College of Technology opted for the easier path of eliminating electives to allow for new courses. The Building Construction Management curriculum committee recognized that it would be more efficient to look at the whole program and address all of the changes and influences at once. While this decision has, and will continue to, create a great deal of work for the BCM curriculum committee over a two year period, it has made the changes easier to implement. Similar to many programs, a freshman is locked into the curriculum that exists when they start. Continual changes makes scheduling and graduation targets confusing for our students, advisors and faculty.

Knowing that the completion date was rigid, the committee backed into a schedule. Two years initially seemed like a large amount of time to complete the process. As the outline of approvals and the proper amount of time for each phase was allocated (Figure 3), it became clear that there was a great deal of time pressure.

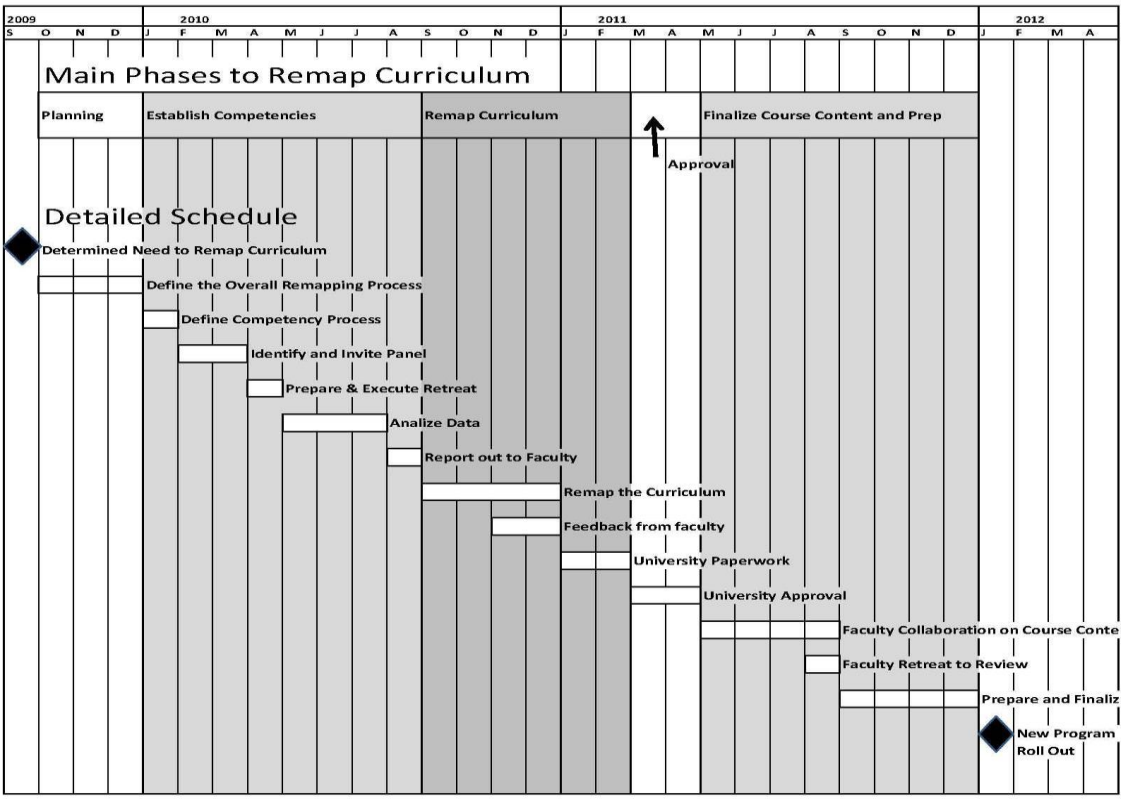

Figure 2

Approvals

Upon completion of the curriculum review and complete faculty approval, the curriculum committee began work on the approval process with the college and university. Purdue's process required templates for each course outlining the changes. The left side included the existing course requirements and learning outcomes and the right side highlighted the new. All forms were compiled into a packet and sent to the college level curriculum committee. Similar to other universities, Purdue procedures can often change and were not well communicated. Templates had to be revised and required a series of reviews at the college level. Upon approval by the College of Technology curriculum committee the changes were voted on by the College of Technology Senate. The Senate only meets twice a semester so timing was crucial to be on the agenda. Upon Senate acceptance the changes were forwarded to the registrar's office for official input. The overall approval process took even longer than the committee's most conservative estimates. Any program looking to make similar curriculum modifications should anticipate a lengthy review process.

Faculty Retreat

Prior to summer break, the curriculum committee made a presentation to the faculty at the year end retreat. Each faculty member was asked to analyze their new courses and to be prepared to share and discuss their course learning outcomes during this retreat. During the summer each faculty member received the learning objectives as defined by ACCE and the industry competencies developed with input from an industry advisory committee in the spring semester of 2010 (Benhart & Shaurette, 2011). These were in Excel spreadsheets which allowed each faculty member to input their own information.

During the summer several of the faculty worked together within subgroups to coordinate their new courses. This work was valuable at highlighting who the primary instructor was on a topic and who was reinforcing these topics within their courses.

In August of 2011 prior to the first week of classes, the faculty met off campus for a full day retreat. Four hours of this retreat were dedicated to review of the curriculum. The first two hours were used to break the faculty into smaller subject groups to discuss their courses. There were two series of breakout groups to ensure that faculty teaching in multiple disciplines could participate. The last two hours were spent filling in large posters of the learning outcomes and competencies. Each outcome was discussed and the courses were listed in the tables. See Figure 3.

Figure 3

Conclusions

Over time the faculty of most CM programs reach a point in curriculum development when a level of satisfaction is reached that all stakeholders in the educational process are being well served by the educational program. This is especially true of long established programs with a consistent track record for student employment within a short period after graduation. Unfortunately, even with this apparent evidence of success, outside influences such as an aging faculty, economic pressure to increase delivery efficiencies, accreditation requirements, and university core curriculum requirements can force a review of the curriculum. Although the authors' experience with curriculum review does not present a universal response to these outside influences, it does serve as a useful case study of a curriculum review which benefited from a complete rebuilding of the curriculum. By starting from a perspective that no portion of the curriculum must be maintained in its current form, the faculty, through the detailed work of the curriculum committee, was able to identify areas of improvement that would not have been apparent if simple curriculum modifications had been the only response to current curriculum challenges. As a result, the committee was able to focus on competencies not addressed in the current curriculum. In addition, the review process exposed overlap in material presented in multiple courses. As a final benefit, the curriculum review prepared the faculty for an upcoming ACCE accreditation review, potentially reducing the preparation time required.

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