

AC 2010-1570: INDUSTRY COLLABORATION THROUGH A TECHNICAL AND LEADERSHIP LECTURE SERIES WITHIN A CONSTRUCTION MANAGEMENT CURRICULUM

Michael Soller, Indiana University-Purdue University, Indianapolis

Michael J. Soller., Strategic Account Manager at Bowen Engineering Corporation. B.S. Civil Eng., University of Dayton, M.S., Purdue University. He has over 24 years of commercial and industrial project management experience and was an adjunct professor for the Department of Construction Technology of Purdue School of Engineering & Technology at Indiana University – Purdue University Indianapolis (IUPUI) for 11 years. Mr. Soller is a member of ASCE, ASEE, AIC, Advisory Board with the Construction Technology department, past chairman of the education committee for AGC/Indiana, a registered Professional Engineer in Indiana and Ohio, and a Certified Professional Constructor within AIC. Mr. Soller was awarded the Associate Faculty Excellence in Teaching Award in 2000.

Daphene Koch, Purdue University

Daphene Koch, PhD is an assistant professor at Purdue University in the Building Construction Management Department. Daphene has over 10 years of college teaching experience and over 10 years of construction industry experience. Her construction experience included mechanical construction and industrial petrochemical projects in Indiana , Texas and East Malaysia.

Industry Collaboration through a Technical and Leadership Lecture Series within a Construction Management

Abstract

Students in construction management programs benefit from the expertise of industry experts who relate real life experiences to technical theory taught in the classroom. The lack of a purposeful series of offerings to the students can result in a haphazard approach to providing timely and topical information at appropriate levels of education. Industry advisory boards consistently encourage universities to provide students with current technical and application information. A coordinated series of lectures conducted by non-faculty subject matter experts can provide a connection between the university and industry. Using guest lecturers in a seminar format to presenting technical and management leadership information is one method to achieve the goals of timely and topical information. When the lecture series is organized to complement the academic department offerings educational goals can be reinforced.

This paper focuses on a series of lectures which provide specific technical information and management leadership practices that students will use in their profession. The paper describes a series of ten lectures focused toward two groups of students. Lectures focused toward freshman and sophomore students address topics related to construction applications, industry organization, and field production management. Junior and senior lectures address topics related to labor management, technical construction methods, and risk assessment. Each lecture is organized to complement the student level of education and generalize topics that are discussed as part of the academic curriculum. The paper identifies the ABET accreditation and department strategic goals that are achieved through the presentation of the coordinated lecture series.

Introduction

Educating students in a construction management curriculum involves exposing the students to a wide variety of technical and business management topics. Many of the subjects covered are introductory in nature because in total they are required to educate the student about the colloquial language and limitations of the construction industry. A common approach to supplement a curriculum is to invite industry professionals to lecture students on new methods or technologies used in the industry¹. Many times however, these lectures are on disparate topics that may not have a direct application to the curriculum. In other cases the lecture is presented to a large group of students that have different educational tenures with the result that the topic may be too advanced for some, or repetitive for others. Regardless of the approach, collaboration between industry and academia is beneficial because students receive current information from practicing professionals². When the curriculum and lectures are coordinated to purposefully supplement the student at their educational level, students gain a more complete understanding of a subject at the time the subject is taught. In addition to technical knowledge, companies also expect universities to train student to be successful contributors to their businesses³. A critical component of this business training for the construction industry is leadership training. Leadership is needed at all levels in the industry because of the team approach and collaborative nature of the industry. By identifying proven leadership characteristics at the same time

technical information is presented, students gain the tools to accomplish working with people at the same time they are working on complex solutions.

This paper describes the approach taken to develop and deliver a lecture series that is provided by industry professionals and coordinated with the institution curriculum. The lecture series addresses current topics within the construction industry while integrating five leadership characteristics from noted leadership authors Kouzes and Posner⁴. As part of the value for the institution, the accreditation, and institutional goals are identified to document the benefit of the series and coordination with the mission of the institution.

Significance of Collaboration

Institutions of higher learning are tasked with educating students so that they can enter the workforce with the knowledge necessary to contribute to business. Collaboration with industry is important for faculty to remain aware of the latest trends as well as guide students to opportunities for on-the-job training¹. In some cases institutions have developed specialized programs focused on a specific sector of the marketplace². In other cases institutions have used adjunct faculty to teach courses³. Regardless of the collaborative approach used, the construction industry needs individuals who can critically think about technical subjects, while simultaneously leading and working within a team environment. For this reason, academic professionals have access to new sources of information by collaborating with industry subject matter experts who also identify positive leadership characteristics. It is the leadership component, from a regulatory or business point of view, that represents the difference to the student.

By coordinating academic course work with the lecture topics, specific topics may resonate with students because they are learning about the subject during the same period of time in their educational career. Simply put, speakers from industry provide a different voice on a given subject. This subtle, yet clearly identified change in delivery method has a positive effect on the students. Similarly, when an industry professional identifies proven techniques that the student can use to be successful, the information provided by the educator is bolstered. It is this elevation of the subject and methodology that creates the synergy between academia and industry.

ABET Accreditation

Accredited engineering programs are evaluated on the basis on their ability to meet criteria established by the accreditation board of engineering and technology (ABET)⁵. The eight primary criteria for baccalaureate programs include descriptions for the outcome for students, program educational objectives, program outcomes and assessments, professional component, faculty, facilities, institutional support and financial resources, and specific program criteria⁵. Creating and delivering student instruction that meet some or several of these goals is important to the ongoing viability of the institution. Collaborating with industry on a technical and leadership lecture series achieves the criteria goals of program outcomes and assessment, professional component, and institutional support.

Specifically the ABET program outcomes and assessment criteria include that “programs must demonstrate that students attain....(d) ability to function on multidisciplinary teams, (g) ability to communicate effectively, (h) the broad education necessary to understand the impact of engineering solutions in a global economic, environmental and societal context”.⁵ Through the involvement of industry professionals who lecture on current technical topics while also describing the leadership characteristics that help implement the solutions, these goals are cohesively achieved. This particular lecture series does identify the multidisciplinary teams that are involved with construction, and the leadership component identifies the traits necessary to work with a variety of stakeholders to achieve project completion.

The general educational component of the professional component criteria is satisfied by involving industry professionals. This criterion requires that the general educational component complements the technical content of the curriculum. Supplementing the published curriculum with specific topics not covered during class periods meets this specific objective. By virtue of the ongoing engagement of speakers throughout the annual curriculum the institutional support criteria is partially met. The constructive leadership component of the criteria is addressed through the assessment of lectures by the students and through the curriculum review by the industry advisory board. The ongoing bidirectional feedback and subject matter content adjustment to relate updates in the industry assures that the topics meet the constructive feedback part of the criteria.

Institutional Goals

A new synergistic strategic plan was announced at this university in 2009. The plan will position the Purdue University to meet the challenges facing humanity, grow and create opportunities for the state Indiana and the global economy, and enhance student learning for success in a changing world⁶. The Purdue College of Technology new strategic plan has a mission to “provide a student-centered learning environment maintained to ensure that graduates are accomplished in technical expertise, leadership, and collaboration skills necessary to excel in the global technological economy.”⁷ Departments teaching construction management can be ABET accredited or accredited by the American Council for Construction Education (ACCE). Both accreditation groups require departments to demonstrate relations with industry.^{8,9} The lecture series demonstrates the connections with industry and academia and becomes an assessment tool for aligning the department goals and accreditation.

Leadership Traits

What makes this lecture series different than strictly supplemental technical seminars is the identification of a leadership characteristic associated with each topic. The series was developed as a part of a company’s leadership training. This company is in their third year of an in-house leadership program. This industry partner has embraced connecting industry to academia to fulfill their leadership goals. The development and implementation of the lecture series is an industry service part of the program. Subject matter experts from the company present the lectures and are experienced in leading project teams. These individuals have the technical experience and have been successful developing leaders in the industry.

There is extensive research about the role of leadership in organizations. Documenting these roles is not within the scope of this paper, however, through the leadership program based upon the Kouses and Posner book “the Leadership Challenge”⁴, the characteristics discussed ring true. Kouses and Posner say in their leadership book, that “Leadership is not about personality; it’s about behavior”⁴. The five leadership practices that Kouses and Posner say represent best in class are; “Modeling the way, inspiring a shared vision, challenging the process, enabling others to act, and encouraging the heart”⁴.

In their book, Kouses and Posner describe what specific behaviors are associated with each common leadership practice. Through descriptive stories and specific examples of poor behavior the benefits of good behavior are documented. Based upon the universal opinion that leadership is not a title specific expectation, students need to be consistently exposed to leadership subjects that teach them how to accomplish their goals. These goals can specifically apply to technology implementation, business matters related to managing clients, or personal subjects regarding their interactions with their internal or external relationships. The value of describing these traits in context with a technical subject is to generalize the application of positive leadership behavior. These behaviors are associated with specific lecture topics based upon the type of topic and year of the student in their education. By identifying a tangible leadership behaviors through the course of a multi-year education at the institution, each student will receive a recurring message about proven best leadership practices.

Organization of Lectures

Information presented to students by a guest lecturer should address topics that are relevant and interesting. The lecture series offerings are included in Table 1. The table aligns the topics of each lecture to a course title and student level. This alignment allows the instructor to tailor the specific course content and timing of the external lecture with the approved syllabus. The primary result is a reinforcement of the course content through the presentation of industry information from a practitioner point of view.

Table 1. Lecture series topics as tied to class and course

Existing Course Title	Lecture Title	Student Classification
Introduction to Construction Management	Introduction to Construction Applications	Freshman
Introduction to Construction Management	Information Management in Construction	Freshman
Construction Management	Production Management	Sophomore
Student Organization or Design Build Class	Overview of Design-Build	Sophomore
Project Management for Construction course	Leadership in the Construction Industry	Sophomore
Design course	Advanced Membrane Filtration Technology	Junior
Mechanical Systems for	Common Water/Waste Water	Junior

Buildings	Technologies	
Supervision or Labor Management Course	Working in a Union Environment	Senior
Construction Company Management Course	Project Labor Agreements	Senior
Cost Engineering Course	Estimating & Contingency Cost Development	Senior

Topics that are too broad or discuss subjects, for which students do not have an initial content background, could bore the students. Thus they will not actively listen and generalize the information. In a similar manner, if a subject is germane to the course content that is recently relevant, then the student will likely understand the purpose and potential benefit of the lecture content. This subject matter relevance is a primary reason for organizing this lecture series with a stratified approach. The student classification is based upon the academic credit achievement, not their age or tenure in school.

Lectures focused toward freshman and sophomore students address topics related to construction applications, industry organization, and field production management. Junior and senior lectures address topics related to labor management, technical construction methods, and risk assessment. Each lecture is organized to compliment the student level of education and generalize topics that are discussed as part of the academic curriculum. Through the focused lectures students receive specific instruction regarding specific industry issues and solutions that otherwise may not be addressed in detail within the customary class lectures. The collaboration of the lecture content with the academic instructor is an inseparable component to achieve the ABET and departmental goals.

The introduction to construction application lecture covers: Modern history, labor classifications, common equipment and systems, vocabulary, management leadership, financial risk/reward, safety considerations, business management, administrative, personnel, financial, technical, and safety issues. These introductions are necessary for students to understand that construction professionals should be conscious of each subject because each directly relates to client satisfaction and business success.

Addressing information management, the subjects discussed include key performance indicator (KPI's), industry reporting repositories, common reporting functions/ formats, roles / responsibilities between parties, what is important info, what is important to clients, and indentified best practice resources. These subjects are focused on providing a baseline for students to understand the relative importance of information management to the overall construction process. In the multitasking environment that students currently operate, identifying the relative importance of different information subjects is important for career success. By giving the students practical examples when and where each type of information management can be used to structure and focus project information, a disciplined approach to maintaining communication can be reinforced.

The subjects of production management, design-build construction, and leadership in construction are presented to sophomores because each involves the students knowing more that

the basic industry operation. In production management the history, applications, purpose, benefits, methods to track planning and results, requirements to apply concepts, examples of applications and results are presented based upon proven field applications. The subject matter expert presenting this information describes how manufacturing efficiency is applied within the construction industry.

Although design-build construction is discussed in academic courses, this lecture focuses on the current applications and how the delivery method has changed over the past decade. Design build is alternative method of procurement and is becoming an increasingly prevalent method for public works construction. This presentation provides a brief overview of its historical perspective, how it is being utilized in the US, and the potential benefits for an owner.

The general lecture regarding leadership in construction is offered to sophomores because as they continue their education, leadership practices are the way through which the theoretical concepts are implemented as part of field operations. This lecture reviews the specific Kouses and Posner leadership behaviors in a single seminar format. The lecture reviews the five qualities of management leadership and how they are applied within the construction industry.

As the series continues, junior and senior students are presented information that is more technically focused. Junior students will receive specific implementation information about water treatment technologies and working with business concepts. Juniors will receive information on advanced membrane technologies and their applications. Specifically the students will hear about the history of advanced membrane technologies (AMT), what they can and are used for, benefits and limitations of systems, and common installation and operational issues related to AMT.

A separate overview lecture will address common systems and materials used in water treatment systems. Some students will receive a background in the technologies used if they are educationally focused on treatment. For those students who are not, this lecture will provide a current industry application perspective. The concepts reviewed include a description of common process flow diagrams associated with water and waste water systems, a description of the different treatment steps, and reasons for the treatment processes. Information on the national water and wastewater standards and trends and a description of the different materials and mechanical systems used to install and operate treatment systems. Although some students will gravitate toward commercial or residential construction, an underlying education in water systems is necessary for anyone involved with managing construction.

As students complete their senior year lectures on working in a union environment are offered due to the unique nature of the labor relations. Subjects covered include a description of the development of construction unions and the crafts covered by agreements. A review of articles common in union agreements including; Work hours, holidays, overtime, and interaction between crafts. Finally, a discussion about union organization within states and nationally. These business issues are important to provide a specific yet important perspective for working in certain sections of the country.

For similar reasons the lecture on project labor agreements provides a construction business perspective that relates to public policy yet not generally examined within an academic curriculum. Subjects covered in this lecture include a history and review of project labor agreements (PLA), their uses, and applications. It includes a review of what is covered by agreements and what is not covered by agreements and a discussion about the purpose and application of PLA's. This particular lecture is intended to meet the generalization criteria identified as a goal by ABET.

Finally, senior students are presented with a lecture on estimating and contingency cost development. This lecture identifies five methods to develop cost contingency amounts in construction projects. It also describes the methods and stages of design development and when each estimating method can be applied. The lecture ends with a description of the limitations and risks associated with the use of each method in the development of cost to include in construction pricing. This lecture exposes the students to concepts about understanding the variability of information and addressing this variability within a business decision making environment.

Curriculum Coordination

Development of the technical topic lectures originated from the industry professionals who are subject matter experts. Several of the lectures had previously been offered as independent seminars. The initial cohesive list of topics was reviewed by faculty to aligned with curriculum. By diversifying the offerings, and pairing them with the classes offered to the students of a stratification group, students are universally addressed by outside lecturers. Exposing students at different stages in their education to industry professionals achieves the ABET goals along with others that different institutions have documented are beneficial¹.

Focus on Student Benefit

For each of these lectures, the essential goal to achieve is the cohesive and relevant presentation of information. By combining technical topics that have been requested by the department, and endorsed by the external advisory committee, this lecture series provides a definitive method to achieve industry collaboration. By adding the leadership education component to each of these lectures students receive information that reinforces their non-technical coursework with interaction from industry professionals. Finally, by purposefully coordinating the topics and timing of the lecture delivery, the role and purpose of the series can demonstrably meet the accreditation and institutional goals.

Recommendations and Future Work

The lecture series is being planned for Spring 2010. Courses which have been identified will include the speaker as a part of the course schedule. Data regarding information retention and generalization will be collected from students upon completing of each lecture through the use of quiz and lecture evaluation feedback surveys. Using this information, the lectures will be revised as necessary to refocus the lecture content. Other issues such as the coordination of the course

curriculum and the relevancy of the information will also be evaluated using the information received from the students. The results of the assessment will be the subject of future studies.

Bibliography

1. Wahby, W.S. *Industry and ET education collaborations from a construction engineering perspective*. in *2004 American Society of Engineering Education Annual Conference and Exposition*. 2004: American Society of Engineering Education.
2. Viswanathan, S. and H. Evans, *Harnessing industry collaboration in developing graduate-degree programs*, in *2009 ASEE National Conference*. 2009, American Society of Engineering Education.
3. Dobrowski, T. *University and industry collaboration ideas beneficial to both*. in *2006 National ASEE Conference*. 2006: American Society of Engineering Education.
4. Kouzes, J.M. and B.Z. Posner, *The leadership challenge*. 4th ed. 2007, San Francisco, CA: John Wiley & Sons, Inc. 351.
5. Accreditation Board of Engineering and Technology, *Criteria for accrediting engineering programs*. 2007, ABET: Baltimore, MD 21202. p. 24.
6. XXXX University Webpage.www.XXXXX.edu.
7. College of Technology Strategic Plan, 2009, http://www.tech.xxxxx.edu/About_Us/Mission_and_Vision/index.cfm
8. ABET, Inc. (2006, December 27). Criteria for accrediting engineering technology programs – Effective for evaluations during the 2006-2007 accreditation cycle [PDF Document]. URL [http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/T001%2006-07%](http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/T001%2006-07%20).
9. American Council for Construction Education. (2007, February 13). Document 103: Standards and criteria for accreditation of postsecondary construction education degree programs [PDF Document]. URL <http://www.acce-hq.org/PDF/form103.pdf> .