Burning the Candle at Both Ends: Igniting Advisory Board Assessment at Capstone

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Advisory boards help establish outcomes, set priorities and shape curriculum, igniting the first end of the candle. But too often this important relationship flickers and wanes as educators try to implement the vision provided by advisors. We need to fuel the fire instead. Bring boards and students together, demonstrate skills, establish relationships and networks, and assess students and faculty at the capstone phase, igniting the second end of the candle. Explore options for engaging advisory board members at both ends of the academic cycle, but especially at capstone presentations when feedback and connections are critically important.

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Introduction

"The term "capstone" is widely used to describe a course or experience that provides opportunities for a student to apply the knowledge gained throughout their undergraduate degree. This involves integrating graduate capabilities and employability skills, and occurs usually in the final year of an undergraduate degree."[1] Capstone courses are integral to many college curriculums, but are especially prevalent in the engineering and technology disciplines. A capstone course is typically designed to allow students to demonstrate the skills and knowledge they have accumulated during the whole of their studies. Often this demonstration takes the form of a team of students working together to solve a complex problem specific to their discipline. The problem may be hypothetical and designed by faculty, or real and driven by industry requests.

Advisory Boards

The role of the advisory board is critical, as they are guiding the overall direction of the programs. "One of the principal needs and wants of industry from schools, is access to a pool of good graduates that they can choose new employees from."[2] At Sinclair we hold annual meetings of each of our discipline-specific advisory boards. The goal is to determine industry trends and expectations, as these businesses are, hopefully, the future employers of our graduates. At these annual meetings we provide an overview of the current curriculum and corresponding skills our students should possess upon graduation, as well as a summary of improvements we anticipate making in the coming year. We then ask for feedback and a discussion ensues regarding content and philosophy of the programs. This feedback, coupled with ABET and college criteria, inform the curricular changes and adjustments made each year.

Additionally, we invite advisory board members to our annual capstone presentations to garner feedback. The improvement of this feedback loop is the focus of this paper.

The goal of polling the advisory board on a regular basis is to inform improvements to the curriculum.

Community College vs University

A typical community college course of study spans two academic years[3], with students being required to take approximately 105 quarter credit hours or 70 semester credit hours. Faculty at community colleges function primarily as teachers, as there are no courses above the "200" level and therefore no advanced students to act as teaching assistants. New course design, curriculum revision, research and other traditional activities of the academic must be completed outside of a typical teaching load of fifteen to twenty quarter credit hours.

Another distinction of a typical community college curriculum is the depth of exposure students are provided on a specific topic. In Sinclair's architectural technology course of study approximately two thirds of the required credit hours were general education or electives, leaving thirty to forty quarter credit hours to cover all required discipline-specific material. As a result, most topics have one course dedicated to them. In respecting the time requirement for a community college curriculum we must cover information as efficiently and effectively as possible. Skills, such as computer literacy or communications, are embedded in each discipline-specific course, working to reinforce learning as much as possible.

There are many other factors which make community college teaching unique, such as the profile of our typical student and the amount of time most students take to complete a "two year" degree. These factors are beyond the scope of this paper.

Status Quo at Sinclair

Sinclair's Engineering Technology Design department includes six disciplines which have historically all completed separate, discreet capstones. These disciplines include:

- Architectural Technology
- Civil Engineering Technology
- Construction Management Technology*
- Environmental Engineering Technology*
- HVAC R Technology*
- Mechanical Engineering Technology*

  ** indicates ABET accredited program*

When viewed as a conglomerate, these disciplines constitute the study of the "built environment'. Built environment encompasses all aspects of how mankind impacts the earth, from constructing roads and transportation to erecting building to managing landscape and natural resources. Anytime we alter the earth we are participating in an aspect of the built environment.

Until 2009, these single-discipline capstones would culminate with a team displaying work to faculty and advisory board members. Team size would typically range from four to six students, with a faculty from their discipline mentoring three or four teams. Faculty and advisory board members would critique the work for each team.

These presentations utilized low technology, often nothing more than drawings posted on a wall and a corresponding written report or other paper documentation. Sometimes a physical model was constructed, depending on the discipline. Feedback from advisory board members was gathered via paper surveys or comment cards and tabulated by faculty.

This was also the status quo across the country. Todd et al[4] completed a 1994 National Survey of Engineering Capstone Design Courses, with a follow up survey completed in 2005 by Howe and Wilbarger.[5] Sinclair's development of traditional capstone methodology was in keeping with national trends.

Capstone Redesign

In 2009 many factors converged at Sinclair and in the industry that prompted the development of a more advanced, multidisciplinary capstone offering, as well as a more advanced and rigorous tracking of feedback regarding outcomes.

Tradeshow

In place of the typical presentation format we have implemented a "tradeshow" approach. After dinner is served to the group each team is invited to make a brief (5 minute) presentation to the entire gathering, highlighting their solution for the challenge and encouraging them to visit their "booth". Each team is provided with computers, projectors, tables, etc. to facilitate the displays, which typically include hardcopy documentation, computer animations, computer interaction, collected data, material samples, equipment, physical models, etc. Advisory board members circulate through the displays, discussing with students as appropriate. Students are provided with business cards to distribute to guests.

At the end of the evening guests are asked to complete a survey as they leave, providing important feedback as described below.

Integrated Project Design (IPD)

Virtually every built environment project, real or hypothetical, involves multiple disciplines. Building a typical small office building, for instance, will involve the design efforts of an architect, structural engineer, civil engineer, mechanical engineer and perhaps a landscape architect. During the construction phase the work of a general contractor or construction manager will coordinate more than a dozen trades to complete the project.

In a traditional project delivery model the architect would typically lead the design effort, bringing in the services of various other design professionals as required to complete the work. This series of design efforts was often linear in nature, with the architect completing their work first, followed by a civil engineer, a structural engineer, and finally a mechanical engineer. This linear progression meant that designers who touched the project toward the end of the cycle had little opportunity to impact the overall design. These folks were usually relegated to "making it work" within the confines already established by the earlier design work. Many projects suffered because the important contributions which could have been made by a variety of designers were lost due to timing of their input.

Beginning in approximately 2005, the built environment industry made an effort to integrate the design process. Now, rather than a linear process for design we bring all of the design disciplines to bear on the project in the very beginning stages of design. With the advance of computing technology and modeling software it is now possible to quickly create preliminary designs and analyze using criteria for energy performance, lifetime costing, orientation to sun, day lighting, etc. This early analysis can be brought to bear by a variety of disciplines, giving importance to all constituents rather than reinforcing the linear progression of design. The design process has become integrated, with the priorities of all built environment designers being heard at the inception phase.

As a result of the industry move toward IPD, our department has structured interdisciplinary teams for the capstone, with students representing each of our six disciplines assigned to each team. If a low student count for a particular discipline prevents an even distribution of participants we may elect to establish a "consultant" discipline team which will provide services to all teams. Again, this multidisciplinary team approach has been embraced by the industry.

Beginning with the 2009 capstone the Engineering Technology Design department began inviting allied disciplines to participate in the capstone, either as members of an interdisciplinary team or as client constituents. Interior Design students have joined our teams while Culinary Arts students have been clients for a new restaurant design project.

Building Information Modeling (BIM)

Approximately ten years ago, in 2000, computing technology advancements allowed for the development and deployment of software that enables designers to quickly and accurately model buildings in a specific geographic context. The important aspect of these models is the level of detailed information which could be embedded in the model. For instance, a wall on an architectural plan was previously represented with a series of lines signifying the inside and outside edges of the wall mass, and perhaps additional lines to represent cavities or studs.

With BIM software drawing a wall is actually placing a system made of components, including studs, drywall, insulation, siding, vapor retarders, etc. These are referred to as smart components because each brings with it the necessary information to allow the model to be analyzed. R value, price, availability, distance for shipping, weight, color and other attributes are all attached to the various materials, allowing analysis software to provide feedback on energy consumption, budgeting, etc. This feedback, combined with the ability to quickly make adjustments, leads to a greatly improved design influenced by all disciplines early in the project lifecycle.

Teamwork Focus

Advisory board members have consistently reinforced the need for graduates to be adept at teamwork. As indicated above, the majority of built environment projects will require the interaction of multiple disciplines. Team members may all come from within one firm, but are more likely to be assembled on a project-by-project basis from a variety of discipline-specific firms. As a result, employees must be able to transition quickly from team to team.

Work has been undertaken to determine the appropriate team structure for the Sinclair capstones. "First, as groups become large, there are problems of free-riding, social loafing and conformity; factors which Steiner refers to as process losses."[6] Balancing numbers of students of each respective discipline, as well as their relative academic performance, was a starting point. Further work has been done to factor in personality and leadership abilities. CATME, an online peer assessment tool, has been used in each capstone to allow students to assess each other, and this has been factored into final grading.

Assessment

The development of our capstone includes serious efforts to track and assess program outcomes established with our advisory board to the current knowledge demonstrated by our graduates. We have enlisted the help of Kevin Jolly, PhD, of Sinclair's Research, Analytics and Reporting Department to create on-line surveys for each participating discipline, tracking outcomes, including ABET accreditation outcomes, to work shown.

At the capstone presentation a bank of laptops is set up to allow advisory board members to complete online surveys of the student work and program outcomes. Surveys are administered anonymously following student presentations. Respondents are asked first to select a student team to evaluate and then a discipline within the team to evaluate. Likert scale rankings are gathered for performance as correlated to various program outcomes. (Program outcomes differ from discipline to discipline.) Following the completion of a survey regarding the performance of students of a discipline on a team, respondents are invited to complete surveys of other disciplines or of other teams.

This information is compiled and presented by Dr. Jolly, and used to inform curricular improvements, as well as summary reporting for ABET accreditation visits.

Assessment Improvements

Planned improvements for the assessment surveys include developing behavior-based rather than Likert scales, as much of the response gathered via rankings is subjective.

Part of building a strong culture of assessment within the department and the various disciplines has been to involve the advisory boards in our process. To do this we stress the importance of their input, with emphasis on "closing the circle" with program assessment and feedback, or igniting the other end of the candle.

For the 2012 capstone we will invite advisory board members to bring their web-enabled devices, such as iPads or smart phones. This will enable participants to take surveys online utilizing these devices and college Wi-Fi, in addition to the laptops we have traditionally provided. The surveys will be identical, regardless of the method utilized.

A series of 2D tags will be created for each team and each discipline. The tags may be read with a free tag reader application, such as Microsoft Tag. Attendees will be encouraged to install this or a similar application prior to attending. (Invitations will include instructions and tags for demonstration purposes.)

Utilizing tag technology we hope to allow attendees to respond immediately after visiting each tradeshow booth. Our hope is that more immediate feedback based on a single presentation will provide more in-depth and focused critique, though we risk losing a qualitative analysis that may be present of respondents viewed all displays prior to completing the survey.

Additional tags will be provided on the evening's program to allow attendees to evaluate the general capstone effort and the programs.

There is consideration being given to having student websites established which are accessible via tag link which may encourage additional interaction between students and participants. Guests could scan a tag on a student name badge and be taken to a website which includes the team's work, the student's individual work, biography, resume, etc. This is in the early planning stages and has not been tested, though the web version has been implemented by Penn State for several years.[7]

Conclusions

Sinclair's ETD capstone has made significant improvements during three years of intensive efforts to include Integrated Project Design (IPD) principles, Building Information Modeling (BIM) and a general embrace of technology-driven assessment. Including our various advisory boards in this process, especially during capstone assessment, provides crucial information for the future success of our students and the continued viability of our programs, igniting both ends of the advisory board candle of assessment. Our task now is to continue to raise the bar, such as with this year's implementation of tagged presentations and wireless web-based assessment tools.

References

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