Utilizing Industry Professionals in a Senior Capstone Project

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Abstract

Starting in the academic year of 2016, two regional campuses of Purdue University unified. In doing so, degree programs that were the same on each campus had to align themselves to offer identical courses to allow students to seamlessly move between the two campuses. In general, this did not pose much of a problem for the Construction Engineering and Management Technology (CEMT) degree program as all but two of the courses in the degree program were already being offered on both campuses.

The one course that did offer a challenge was Senior Project. The Hammond campus had always had individual projects while the Westville campus (which only started offering the Bachelor of Science in CEMT in 2009) had started using a team project approach. The team projects also involved members of the Industrial Advisory Board, as well as other members of the construction industry, to help plan and evaluate the projects. This paper will look at how the 2018 Senior Project collaborated with industry on the project and the role that the Industrial Advisory Committee had in forging a compromise on how the Senior Project is now being offered on both campuses.

Background

The author graduated with a Bachelor of Science in Construction Technology from Purdue University Calumet in December of 1988. In the Fall of 1990, he was invited back to teach a Design of Reinforced Concrete class and this began a nearly fifteen year stretch of teaching two to three classes each semester while working on a full time job and managing to squeeze in a Graduate School. However, after a child and moving to farther from campus, it became apparent that this was not going to last much longer and the author decided it was time to back out. Another regional campus however had an opening for an Adjunct Professor and in the Spring of 2004, the author went from one campus in the fall to another in the spring. It was during this time that the new campus decided to hire a new, full time faculty member and in the Fall of 2004, the author became a new tenure track faculty member.

The first task given was to upgrade the program. The program had a generic Bachelor of Science in Engineering Technology with an emphasis in Building Construction Management. In setting up the new program, the author relied on what he knew and was he also knew was successful. The new program was patterned after the program on the previous campus that he had attended and taught at. While the planning took less than a year, the bureaucracy took another four years. Finally, in the Fall of 2009, a brand new Bachelor of Science in Construction Engineering and Management Technology was now offered.

But as in all things, there is always something around the corner to that is unexpected. It was announced in the Fall of 2014 that the two campuses would be unifying. The reasoning was that with two campuses only forty miles apart, one administration should be able to manage both campuses as a single university.

Unification

For much of the first year, not much progress was made on the academic front. However, in 2015 as the deadline loomed, a sense of urgency had the Colleges were ordered to align similar programs on each campus. The original thought was that if a student was studying a degree program on one campus for seven semesters and then moved, they should be able to flawlessly pick up the eight semester on the other campus. Therefore, all degree programs that were offered on each campus must have identical plans of study. While this caused some major rifts in other programs, because the degree program at Westville was patterned after the degree program at Hammond, there was only two courses that were different on each campus. A compromise was reached and each campus kept one of their respective courses while adapting the other course from the other campus. The one class, however, that an agreement could not be reached was Senior Project. The Hammond campus had always done an "individual" project in which the students each work on an independent project. The prerequisite is "Senior Project Survey" which is a one credit hour course in which the students submit written proposals which the faculty evaluate for worthiness. Upon acceptance of a proposal, the balance of the semester is spent on research and oral presentations to the faculty.

The Westville campus had decided to not place the Senior Project Survey on the plan of study as General Education (GenEd) requirements as well as a decision by the Indiana Commission of Higher Education to limit Bachelor programs to 120 credit hours were starting to infringe upon the program, so it was decided to maintain an entry level freshman course at three credit hours, so as to leave the credit hour in "reserve" in the event that further intrusions of GenEd were advanced, the entry level course could be kept as an alternative to the GenEd general freshman course. The problem was that students coming into Senior Project, in many cases, did not have an idea as to what is was they wanted to research/test. In 2011, there was a large group of seniors (nineteen) who took Senior Project, and several weeks into the semester, five of them had not yet found a suitable project. To compound the issue, the author served as the sole advisor for Senior Project who met with the individual students on a weekly basis (as opposed to PUC which allowed the students to choose advisors who did not receive contact hours for this). Needless to say, the overall quality of the Senior Projects at Westville in 2011 was not what one would expect from a capstone type of project. At this point, the author decided to switch to a team based Senior Project and eliminate the need for the Senior Project Survey course altogether.

Because of the lack of a prerequisite course for Senior Project, it was decided to assign projects that would encompass lessons from as many of the required courses as possible. It was decided to divide the students into assigned teams and give them the same problem to work on as a design build competition. The project typically involves a given parcel of land, the requirements of the building from the owner as to the use and occupancy of the building, and a long term financial component. The Industrial Advisory Committee (IAC) was recruited to review the project and offer suggestions towards the end of the Fall semester. The first week of classes in

the spring, all of the students meet and the assignment is distributed. Groups are assigned (names are dropped into a 6" x 12" concrete test mold and drawn) and are limited to no more than five students. Because registration starts in October, the approximate class size is known well before the start of the Spring semester. This allows for customization (size and complexity) of the project to accommodate the number of students to ensure a realistic distribution of work.

Unification and Senior Project

With the unification, Senior Project was the one course in which the faculty could not come to a consensus on. The Hammond campus was insistent on maintaining the individual projects while the faculty on the Westville campus were equally insistent on maintaining the group projects. Upon presenting what was being done in Westville, the faculty of the Hammond campus were not in favor of this as they felt that the teams would be loaded up with friends and that there would not be an even distribution of work. Also, they did not feel that there was not an adequate amount of work to be worthy of a full semester project.

The matter was brought before the Industrial Advisory Committee and the members who had previously participated in the Senior Design evaluations from the Westville campus were heavily in favor of keeping the team projects. The committee members originally from the Hammond campus were somewhat evenly split as to which approach they liked better, with no strong opinions either way. It was decided to compromise and offer both options on each campus. Because of this, the Senior Project Survey had to now be offered on the Westville campus. Because the project was to be assigned, those students wishing to take group project option now needed something else to do for Senior Project Survey. The students are first assigned a past project in which they write a sixteen page critique for the project. A second assignment involves answering a series of questions relating to design which could be calculation based or code based (the project could located anywhere in the continental United States). The final component is to interview a graduate who has taken the course so that the students have an idea of the commitment involved in performing the project.

The first three years of unification has seen a shift in the student participation in Senior Project. In the first year all of the students in Westville performed group projects while all the students in Hammond chose the individual option. These students in Hammond reported liking the concept of the group project, but balked at the idea of not being able to pick their own groups. One very positive outcome of the unification however, is the ease in which students can now sign up for classes on the other campus. Before, they actually had to fill out paperwork to "transfer" if they wished to take a class on another campus (typically because it worked better for their schedule. Now, they simply can choose where to take the course as they sign up. Because of this, there is far more interaction between the students and also a better understanding of the process. As a result, there are more student crossing over to participate in the group projects. Also, since the unification, the entire IAC is invited to evaluate the projects and there has been participation for members who were not previously involved. Now that this has happened, the committee is overwhelming in favor of the group project.

Senior Project – 2017 Westville

A great example and further expansion of industry involvement was the 2017 project. The instructor was visiting two graduates of the program at their office. They both work for Clayco (a $2B/year design/build/real estate firm with main offices in Chicago and St. Louis) and noticed pictures and a model of the newly completed Zurich World Headquarters. The graduates arranged for an introduction with the Division Manager and Executive Vice President who were in charge of the project. Two meetings were arranged and the Clayco representatives give the instructor cost data, design information, and other details that would allow him to put together a detailed set of project requirements. The Clayco representatives also reviewed the project at the same time as the IAC and were also invited to participate in evaluating the project. There were nine students registered in the Westville campus and the project was given as a forty acre parcel of land with a creek running through it. The owner wanted to build a large (650,000 square feet) research and development facility that straddled the creek. The project required a full set of drawings for the shell only (full details drawings were not required, but enough information is required to determine an accurate cost estimate). A full set of civil drawings was also required and the students were not told that the parcel of land was classified as a wetland. In addition, all structural calculations, as well as sizing of heating/cooling units, fire protection, and plumbing was required. In addition to the cost estimate, a complete schedule encompassing the entire project including design through occupancy, a Quality Assurance/Quality Control (including the design) Manual, Safety Manual (including lift plans), and a financial component. The financial portion of the project was to encompass determining operating cost including maintenance and projected utility costs for a ten period. The final component is a formal presentation in which the students "sell" their design to the "owners".

Project Scoring

Once the students have completed the project, their work is posted to Dropbox and the usernames and passwords are forwarded to the committee members. With this, the committee members also receive an excel spreadsheet with the above listed project requirements listed (they are not equally weighted) as well as a line item for the presentation. They are invited to score (0-100) individual line items and can pick and choose which items they wish to evaluate. Because many people in the industry have expertise in a particular discipline, this works well as many of the committee members (referred to as "Evaluators" to the students) choose to only look at one particular area. It should be noted that the individual committee members scoring of the projects are equal in weight to the instructor. All of the scores are simply entered into a master excel spreadsheet and averaged, giving the group the overall grade.

Knowing that sometimes group projects are not really "group", it was decided to not simply give the entire group the same grade. Following the presentation, the students are also given an excel form in which they evaluate themselves and their groupmates. Each student comments on the others work (quality, quantity, attendance at meetings) and assigns a percentage of the work that they think each group member, including themselves, performed (these evaluations are kept strictly confidential). One note on this, the syllabus contains verbiage allowing the instructor to disregard any student evaluation that is deemed self-serving or malicious. Having used this approach for several years now, it has been observed that the students who do not carry their full

weight tend to evaluate everyone one in the group as performing equally and deserving of an equal score. Those students, however, who shoulder the majority of the work tend to be brutally honest in their appraisal and scoring. Because the instructor meets with the students on a weekly basis, he is well aware of what each student is doing and can make an educated judgement if the need arises. A great example of this occurred several years ago when a student was not satisfied with his final grade and brought his parents in to see the Dean of the College. The instructor was asked to attend the meeting and brought the evaluation sheets. Once permission was granted from the student to read them (in compliance with FERPA laws), the instructor read the evaluations (with the Dean reading them over his shoulder) so that everyone could hear what his fellow groupmates thought about his performance within the group and without allowing the student or his parents to see the individuals who wrote the evaluations. The matter was dropped immediately following the meeting.

This is also a good example of how the Hammond campus's faculty concern regarding "friends" giving good reviews to fellow students even though they did not perform well was shown to be, to a great extent, unwarranted. In the two years (and two cycles of Senior Project) since the unification, seventeen students had worked on the group projects with five of them not achieving a satisfactory final grade.

Conclusion

Being that the Industrial Advisory Committee if filled with industry professionals, many of whom are graduates of the program, their initial input on the project serves two purposes. First, they have varied experiences and their suggestions often lead to a greatly enhanced project. Second, they start to become invested in the project from the beginning. Because of this, more of them are likely to continue to serve as evaluators. In 2016, of the twenty two committee members, seven attended the presentations and a total of ten turned in evaluations. In 2017, only two attended the presentations (there was inclement weather and during the second presentation the tornado warning alarm was triggered and everyone in the building had to evacuate to the basement) but thirteen submitted evaluations. To be clear, not all of the evaluations were full reviews as mentioned before some evaluators select only certain sections (such as the cost estimate) to review. However, considering the amount of time it takes to actually review, score, and comment on this, getting roughly half of the committee to do so seems like a high percentage.

The added benefit is that the program is showcased to our advisory members who in turn promote the program. In addition, in 2017 soliciting the help of a major firm with no real connections to the university not only introduced us to them, but has started talks with them on how we can partner with each other in the future.

This has all become important as since the abstract for this paper was submitted, the dean as stated that following this academic year, he no longer wants two methods for performing Senior Project and that he would prefer that we adopt the group project approach. While the faculty in Hammond are still insistent in maintaining the individual project, the fact that the Industrial Advisory Committee, along with the students, prefer the group project weighs in the decision.

Biographical Information

Thomas J. Dobrowski received his Bachelor of Science (1988) and Master of Business Administration (2001) from Purdue University-Calumet. He started as an Adjunct Faculty Member in the Construction Technology Department in 1990 and taught continuously for fifteen years at Purdue University-Calumet before accepting a full time faculty appointment at Purdue North Central (now unified with Purdue Calumet and known as Purdue Northwest) where he is an Associate Professor. He has worked continuously in the construction (Project Manager for a commercial general contractor) and engineering (engineering manager for a firm specializing in testing of the post tensioned containments of nuclear reactors and in various capacities for a consulting engineering firm) field since 1985. He has two children and lives with his wife Sherrie in Valparaiso, Indiana.