AC 2008-2694: TEAM TEACHING TO INSTILL INTEGRATION IN A MULTI-DISCIPLINARY CLASSROOM

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Multi-disciplinary Teaching to Instill Integration in a Multi-disciplinary Classroom

Introduction

One of the missions of our college is to engage students in multi-disciplinary activities. This is a goal for our department also, primarily because many of the instructors graduated from the college, worked elsewhere, and have returned to share their academic and professional experiences with students. There are class room models available for integrating multiple disciplines into a single project – some linear, some parallel, and some truly integrated. Regardless of the model it is beneficial to have instructors who have a passion for what they teach and who want to work together, and have a team of instructors who can bring multiple perspectives to a given topic.

It is not uncommon for college level courses to be team taught, but it is not the norm. Instructors involved in team teaching typically have two options available for implementing the course.

- A tag team approach where one instructor may teach the first half of the class and the second instructor the later half
- A collaborative model where each instructor attends each session and lectures at each session.

Classes which utilize the first option optimize teaching resources, but without meticulous coordination, the students can be left with a disjointed learning experience. Students may comment about conflicting design philosophies, varying nomenclature, adjustment to varying teaching styles and assessment techniques, or simply a repeat of material covered in a previous lecture.

The most successful teaching endeavors have occurred when the teaching team collaborates before, during, and after each lecture topic. While this may require additional hours to prepare the course material, the learning benefits and learning experience have proven to be positive based on student evaluations and feedback from professional advisory councils. The author has implemented two new design courses which incorporate multi-disciplinary teaching teams for multidisciplinary studios or labs, as well as, participated in and observed the effects other models of team teaching.

This paper will explore the advantages and disadvantages in team teaching to enhance student learning in a multi-disciplinary environment. Using new and existing courses as case studies for describing the pros and cons of the two team teaching models, the paper will highlight how multi-disciplinary teaching teams have helped encourage students to participate in design studios which promote an integrated delivery approach

Uni-disciplinary Teams – Uni-disciplinary Class

One model for team teaching is the tag team approach where one instructor may start the term and another will finish the second half. The instructors typically do not attend lectures led by the

other professor and coordination occurs at the beginning of the term to divide up the work and again midway to find out what topics were covered and a general overview of the students' accomplishments. There maybe a sense of comfort between the teaching team because teaching is within its' concentration. There are numerous reasons why this mode of team teaching is proposed: instructors may be unavailable for significant portions of a term due to external obligations, balancing work loads, matching instructor's with different strengths in a particular topic to provide a well rounded exposure to a subject, enhancing student learning by exposing students to multiple view points, etc.

In my experience, which is based on personal observations and student feed back, this model is successful when the two instructors have been working together for a long time and have compatible goals and pedagogy or if team teaching is proposed as a benefit to the students rather than to accommodate the needs of the faculty members. In the latter case, the team must commit to regular meetings to coordinate lecture and homework assignments in order to minimize overlap in material and provide a smooth transition from one instructor to the next. In reflection, the requirements of team teaching are no different than the team building skills we try to impart on the students by assigning group projects. When a project is completed by a group it is essential that the work be completed collaboratively to increase the chances of success. This model is relevant in academia, i.e. team teaching as well as business, i.e. Construction projects.

Our department has recently started a new degree program for the students. In order to "lighten' the load on the instructors and to provide a broader view on engineering topics, the department has elected to invoke a team teaching approach for the new program. The classes have been taught in two manners, one tag team and as a couple. An informal survey of the students was conducted and their comments or apprehensions for the tag team approach are;

- I'm worried about the approach our next instructor is going to take since we haven't seen him in class.
- I know the two instructors teach differently and I'm curious how this will work out.
- Will the homework be similar?
- How will the grading work?

In this particular class there was nominal coordination and communication between instructors and very little communication between the students and the instructors regarding how the "torch would be passed". In situations such as this, the burden of team teaching falls on the students rather than on the faculty. If our goal as instructors and mentors is to impart knowledge not just pass information along, then, as a profession we must consider continuity from instructor to instructor whether it is within an hour long lecture or within the context of an academic term.

The chances for successful team teaching increase when both instructors are present at each and every lecture and they meet on a regular basis. A partnership is formed between instructors and the ebb and flow of a class can be monitored by each instructor, and the transition between instructors is smoother since each is aware of the topics covered, past class room discussions, and any barriers that exist.

Collaboration is when the instructors work together to discuss course content, and also when the instructors attend each lecture regardless if he is leading the discussion. The goal is to provide continuity between lectures and to provide anecdotal comments that reinforce what the primary instructor is discussing. These types of teaching collaborations require not only continual attendance in class, but regular coordination meetings outside of class. In most instances, lecture preparation requires more effort, because one is preparing not only the lecture, but soliciting input from the other teammate. For example, when leading a lecture the topic is prepared one to two days early so the other instructor knows the content and a short meeting is planned to discuss points they feel relevant to the topic and ways in which the supporting instructor can contribute. In this way the students realize the advantage of team teaching rather than feeling overwhelmed by having two or more instructors. For classes such as these, student comments have ranged from:

- It's okay that you discussed the same topic, it gave us two perspectives about the same topic which helped us understand
- This method was easier to follow than when we had our other class where the instructors…

Multi-disciplinary teaching to a uni-disciplinary class

There are also classes where the topic is broad enough that there are distinct advantages in having instructors with different backgrounds teach a class. The models for this type of class have been very collaborative. The collaboration exists because the teams share common goals, the teams are open to working together, and the teams work to compliment each other rather than to overshadow one another. These characteristics of team teaching are also hallmarks of design teams outside of academia.

As an example, our curriculum includes a graduate research and writing course. In this class students learn about engineering topics related to research and report writing from an engineering professor, but they are also taught how to present the material in a clear and concise manner from an English instructor with a background in composition and communication. Together, the two instructors have taken this course far beyond what an engineering professor could impart working alone. With the addition of a complimentary instructor (and there is debate as to who is complimenting who in this example) the students gain not only knowledge about how to conduct engineering research and what constitutes engineering research, but how to clearly explain the findings of the research both verbally and in written form. Students were excited about their research work, but also discovered the time commitment required to produce a presentation. Plastered across the room was the motto "3-15" as a reminder that fifteen minutes are required to produce a 3 minute presentation. Upon exiting this class students discovered the nuances of communication, research, and writing that will better prepare them for conducting research, but also presenting their work to others.

Multi-disciplinary teaching to multi-disciplinary students

The last examples, which are the most challenging, as well as, the most rewarding are courses that have multi-disciplinary student bodies and employ a multi-disciplinary teaching team, one to

represent each major in the class. Over the past three years, the author has participated in two different classes where team teaching with an instructor from another discipline has been implemented and the students from two or more disciplines are enrolled in the course. Specialization is the norm in the building industry, as is the formation of multi-disciplinary design teams. Thus, the need for interdisciplinary classes to instill collaboration and integration of other trades when solving today's design problems is beneficial to the students.

Three years ago an idea was hatched to start a multi-disciplinary design studio involving architecture and architectural engineering students from two different campuses. One was located on the west coast and the other in the Midwest. The premise was to collaborate on a design competition and form teams of structural and architectural design majors. The partnership for the lead instructors was formed years earlier as each worked together on a building project when one practiced architecture and the other structures. As both individuals moved into academia there was an impetus to create a class that emulated the real world design process. To help transition this relationship into academia, the two instructors would sit on design review juries together to ensure each had similar academic objectives so that their previous working relationship could be extended to the classroom. The framework for the course was determined about one year in advance and issues such as travel, design charette format, scheduling, cross country communication, and student bonding were all addressed. Once the course started, weekly telephone meetings were held, as well as, e-mail messages about any trends within the classroom. The instructors taught the class as a singular group twice during a ten week period – at each design charette. The success of the class hinged upon the instructors imparting the necessary knowledge to all of the students about topics which were on the critical path for the project. The topics primarily dealt with areas of cross over, where the structure was dependent on the architecture and visa versa.

As an example, the design project used for the studio incorporated long span structure. In the process most students gravitated towards systems which utilized trusses; one-way truss system, two-way truss system, and space trusses. As a structural design professor, the engineering students were taught how to quickly assess the truss sizes, member deflections, etc…, but also to be aware of how the modularity of the system can relate to the rest of the structure or in some instances be used to reinforce the interior design strategy. Additionally, when speaking to the architectural students, emphasis was placed on triangulation, the spatial requirements of creating a one-way versus two-way truss system, and how truss modularity can be modified to meet the architectural design intent without impacting the efficiency of the structural system. All topics that concern the design team, but each given a different slant to help the students create and communicate.

Meanwhile, the architectural design professor would challenge the architects to create truss forms that truly reinforced the designers approach to space and massing. How can is a truss used to help glorify a space or direct attention to a prominent feature on the site? How do curvilinear trusses read differently than rectilinear trusses, or how do the shapes of the truss members reinforce or detract from the truss form? And similarly, challenges were made to the engineering students to push the envelope of structural design and to compare the designs being proposed to those used in previous real world projects. The intent was not to intimidate, but rather help initiate a process where students would be willing to explore new forms and see how structural

expression can be part of the design. Exchanges with two different instructors with two different backgrounds provided the students insights into their area of study which they had not been exposed to in any of their prior classes.

This also enabled the students to become instructors to their teammates. It was common to see the structures people describing to the architects how a building would behave or how pieces of the building were constructed and how structural proposals could blend with the architecture. Or the architects would explain what the intent of their design was and if the initial proposal was unacceptable, how moving framing members in a particular manner would keep the structure stable or help make the system efficient yet retain the design integrity.

Discussions such as these can not occur unless a class exists that has more than one discipline, but also more than one type of instructor. Together, the instructors can compliment each other; show how one discipline is intertwined with the other, and how successful projects require seamless integration to be successful. In this particular class, the student reviews have been above average for both instructors. In fact, this course has been amongst the highest rated for the Midwest college.

Another Multi-Disciplinary Approach

Another class has been developed where instructors and practitioners from architectural engineering, architecture, and construction management combine their knowledge and resources to discuss topics on building envelope design, project delivery methods, integration of structure and architecture, influence of constructability and sequencing on detailing and design, etc. in order to expose students to the myriad of issues that must be addressed, in order to make an informed decision. This class was initiated two years ago as an experimental project and has now become a class that is cross listed in the three departments and is advertised as a collaborative design studio.

The course started as an idea to expose students to the building envelope and the issues surrounding its design and construction. All three curriculums, ARCE, ARCH, and CM do not cover the building envelope in detail. The idea was to select topics that impacted design and construction and then have faculty from each department discuss that topic from their perspective. The thought being that no one person could provide the breadth or depth necessary to give the students a holistic view of the building skin and the design and construction challenges that must be overcome to create an efficient, iconic, and cost effective solution. Additionally, to help drive home a concept, industry practitioners were invited to speak and attend design reviews to provide real world examples of how building skin systems work, are designed, and are delivered.

One of the first lessons for the students was learning each others trade language so they work together as a team. As an example, when the word material or materiality is used it means different things to different professions. Materials were discussed in the class and the students learned that materiality to an architect implies texture, color, light and shadow, and composition. All things that are visual and can make an impact the instant one looks at a building. To the engineer, materiality is much more rational. How heavy is the material, how large are the

sections that are applied to the building, how large are the forces as a result of the material selected. Issues related to the impact of the material. To the contractor, materiality means materials and issues such a procurement and material sourcing become important. How will the procurement and installation of the material fit into the larger building schedule, what type of crane will be required to help install this type of material, and is a staging area required? All tangible issues related to the completed building.

When topics are presented as a package, the students learn the concerns of each discipline and in greater detail than could be provided by a singular instructor. This was important since the students worked in multi-disciplinary groups. An understanding of the design and construction issues was vital if the student groups were to work collaboratively. Without a general understanding of all the issues, elegant and efficient designs could not be achieved.

As with other team taught classes this course required weekly coordination meetings to review presentations, offer ideas for improvement, and brain storm about student assignments. The weekly meetings were important for the success of this class. Typically, the instructors would have a quick chat after the lecture to discuss what might be done the next time the class is offered or topics that needed more lecture time and required time during the next session. The give and take was essential in helping to shape this class. Both instructors have been very open to one another for advice and feedback, especially when the discussion became technical or design oriented.

Another key aspect to this class was the attendance of guest practitioners from each of the disciplines, engineering, architecture, and construction. The guests would discuss how the lecture topics were incorporated into real world projects and how important it is to have a working knowledge of allied disciplines when working in a collaborative environment. The guest speakers discussed topics ranging from delivery methods and contracts to engineering and fabrication. The inclusion of practitioners helped bring each topic full circle from design inception to completed project.

In closing, the addition of the practitioners has been an invaluable resource. It not only gives the students access to recently built projects and real world feed back, but the guest speakers and reviewers always tell the students that;

1) they wished they had a course like this when they were in college
2) the collaboration the students are being exposed to now is necessary in the working world
3) they all volunteer to return next year when we hold the class

The class had 16 students in the inaugural year and this year we had 25 students. This implies that students are interested in courses which emphasize collaborative models, but they are also intrigued by having classes team taught by a multi-disciplinary faculty.

<u>Reflections</u>

As a side note and in fairness to those who like to teach solo, the transition to team teaching is not for everyone. Individuals in our department would like to teach courses by themselves so they can put their stamp on the course – ownership. In time this may happen for the new degree program, but for now we feel team teaching is the best approach for mentoring the students. The

next step is to develop a system where everyone collaborates to create an environment where the department views team teaching as a whole that is greater than its parts.

And for those open to team teaching and exploring where an idea might take the class, remember that the same individual traits that make successful teams in industry are the same traits that make a successful team in academia: openness, humility, imagination, and ingenuity. When there is a symbiosis between individuals that's when teaching becomes special. In each of the classes the instructors exhibited a willingness to be fluid in their teaching, a willingness to explore, and more importantly an acceptance that the path to success is not straight and there will be set backs along the way. But everyone also realized that when the team works together as a unit and communicates on a regular basis, the class will be a success for the instructors and the students.

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Bibliography

Davis, James R. *Interdisciplinary Courses and Team Teaching.* (Phoenix: American Council on Education/Oryx Press Series on Higher Education, 1997).
Maroney, Sharon A, *Some Notes on Team Teaching*, Western Illinois University – Quad Cities