Dissemination of Capstone Design Projects through Interdisciplinary Collaboration
Carlos Pomalaza-Raez, IUPU - Fort Wayne

Abstract
This paper describes an innovative interdisciplinary collaboration where students in the Division of Organizational Leadership & Supervision (OLS) worked with engineering senior design teams on developing multimedia presentations and posters highlighting the various design steps and the final prototypes. The OLS students were enrolled in a junior level course in their program that required them to create that type of material to fulfill the service learning component of the course. Each engineering design team, which has on the average four students, became in effect a “client” of an OLS student for the purposes of marketing their prototype and disseminating the results of the project to a technical and non-technical audience.

The final products of this collaboration were of a poster and a multimedia presentation for each project which were evaluated by faculty from the engineering and OLS departments. Each OLS student was also to write a paper commenting on the project itself and the interaction with the engineering students. This material was then used to disseminate the results of these projects to a diverse audience.

The benefits of this pilot collaboration went far beyond the final product. Both groups were able to experience the dynamics of working on an interdisciplinary team. This was a challenging experience for them at first because they had to learn how to communicate effectively with students outside of their own discipline. Ultimately, they realized that an interdisciplinary team has a larger skill set to work with to master their common goals. This collaboration also provided them with a teamwork experience that is more indicative to what they will encounter in the diverse workforce.

Key Words
Interdisciplinary Approaches, Technology in the Classroom
Dissemination of Capstone Design Projects
Through Interdisciplinary Collaboration

Carlos Pomalaza-Ráez
Department of Engineering
Indiana University – Purdue University Fort Wayne

Brenda Henry Groff
Division of Organizational Leadership and Supervision
Indiana University – Purdue University Fort Wayne

I. INTRODUCTION

Multidisciplinary capstone senior design projects have been adopted by a large number of engineering programs as an effective way to expose students to a complete design engineering experience, from conception to the delivery of a working prototype\(^1\). The measure of the senior design project outcomes is one of the most important tools to assess how an engineering program meets its learning outcomes. Considerable effort and time are spent by faculty and students on the successful completion of these projects to ensure and maintain the quality of an engineering program.

Since these efforts often include engaging industry for technical and sponsorship support there is little time left for the dissemination of the projects to a large and diverse audience. The dissemination of the projects has usually been through written technical reports, conference presentations, and journal publications. Depending on the resources and time available, web sites have also been used.

This paper describes a pilot collaborative work where students in the Division of Organizational Leadership & Supervision (OLS) work with engineering senior design teams on developing multimedia presentations and posters\(^2\) highlighting the various design steps and the final prototypes. The OLS students are enrolled in a junior level course in their program that requires them to create that type of material to fulfill the service learning component of the course. Each engineering design team, which has on the average four students, becomes in effect a “client” of an OLS student for the purposes of marketing their prototype and disseminating the results of the project to a technical and non-technical audience.

The final product of this collaboration is the production of a poster and a multimedia presentation for each project. This material can be used to disseminate the results of the projects to a very diverse audience. By participating in this pilot project students and faculty at IPFW have gained a collaboration experience that is wider than the ones offered by common multidisciplinary projects that involve several engineering disciplines.
II. BACKGROUND

At Indiana University – Purdue University Fort Wayne (IPFW) the Department of Engineering is host to four engineering programs: civil, computer, electrical, and mechanical. Students must complete a major design project by taking a required two semester course sequence during their senior year. The design project reflects a balanced view of hardware/software trade-offs, requiring the use of good design methodology and consideration of non-technical aspects, such as design process, cost, safety, and reliability.

All senior design projects are performed as teams. Each project is advised by at least one engineering faculty member. Most of the senior design projects are of multidisciplinary nature involving students from more than one engineering program. The senior design program is structured as a two-semester sequence where the prototype building, debugging, and testing take place in the second semester. The project illustrated in Fig. 1 is one of such projects conducted in 2006-2007 academic year. Three electrical engineering and three mechanical engineering students participated in the design, building, and testing of the prototype. The mobile autonomous sensor package unit is capable of intelligently interacting with its intended environment. The sensor package can acquire and process data (i.e. sound and motion) to make “intelligent” decisions on how to react by means of audio, visual, and mechanical output.

![Interactive Sensor Package Unit](image)

The delivery of a working final prototype is very time consuming and students have barely enough time to prepare their final report and presentation (both for a technical audience). Often, it is the faculty advisor who, after the project is completed, takes the role of disseminating the results through conference and journal papers. Other than citing the projects in department and university wide brochures or web pages the dissemination of the projects to a wider audience has been ignored.

OLS students’ strengths are in conducting well-organized meetings, managing projects using effective communication skills, and the understanding of leadership principles and conflict management principles. These qualities are very useful in a wide range of scenarios that definitely includes engineering projects. In the junior level course, “Advanced Word Processing, Desktop Publishing, and Presentation Graphics” OLS students combine these strengths with technology skills to create multimedia presentations and posters.
The collaborative project with the engineering students provides OLS students with an opportunity to use their newly acquired technology skills and their organizational, leadership, and communication skills in a service learning type of experience. The engineering students’ projects provide a real-life situation that requires OLS students to work with their engineering “client” to produce a presentation that not only benefits the client, but also gives them an opportunity to demonstrate their proficiency in using these skills.

III. REQUIREMENTS AND OBJECTIVES

Each engineering team is required to submit a final technical report, to generate a poster and to make an oral presentation at the end of the second semester. Since the intended audience of the presentation is composed of engineering faculty and students as well as technical representatives from the industry, the content of the audiovisual material used in the presentation is full of technical minutiae and jargon. It is not a presentation that can be used for more diverse audiences that includes people with no technical background.

Each OLS student is required to create a poster and to design and develop a multimedia presentation that is based on a need from the community. In this case, students from the IPFW community have a need for these materials. OLS students are to work with the engineering students to create materials that are meaningful to a technical and non-technical audience. This requires that the OLS students use their new technical skills in conjunction with many of the organizational and leadership skills they have acquired from their prior coursework to be able to successfully complete this project.

The overall goal of this collaboration was to provide engineering and OLS students with the opportunity to:

- express their thoughts coherently and logically when working together as they develop the material
- critically appraise the strengths and weaknesses of the design of the presentations, proposing solutions to problems affecting the success of understanding the content
- improve their technical communication skills by designing comprehensive stand alone presentations that can be given to technical and non-technical audiences

IV. INTERDISCIPLINARY COLLABORATION

During the spring 2007 semester four teams of engineering students were paired each with an OLS student. Halfway into the semester each OLS student and the engineering students of her/his assigned team started to meet on a regular basis while developing the poster and multimedia presentation. At first they struggled to find a “commonality of purpose” even though they knew what needed to be accomplished. This was because their academic disciplines are so different. They had to learn to work as a team and find value in what they could offer each other. Soon, they found “comfort in difference” because they became aware of each other’s strengths...
and learned how to have a meaningful dialogue with each other. Ultimately, they realized that an interdisciplinary team has a larger skill set to work with to master their common goals.

Each multimedia presentation developed was around ten minutes of video, voice, graphics, and text. Fig. 2 shows a snapshot of one of these presentations which was generated using Microsoft Producer. This software makes it relatively easy to capture, synchronize, and publish audio, video, slides, and images.

![Figure 2. Senior Design Project Multimedia Presentation](image)

The raw material for this presentation was provided by the engineering students on a series of meetings with their designated OLS student. A portion of this material (figures, text, video, etc.) was also being used by the engineering team in their technical presentation to the engineering faculty and students. This presentation is around 45 minutes in duration and primary focus is on the technical details of the whole design process. Likewise, the OLS student in consultation with the engineering students generated a poster as illustrated in Figure 3. The poster clearly displays a large amount of data using a mix of text and graphics in a way that is robust and pleasing to the eye.

V. ASSESSMENT

The posters and multimedia material were evaluated by the instructor of the OLS course. Part of the same material was used in the technical presentation by the engineering students at the completion of the project. These presentations are evaluated by the engineering faculty attending the presentation using a form with a set of well defined rubrics. On the scale of zero to ten the presentations were rated, on the average, eight or above on the categories of clarity of presentation, level of organization, and content. This assessment process measures the
achievement of the first two goals described in Section III whereas the direct assessment of the presentation and the poster by the OLS faculty addresses the measurement of the third goal.

Figure 3. Senior Design Project Poster

OLS students wrote a reflective paper. They were asked to comment on the project itself and the interaction with the engineering students. Their main comments about the experience were:

- to start the collaboration earlier in the semester to allow for more interaction time between all the students involved
- to designate one or two engineering students in each team to be the main contacts for this project and thus minimize schedule conflicts

The OLS students were very satisfied with the end results of their project. All of them found the experience rewarding in the sense that they had a chance to work with people that had a very different educational background to develop such high quality presentation projects. These conclusions are validated by the following excerpts from their reflective papers:

“Overall this was a good experience. One thing that made it difficult was that their (engineering team) presentation was to be forty minutes long and I only needed ten or so. My presentation would then have to be a scaled down version and for an audience that include people who are not engineers. While satisfied with my Producer presentation I believe that it could have been much better if I had a little more time work on it.”

“Through OLS classes we have learned how to work with groups that are in our class. In life we also have to work with people that are not in our set work group. I have found that working with people outside our set work environment is a little easier, as these individuals want to get to work and work only. There is no chit chat and when the work is done, the group moves on. The engineers were fun to work with, but I feel this project should be started very early in the semester.”
“The collaboration between the engineering students and I was a great success. I asked the engineering students if they had any suggestions for future collaborations. They, as well as I, would suggest that this project should be done before the end of the semester. Contact between the OLS and engineering students should be made at the beginning of the semester.”

“This was not the easiest project that I have worked on; one reason being that it was very difficult to get the engineers’ schedules to fit with mine. Even though the engineering team I collaborated with for this project wasn’t the most efficient group, we ended up with a great final product.”

Both, the poster and the presentation were used on “Technology Day” at the end of the semester. On this day the engineering projects were showcased in the lobby of the Engineering and Technology building to the community in general and to the local industry in particular. Both, engineering and OLS students were on hand to explain their work. The comments on the quality of the posters and the multimedia material were unanimously very positive.

VI. DISCUSSION

The engineering students benefited by being asked to explain their project to the OLS partner student who does not have a technical background. The planning sessions they had gave both sides an appreciation of each other’s field and how each side saw the task or project being developed. This collaboration did not save time for the engineering students so they could spend more time on the completion of the project. What the collaboration effort accomplished is that there was now the time to generate material that can be used to disseminate the projects to a larger audience. To produce this type of material is not an expected outcome of the current senior design program.

Engineering students still had to prepare a final technical presentation. The original senior design program outcome of improving or honing their communication skills did not change. This pilot project provided the engineering students with an opportunity to further improve those skills since now they were asked to explain their project to a non-technical audience.

An unexpected outcome of this collaborative work has been its use in recruitment and outreach activities. The last weekend of the semester, after all the final presentations were made by both the engineering students and the OLS students, IPFW hosted an open house for incoming and prospective students in all fields. The engineering faculty who participate in this event took the multimedia presentations and the posters to the site where each department had a table to engage the visitors. The faculty members involved in this event have done this assignment for several years so they were in the position to compare previous events with this one regarding the advantages or not of using this new material. Their unanimous conclusion was that it greatly facilitated explaining engineering coursework to the visitors and in particular what is expected of the students at the end of their education. The posters and the multimedia presentation gave the visitors compelling images of what engineers can do. Because of this very positive response IPFW admissions office has used the multimedia presentation and hand-out letter size version of the posters during their recruitment visits to high schools in the fall of 2007.
The OLS students benefited from the experience of working in a non-OLS team. These students take several courses covering teamwork dynamics, but their previous team assignments were always with other OLS majors. This project put the students in a situation that challenged them to work outside of their content knowledge base. This was a very new experience for them and is more comparable to what they will find in the workplace.

VII. SUMMARY AND CONCLUSIONS

This pilot project achieved its intended objectives of improving the level of collaboration between faculty and students from completely different fields. The participants experienced a situation closer to what takes place in a real world work experience where one has to interact with people of different backgrounds and levels of education.

The project deliverables were the multimedia presentation and a poster for each engineering senior design project. These results were evaluated by faculty and through students’ self-evaluations. All the participants involved were very satisfied with the final product. The main recommendation was to start the collaboration process earlier in the semester to allow for more time for the students to exchange ideas and design the presentation and the poster.

This collaborative work will take place again in the spring 2008 semester. The collaboration process will start earlier in the semester and the software used will be different since Microsoft Producer has not been upgraded.

REFERENCES

**Author’s Biographical Information**

**Carlos Pomalaza-Ráez** {raez@ipfw.edu} is professor of radio frequency communications at Indiana University-Purdue University Fort Wayne (IPFW). He holds M.S.E.E. and Ph.D. degrees from Purdue University, West Lafayette, Indiana. He has been a faculty member of the University of Limerick, Ireland, and of Clarkson University, Potsdam, New York and member of the technical staff at the Jet Propulsion Laboratory of the California Institute of Technology. Since 2003 he has also been a visiting professor at the Centre for Wireless Communications, University of Oulu, Finland. His research interests are wireless communications networks, and signal processing applications.

**B. H. Groff** {groff@ipfw.edu} is a faculty member in the Division of Organizational Leadership & Supervision at Indiana University-Purdue University Fort Wayne (IPFW). Previously, she has been an Advising/Teaching Associate in the Computer Science Department. She also served as Director of Student Services for the School of Engineering, Technology, and Computer Science (ETCS) where she co-developed and taught the freshman success course ETCS 101. She earned a M.S. in Technology at Purdue University, West Lafayette, IN and B.S. and M.Ed. degrees in Business Education from Bowling Green State University, Bowling Green, OH.