

Enhancing Learning with a Poster Session in Engineering Economy

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Abstract

This paper outlines the process and benefits of using a case analysis poster session in a Miami University undergraduate engineering economics course. Use of a comprehensive case at the end of an engineering economy course allows students to synthesize their learning while applying concepts to a realistic situation. Presentation of analysis and results in a poster session, while developing teamwork and communication skills, provides enhanced opportunities for learning when compared to the standard oral presentation and written report assignment. The process used to incorporate a case analysis poster session into the course is described. Student feedback on the use of a poster session over two semesters is presented.

Introduction

In the engineering programs of the School of Engineering and Applied Science at Miami University, engineering economy is a required course in the junior year of study. The course emphasizes understanding the engineering economy concepts and application of techniques to making engineering decisions. The engineering economy course, as taught by the authors, followed the textbook *Engineering Economy: Applying Theory to Practice* by Ted G. Eschenbach.¹ Throughout the semester, several computer laboratory sessions with excel spreadsheets were used to reinforce text content and perform sensitivity analyses. Several mini-cases were used in the course to reinforce the engineering applications of engineering economy. In order to actually demonstrate understanding and application of engineering economy theory and concepts, a comprehensive case is assigned to the class towards the end of the semester.

Effective application of engineering economic principles within an industrial setting requires not only understanding and application of the subject matter, but effective communication and teamwork skills. To simulate this aspect, teams perform the final case analysis and present findings and recommendations in a poster session presentation format. Schmahl and Noble suggested that the poster format facilitates creation of “better products, fosters student interaction so students learn from each other and enables students to develop some planning and team skills.”² To assess the effectiveness of this approach in the engineering economy course, surveys were administered to students.

The Case

The final case focused on evaluation of after-tax cash flows of multiple alternatives of equipment purchases with uncertainty of projected production volumes. A modified version of “The Cutting Edge” case from *Cases in Engineering Economy* was used with permission of Ted. G. Eschenbach.³ In the case, means of adding production capacity must be evaluated in order to bid

on a proposal with a five year delivery schedule which did not specify the number of parts to be produced.

Four alternatives, from manual to highly automated equipment, were to be analyzed. Inputs to the cash flow included purchase cost, annual maintenance cost, set-up and run costs with shift differentials, and material and tool costs. This data is provided in the case. In a previous class exercise during the semester, the students discussed inputs to equipment justifications, but most had not taken the engineering cost analysis elective course. To assist the students in the cost analysis portion, they were provided with a worksheet which was discussed in class, then given an excel spreadsheet. The students were required to enter the basic cost analysis variables and appropriate formulae into the worksheet. Besides the above data, the students had to make and input assumptions about lot size for each alternative, hours available to be worked each year, the number of machines that one operator could operate, and the uptime of the equipment. The spreadsheet then calculated the total annual costs (expenses) and the number of pieces of equipment required to meet the assumed input production rate. The students were prompted to review the analysis assumptions for reasonableness and impact on total expense. (In particular, the lot size had a significant impact on the automated alternatives due to set-up costs.)

The students were then required to build their own spreadsheets to project annual costs and perform appropriate after-tax analysis of the cash flows. Again, assumptions had to be made by the students as to the appropriate interest rate and number of years to be included in the analysis. Sensitivity analysis was to be performed across key variables for the alternatives. Recommendations were to be provided for courses of action to be taken by the company should the bid be won. Depending on the assumptions, the recommendations varied.

The poster/case requirements

The students were required to display the results of the case analysis in a poster session and prepare a notebook with back-up spreadsheets and notes. In the creation of a poster, the challenge is to identify the key information and present it in a concise yet complete fashion. The students were given a page of general poster hints and suggestions which emphasized the importance of conciseness, use of figures and graphs, need for large type, arrangement of information in a logical order and creativity. The poster had to fit within allotted space, 42"x66", the size typically found at conferences.

The students were given evaluation criteria as follows:

- Logical flow of information presented
- Introduction of project alternatives – concise and understandable
- Data and assumptions – Summarized in appropriate level of detail
- Cash flow analyses – Summarized in appropriate level of detail
- Sensitivity Analysis – Figures provided analyzing significant variables/assumptions
- Conclusions – Specific recommendations made
- Visual appeal

The completeness of the supporting documentation was also part of the case grading criteria. The back-up notebook was important in providing an audit trail of the analysis presented on the poster. It also allowed the students to show the full extent of their analysis that may have considered other aspects not included on the poster. To facilitate grading, each team disassembled their poster into the smaller components (typically 8 1/2 by 11 size pieces), and turned in these pieces, the back-up notebook, each team member's evaluation of another team's poster and the poster creation feedback form.

The poster session

Learning did not stop with the creation of the poster. The poster presentation session was viewed as another opportunity for student learning. Each student was required to present their poster to a classmate and to review another team's poster. In reviewing each other's posters they were required to provide written responses to the following questions:

1. What data did/didn't the poster provide in presenting the basic information on the alternatives that differed from what you provided? Ask the presenter why they included or did not include the item. In retrospect, how important do you think the item is?
2. How did your team's assumptions differ from the team's poster you evaluated? What should you have included that they did? What should they have included that you did?
3. How detailed is the cash flow analysis? How did their approach to the analysis differ from yours?
4. Which sensitivity graphs do the "best" job of depicting the approach to analyzing the problem? Are these the same ones that you decided to use?
5. Are the recommendations clear? Do they differ from yours?

The atmosphere in the poster session was casual and even somewhat festive, with refreshments provided by the professor.

Use of the case/poster format

The case analysis/poster format was utilized in classes in two semesters with two different instructors. The first was in a class of sixteen students, the second time with a class of thirty-seven students. Only minor changes to the case were made between semesters.

In the smaller class, students worked in teams of two. The students were given the choice of doing a poster presentation as a team or a written report as an individual. Two students opted to do an individual case analysis. The poster session was held in a classroom on professional type bulletin boards of the required size. The students had five minutes to place the material on the boards. They were provided a schedule where twenty minutes were allotted to review another team's poster and twenty minutes were to be spent answering questions about their own analysis. The final few minutes of class were spent in completing the evaluation forms.

In the larger class, 10 teams of three or four students were formed with no individual option offered. The poster session posed more logistical problems. The bulletin boards were not delivered in time for set-up prior to class. The “posters” became wall displays as tape was obtained from nearby offices. Other than the quick rearrangement of the room, this session was conducted following the schedule used in the first class.

Student evaluations of poster sessions

Students in both classes evaluated the case/poster assignment in general and by comparing it to a more typical (traditional) case/presentation/paper format. The actual survey instrument is shown in Table 1. A summary of these evaluations is presented in Charts 1-4. In both classes, the student feedback on the poster/case assignment was similar and very positive.

Poster Creation Feedback

Please indicate your level of agreement with the following statements (5 strongly agree, 3 neutral, 1 strongly disagree)

For your poster -						
Creating the poster was harder than putting together a team report and presentation.	5	4	3	2	1	
Creating the poster required more of a team effort than creating a report would have.	5	4	3	2	1	
The poster allowed more of a “creative” element than a paper or presentation would.	5	4	3	2	1	
I take more pride in the poster than I probably would have with a paper.	5	4	3	2	1	
In looking at others’ posters -						
I enjoyed looking at other teams’ posters more than I would have listening to presentations.	5	4	3	2	1	
I got ideas from other posters that I could use if I ever had to do a poster again.	5	4	3	2	1	
The posters were an effective method of presenting the projects.	5	4	3	2	1	
I learned something different about the project from evaluating another poster.	5	4	3	2	1	
When standing by your poster -						
My poster prompted good discussion from the viewer.	5	4	3	2	1	
The viewer gave my poster appropriate consideration.	5	4	3	2	1	
I felt rather proud standing by my poster.	5	4	3	2	1	
In general -						
My team’s poster was better than most of the other posters.	5	4	3	2	1	
The posters were a good change of pace.	5	4	3	2	1	
I would prefer to do a poster than a paper and presentation.	5	4	3	2	1	
# of previous posters you have done in college classes	more	5	4	3	2	1 0

Performing the project would have gone more smoothly if...

Any additional comments regarding the poster

TABLE 1

As shown in Chart 1, students found the assignment required no more of a team effort than creating a report would have. They thought the poster assignment was no harder than a traditional report, but it did allow them to be more creative and take pride in their work. Typical student comments were “I liked creating the poster because it gave me a creative outlet that I don’t get in my other classes.” and “The poster assignment encourages us to look at multiple viewpoints in solving the problem.”

Chart 2 shows that the students believed that they learned something from the poster session that they would incorporate in future work. The poster assignment was an effective method of presenting the material and generated the opportunity for new ideas. The students enjoyed viewing other teams' posters. "I really liked doing the poster. It was more informative to actually read through other peoples' posters rather than do a formal presentation." was one student's response.

Review of the students' written responses in evaluation of teams' posters supports the idea that the poster session enhanced learning. Generally the students had some compliments for the other teams posters as well as some constructive criticism. "I really like how they had each individual option presented.", "They kept production and lot size constant. I believe that they should have included these changes." "They assumed a lower wage. Maybe we should have varied labor costs. They should have included...", and "Theirs was excellent. They had actual cash flows for each option." were typical responses.

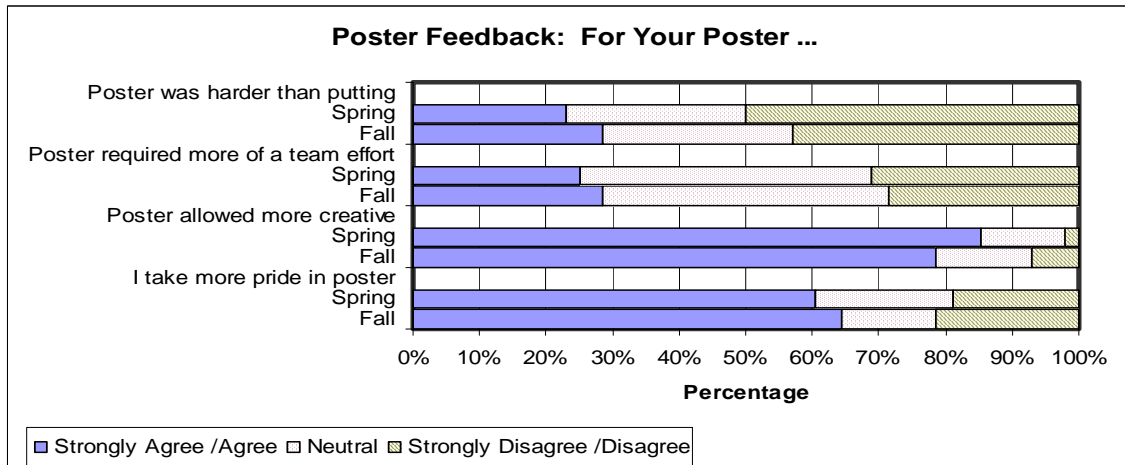


Chart 1

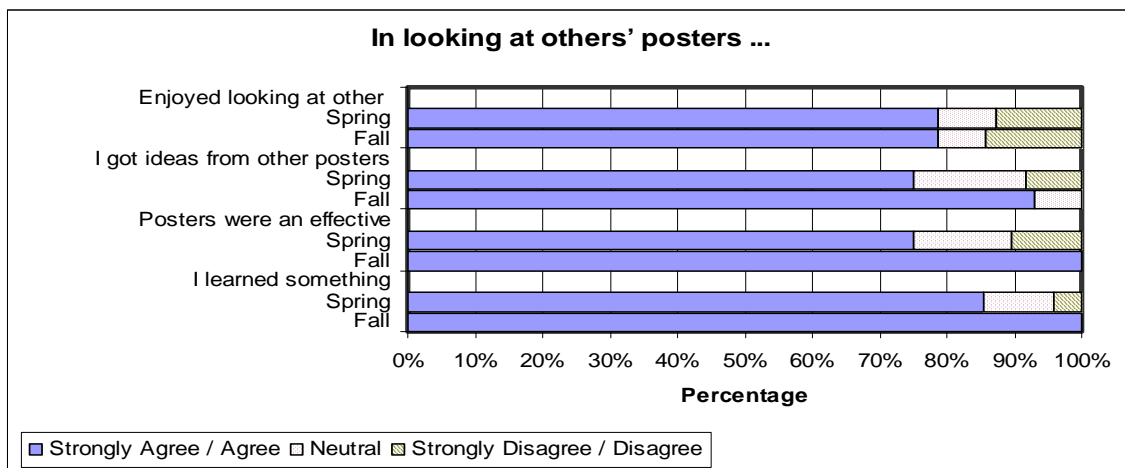


Chart 2

Chart 3 indicates that the poster session prompted good discussion and students were considerate of others' posters/presentations and very proud of their own poster. Seeing other posters "provides insight as to things that could have been taken into consideration while doing the project." commented one of the students.

In general as shown in Chart 4, the students thought the assignment was a good change of pace and indicated that they preferred this approach to the more traditional group report. "I generally liked them because they were colorful, easy to follow, and we had a 1 on 1 Q &A session during the presentation. I also liked getting away from the formal presentation idea, which is rather dull and dry." is how one student summed up the experience. Another student said "It would have gone more smoothly if the assignment had been given a little more specifics, but I liked that we had to think through it on our own. I learned more that way."

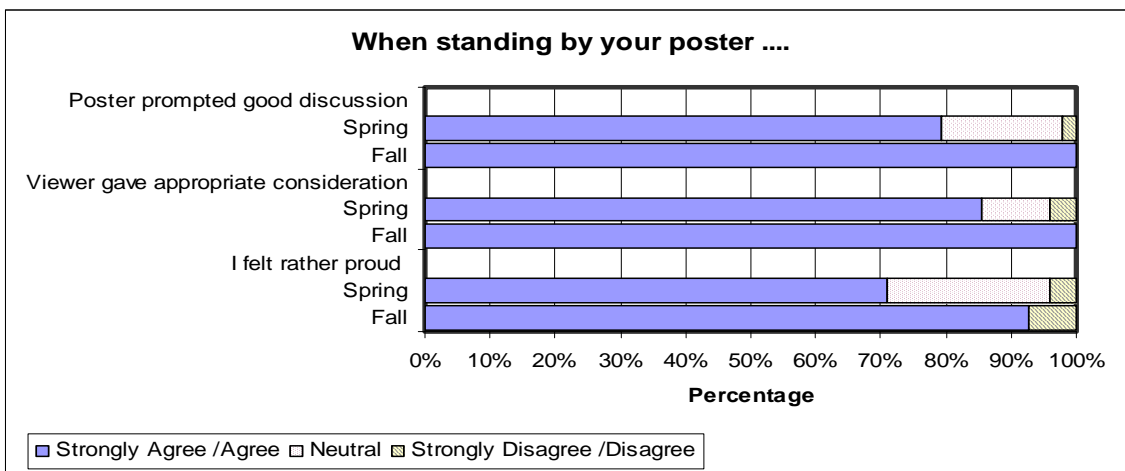


Chart 3

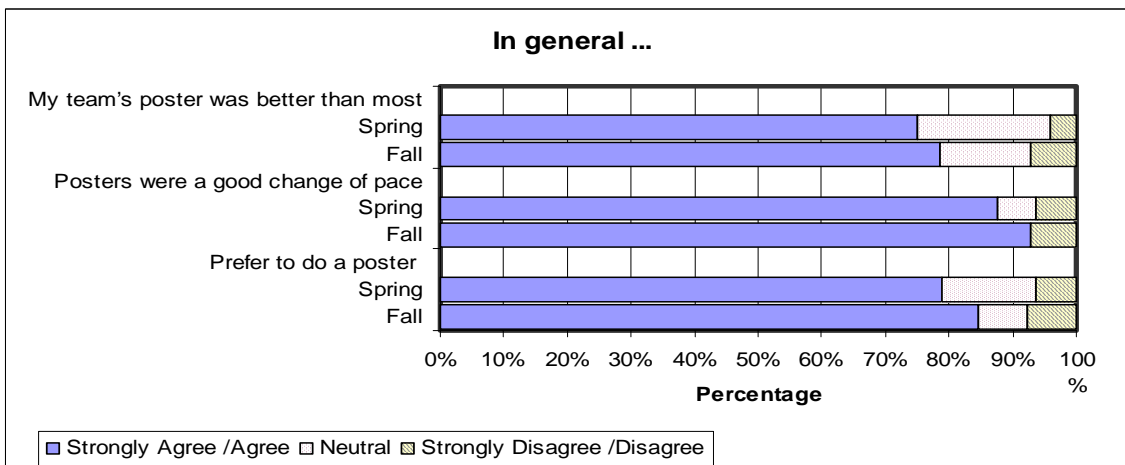


Chart 4

From the instructors' viewpoints, there was still quite a range with respect to grades earned / quality, but in general, the material the students created was better integrated and more cohesive than the deliverables usually received from team projects. The poster, by presenting a visual picture at a glance helped the teams to realize that the work needed to be integrated rather than just assembled by putting sections of a report together. Students were more engaged in the process (than they are listening to a report) since it required they visit other teams' posters and ask questions.

Concluding remarks

There is value in providing students with a variety of learning opportunities. Traditionally students have many opportunities for formal reports and powerpoint presentations imbedded in the standard assignments of their required curricula. Using a poster/presentation assignment provides an alternative learning opportunity. From the student and instructor viewpoints, the analysis of the case proceeds in generally the same way irregardless of whether the end product is a team presentation/report or a poster session.

It is the point at which the final product is being created that the dynamics change. Typically, a student team's approach to a final report/presentation is to divide up the work and then insert pages/paragraphs into the final report and handoff to each other in the oral presentation. In the poster assignment, since the deliverable is experienced as a whole rather than as parts, students became much more aware of the importance of working together as a team and integrating their separate contributions.

In addition, the opportunity for learning does not stop once the students have completed their own team's poster. By requiring students to evaluate other team's posters, and guiding this evaluation with directed questions, students were required to compare their own results with others and to reflect on the importance of the differences they observed. This step helped students to further integrate the knowledge acquired through the poster creation stage. With the typical oral presentation and written reports, students often are disengaged as they listen to other team's presentation.

Students need a variety of learning opportunities to develop teamwork and presentation skills. A poster assignment provides many of the same learning opportunities as a traditional team presentation and report, but rounds out the type of presentation opportunities students experience. Also, by the nature of the assignment, students continue to integrate the material after they have finished their own team's final product, by having the opportunity to compare their work with other teams' work and to reflect on the whole experience.

Bibliography

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