AC 2011-2812: EFFECTIVE PRACTICES IN MULTIDISCIPLINARY TEAM-WORK

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Effective Practices in Multidisciplinary Teamwork

Abstract

This article presents the content of a one-credit course that provides students with skills in job interviewing, team-work, learning about the future job market and some business skills. The course was delivered to students receiving the National Science Foundation (NSF) Scholarship in Science, Technology, Engineering, and Mathematics (S-STEM) that focused on teamwork. Students were grouped in teams of 5 students from sciences, mathematics, engineering technology and computer information systems disciplines. This article presents the students' perceptions of the course which exposed students to job search skills, and helped them develop teamwork skills by researching a company and presenting the results to the class. In addition to class meetings, students regularly met in groups outside of class to discuss their findings and to create their PowerPoint presentations. Student's understanding of team-work was periodically assessed for effectiveness. If sufficient progress was not accomplished, suggestions were made by the instructor.

Introduction

Teams and teamwork are important components of both industry and organizations. While teamwork is a major component of industry core requirements, the students attending higher education institutions may not possess extensive teamwork experience[1]. Employers, along with the Accreditation Board for Engineering and Technology (ABET), expect that engineering programs expose their students to these important skills. The ABET stated in EC 2000, Criteria for Accrediting Programs that "one program outcome and assessment measure for engineering programs is to demonstrate that their graduates have an ability to function on multi-disciplinary teams." To help students be effective team members and develop leadership skills in a multidisciplinary environment, S-STEM recipients were required to register for a one-credit course that utilizes a team project.

Adams and Simon suggest a teamwork model and believe that ABET requirements and the engineering industry's need for teamwork suggest four questions concerning teamwork;

1. What does it mean to function on a multi-disciplinary team?
2. What should be used to measure students' ability to do so?
3. How will teamwork in the classroom be used to enhance this ability?
4. What effect does teamwork have on the enhancement of learning?

Answering these questions is essential if engineering educators are to successfully incorporate teams into the engineering classroom. Adams and Simon also claim that when individuals have an effective teaming experience the following will occur: a) individually, team members will grow in their understanding of teaming constructs; b) the team as a whole will grow in their understanding of team constructs and c) proper synergy of task and team processes will occur.[2]

The team members in this one-credit course were from undergraduate disciplines in mathematics, computer science, electronic engineering technology, biology, computer

information systems, chemistry and biochemistry**.** To provide mentorship to the freshman students, teams included students from freshman to senior level and students from different disciplines. A senior student in each team was appointed as the team leader. To improve students' communication skills, all team members were required to participate in presenting the project. Each team member was expected to have a thorough understanding of the project and the presentation.

Course Activities

This course was offered during the fall 2010 semester. Twenty-five students who were recipients of the NSF S-STEM scholarship registered for the course. The first task for students was to create an updated resume. A sample resume was provided to the class by the instructor to aid students in the preparation of their resume. Next, each student participated in a simulated job interview. For the job interview, each student gave a presentation to the class and discussed why he/she was the best candidate for the given job. The interviewees used their education, experience, personal characteristics to convince the audience that he/she was the best fit for the job. Feedback was provided by the instructor and questions were asked by the students. These two job preparation skills will help student be more effective at job career fairs, forced them to have updated resumes, and sharpen their oral communication skills.

To provide students with more information on teamwork, a guest speaker, who had extensive experience in team development and team-working, was invited to the class to speak about effective teamwork. The speaker emphasized the importance of collaboration and discussed Gregoric's Learning Style preferences. The speaker also indicated the importance of equally dividing the work among the team members and explained how team members have an opportunity to evaluate each other contribution at the end of the project.

For the actual project, the 25 students were divided in 5 teams with 5 students per team. The task for each team was to choose a real company that hires graduates from their disciplines, interview a person from the company and give a 30 – 45 minutes presentation about the company. A set of suggested questions were made available for students to ask the company's representative during the interview. The following list is a suggested set of topics that may be discussed while interviewing a company's representative:

- Company Vision
- Company Products
- What are secrets to companies?
- What are secrets to individual success?
- How to increase productivity
- Their competitors
- How do they compete?
- How to increase worker's loyalty
- Magic Box: How do you keep the new products secret?
- How do you make sure the workers are happy? High Moral?
- Retirement
- In terms of loyalty on a scale of 1 to 10, how would you rate yourself?

- What are the strengths and weaknesses of your company?
- Future Forecast of your company
- What do you see as a threat to your company?
- What are strengths and weaknesses of your company?

The companies chosen by students were Intel Corporation as shown in Figure 1, ENMR-Plateau Telecommunications, LabCorp, Presbyterian Healthcare Services, and Merck & Company Incorporated. Some teams were able to contact the company's representative quickly, while other teams have to be more aggressive by making multiple calls.

Figure 1. Sample Student Presentation

Evaluation and Assessment

Adams and Simon[2] argue that highly effective teams exhibit 7 characteristics: common purpose, clearly defined goals, psychological safety, role clarity, mature communication, productive conflict resolution, and team member accountability. An assessment tool was developed that uses these 7 characteristics to assess the effectiveness of teamwork. It became clear that the teams which were most cohesive tended to develop a more practical and effective job. According to Forsyth[3], cohesion is the strength of the relationship linking the members of the group to one another and to the group itself.

As indicated in Table 1, twenty-one of the scholars participated in the survey and the majority of students felt that the project they worked on was effective in increasing their teamwork skills. As indicated in the Table 1 for the first question "Was your team effective in accomplishing the given task?"   Eleven students out of 21 rated the project Effective and ten students rated it as Very Effective.

Mark only one	Not at all	Partially	Effective	Very Effective
Was your team effective in accomplishing the given task?	0	0	11	10
Were you an effective member of the team?	0	0	12	9
Did you increase your own teamwork skills?	0	5	11	5
Did you and every team member have a positive attitude toward the teamwork	0	3	9	9

activity?				
Did every team member behave professionally and positively toward the teamwork?	0	1	9	11
Did team members add to team effectiveness?	0	1	10	10

Table 1. Team Work

As suggested by the speaker, the students should have an opportunity to evaluate themselves and their fellow team members. As indicated in the "Yourself" column from Table 2, the students rated themselves on average from 4.00 to 4.92 and their fellow team members from 2.94 to 4.88.

CHECKLIST SCALE FOR RATING COLLABORATIVE SKILLS
OF SELF AND GROUP MEMBERS

5 = Ideal team member
4 = Very good team member; mostly helpful; mostly reliable
3 = Helpful when present, but not always reliable
2 = Causes more problems than providing benefits
1 = Quality of work poor; did not share equally in completing
N.A. = not applicable

NOTE: unless your group is unique, it is not likely that everyone will receive 5's in every category.

Collaborative Skills	Yourself	Member-1	Member-2	Member-3	Member-4
Common Purpose: was the main objective of the team understood and shared by all team members?	4.29	4.43	4.38	4.33	3.47
Clearly Defined Goals: were the goals of your project clearly defined?	4.30	4.25	4.30	4.25	3.36
Role Clarity: was the role of each member clear?	4.92	4.33	4.48	4.38	4.00
Mature Communication: was each member communicating in a mature fashion?	4.48	4.33	4.29	4.29	2.94
Behavior: was every member behaving professionally?	4.00	4.57	4.43	4.62	3.63
Performance: was each member performing	4.67	4.38	4.62	4.38	3.75

professionally during the length of the project?					
Attitude: did each member have positive attitude toward the common goal?	4.48	4.33	4.33	4.88	3.81

Table 2. Evaluation

One of the goals of this project was to improve students' oral communication skills. As indicated in the Table 3, 9 of 21 students felt that their presentation skills were very effective. On a whole the majority (13 of 21 students) felt no changes needed to be made in future classes as indicated in the row 2 of the Table 3.

Mark only one	Not at all	Partially	Effective	Very Effective
Did your presentation help you with your presentation skills?	2	5	5	9
	No Change	More Presentations	More Individual Presentations	More Group Presentation
How can we make the presentations more useful?	13	2	5	1

Table 3. Presentation

Conclusion

The goal of the course was to create an environment where students could work in teams from different STEM programs. An additional goal was to enhance student's communication skills, as well as their ability to work together on team-oriented projects. The data collected was indicative of the same concerns that have been observed in the past year and implies that (1) every team was effective in accomplishing the given task (2) every team member increased his/her teamwork skills (3) every team member had a positive attitude toward the teamwork activity and [4] team member's presentation skills were enhanced significantly.   There were some concerns and suggestions that included: (1) it would be more practical to group students in the same discipline (2) the project was too time consuming for one-hour credit (3) some members did not work as hard as others. Overall, students agreed that the course provided them with business and teamwork experience as well as it enhanced their communication skills.

Acknowledgement

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