

AC 2008-1881: EVALUATION OF INDIVIDUAL PERFORMANCE ON GROUP PROJECTS

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Evaluation of Individual Performance on Group Projects

Introduction

Group projects have and will continue to be common in Engineering education. As stated in ABET Criterion 3 Program Outcomes and Assessment, (d) “Engineering programs must demonstrate that their students attain an ability to function on multi-disciplinary teams.”¹ Students and instructors are accustomed to group or team oriented projects. Typically the class is divided into groups that work together toward completion of the assigned task. The project is evaluated and graded based on meeting the criteria or objectives in the problem statement. Grades assigned to each individual depend on the expectations of the instructor. The simplest approach is to assign the same grade to all members of the group regardless of the individual’s contribution to the project. Assigning grades that reflect an individual’s effort require measurement and assessment of criteria to allow differentiation within the group.

If one of the educational objectives is learning to work in groups, then evaluation of team skills should be part of the grading process. Techniques, skills, and methods of working together should be incorporated into the group project. Measurement of the student’s application of these team skills should be part of the grading process. Combining the evaluation of the project meeting the stated criteria and the individual’s ability to apply team skills should allow assignment of individual grades in a group project.

The course where these methods have been applied is a first year Engineering design and communications course taken by Associate and Baccalaureate degree students in a variety of Engineering and Engineering Technology majors. In response to the student population, the course uses a series of projects that emphasis creation of documentation including formal reports, drawings, web pages, and other presentation methods. The projects take approximately two weeks to complete with a total of four projects and a final project in a typical semester. Each project used the skills developed during the semester with the final project as the most complex with a formal report, full set of drawings, web page, presentation, and a physical model as project deliverables.

The subject matter of the projects has been dependent on the student mix, current events, and available materials. Topics have included;

1. Energy applications such as evaluation of the cost of photovoltaic solar collectors, calculation of an individual’s carbon footprint, and comparison of gasoline costs.
2. Design of a handicapped assessable residential bathroom.
3. Creating a scale model of the I35W bridge center span for testing on a universal testing machine.
4. Autonomous controlled battery powered vehicles for a race or hill climb competition.

The projects were common for the entire class. If appropriate, competition was encouraged between groups. For example, designing and building the strongest bridge or the fastest vehicle.

Emphasis has been placed on the form of the deliverables, working in groups, and making decisions. Technical aspects of the projects have been minimized due to the academic level of

the student and the diversity of the classes. Multiple projects provide the students with the advantage of learning to work with a variety of their peers. Johnson and Johnson² indicate that changing team members with projects works better than single teams through the semester. The multiple group method did reduce the opportunity for team development. However, students working with a variety of their peers provided a social benefit to the cohort.

Students were assigned to groups by the instructor. Initial selection was random. The desirable group size was four students³. The actual size varied from three to five depending on the size of the class, conflicts, and students with attendance avoidance problems. Subsequent group selection attempted to mix students so each student had different group members for each project.

The groups were not independent self directed work teams. The students were allowed to determine who had responsibility for different parts of the projects but the groups were given daily tasks and assignments to “direct” them through the assignment. The students were required to make their own decision on aspects of their project, but the scope of the assignments required close control and direction by the instructor.

Objective

The objective of the paper is to report on methods used in a freshman engineering course to evaluate individual performance on group projects.

Procedure

Evaluation of the individual started with the project assignment. The grading rubric was included with the problem statement and evidence of group participation included in the grading procedure. To receive full credit a daily report from each team was requested that listed attendance, the activities of each group member, goals for the next class, and answers to questions that were posed in the daily assignment. The daily assignment was specific enough to give the students guidance for completion of the project and general enough to allow individual decisions by the group. This requires close contact between the groups and the instructor.

Daily review of the progress of the group and the interaction between students was necessary for the instructor to gain a qualitative measure of performance of the groups and individuals.

Quantitative measures were determined with attendance and a group evaluation. At the end of the project every student was directed to an evaluation form where each student rated all the group members, including themselves, on the following questions.

1. Rank the member's overall contribution to the project?
2. How much time or effort did the member contribute to the project?
3. What was the individual's willingness to work with other members of the group?
4. Did the member provide anything exceptional to the project?
5. How well did the member complete their "assigned" part of the project?
6. How well did the member review all portions of the project?

Additional comments were also solicited in an open format. These comments were used as another qualitative measure.

The questions were all ranked on a 0 to 4 scale for each question. The results from the web form were e-mailed to the instructor without indentifying the sender.

The response to the group evaluation tool was used to determine if there was a significant difference between students. The data was analyzed using an analysis of variance (ANOVA) two factor with replication⁴. The questions are treated as treatments and the students as blocks. The ANOVA was used to look at the variation between students and give a determination of the groups' evaluation of itself.

After the project was completed, a follow-up quiz or assignment was given to each student with questions specific to the project. This was specifically designed to encourage the students to understand the entire project and not limit themselves to their portion.

Results

The evaluation of each individual's performance can only be completed with appropriate data. Feedback that includes daily reports, deliverables of the project, group evaluation, and follow-up questions provide that data.

The easiest condition to grade is the student who did not participate in the group project. Attendance records and the group evaluation typically reveal those students.

A condition posing greater difficulty is conflict between students within a group. The instructor should also pay attention to daily reports and classroom activities to mitigate problems.

The criteria regarding expectations of group activities must be established at the beginning of the project. Students must understand the importance of working with the group regardless of the individual's likes or dislikes. The instructor may find themselves as a conflict mediator. Classroom group operations do not save instructor time^{5,6}. Insufficient structure or explanation of working in groups can lead to dysfunctional team processes, poor team performance, and a general reduction in the interest in team operations by the student.⁶

Conclusions

Evaluation of individual effort on group projects requires significant planning, testing, and implementation by the instructor. Students receive the greatest benefit from working in groups when they are fully informed about how groups work and the roles and responsibilities of group members. Qualitative methods of data collection including daily reports and close observation of class can be used with quantitative methods of evaluation forms and attendance to provide criteria for grade adjustment. Any criteria used for adjustment of grades should be well stated at the beginning of any group assignment with consequences understood by the students.

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