Using Student Evaluations for Individual Grading in Team Projects

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I. Introduction

One of the challenges involved in using teams in the engineering educational process is the assessment of individual performance in the team activity. Typically, there are two extreme approaches to this challenge. One approach is to ignore individual contributions and assign the same grade to all members of the team. This approach can lead to poor student morale, and even more important good students may develop a negative attitude towards team activities. With the prevalence of teams in industry, this negative attitude could be detrimental in these students' career development The approach at the other extreme would be to do a comprehensive team survey as suggested by [1]. The difficulty with this approach is the time and effort required by the instructor to implement it. In many cases what is needed is some useful feedback tool that will give an indication as to poor team performance. A mechanism has been developed in a senior level class in thermal design to provide this sort of information.

A primary premise in this mechanism is that the best individual grade a student may receive for the team activity is the team grade. However, due to lack of participation or performance, the student may receive a poorer grade than the team grade. This premise is based on interaction with industry and attempts to mimic industrial practice in evaluating team performance. How individual participation and performance is evaluated is key to the implementation of this premise. The basis for this evaluation is an assessment the team members provide of their effort and their teammates' efforts on the team project. This paper continues by discussing the implementation of this team effort survey approach. Results of two such implementations are then provided.

II. Implementation of Team Effort Surveys

These team effort surveys have been used in two courses taught by the author. This paper will be concerned with the use of these surveys in a senior level technical elective in thermal design. ME 416, Computer Assisted Design of Thermal Systems, is a three credit, semester course with a very strong emphasis on design. During the semester the students work in teams of two on three different design projects. Students are assigned a different partner for each project. These assignments are made by the instructor using a survey form completed by the students, shown in Figure 1. In this survey students evaluate their technical background. The instructor attempts to create project teams that maximize the team's technical strengths, while minimizing the team's weaknesses.

Figure 1. Technical Background Student Survey

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Student Survey Form

NAME: _____ Student Number: _____

E-mail Address: _____

Circle courses you have taken or and box those you are enrolled in:

Thermodynamics (ME 201) Fluid Mechanics (ME 332) Heat Transfer (ME 410)

Please evaluate your abilities by circling an appropriate response.

Heat Transfer

Hot (Good) Lukewarm (Fair) Cold (Poor or None)

Fluid Mechanics

Dr. Foss loves me (Good) I'm a little wet behind the ears (Fair) I'm drowning (Poor or None)

Thermodynamics

I'm a god (Good) I'm OK (Fair) Isn't steam an ideal gas? (Poor or None)

Computers and Programming

I'm a jockey (Good) I can pound the keyboard (Fair) No! No! Not them! (Poor or None)

Please indicate on a 1-5 scale, with 5 being the best, your abilities working with the following software:

Microsoft Excel ___ MATLAB ___ FORTRAN ___

Windows 95 ____ DOS __

Please indicate people you may want to work with on Projects 4 and 5, so I will try not to team you for Projects 2 and 3.

_____ _____ _____

The team evaluation is a very simple form that asks the student to assess their effort level on the project using the University's grading system (4.0,3.5, ..., 0.0). Similarly, they are asked to perform the same assessment for their teammates. Finally, they are asked to provide any comments to explain their grade assignment. The form currently being used is provided in Fig. 2. These evaluation forms are distributed in envelopes versus just passing the sheet out in class, which seems to communicate effectively to the students the seriousness and confidentiality of the assessment. The students are strongly encouraged to complete the survey and submit it with their project materials. For the second project of the fall 1999 offering of ME 416, fifty seven of the sixty four students in the class submitted surveys. For the third project of the same class the response was fifty four out of sixty four.

II. Utilization of Survey Results

The results of these evaluations are used in a couple of ways. First, based on the information provided on these forms and the instructor's observations an individual student's grade may be reduced significantly from the project grade. In fact, in previous semesters a student was even assigned a zero on the project based on the evaluation of two of their teammates. From the evaluations for project #2 from the fall 1999 semester there were four grade adjustments. These adjustments are explained below:

Team #1: The grade for Partner B was 5 points less than the project grade. This was based on Partner A's effort grade assignment of 2.0 for Partner B and 4.0 for himself. Partner A's comment was, "I could have used a little more help". Though the differential in the effort grade would indicate a major problem, the comments cannot support a more significant reduction in the project grade. Partner B's grade assignment was 4.0 for both teammates with no comments.

Team #2: The grade for Partner A was 5 points less than the project grade. Partner B gave his partner an effort grade of 3.5 and 4.0 for himself. His comments were most enlightening:

> Overall R--- and I worked okay together. Unfortunately, I feel that I did a larger portion of the work on the project, but R--- eventually finished the tasks under his responsibility. Based upon my estimates, the workload was distributed as follows:
>
> | | Me | R--- |
> |---|---|---|
> | Water Pump Program | 60% | 40% |
> | Designing of Pumps (w/Excel) | 100% | 0% |
> | Producing efficiency graph | 100% | 0% |
> | Technical Memo | 70% | 30% |
> | User's Manual | 0% | 100% |

Partner A did not submit an evaluation form, which experience has shown indicates some difficulty with his participation.

Figure 2. Team Evaluation Form

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Project #3 Team Evaluation

Please evaluate you and your partner(s) contribution and effort on this project. These responses will be held in confidence.

Your Name: _____ Grade: _____

Partner's Name: _____ Grade: _____

Comments:

Team #3: The grade for Partner A was 20 points less than the project grade. Partner B gave his partner an effort grade of 2.5 and 3.5 for himself. His comments were:

> No help in writing programs. Of the remaining work, it was about 65-35 split to her benefit. I ended up performing the majority of the work, > 70%, in order to meet the deadline.

Partner B also came to the instructor midway through the project and expressed his difficulty with his partner. Once again Partner A did not submit an evaluation form.

Team #4: The grade for Partner A was 20 points less than the project grade. Partner B gave his partner an effort grade of 30% and 70% for himself. His comments were:

> He made contributions and worked toward the project completion when he showed up. He did not show up to meetings a couple of times, and was up to two hours late when he did show up. He did not attend lecture regularly, and therefore did not understand many of the equations. This required me to explain the equations to him before he could write any code. However, he did have a pretty good grasp of programming techniques which helped a lot.

Once again Partner A did not submit an evaluation form.

Our students seem reasonably honest and accurate in their evaluations, though considerably forgiving. Clearly, these forms seem to reflect mostly major problems with an individual's participation in the team project. Students seem to accept minor problems. These evaluation forms also give considerable insight has to how these teams interact. Some of the more interesting comments are provided in Table 1. In Fig. 3 the relationship between self assigned grade and partner assigned grade is shown. The vast majority of students assigned themselves a 4.0 for effort, which was supported by a 4.0 assigned for them by their partners. It is interesting to note that the nine students that assigned themselves a 3.5 were assigned a 4.0 by their partners and that two of the three students assigning themselves 3.0 were assigned 4.0 by their partners. It is important to note that three of the four cases listed for which a grade was lowered do not appear on this figure since only one teammate submitted an evaluation form.

These evaluation forms are also used to assign teams for the next project. Attempts are made to pair difficult team members together. Also, extra effort is made to assign good team members to those students who have had to endure poor team members. This component of the teaming mechanism may be the most productive in modifying student behavior, since by the third project the number of negative evaluations will have decreased significantly. In fact, for project #3 of ME 416 during the fall 1999 semester the number of negative evaluations dropped from four to one. Also all four of the "good" partners for the cases listed above submitted very positive evaluations for their partners on project #3.

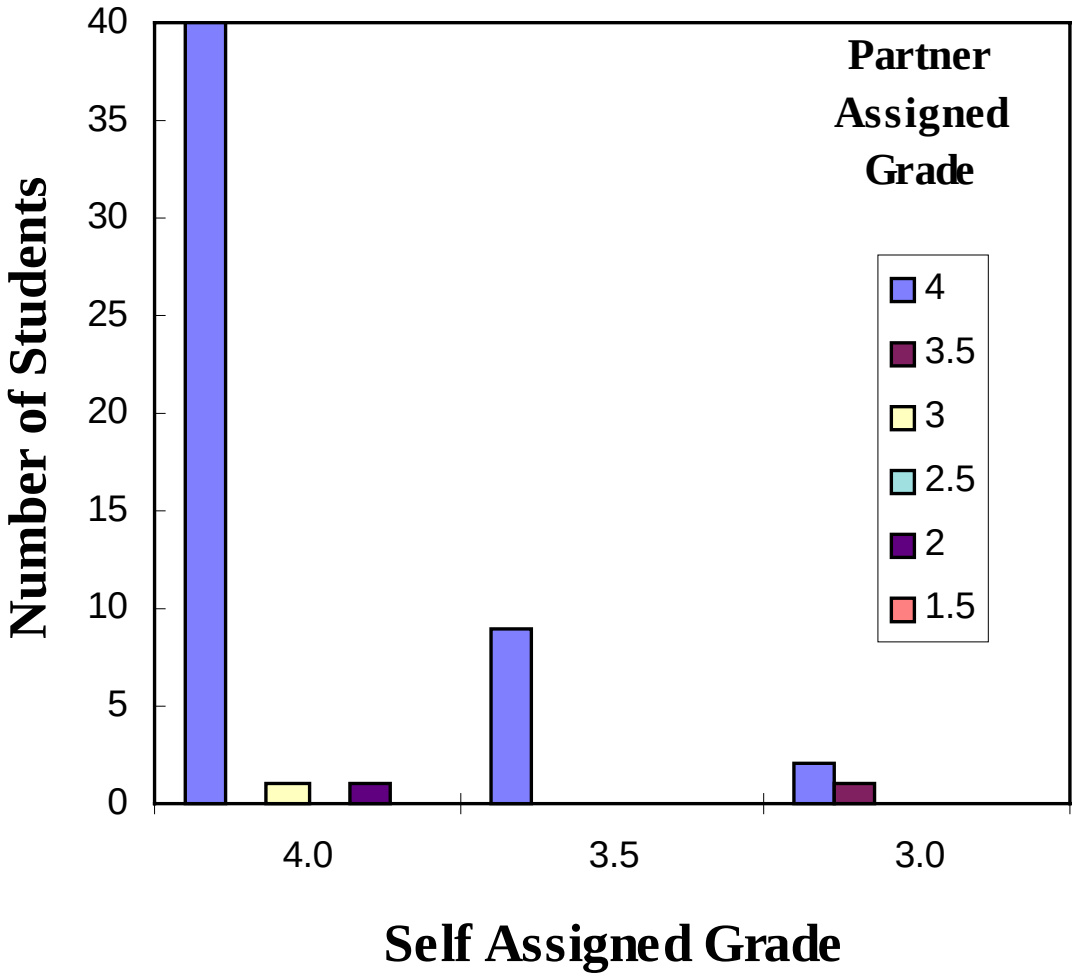
Table 1. Evaluation Form Comments

Partner A	**Partner B**
Self Grade: 3.5 Partner Grade: 4.0 I had a very busy past couple of weeks and really wasn't available to meet for long periods of time. However, we both put a lot of work into this project and it came out great	Self Grade: 4.0 Partner Grade: 4.0 Overall, an outstanding partner. Good work ethic, solid technical skill, and a self starter capable of working independently and keeping up necessary communication with a partner.
Self Grade: 4.0 Partner Grade: 4.0 I feel each of us put equal time and effort into our project. N—may have done a little more work when writing the report, but this is because I was having trouble with the matlab script. He went ahead and did part of the work I was supposed to do that we had previously agreed upon due to time constraints.	Self Grade: 4.0 Partner Grade: 4.0 R--- worked very hard on the Matlab programming portion of this project. However, our minimal Matlab experience definitely hurt us. I was very busy the last few weeks w/ 481 so it was hard for use to meet together and work on code. I did a lot of work on the Excel portion and lab write-up. I helped R--- with the code as much as I could. Both of us logged many, many hours on the project and it would be a shame if we got a bad grade. Work portion: R---- 51%, Myself 49%.
Self Grade: 4.0 Partner Grade: 4.0 I feel as though both J--- and I contributed equally to the project. At times, I felt as though she took over completely and would not let me help or do my part. When it came to the Matlab part of the project, J—took over and completed my section before I even had a chance to attempt the project. She was not a very team-oriented person. At times it seemed that she thought I was incapable of completing the tasks without giving me an opportunity to even try. To compensate, I was "assigned" the 3 analysis projects and the bulk of the written report. J--- completed more than her share, was very dependable and motivated. She was determined and hard-working, and for those reasons I give her a 4.0.	Self Grade: 4.0 Partner Grade: 4.0 My part of the project was: I wrote and debugged the whole program, I wrote the intro, background, & approach for the paper, and I did the benchmarking for the results of my program versus Rhino_Pump. M--- did the analysis parts and she wrote the remaining parts of the paper. In the end, I think it was fair, but at first I was very bitter that she didn't want to help with the MATLAB program.

Table 1. Evaluation Form Comments (continued)

Partner A	**Partner B**
Self Grade: 4.0 Partner Grade: 4.0 We both did equal amounts of work to get this project done and hopefully you will be able to see from our report and program how hard we worked to do a complete job on this project. It's an A+, trust me.	Self Grade: 4.0 Partner Grade: 4.0 I have never, in my 4+ years of college, worked with such a motivated group member, It was a pleasant change, although I do feel guilty for not getting more done with MATLAB. I tried so very hard to get it to work and I just could not do it.
Self Grade: 4.0 Partner Grade: 4.0 She's definitely "type A" personality. She kind of took control for some reason. Maybe she rated herself high and assumed she'd be paired with an idiot. In any case, there was almost equal participation, with most of my input being corrections and trouble shooting. She is a good person, and I would not mind working with her again, but, I might try to wrestle a little more control over the project out of her hands.	Self Grade: 4.0 Partner Grade: 4.0 J--- and I worked well together throughout this project. We both actively participated in all aspects of the project. We taught each other many tricks, both in Excel and Matlab. Dr.S. great job picking partners. Thanks.

Figure 3. Relationship Between Self Assigned Effort Grade and Partner Assigned Grade



III. Lessons Learned

A very simple evaluation form has been used to assess an individual's contribution to a team project. It seems to be a very effective way of collecting information that may lead to a reduction in the student's grade due to lack of participation. It has the further advantage of culling out poor team members. Though for the course discussed in this paper the teams consisted of only two students, the form has been used for teams in other courses of sizes four to six students. It proves to be just as effective for these larger teams.

Bibliography

1. Kaufman, Deborah B., Felder, Richard M., Fuller, Hugh, "Peer Ratings in Cooperative Learning Teams" Proceedings of the ASEE Annual Conference, Charlotte, 1999.

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