AC 2012-5024: RATEMYTEAMMATE.ORG: A PROPOSAL FOR AN ON-LINE TOOL FOR TEAM BUILDING AND ASSESSMENT

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RateMyTeammate.org:
A Proposal for an On-Line Tool for Team Building and Assessment

Abstract

Teamwork is a critical engineering skill, yet many instructors are not experts in the field and are hesitant to get involved in addressing team problems. Numerous courses have a mechanism for students to rate the performance of their teammates. However, these assessments typically occur at the end of the course for rewarding strong team performance and penalizing underperformers. However, this reward/punishment approach is limited in its ability to improve team performance during the project, which should ultimately be our objective as educators.

The approach presented here is to use a teammate peer review that is implemented in the middle of the project and at the end. In addition, the teammate peer review includes specific and detailed feedback to each student. One of the logistical challenges of implementing a teammate review is that the information from individual students needs to be kept confidential, and compiled results of each teammate needs to be conveyed to the proper recipient. To address these logistical issues, an on-line tool was created at the University of California San Diego (UCSD) in the Department of Mechanical and Aerospace Engineering.

Due to the ease of implementation, the on-line peer review can be implemented multiple times within a course. The intermediate peer review brings to the forefront teamwork problems early on. Issues can range from uninvolved students to over-dominant ones. In most cases of minor negative peer reviews, the students automatically correct their own performance. With more significant issues instructors or TAs are alerted early on, and can meet with students to avoid problems from becoming even more significant. This on-line peer review program has been implemented for over 5 years in an introductory design class with 200 students and in senior level design courses with 80 students. In our implementation we have chosen to use the intermediate peer review for informational feedback only, yet the final peer review has a significant impact on student grades.

The UCSD Peer Review Program was developed during the same time period a similar program, CATME, was developed at Purdue. These two tools where developed independently without knowledge of each other, and thus provide an insight into alternative approaches to the same challenge. One key difference is that the UCSD peer review program requires students to rate each other with a fixed-pie scheme to reduce inflation of peer scores. Thus, each student receives a numerical score that summarizes his or her contribution to the team. This overall score is used to identify potential team problems and target corrective actions early on. In addition, the numerical scores can be used to quantify how effectively the teams are working together, and has been used as an ABET metric for assessment of teamwork.

The ultimate goal is improve on-line teamwork assessment tools to provide instructors with various options to help them with teaching courses with team projects.

Background

The needs for an on-line team assessment tool are many. One such tool is Comprehensive Assessment for Team-Member Effectiveness (CATME) [1], which provides a web based interface that has a team formation tool, and also a tool whereby students perform a peer review of their teammates. Such an on-line reduces the logistical work load on the instructor which is critical in large courses. In addition, peer reviews can be implemented multiple times within a project so that students received a "heads-up" on how they are doing and provided direction on how to improve their team performance. In addition the intermediate tool can identify potential team problems before they erupt, and thus direct faculty and TA intervention effectively. This paper presents a web-based peer review tool[2] that was developed independently at UCSD at approximately the same time that the CATME tool was developed. Parallel development can lead to alternative approaches, and in this paper we highlight the differences between the tools and some of the advantages of these features.

UCSD Peer Review Tool

Both the UCSD Peer Review tool and CATME tool have an on-line login that connects the student to their team for assessment. A database connects identifies the student's teammates, and presents them with a review such as the one shown below. Both the UCSD Peer Review tool and CATME tool allow student to rate their peers in a number of categories such as Attendance, Listening Skills, Communication Skills, Responsibility, Leadership, and Team Building. When a student logs into this system they are shown a screen with their teammates names. They quantitatively rate each teammate in a number of categories and also provide comments on areas of strength and weaknesses (as well as private comments to the instructor). When all teammates have completed the peer review, the system automatically averages the quantitative feedback and compiles the comments, which are then individually emailed to each student. The screen shot below if of the UCSD Peer Review tool. This screen shot for 3 person team, but most of our teams have 4-6 members.

Fig. 1: Initial Rating Screenshot

Single Parameter Assessment with a Fixed Pie Approach

A key difference between the UCSD Peer Review tool and CATME tool is that the UCSD tool has a single parameter that the each student applies to their teammate to indicate overall team contribution. Moreover, this single parameter is applied in a fixed-pie fashion, meaning that if one teammate is rated above average then other teammates(s) must be rated below average. The number of points that can be allocated is equal to the number of team members being reviewed times 1000. A student may choose to rate all his or her teammates equally by allocating 1000 points to each of them. However, if one team member is rated above average, then other team members must be rated below average. The fixed-pie approach prevents rating inflation since one cannot rate all team members above average. See screenshot below of what the student is presented with during this portion of the assessment.

Fig 2. Single Parameter Point Allocation

A single parameter score forces each student to summarize the contribution of their peers into a single quantitative value. Some students may receive low peer reviews due to their lack of involvement in the team, while other students may receive a low peer review because they attempt to dominate a project without listening to their teammates. The ratings from all teammates are averaged, and the average score is sent back to the corresponding students. To encourage students to improve their team performance, an intermediate peer review is conducted in the middle of a project, and these intermediate peer review results do not affect the course grade. The peer review is repeated at the end of the project, and these scores do impact the student's grades depending on instructor preference (some use it as a multiplying factor on the team grade and others as a percentage of the overall grade). Some concerns have been raised that an impact on grades can influence the peer review being provided[3]. Indeed, it may seem intense to rate and be rated with a fixed-pie approach. However, we have found that team dynamics can be intense and that clear and concise summary of team performance is helpful in addressing these issues. The impact on grades has lead student to treat this peer review and teamwork as a whole very seriously. Appendix II is a narrative from a student that shows how intense teamwork issues can be in project based courses, and the type of learning about oneself and team performance that can occur.

The instructor encourages students to treat the intermediate peer review as very important and explains that a slightly low intermediate peer review can lead to an even lower final peer review if corrections are not made. The figure below shows how highly rated students in the intermediate peer review generally see their scores increase in the final review, while lower rated students see their scores further decrease. This is not completely unexpected since technical challenges and resulting team stress often occur in the later half of a project when a team may be

struggling to get their hardware to function properly. Thus, low performance of a team member early in the project may not be perceived as detrimental to overall team performance. Comments made in the final peer review have indicated that low performing team members have made corrections and increased their contributions after the intermediate peer review.
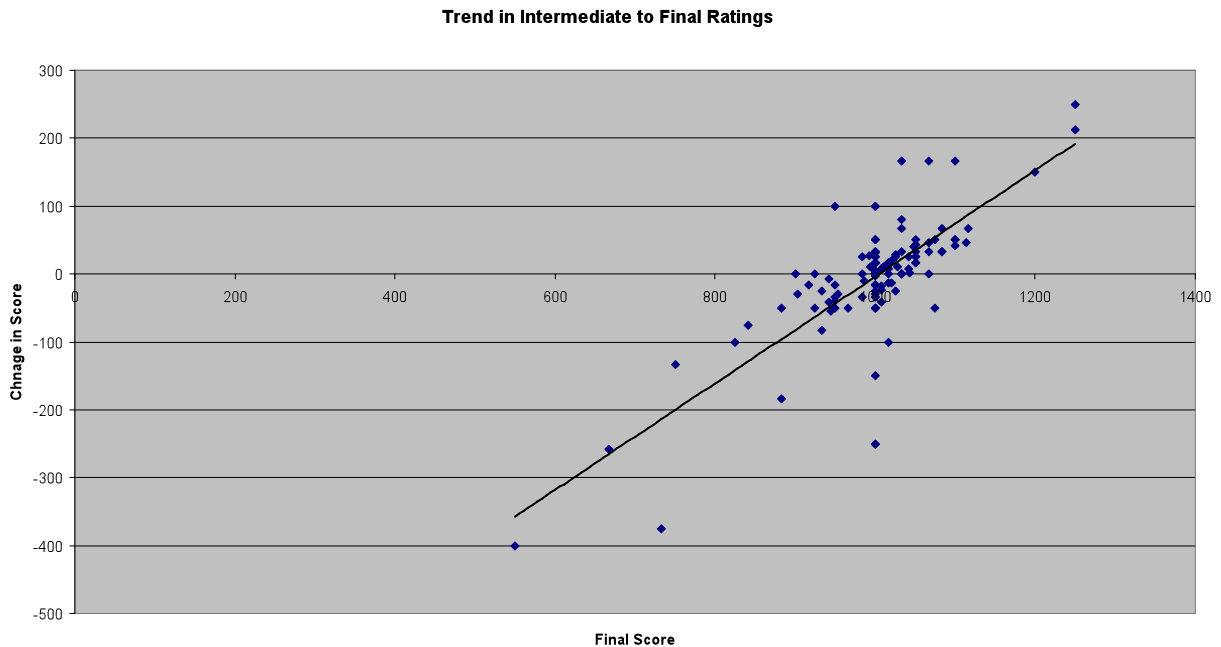
Trend in Intermediate to Final Ratings

Fig 3. Intermediate vs. Final Peer Review

While the plot above shows that not all teamwork issues are resolved within a single course, there is stronger evidence that learning occurs from one course to the next. Evidence of the effectiveness of the UCSD Peer Review Tool can be seen by growth in team working ability as the student progress through their major. The UCSD Peer review tool is used in a sophomore level course, MAE3, and also in a senior level design course MAE156A&B. One senior student attached an enlightening description of his team experience in his senior class and how it compared to his sophomore level class. This frank description is included with the student's permission in Appendix I. This description is noteworthy in that it reminds of us the intensity of team projects. But even more noteworthy is how the student modified his own approach to teamwork between his sophomore and senior year. Personal changes such as this are extremely hard to accomplish, and focused tools like the single parameter fixed-pie method can be the forcing function that facilitates such learning.

Use for ABET Assessment

One advantage of a single parameter to quantify each student's teamwork is that it can be used to assess how well the students are learning to work effectively in teams. If all team members are contributing equally then one would expect that all students would receive a score close to 1000. However if there is a wide variation in scores it is an indication of dysfunction or lack of performance in some team members. This quantitative approach was used during our ABET assessment. We looked at the standard deviation of teamwork scores in our sophomore level

class and then again in our senior classes. We were able to show that the standard deviation decreased in the senior year which is an indication that indeed student teamwork ability is improving. See Appendix II for the ABET assessment describing quantitatively teamwork performance. The quantitative assessment was matched with a noted lack of teamwork "emergencies" that required instructor intervention.

Open Ended Comment Feedback

Another difference between the CATME tool and the UCSD Peer Review tool is that the latter allows students to enter open-ended text feedback both in positive box and in "areas for improvement" box. There is a third text entry box for comments only for instructor. Students treat these comments seriously and the majority are indeed positive as shown below:

- "Great team member, will work with anytime"
- "Always there to do the dirty work, no matter what it was"
- "Great at working off of others people's ideas and always comes through in the end, an awesome person and great teammate"
- "Listens to group members."
- "Always very encouraging, knows how to handle very difficult problems, understand the impotrance of little details"

Examples of "areas for improvement" comments include:

- "Needs to listen to others, tell people before you do something."
- "Ed did not take more initiative to complete the team assignments."
- "would not explain ideas, or give reason for design other than "because i want it too""
- "Needs to inform team members so that everyone can participate and help further the teams goals."
- "You're smart and you have a lot of potential but just relax and be yourself"
- "be more assertive and state what you think. try to do a little in every area, paperwork and machining, not just paper/computer stuff"

These open-ended comments provide very specific feedback, which is essential information that students need to improve team performance. Some of the most challenging team problems are not due to slacking off, but rather lack of respect among team members. A student may be doing more than their share of the workload but receive a low peer review because they do not listen well to their teammates. The specific feedback is often a wake up call for such students.

Expanding Use of On-Line Peer Review Programs

An on-line tool for peer review helps students learn effective teamwork, and helps faculty address teamwork challenges. However, most classes with team projects do not use such tools. Partially this is due to lack of knowledge of these programs. Before the UCSD Peer Review Tool was developed a search was made to see if such a program already existed. At the time we did not find such a tool, and indeed CATME did not yet exist. At time of publication the CATME program is a successful program that can be used without charge by any academic institution.

However, the author's vision is that peer review tools would be even more widely used. The program for reviewing faculty, Ratemyprofessor.com had received wide adoption. Could we create a similarly widely used program such as Ratemyteamate.org?

Conclusions

Parallel efforts often lead to alternative approaches, and useful elements can be extracted from the various approaches. The UCSD Peer Review tool has many similarities but also a few important differences from the CATME tool. The fixed-pie rating scheme or the UCSD tool may initially seem like too intense of a feedback tool to apply within a classroom. However, team projects, especially engineering projects which span a compete term, can indeed be intense. The experience at UCSD has been that direct and quantitative feedback with a fixed-pie method is a useful tool for improving teamwork issues during the project. Other aspects of the UCSD tool include open-ended text input categories, which provide specific feedback and thus identify more directly areas of improvement that are needed. It is hoped that the best of both tools can be integrated together for an even wider use of on-line peer review.

Acknowledgments

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Appendixes

    I.   Teamwork reflections
   II.   ABET Assessment

References

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Off the record:

This Story below means a lot to me. I had a dysfunctional group, but I am very proud of how I handled the situation.

These duties were enjoyable and meaningful to me; however, the most important aspect of my job and the main thing I took away from the robot project was my job as what I call, "Team Secretary…Bitch"(sorry for the language, Professor) my team called me "Project Manager".

During MAE 3 I was overly excited and I basically treated my teammates as idiots and wouldn't allow them to touch my robot. In the end of the class they stopped coming in and we all had ill-feelings towards each other. I ended up building around 90% of the robot ALONE. I had the best intentions, during MAE 3; I put in an insane amount of hours and achieved minimal work. I learned from MAE 3 that a project like this is supposed to be done by a team. I really had to step back and examine my personality and make a change, which was very difficult to do.

I took this lesson from MAE 3 and applied it to MAE 156a. This year my turntable partner and I succeeded in creating a modified turntable which achieved very admirable times and we split the work 50/50 and had a great time bonding and becoming lifelong friends.

Unfortunately, when my team combined with a 3 person group problems arose. The 3 person group was formed by one overachiever student and two average students. What happened during their turntable project was that the overachiever student did all of the work, while the two other students coasted. It was no ones fault really the overachiever turned out to be very difficult to work with and the average students were what many call "slackers." When our groups formed they already had a nasty feeling between each other. Throughout the quarter these feelings escalated as the "overachiever student" tried to boss everybody around, and the "average students" tried to disassociate from the group. I saw exactly the same situation unfolding that happened in MAE 3 to me, I saw that the overachiever student would have ended up working alone. It started to get very bad the slacker students stopped coming in all together and the overachiever student would take it out on me and my original partner. Instead of confronting

them 2 parties I took a different approach. I started call people individually to set up working times. I made sure that whenever somebody was working on the robot I or someone else would be there working on it with them. I also tried to separate the "average students" from the "overachiever" student, by making myself as a barrier intermediary between them. It worked very well, our overachiever student slowly noticed what was wrong and adjusted his arrogant bossy attitude towards others, and the slacker students got excited to work on the robot, which they couldn't go near before for fear of being reprimanded. Though the overachiever student and the two "slacker" students still aren't friends they patched things up well enough to work together as a team. It turned out our overachiever student wasn't as smart as he thought he was; though he did very well in all his classes design is a whole nother ballgame. Furthermore, we found that one of our slacker students, though he wasn't book smart, was a certified machinist who owned a drill press, ban-saw, and actually built his own motorcycle from scratch. He was able to contribute by creating nearly every over half of the machined parts of our robot. Finally our other "slacker", we discovered, was a solid works wizard who had a knack for getting pesky cad drawings together.

In the end I spent by far the most time working on the robot; however, by the end the team was calling me "project manager." In MAE 3 I self appointed myself this title; however, this year I slowly earned this title by earning it through spending the most time and effort coordinating efforts and making sure everybody had something to work on and somebody to work with. This was the most valuable lesson I have taken from the MAE 3 and MAE 156a classes.

2008-2009 Assessment of ABET for ME Education Objective 4d:
An ability to function on multi-disciplinary teams

By: Nathan Delson, May 31, 2009

Preparation: Students work in teams in MAE3, MAE 156A, MAE156B, and MAE171A. Interdisciplinary teamwork is required in a number of projects. In MAE3 teams are assigned randomly between Aerospace, Bio, Environmental, and Mechanical Engineers. Teamwork is explicitly taught in MAE3 with a lecture, assigned reading, exercise, and quiz questions. In MAE156A teams are randomly assigned, and each students is required to take both a machine-design and an interdisciplinary role (software, control, or electronic) in a Mechatronic Project. In MAE156B students' preference is highly considered in team makeup, and students work on industry and research sponsored projects; the nature of these real-world projects requires interdisciplinary team effort.

Assessment: Teamwork is assessed in MAE156A and MAE156B. In both courses a custom web based program developed in the MAE Department is used for peer review. This software program allows to students to provide anonymous feedback to their teammates both with numerical ratings and comments.

The peer review program is implemented at a midpoint in the team project, where it does not impact student grades but provides low performing students with an incentive and specifics on how to improve their teamwork. Instructors meet individually with students who are identified as low performing team members in the intermediate peer review. Instructor feedback indicates that this method is effective in improving performance of low performing team members, and that one student who did not raised their performance failed the course. The peer review is also implemented at the completion of the project, where it is directly used for grading. Assessment was done from a question on taking responsibility, and also overall point allocation, where the number points allocated to all team members must average to 1000. The results for 156A and 156B are shown below.

		Average (out of 5)	Standard Dev	Max	Min
Responsible*	156A	4.4	0.6	5.0	1.7
Responsible*	156B	4.6	0.6	5.0	2.7
Overall Point Allocation	156A	1000	108	1317	575
Overall Point Allocation	156B	1000	56	1200	833

*Responsible and dependable: Gets work done on time, and can be relied upon. (Rated as:, Always=5, Mostly=4, Sometimes=3, Rarely=2, and Never=3)

The ABET rubrics is on a scale of 1-4, yet the peer review is on a scale of 1-5. A rescaling of the question on responsibility converts the average rating of 4.5/5 to 3.6/4. The overall point allocation by definition will always average 1000, so the standard deviation is used for the rating metric. To scale out of 4, a standard deviation of 50 is considered above exemplary corresponding to a rating of 4, and a standard deviation of 100 is considered proficient corresponding to a rating of 3. The average for 156A and 156B is thus 3.6/4.

The Teaching Working Group that covers 156A noted that lower teamwork rating occurred in this course, as shown in the highlight areas above. Plans will be developed to specifically address teamwork early in the course rather then rely on students remembering teamwork topics from MAE3. Team deliverables will also be clarified to make it easier for students to delegate tasks.

In MAE156B, where students work on sponsored project, teamwork is also assessed in a survey from the sponsor. Teamwork related questions are below:

How well did team delegate tasks and utilize the range of skills and backgrounds in the team	3.63
How well did team members work with individuals from other disciplines (sponsors, vendors, or others)	3.71
How would you rank team motivation?	3.63
Average	3.66

Extract from ME156B Sponsor Survey in 2008-2009
4 - exceeds expectations, 3 - meets expectations, 2 - below expectations,1 - not acceptable, NA - not applicable or no opinion

Summary and Recommendations: The on-line peer review is a successful tool in identifying poorly performing team members early within a project, so that low performing students are given specific areas for corrective action. The overwhelming majority of students work effectively in teams in their capstone design project, as indicated by both student peer review and project sponsors. Lower teamwork performance was noted in MAE156A, and corrective actions were agreed upon in the Teaching Working Group.

Rubrics

4d. An ability to function on multidisciplinary teams							
	Performance Criteria	Exemplary=4	Proficient=3	Apprentice=2	Deficient=1	Assessment in Course	Numerical Rating
4d.1	Overall contribution to team project	Exceeds expectations	Meets expectations	Below expectations	Not acceptable	MAE156A and MAE156B Student peer review overall rating	3.6
4d.2	Takes Responsibility	Exceeds expectations	Meets expectations	Below expectations	Not acceptable	MAE156A and MAE156B Student peer review question on Responsibility	3.6
4d.3	Effective performance in team project in the areas of team motivation, and task delegation.	Exceeds expectations	Meets expectations	Below expectations	Not acceptable	MAE156B Sponsor Survey on teamwork	3.7
						Average Rating	**3.6**