Using CATME Team-Maker to Form Student Groups in a Large Introductory Course

Chelsey S. Simmons, Ph.D.

Department of Mechanical and Aerospace Engineering, University of Florida

Abstract

CATME SMARTER Teamwork tools, pioneered by Matt Ohland of Purdue University, are a suite of tools that allow faculty and students to communicate with each other about the effectiveness of individual teammates. The "Team-Maker" tool automatically forms teams based on student responses to a variety of categories including demographics, performance metrics, and convenience. Team-Maker is a valuable tool, but there is a learning curve associated with administering the program and motivating students to use it and its partner assessment tools effectively. Here, I present my experience administering Team-Maker to an introductory-level class of ~100 students in an effort to help other faculty use this powerful tool. Specifically, strategies for motivating students to complete the surveys and incorporating peer evaluations into grading will be discussed. Self-reported student satisfaction is also included.

Keywords

CATME, Teamwork, Group Projects, Large Lectures

Introduction to CATME and Team-Maker

Effective teamwork is a critical component of engineering education. However, allowing teams to self-select can create negative attitudes toward the assignment and lead to excessive homogeneity, while random- or instructor-assigned teams can create scheduling conflicts (reviewed in Layton et al.[1]). Fortunately, well-researched tools to intelligently form teams are available from the CATME collaboration at www.catme.org. Originally developed as the "Comprehensive Assessment of Team Member Effectiveness," the expanded suite[1-4] includes a "Team-Maker" tool, as well as peer evaluation and teamwork support tools (Table 1).

The Team-Maker tool, invented by Richard Layton of Rose-Hulman Institute of Technology, automatically forms teams based on faculty-selected metrics and student responses. Team-Maker encourages students to input responses to pre-programmed and/or custom categories, including demographics (gender, ethnicity), performance metrics (grades in past courses, GPA, hours/week dedicated to this course), and convenience (class schedule, on- vs. off-campus housing). Faculty are prompted to rate importance of individual categories in forming teams and are coached as to the sociocultural implications of their decisions, especially regarding team demographics.

Team-Maker is a valuable tool, but there is a learning curve associated with administering the program and motivating students to use it and its partner assessment tools effectively (see helpful review by Hrivnak[5]). Here, I describe an example implementation of Team-Maker and its partner tools Rater Calibration and Peer Evaluation at our institution.

Table 1. CATME tools available. Descriptions adapted from http://info.catme.org/catme-tools/

Team-Maker	Useful for instructors to gather information from students and assign students to teams. Instructors choose the criteria and weighting that are most relevant to successful teamwork in their classes.
Rater Calibration	Familiarizes students with CATME's science-based model of team-member contributions. Students rate fictitious team members to learn how to accurately rate team-member contributions.
Peer Evaluation	Enables instructors to gather information about the contributions of team members and their team experiences. It includes self and peer evaluation of five dimensions of team-member contributions. The system analyses the data, flags unusual rating patterns, and allows instructors to use the information for student feedback and grading purposes.
Student Teamwork Training	Provides a set of training modules that instructors can assign to their students to build students' knowledge about teamwork.
Meeting Support	Provides templates for writing team charters, meeting agendas, and meeting minutes, as well as tips on how have effective meetings.

Example Usage of CATME in Large Introductory Course

In Spring 2014, CATME Team-Maker was used to form final project teams of 3-4 students in my sophomore-level "Mechanics of Materials" section (total enrollment: 97 students). Team-Maker allows the instructor to upload a spreadsheet of student information, for example, a class list downloaded from other online course management tools. The instructor can then pick questions for the students to answer to be included in the algorithm when forming teams. I used the five categories listed in Table 2, though there are dozens to choose from.

Once the students have answered the selected questions, the instructor uses Team-Maker to automatically form teams. The instructor can choose how much to weight different questions, both in terms of (dis)similarity on a given team and overall importance by selecting from a scale of 1-5 within the CATME interface. CATME System Help can guide faculty as to why one metric may be more or less important than others. For example, faculty often assume that having one female on each team is an ideal way to distribute a minority female class, but research indicates that outnumbering minorities is detrimental to group work.[6] Thus, Team-Maker automatically supports the option to ensure minority students are not outnumbered. In addition, I chose to rate "Schedule" as the most important factor, ensuring teams would have ample time to work together.

When administering Team-Maker, the instructor has a choice of whether to include "Rater Calibration" in the process. Rater Calibration is designed to help students rate their peers fairly during group work. However, students were frustrated with this feature because they were not prompted to log out of Rater Calibration and re-log into Team-Maker, a necessary step to complete the Team-Maker survey.

Once the final project was turned in, I asked students to complete the Peer Evaluation module. As with Team-Maker, the instructor selects the desired categories for inclusion. Once students

Table 2. Example categories and heuristics used by Team-Maker to assign final project teams. Details on category and weighting adapted from https://www.catme.org/faculty/help#TeamMakerQuestions

Gender	Research has shown that it is important that female students not be "outnumbered" by male students in a given team, so this heuristic is structured to favor more than one female per team.
Race	Like the gender question, the scoring heuristic for the race question attempts to ensure that no racial minority is outnumbered on any given team.
GPA	All of the questions which have numeric responses are scored similarly by dividing responses into "buckets" and comparing number of team members per bucket. This includes "grading" questions like GPA and prerequisite course grade.
Previous Course Grade	This numeric response is treated as above. The instructor can write in the previous course they would like to include; for Mechanics of Materials, I asked students to report their Statics grade. I then grouped students with similar course grades so that strong students would not end up doing all of the group work on behalf of weaker students.
Schedule	The scoring heuristic for the schedule question tries to maximize the number of useful meeting blocks available to the team throughout the week. **Based on student comments, this is a very important and useful feature of Team-Maker.**

have rated themselves and team members on a number of metrics, the Peer Evaluation report provides an "adjustment factor" score, with and without self-reported values. The adjustment factor (AF) suggests a weighting factor for students who contributed more or less to the team, and 22/25 teams had adjustment scores clustered around 1.00. The remaining teams had one student each who received an AF of 0.8 or less, indicating those teams identified teammates with a noticeably lacking contribution. Interestingly, the AFs with and without self-reported scores had similar trends, indicating that students honestly assessed their (lack of) contribution.

To ensure completion of teamwork tools, I incorporated participation into the grade for the final project. Out of 100 points total for the final project, students received 5 points for completing the initial Team-Maker survey and 5 points for completing the final peer review. An additional 5 points maximum was awarded according to peer feedback and the AF. Since the AFs appeared to identify only the most extreme cases, I did not use it as a multiplicative weighting factor and instead used each quintile to decrement the peer feedback score by two points. For example, a student scoring an AF of 0.8 received 3/5 points and a student scoring 0.6 received 1/5 points.

Student Satisfaction with CATME-Assigned Teams

As part of the Peer Evaluation, students are asked to rate satisfaction with their teammates by responding on a scale of 1-5 (1 = low, 5 = high) by responding to three statements:

1. I am satisfied with my present teammates.
2. I am pleased with the way my teammates and I work together.
3. I am very satisfied with working in this team.

Students indicate great satisfaction in response to these three statements as reflected by mean ratings of 4.53, 4.46, and 4.40, respectively, and median rating of 5 for all three statements.

Lessons Learned and Tips for Usage

- DO incentivize students to fill out the survey(s), e.g. by awarding points toward the final score for completion or assigning a zero score for the entire assignment if not completed. The usefulness of CATME modules relies on full participation.

- DO instruct students to log into CATME multiple times if you choose to use Rater Calibration to ensure Team-Maker survey completion.

- DO take student feedback seriously by incorporating adjustment factors into grading, as the AFs do seem to identify true problem students.

- DO NOT form teams until all students have completed the Team-Maker survey. Incomplete survey results when forming teams may cause students with conflicting schedules to be assigned to the same team.

Conclusion

CATME SMARTER Teamwork tools offer an informed way to organize and manage group work in large classes. As with any new technology, there is a learning curve for optimal implementation. However, by consulting the CATME website, published reviews, and anecdotal advice from colleagues, these tools can be used to manage one-time or ongoing team projects efficiently and effectively.

References

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Chelsey Simmons

Chelsey S. Simmons, Ph.D., joined the UF Mechanical and Aerospace Engineering faculty in Fall 2013, following a visiting research position at the Swiss Federal Institute of Technology (ETH) Zurich. She received her B.S. cum laude from Harvard University and her M.S. and Ph.D.

from Stanford University. In addition to her engineering research and coursework, Dr. Simmons received a Ph.D. Minor in Education and was a founding officer and President of Stanford's ASEE chapter. She also serves on the advisory board of a company based on one of her pending patents. Dr. Simmons' research lab focuses on mechanical design for biomedical benefit: inventing, prototyping and testing microsystems to mimic bodily functions in a dish.