

Work in Progress: Promoting Equitable Team Dynamics in an Introductory Biomedical Engineering Course

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Introduction

Team-based projects are widely utilized in the engineering curriculum, and often used in introductory engineering design courses. Creating the conditions however, to promote effective participation from all students in a team is certainly a challenge many instructors may face. This challenge often lies in the complexity of group dynamics and untaught skills that are necessary to function effectively on a team. Instructors may recognize the value of teaching process skills to students, however many may not feel qualified to teach these skills, or may even feel uncomfortable with coaching teams through their conflicts. Traditional mechanisms for promoting effective team process skills include strategies such as assigning team roles, developing team contracts and organizing project timelines [1]. While these practices have tremendous value, they often focus on an equality-based structure, ensuring that each student on the team contributes equally. The reality of stereotyping and bias among team members however, can inhibit team effectiveness despite having traditional procedures in place [2]. This work in progress explores the application of asset mapping, a strategy to integrate and support equity-based team dynamics, in an introductory biomedical engineering course. Asset mapping, an approach that enables each team member to communicate their assets, strengths and experiences with the group before the first group task is assigned, has previously been shown to be beneficial in creating and supporting more equitable team environments [3].

Methods

Description of Asset-based activities: Individual asset maps, team-based asset charts, and asset-based cover sheets were incorporated into our Fall quarter, first year introductory biomedical engineering course, in which students were engaged in a 10-week team-based design project (Figure 1). Each student generated an individual asset map during week 1 of the course. Asset maps provided students with the opportunity to highlight their experiences, acquired skills and desired areas for growth through a constructed web of connected text [3]. Students were encouraged to utilize a freely available mind mapping software, www.bubbl.us, to create their maps. Students noted their assets in various areas including: team and project skills, personal background and culture, clubs/organizations/sports, technical expertise, passions and interests, relevant experiences, related coursework and jobs, and creativity. Once teams were randomly formed in week 2, each team member shared their asset map with their teammates. In the virtual environment, students shared their screen when discussing their generated maps in Zoom breakout rooms. Collectively in the same session, teams then produced team-based asset charts which listed all team-based assignments in the course and assigned members based on their assets and/or desire to grow in a particular asset. For each team assignment, teams were also required to submit an asset-based cover sheet the week prior to the deadline, which divided the assignment into tangible deliverables in which each team member's contribution was articulated.

Peer Evaluation: Two times during the quarter (week 4 and 9), students evaluated their teammates using the CATME peer evaluation tool. In this online peer evaluation tool, students rated their peers (1 to 5) in each of the following areas: Contributing to team, Interactions with team, Keeping team on track, Expecting quality, and Having knowledge, skills and assets.

Quantitative individual team member scores from the second peer evaluation were compared to aggregated scores from the four previous course offerings (2016-2019).

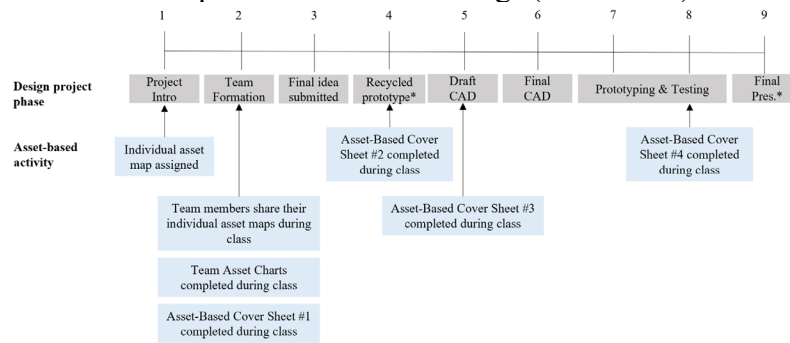


Figure 1. Timeline of asset-based activities within context of quarter long team-based design project. Weekly class sessions in which activities were completed were 3-hour TA-led virtual discussion sections. *CATME Peer evaluation

Student feedback survey: A survey was administered to gain preliminary feedback on team dynamics and perceived effectiveness of the asset mapping approach. Students rated their level of agreement with statements regarding the usefulness of the asset-based activities along with their perceived impact. Students were also asked to describe what assets they would be able to add to their individual asset maps as a result of the design project, how their team experience differed from other team experiences, along with any strategies that the team used to promote a more effective and equitable team environment. In this works in progress paper, students' attitudes towards usefulness and impact of the asset-based activities along with their responses to how this team experience compared to other team experiences will be discussed.

Results and Discussion

Students rated the usefulness of each asset-based activity positively (Figure 2). Specifically, students felt that creating their individual asset maps not only helped them articulate their assets (77% somewhat or strongly agreed) but felt that sharing their individual asset maps with their teammates was useful for the team (77% somewhat or strongly agreed). When asked if the activities helped to create a more equitable team environment (Figure 3), 90% of students somewhat or strongly agreed. Additionally, students felt that their assets were utilized (94% somewhat or strongly agreed) and they grew in at least one asset area (96% somewhat or strongly agreed). To illustrate this further, one student commented, *"The design project placed a greater emphasis on outlining and forming new assets, which was helpful for my team, when we organized our roles and tasks for a given assignment."* Another student commented, *"The experience was better because none of my teammates were judgmental resulting in a safe environment to share ideas."* While a number of students commented explicitly on the value of sharing and growing one's assets through this project, and thus leading to more welcoming and equitable team environments, a common byproduct mentioned included satisfaction with the resulting workload distribution. For example, a student commented, *"This experience was very enjoyable. My teammates worked well together and split up the work equally. We all got our ideas heard and followed up with each other frequently."* Likewise, a student explicitly wrote, *"This experience was better than most groups I've been in because everybody pulled their weight and worked together."* While additional analyses are needed, the survey responses and comments received support the benefits that have previously been reported which include

building student confidence, allowing students to get to know one another on a personal level, providing students with a process to divide workload and documenting links between individual assets to work tasks [3]. Upon comparison of peer evaluation ratings during week 9 of the 10-week quarter to that of the previous 4 offerings in which asset-based activities were not incorporated, there was no significant difference in how students rated their teammates in each of the following areas: Contributing to team, Interactions with team, Keeping team on track, Expecting quality, and Having knowledge, skills and assets.

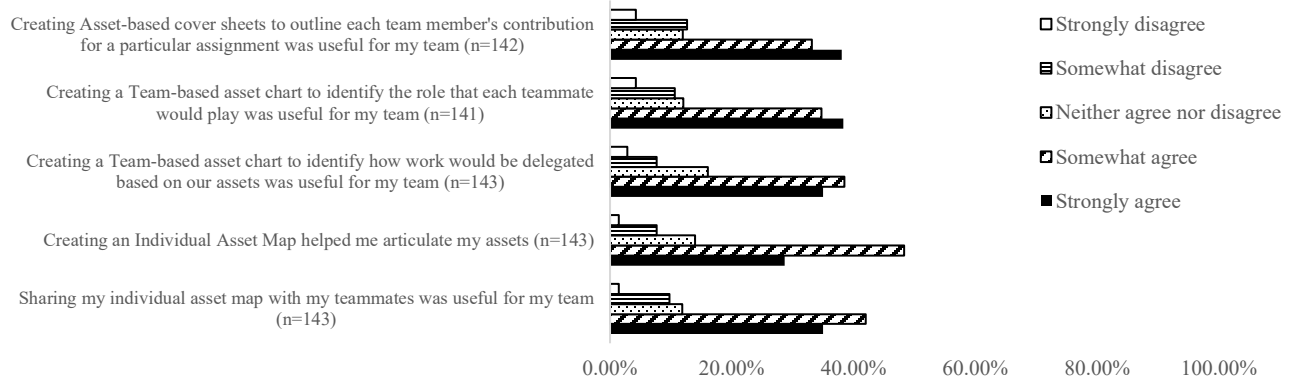


Figure 2. Student attitudes toward usefulness of asset-based activities was measured by level of agreement with each of the five indicated statements (number of student responses indicated in parentheses).

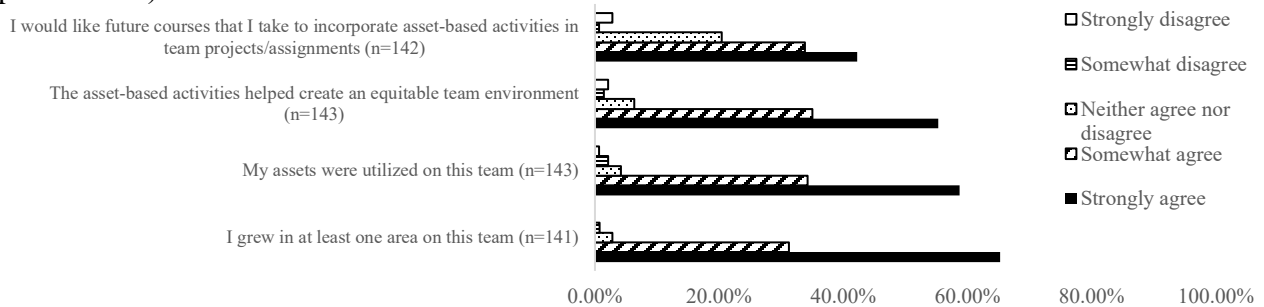


Figure 3. Student attitudes toward impact of asset-based activities was measured by level of agreement with each of the four indicated statements (number of student responses indicated in parentheses).

While differences were not noted in peer evaluation scores compared to previous years, it is important to note that previous average scores were relatively high, ranging from 4.1-4.3/5.0. Thus, this may not be an appropriate measure to evaluate impact of asset-based activities on team dynamics. Alternate means of assessment may be needed, such as the Team CARE assessment, which is a tool that focuses on team function and feedback as a group versus feedback and performance of the individual team member [4]. Students' positive attitudes noted by survey responses however, provide preliminary data to suggest that equity-based team activities can help facilitate the development of effective team dynamics. Instructors noted that the asset-based activities were straight forward to implement, thus suggesting that these activities are a feasible method for those who may not feel qualified to teach effective team process skills. Subsequent studies to further explore student interactions during team asset activities, along with the potential benefit of vertically integrated asset-based activities across the curriculum, are needed to further evaluate the longer-term impact and effectiveness.

References

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