A TEAM HEALTH SELF-ASSESSMENT TOOL AND WORKSHOP FOR CAPSTONE DESIGN TEAMS

Ada Hurst, Maria Barichello, Erin Jobidon and Rania Al-Hammoud
University of Waterloo
adahurst@uwaterloo.ca

Abstract – The ability to work in teams is an important learning outcome for graduating engineering students. There are, however, limited intentional and structured teaching opportunities through which engineering faculty can instruct students on effective team behaviours.

In this paper, we describe a workshop in which student teams self-assess and create a plan to improve their team processes. Students first complete individual surveys, reflecting on their perceptions of the effectiveness of their teams. Individual responses are then aggregated at the team level, with each team receiving summary team scores. A structured in-class activity provides teams with an opportunity to reflect on effective and ineffective team processes, share strategies and best practices with other teams, and develop plans for improvement.

Multiple deliveries of the module in various engineering programs, including in a capstone design course, have shown that the module is an effective tool for teams to self-assess and self-correct.

Keywords: teamwork, team processes, self-assessment

1. INTRODUCTION

The ability to work in teams is a learning outcome mandated by engineering accreditation requirements [1]. Capstone design courses, in which students typically complete a significant design project in teams, offer a valuable opportunity to instructors to teach and assess teamwork skills. Due to the relative significance and length of time that students devote to these projects, they also become an important setting where students come to appreciate the value of team management and develop effective team behaviours and practices.

At the same time, poor teamwork skills can significantly affect project outcomes. A recent study at our institution found that 22% of students experience at least one significant conflict in their capstone design project team [2].

Traditionally, engineering programs have not devoted sufficient time to teaching teamwork skills to students in targeted and purposeful ways, instead relying on students to develop teamwork skills on their own, through their experiences in project teams. Recognizing the importance of teamwork to engineering education and the scarcity of existing teamwork learning opportunities that are structured and intentional, in 2015, a number of individuals at our institution created a working group with the mandate of creating a series of teamwork training modules. This was fundamentally a group of volunteers, composed of faculty and staff from various engineering departments as well as other teaching and student support units [3]. The instructional series was envisioned to direct and support student learning in key teamwork skills, scaffolding the modules such that the material introduced in each module built on and reinforced material covered in prior modules.

We have previously described the four first modules of the series: introduction to team processes [4], communication in teams [4], introduction to conflict management [5], and giving and receiving feedback [5, 6].

Here we describe a fifth module, Team Health Assessment, which serves as an intervention for already-established teams. Team members reflect on the effectiveness of their teams and partake in an internal discussion as well as a class-wide activity to come up with concrete actions to strengthen areas of weakness. Instructors – at our or other institutions – wishing to implement this workshop in their classes can freely access workshop components and materials, as outlined in the Appendix.

2. DESCRIPTION OF THE TOOL AND THE ACTIVITY

The module as a whole is composed of two components: a before-class survey that students complete individually (self-assessment) and a series of in-class activities in which students participate in their teams (class workshop). Figure 1 graphically represents the various steps, which are further described in the subsections below.
2.1. Step 1 – Self-assessment data collection

Several days before the class workshop, students receive an email with a link to the Team Health Assessment Survey, which is a brief individual survey they must complete individually. Students are not required to provide their names but must identify their team affiliation in order to facilitate the aggregation of student data by team (see Step 2). Prior to starting the assessment questions, the students also rate their team as either high functioning, moderately functioning or low functioning.

The Team Health Assessment Survey is composed of 76 true/false questions about the students’ perception of the effectiveness of their team. The questions were adapted from a variety of existing team assessment surveys [7-9]. The questions fall under nine broad categories, which capture nine processes and attributes possessed by highly effective teams [10]:

1. Members **communicate** effectively, by listening carefully to other team members, clarifying received information, and having a shared understanding of other team members and the team.
2. They **address task conflict** effectively, by productively managing task conflict, which can be beneficial to team performance, and minimizing personal conflict.
3. The **cultures** (i.e., norms and values) of high performing teams produce patterns of interaction that support team performance.
4. High performing teams **make decisions** in a systematic way, using carefully developed and agreed-upon decision criteria, and by generating and evaluating a number of alternatives.
5. High performing teams are energized to achieve clear objectives. Team members derive **motivation** by valuing their membership in the team and through their alignment with the team’s objectives.
6. The team holds effective, properly managed group **meetings** (later referred to as Team Processes), where team members discuss and decide on important issues to the team.
7. Effective teams have clear **mission and/or goals**, with the latter being specific and measurable such that success can be achievable and team progress trackable.
8. Individual members of high performing teams can effectively **self-manage** in order to achieve their obligations to the team.
9. Effective teams have one or more team members that can perform and cover all necessary **leadership** functions, including planning, task assignment, and performance evaluation.

Examples of the final Team Health Assessment Survey true/false questions include:

- “Team members openly seek feedback from one another” (communication)
- “Team members are able to work through differences of opinion without damaging relationships” (conflict)
- “I feel a strong sense of belonging to the team” (team culture)
- “The team takes time to consider how it makes decisions” (decision-making)
- “All team members are committed to the success of the team” (motivation)
- “Our team members all prepare for and contribute to meetings actively” (meetings)
- “We devote time to reviewing our efforts to ensure they are worthwhile and on track” (missions/goals)
- “I take initiative to develop the skills necessary to complete quality work” (self-management)
- “Our team has adopted an appropriate leadership style” (leadership)

2.2. Step 2 – Self-assessment data aggregation

Once all individual responses are collected, the course instructor (or workshop facilitator) proceeds to aggregate the data by team. For each team, the aggregator identifies questions to which one or more team members answered in the negative. Depending on the class context (team size, general team effectiveness), the aggregator will also
determine the number of false responses in a team that will cause a question to be flagged as a “question with variance”.

Setting the number of false responses too low can result in too many questions flagged as possible areas of concern. If the number of “problematic” categories generated for a team is unreasonably high, the team will have a difficult time determining what its greatest area of concern is. In this case, increasing the threshold of false responses will result in fewer questions being flagged as areas of concern, and will help students focus on the most important issues in their group. Conversely, for highly functioning teams, which are typically those in their senior year and those who have worked with their teammates before, it may be necessary to decrease the threshold of false responses that flag a question to have “variance”, otherwise very few, or no, questions will be flagged as areas of concern.

An important factor that can affect the suitable threshold is the process by which teams form in the class. According to the literature [11], as well as based on our experience, whether students are randomly assigned in teams or allowed to form their own teams can significantly affect team dynamics, team members’ attitude towards their experience in the team, and ultimately, project outcomes. Therefore, the aggregator may choose to decrease (if the former) or increase (if the latter) the number of false responses flagged.

For each team, the aggregator creates a Team Health Assessment Report, which includes an overall team score, sub-scores for each of the attributes described above and the list of assessment questions with variance. For example, a team might learn that it has achieved a score of 80% on the category of decision making, 90% on the category of leadership, and 100% on all other categories. A score of 80% on a category would indicate that 20% of the questions related to that category were flagged as having variance (i.e., depending on the threshold, more than one team member responded in the negative). Below the category scores, the team would see listed all flagged questions.

Manually aggregating the data, computing team scores and creating team reports can be time-consuming and error-prone. To address these concerns, a team of third-year management engineering students at our institution developed a Microsoft Excel-based tool that automates the process. The tool is now available open-source. A more detailed description of the tool and instructions for how others can download it and use it are available in the Appendix.

2.3. Step 3 – Team reflection on Team Health Assessment Report

Students complete the remaining steps (3-5) of the module in an in-class workshop. The workshop components require active participation from all teams.

At the beginning of the workshop, each team receives its Team Health Assessment Report, as well as an additional handout, which describes in detail how effective teams model the subset of attributes on which the team received a low score.

As students receive their reports, they are urged to refrain from asking how their teammates responded to particular questions. Instead, they are encouraged to accept their teammates’ (anonymous) perspectives and seek to resolve any discrepancies openly and without judgement.

Teams are given ten minutes to review their reports and asked to reflect on their top three high scores. This step prepares them for the first activity of the workshop, which is to reflect on the strategies or habits that made their team successful in those areas (Step 3a). The team identifies the three categories they scored the highest on and lists successful strategies they have used to achieve success in those categories. Next, the team identifies the three attributes on which they scored the lowest and notes them on a large chart paper provided by the facilitator (Step 3b). (Note: If a team’s attributes have equal scores or if only a few attributes have low scores, the team is directed to select an attribute about which they believe they would benefit learning more best practices. Alternatively, the instructor can pre-select an attribute for the team ahead of time to ensure all attributes are addressed during the brainstorming session).

2.4. Step 4 – Gallery walk

In Step 4, teams post their (anonymous) chart papers with their three top weaknesses on the classroom walls (from Step 3b). Each team then goes around the room for roughly ten minutes and observes the areas of weakness shared by other teams. Whenever an area of weakness matches a team’s own area of strength, the team writes its strategies and habits for success (from Step 3a) in that area in the other team’s chart paper.

2.5. Step 5 – Teams reflect and develop plans for improvement

The facilitator asks teams to return to their desks and provides each with a handout that lists additional strategies they can consider implementing in order to support improvement in each of the attributes. Teams then briefly review these strategies, along with the strategies that received from other teams during the gallery walk, and the initial handouts (the actual health assessment report and handout describing how effective teams model each attribute). Teams use these resources to discuss why they feel they scored low in a particular attribute and to identify strategies to improve each area. The Team Health Assessment Report also provides each team with a list of the specific survey questions that had variance so they can revisit those statements during the discussion.
In order to genuinely and effectively address team weaknesses, students need to critically and openly discuss their experiences and perceptions with the other members. Teams are encouraged to be respectful and open-minded during this process since discussing conflicts and concerns can be emotional and challenging for some students. Teams should ensure each team member has a voice and contributes to the discussion. The facilitator should remind teams that using active listening, paraphrasing and summarizing throughout the discussion can help avoid misunderstandings. One recommended strategy for teams who are having a difficult time getting a dialogue started is to conduct a ‘blind brainstorm.’ Using this strategy, each team member anonymously writes down one thought regarding the attribute at hand and reads all others’ notes without comment before beginning the discussion. During the discussion, students are free to maintain the anonymity of the individual written comments.

At the end of the workshop, the facilitator provides each team with a Team Health Improvement Plan handout. The handout prompts teams to select two of their three lowest attributes and to document why they feel they scored low in each area, which new strategies they could implement to resolve their low scores, and how they plan to address the team’s weaknesses over the remainder of the term. This final activity concludes the workshop.

3. IMPLEMENTATION AND OBSERVATIONS

We have delivered the Team Health Assessment module in four courses in the management, civil, geological and systems design engineering programs at our institution, with more deliveries planned in the near future. Below we summarize some initial findings on the effectiveness of the workshop and outline how different program and course contexts affect the in-class workshop delivery. We base our findings on the generated Team Health Assessment Reports and in-class observations.

In general, the workshop was very well received by students and instructors alike. Students engaged well with all components of the module and expressed that the most important part of the workshop was that it provided them with an opportunity to speak openly with their teammates about team issues. Students felt comfortable opening up to their instructor about problems and conflicts in their groups. In addition, by reviewing handout materials, students acquired terminology and concepts that they could refer to when connecting with the instructor over the rest of the term.

It was noted that in the courses that had randomly assigned teams, the variances on the individual survey questions were the highest. This speaks to the increased teamwork challenges when team members are not already familiar with each other. This variance was less pronounced when the instructor assigned team members to teams in a more intentional (i.e., non-random) way, taking into consideration previous experience and skills such as design, leadership and written communication. The variance was the smallest in a capstone design course. In capstone design courses at our institution, students typically choose teammates whom they know and with whom they feel comfortable working.

Across all courses, Team Processes was the attribute that had the highest variance. Team Processes refers to how the team is utilizing meetings to facilitate communication, decision making and monitoring of their work and procedures. The most common concern was the punctuality of team members at meetings and their contributions to the team project. However, Team Processes is also one of the easier aspects to address as team members can agree to change processes that are not working for them in order to elicit immediate behavioral change.

In the single case where the instructor randomly assigned teams, Team Culture – which refers to relationship building, openness to ideas, and team climate - had the second highest variance. For example, as students began considering different design alternatives, they closed themselves off to other team members’ ideas, which resulted in heated arguments and conflict. This category did not surface as an issue in the other courses where the teams were self-selected, or assigned by the instructor in a more intentional way. The fact that students were randomly assigned and for the most part did not know each other well, could have been the major contributor to this area of concern. This aspect is also more difficult to address as individual personalities and behavioral skills take time to adapt and require high motivation on the part of students.

Two other team attributes - Decision Making and Mission and Goals - typically had high variance for many teams in all workshop implementations. With regards to decision making, often times teams identified that they had not explicitly considered how they were making decisions or that they had not thought to utilize a specific decision-making process based on their needs. This led to some members feeling as though they did not have a voice or that their opinions and desires were less valuable. With regards to missions and goals, many teams identified that they had not taken the time to establish their overall mission or set goals beyond meetings the milestones imposed by the course project or assignment. This led to misaligned expectations, conflicts and deadlines that were not met.

CONCLUSION

We have described a comprehensive learning experience – the Team Health Assessment module, which can be used by instructors of capstone design courses or other courses that feature a significant team project. The module, which includes both a before-class individual component and an in-class workshop, enables teams to
reflect, articulate teamwork issues and constructively develop plans for improvement. Class observations and informal feedback from students and instructors alike have shown that this can be a valuable learning experience and engaging activity for teams.

ACKNOWLEDGEMENTS

We thank Professor Matt Borland for implementing the workshop. We also thank management engineering students Hassan Al Mulla, Faiza Noor, Mathan Premachandran, Melissa Pulenzas, Melanie Roy, and Shawn Shao for developing the automation tool for aggregating team scores and creating team reports.

REFERENCES


APPENDIX: ACCESSING MODULE TOOLS

Instructors at our or other institutions that wish to implement the module in their courses are welcome to do so. Module components are made available and free to use by accessing the following repository: https://github.com/melissapulenzas/UW-Team-Health-Assessment. Documentation on how to use the tool is also included.

Three files are required to aggregate the student data and to generate the reports: Team Health Assessment Report Builder.xlsx, Team Health Assessment Report.xlsx, and Team Health Assessment Report Template.docm. Prior to the start of the workshop, and after students have completed the Team Health Assessment survey, the raw data is exported to a csv file. The Team Health Assessment Report Builder.xlsx file imports this csv file and allows the user to generate the team data and reports. The Team Health Assessment Report.xlsx and Team Health Assessment Report Template.docm files are Excel and Word templates, respectively, that are populated with the aggregated data from the Builder file. The Report Builder file has functions that allow the user to customize certain settings. Users have the ability to set the number of false responses that will cause a question to be flagged as a “question with variance”. Finding the right number of false responses is a function of the size of the team as well as the variation in team responses.