

SHARE: Scaffolded Activities to Practice Teamwork Skills

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Motivation

This Strategies for Hands-on Activities, Resources, and Engagement (SHARE) paper outlines a set of activities to support collaborative learning intentionally and equitably. Collaborative learning involves joint intellectual effort by students (and often instructors) to mutually create or find meaning, solutions, or products [1]. Equitable collaborative learning leads to high achievement and productivity; caring, supportive relationships; and self-confidence and sense of social competence. In addition, teamwork is among the most commonly identified desirable professional skill listed by employers of biomedical engineering (BME) students [2]. BME courses ranging from first-year design to fourth-year Capstone often assign projects to be completed in teams, suggesting that scaffolded activities to support development of teamwork skills would be beneficial. However, teaching collaborative learning requires intentionally structured activities that encourage equitable and synergistic contributions from all team members, leading to meaningful learning experiences [3], [4].

Learning Objectives

The objective of the activities presented here is to help students intentionally develop and apply teamwork skills equitably and synergistically.

Implementation

Students complete a set of activities throughout the semester to introduce, review and revise, and report out on teamwork skills. Activities include (1) a team expectations worksheet, (2) reflection questions, (3) self-reporting of teamwork strengths and challenges, (4) reporting of examples of peer teaching and learning in the team, and (5) learning assessment activities designed to require synergies among team members. The learning cycle consists of spaced repetition (i.e., distributed practice), beginning with the team expectations worksheet. Each activity is revisited and/or revised multiple times during the semester, culminating in the summative learning assessment at the end of the semester.

Team expectations. After team formation, the instructor posts a message to the class with suggested strategies for successful teamwork (Appendix 1), which prepares students to complete a Team Expectations Worksheet (Appendix 2), similar to a team contract [5], during the next class session. To support equitable contributions from students who prefer time to compose thoughts before verbal discussion, students to first complete the worksheet individually before discussing and arriving at consensus on team answers. During the semester, teams revisit and revise their worksheet based on their experiences on intermediate assessments.

Individual reflections. During some classes, students complete individual questions designed both to reflect on their learning process and strategies for teamwork and to provide the instructor with feedback on their progress (Appendix 3). Questions may be included in other low-stakes formative assessments or may be administered separately as warmup or exit ticket activities. Some questions contribute to co-creation of class norms, and others are opportunities to self-

assess teamwork on class activities generally. Some reflections are tailored to specific assessments such as collaborative (two-stage) tests [citation blinded].

Teamwork strengths and challenges. Students complete the CATME Peer Evaluation to rank themselves and their team members on five teamwork dimensions [6]. In addition, they complete three additional CATME evaluations on Team Interdependence, Team Satisfaction, and Psychological Safety. Positive interdependence leads to learning benefits through synergistic interactions among team members [4], [7], and satisfaction and psychological safety encourage continued efforts to work together [8]. The CATME data provide feedback to the instructor, who meets with each team to discuss strengths and challenges. Meetings follow a structured conversation (guided by questions in Appendix 4) and serve to build trust between the instructor and the team [9].

Peer teaching and learning. As part of the final summative assessment in the course, students complete a peer teaching and learning assessment (Appendix 5). Students share specific examples of teaching a team member, examples of a learning from a team member, and examples of working together synergistically.

Assessment of synergistic learning. Both intermediate and final assessments are designed to promote positive interdependence among team members [4], [7]. Positive interdependence occurs when team members perceive that others' contributions are essential for team success. For example, create a reward structure in which individual grades depend on team performance. Alternatively, design group projects that require a diverse skill set, encouraging team members to contribute their different experiences and expertise.

Situational Factors

When considering how to implement these activities, a variety of resources are available from teaching and learning centers [10], [11], [12] and published work (e.g., [1], [13]). A number of situational factors impact implementation choices. First, in an active learning classroom (e.g., problem-based learning, flipped classroom, interactive lecture), reflection questions and instructor-team discussions are easily implemented during class activities. However, in traditional class formats or larger classes, audience-response systems (e.g., PollEverywhere) or exit tickets improve scalability of opportunities for student reflection. Second, students' previous experiences with teamwork or collaborative learning will affect their willingness to participate in reflection activities and self-assessment [14]. Instructors build trust to overcome student resistance by encouraging student self-assessment, by communicating high expectations, and by showing empathy to students. Meeting with student teams increases the likelihood of meeting these needs but is not practical in larger classes. In larger classes, "trust moves" [15] include showing personal concern for students and their identities, sharing personal values and identities, and designing activities to make the class feel smaller [16], [17], [18]. Overall, instructors may choose to implement activities in a variety of modes, including verbally or using classroom technology tools, to create opportunities for reflection and self-assessment in teams and to support an equitable, inclusive community of learning in the classroom.

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Appendix 1. Strategies for Successful Teamwork

You should have received an email from CATME with your team assignments for the rest of the semester. Tomorrow, you'll begin sitting with your teams. As you're beginning to work with your teams on [the team project(s)], I thought it would be useful for you to reflect on strategies for successful teamwork. Strategizing for success is especially important to make sure each team member is included and has an equitable chance to achieve their learning goals. We'll take some time for your teams to discuss tomorrow, and here's some suggestions for you to consider:

1. Think about the roles you tend to play within teams, and make a conscious effort to be open-minded about how these roles will play out in teams. For example, if you usually lead, take time to step back and listen.
2. Be aware of how factors such as gender, race, cultural backgrounds, socioeconomic status and life experiences could affect your team members' performance.
3. Assume that your team members are doing their best and want the team to succeed.
4. In meetings, communicate clearly, directly, and respectfully. If a team member's behavior is inhibiting progress, address the issue in a timely, professional manner.
5. Communicate expectations, schedules, and goals for the project at the onset of working together.
6. Be prepared to make sacrifices and be considerate of each other's schedules. Team members may have to rearrange their schedules to get everyone in a meeting, and they may have to hand over part of the project or make changes in plans to accommodate everyone's unique situation.
7. Organize and use time carefully. Set agendas for meetings, be clear about the action items for each team member before leaving each meeting, leave time to work as a team, and make use of each team member's skills and interests in order to take advantage of working with a diverse team of students.

Appendix 2. Team Expectations Worksheet

Goals

What are our team's goals for [the project]?

How will working together help us learn or achieve those goals?

What individual skills do we want to help each other develop or refine?

Expectations

What do we expect from one another with respect to...

...availability and attendance at meetings?

...methods/frequency of communication?

...quality/quantity of work?

...inclusion of everyone's voice and respectful conduct towards each other?

...other expectations?

Procedures

What procedures do we agree on to help us achieve our goals and expectations?

What roles will each team member fulfill? How will we agree on those roles?

Will roles change during the semester?

Self-Evaluation

How will we address non-performance with respect to our agreed-upon goals, expectations, and procedures?

Appendix 3. Individual Reflection Questions

Co-creation of class norms

Discuss with your neighbors what constitutes courteous behavior in the classroom that supports a positive learning environment. When you're ready, write one most important rule that should apply to our class.

Self-assessment of teamwork generally

When you can discuss with neighbors in class, what is your strategy to include everyone in the group and help them learn?

Our team met our goals working together the past two weeks. (strongly disagree / disagree / not sure / agree / strongly agree)

What worked well for your team? What would you change about how you worked together?

Reflection on strategies to prepare for a collaborative assessment [19]

In what ways are you and your group preparing for [the test]? (Check all that apply.)

- We discussed the Expectations for Success worksheet.
- We collaborate to answer questions in class.
- We take turns explaining answers to each other.
- We check in on how each other are doing during each class.
- We plan to study together.
- We will plan a strategy together for the team part of the test.
- Other (please specify)

Briefly describe one specific effort you will make to help your team prepare for [the test].

Self-assessment of teamwork on a collaborative assessment [19]

I feel like completing questions with a team helped me meet specifications on the test. (strongly disagree / disagree / not sure / agree / strongly agree)

I feel more confident in my learning as a result of the team activity on the test. (strongly disagree / disagree / not sure / agree / strongly agree)

Appendix 4. Guiding Prompts for Instructor-Team Meetings

In what ways are/aren't you adhering to your Team Expectations document?

Think about your responses to the CATME Peer Evaluation.

- Have you talked about the scores?
- How do you think you scored each other?
- How should I use these scores?

Name something going well for your team so far.

Name something your team still wants to work on together? What will be your strategy to work on it?

In what ways do each of you check in to be sure everyone can contribute to the team's work in ways that work for them?

Appendix 5. Peer Teaching and Learning Assessment

How did you help your team achieve its learning goals? If possible, include specific examples of instances in which you helped someone to learn a new technique or concept.

Rubric:

- Meets expectations—Described specific strategies they used to help team members learn concepts or ideas during the course
- Partially meets expectations—Described general strategies for helping others learn
- Does not meet expectations yet—Described learning without any specific contributions to helping team members

How did your team help you learn concepts and techniques that will help you after this class? If possible, include specific examples of instances in which you learned a new technique or concept from a specific person or group.

Rubric:

- Meets expectations—Described specific strategies used by team members to help them learn concepts or ideas during the course
- Partially meets expectations—Described general strategies team members used to help them learn
- Does not meet expectations yet—Described learning without any specific strategies used by team members

Describe an example of a time when your team's collaboration strategy enabled you to learn or co-create something as a team that you could not have learned or produced individually.

Rubric:

- Meets expectations—Reflected on their own learning synergistically with their team's learning
- Partially meets expectations—Reflected on their own learning
- Does not meet expectations yet—Described a general example of their team working together