## Overview

Good problem solving skills are an essential skill for employment and life in the 21st century. Good problem solving uses a process to identify the issue, develop possible solution paths, and take the appropriate action.

This case study, consisting of a website and an instructor guide, uses a "flipped classroom" model: students complete a web-based experience for homework that includes content, videos, activities, and an "Idea Log" and then participate in additional active learning activities in class to apply and extend the content. The case study, which is contextualized with Advanced Manufacturing industry examples, is designed to be engaging and to help students learn about a variety of problem solving methods and practice applying them. The online case study even includes a "choose-your-own-adventure" activity that can be done again and again!

## Objectives

Students will:

- Identify successful problem solving processes
- Learn about multiple problem solving strategies
- Practice problem solving strategies to improve results
- Learn why good problem solving skills are important to employers
- Learn why good problem solving skills can improve safety and productivity

## Time Required

Students will spend 1–1.5 hours to complete the web-based case study. The in-class activities will take a full class period (45–90 minutes) with optional activities for extending the instruction.

## Materials Required

Post-It notes, or index cards and tape. Internet, laptop, and projector; large sheets of paper and markers for team posters

## Requirements / Assessment

1. Students are expected to complete the case study module outside of class.
2. Students are expected to complete the Idea Log thoughtfully and submit to Instructor digitally or in print.
3. Students are expected to actively participate in in-class activities.
4. Students should be assessed based on completion and thoughtfulness of Idea Log, and participation in class activities.

# Learning Plan At-A-Glance

1. Instructor preparation: review online case study.
2. Introduce topic in class and assign online case study as homework.
3. Follow-up in class: Facilitate activities and discuss.
4. Optional group project to extend topic.

# Learning Plan Detail

## Preparation

Before assigning to students, plan on spending 45–60 minutes to review the case study: https://casestudies.mit.edu/problem-solving/

## In-Class Introduction to Topic:

1. Introduce the topic of problem solving skills to students. Ask students:
   - Why do you think that employers value good problem solving skills?
   - Why do you think problem solving and critical thinking always appear on lists of the most important 21st century skills?
   - On a scale of 1-10, how would you rate your own problem solving skills?
   - What do you think you could do to improve your problem solving skills?

2. Assign web-based case study as homework. It will take most students 1–1.5 hours to complete, so it will be helpful to give students a few days before it is due. Central to the instruction in the case study is a "choose-your-own-adventure" type of activity. It is designed so that students may go through it multiple times and gain different embedded instruction each time. Encourage students to complete the adventure at least twice, making different decisions each time

3. The case study provides several places where students are asked to write down their ideas, questions, and experiences in an Idea Log. On the last screen, students may download their Idea Log as PDF or have it emailed to them. Remind students to bring their Idea Log to class (either print or on computer).

4. If you want to assess the Idea Log for completion and thoughtfulness, students may submit it via email, print copy, or even upload it to your course Dropbox/website.

## Follow-up Discussion and Activities in Class [45–90 minutes]

1. [5 minutes] At the beginning of class, ask students to think about their experience going through the online case study and what they learned, and then share on Post-It notes, index cards, or torn pieces of paper (one item per piece of paper):
   - One word
   - One thing you learned
   - One question you have

   Designate areas of your classroom walls for each category and ask students to stick their notes on the walls. The goal of this activity is to quickly capture the ideas of every student and use those ideas as a way to start the discussion. While something as simple as a word will not tell you much about what the students understood about the case study,

the explanations they later provide will say a lot.

2. [5–10 minutes] Ask students to review each other's thoughts and put a check mark on the three ideas for each category that they think represent the biggest take-ways from the case study. Students may vote for any idea or question other than their own; this helps them critically read each other's work.

3. [20–45 minutes] Identify 2–3 words, statements, and questions that are the most popular and share them with the class. Facilitate a whole group discussion to get students sharing what they learned with a focus on how this relates to the workplace, and identifying strategies that they can use to improve their own problem solving skills on the job. Possible discussion questions:

   • The most popular words you chose are _____.  How do you think these words briefly describe the essence of the case study?
   • The things you identified that you learned are _____.  Are these the most important take-aways about problem solving skills?
   • You identified several questions. Let's try to answer them based on what we know or figure out what else we need to learn to answer these questions.
   • What was the most surprising thing you learned about problem solving skills?
   • What are the best ways that you can personally improve your problem solving skills?
   • What might you say to a potential employer about your own problem solving skills to get him/her to hire you?

4. [15–20 minutes] Project the case study website on the wall and go through the "choose-your-own-adventure" activity (screen 5) as a class. Many students will have only gone through the activity one or two times and missed the embedded instruction about the other problem solving strategies. A fun way to start is to ask the students to pretend that they are a new hire with terrible problem solving skills. Assuming this role, ask them to vote on the worst decision at each point and share their rationale for why it is the worst decision. This strategy should provide a different path through the adventure than the students took at home. As long as they can justify their answers, they are doing the deep thinking required to unpack problem solving as a process; understanding and being able to articulate why a decision is wrong can be very revealing.

5. [10–30 minutes] Small group discussion options, if you have the time. Small groups provide an opportunity for all students to share.

   • Which problem solving processes did you consider to be the most important from the Adam Savage of Mythbusters video? Why did you choose these five? Compare your list to the other lists in your group.
   • How do the processes that Adam Savage uses compare to the chimpanzee's process?

## Optional Extension [2 class periods]

This optional project gives students an opportunity to deepen their knowledge even further by teaching others how to improve their problem solving skills. Give students one class period to prepare their presentations and then present their work at the next class.

1. Place students in teams of 3–4.

2. Ask the teams to imagine that they are in charge of training employees at a small advanced manufacturing company to improve their problem solving skills. Each team should prepare a presentation that outlines how they would structure a 2-hour employee workshop.

3. Groups work best when each person has a role. Possible roles for this project and the types of things that person should say:

**Taskmaster/Coordinator:**
- We've spent enough time on brainstorming, let's decide which ideas are our favorites.
- How should we sequence the workshop?
- Let's get back to the main point.
- We have 10 minutes left.

**Recorder:**
- Here's what we brainstormed.
- Here's our presentation so far.

**Group Understanding:**
- How well are we collaborating?
- Has everyone contributed to the presentation?
- Let's each choose a part of the presentation so that we can show how we were all involved.

**Quality Control:**
- Is this our best work?
- Is the presentation written well?

4. To begin the teamwork, ask students to go around and brainstorm answers to "What can we do for the workshop?" Students listen to each other and begin their ideas with, "Yes, and we could do this _____. The "yes and" approach to brainstorming yields better ideas and better teamwork than the "no but" approach because the focus is on building up rather than tearing down. The teams should round robin brainstorm until everyone is out of ideas.

5. [15–30 minutes] Gallery Walk: Students may hang their posters along with a blank sheet for peer review. Ask students to identify the strengths of the posters on the feedback sheet.

6. Resources: Team projects can be a valuable part of student learning when they are structured well. These resources provide useful strategies for facilitating group work and other active learning activities:

- Three Pillars of Cooperative Learning
- Coping with Hitchhikers and Coach Potatoes on Teams
- How About a Quick One?