



CRITICAL THINKING

Problem-solving

Problem-solving



Strategies to share with students

Suggested ideas and practices educators can share with students to support awareness of the topic and development of the skill. Strategies can be adopted/adapted as needed.



Strategies for problem-solving involve many steps that individuals can use to reach the goal. This is referred to as the “problem-solving cycle”. There is no one specific way to solve problems and each person may find different strategies more useful than others.

- *Define the problem:* List what is known about the problem and identify the knowledge needed to understand (and eventually) solve it.
- Think about it: Use this stage to collect critical information and ponder the problem.
- *Use an analogy:* Analogies can be used to help solve analogous problems with abstract concepts.
- *Trial and error:* Test many possible solutions until the correct solution is found.
- *Means to an end:* Select your actions one at a time that will help you get one step closer to the solution each time.
- *Reduction analysis:* Transform the problem you currently have into another problem that has already been solved.
- *Plan a solution:* Consider all strategies and then choose the best strategy for the task at hand.
- *Carry out the plan:* Be persistent. If a plan does not work immediately, do not get discouraged. Try a different strategy and continue trying.
- *Look back:* Reflect on the problem. If you could do it over, would you have done it another way?



Problem-solving



Tips for course design and delivery

Ways educators can bring awareness of the topic and incorporate development of the skill into post-secondary course design and delivery.

- ✓ **Model a useful problem-solving method.** Problem solving can be difficult and sometimes tedious. Show students by your example how to be patient and persistent and how to follow a structured method, such as Woods' model described here. Articulate your method as you use it, so students see the connections.
- ✓ **Teach within a specific context.** Teach problem-solving skills in the context in which they will be used (e.g., mole fraction calculations in a chemistry course). Use real-life problems in explanations, examples, and exams. Do not teach problem solving as an independent, abstract skill.
- ✓ **Help students understand the problem.** To solve problems, students need to define the end goal. This step is crucial to successful development of problem-solving skills. If you succeed at helping students answer the questions "what?" and "why?", finding the answer to "how?" will be easier.
- ✓ **Take enough time.** When planning a lecture/tutorial, budget enough time for: understanding the problem and defining the goal, both individually and as a class; receiving questions from your students; making, finding, and fixing mistakes; and solving entire problems in a single session.



Problem-solving



Activities to do with students

Downloadable activities with suggested guidelines that educators can do with students. Activities can be adopted/adapted as needed.

Activity: Problem-Solving Course Content

Overview

Students reflect on and discuss course and discipline related issues and problem-solving approaches with their instructor. Students consider the ways that these problems within a field/discipline can be approached and identify which problem-solving ideas can be applied. The discussion may also include points about which problem-solving methods have been used in the past and presently.

Review the [Educator Activity Guide](#) before getting started with this activity.

Time

- Under 20 minutes
- 20 minutes to 1 hour
- More than 1 hour
- Over several classes

Modality

- In person
- Online synchronous
- Online asynchronous

Format

- Individual
- In pairs
- Small groups
- Large groups
- Whole class

Resources

- Module notes
- Paper
- Pen/pencil
- Laptop/tablet
- [Problem-solving Strategies PDF](#)



Problem-solving

Instructions

1. Explain to students that every course's curriculum includes problems: historical crises, gaps pursued by researchers, limitations related to technology, opposing opinions, etc. Tell students that discussing these problems brings problem-solving to the forefront while focusing on parts of the subject or field that might not otherwise have received the spotlight.
2. Present and briefly discuss these problems with your class.
3. Provide students with the [Problem-solving Strategies PDF](#) and discuss the content.
4. Have students form small groups.
5. Ask each group to choose one of these problems and to identify the problem they need to solve. Have them discuss past and current solutions to this problem that have been / are being tried as well as each solution's effectiveness in relation to this specific problem.
6. Follow up with a large class discussion about each groups' problem, suggested solutions, and further implications.
7. Ask students to individually reflect on how they can continue to learn about the problems in the course/discipline.

Variation(s)

- Students can create hypothetical situations that could occur in your field/discipline. These can be used in a case study approach to develop student problem-solving skills.



Problem-solving



Activities to do with students

Downloadable activities with suggested guidelines that educators can do with students. Activities can be adopted/adapted as needed.

Activity: Assignment Redesign

Overview

In this activity, students update an assignment you've used in previous years by deciding what to keep, what to remove, and what to add. The 'problem' here is to redesign the assignment with attention to relevance and creativity while ensuring the assignment's expectations do not change. By demonstrating their ability to maintain the key features of the assignment, students show their grasp of the content/knowledge/skills of the original assignment measures.

Review the [Educator Activity Guide](#) before getting started with this activity.

Time

- Under 20 minutes
- 20 minutes to 1 hour
- More than 1 hour
- Over several classes

Modality

- In person
- Online synchronous
- Online asynchronous

Format

- Individual
- In pairs
- Small groups
- Large groups
- Whole class

Resources

- Module notes
- Paper
- Pen/pencil
- Laptop/tablet
- Copy of past assignment



Problem-solving

Instructions

1. Select one of your assignments from a previous course offering.
2. Have your class to small groups. Provide students with a copy of your chosen assignment.
3. Inform students that they will be revamping this assignment and then they will be completing it and submitting it for course credit.
4. Assign students to revamp the assignment by making it more up to date, engaging, and creative while maintaining the goals and learning outcomes of the original assignment (stated on the original assignment). They will need to explore which parts to keep, which parts to remove, and which parts to add. Be sure to mention criteria that cannot be negotiated (e.g., submission date, grade weight etc.).
5. Build in opportunities throughout this activity for you to connect with students to support their work (e.g., circulating throughout the room, asking questions).
6. Engage students in a whole class discussion and invite them to share how they made these assignments more up to date, engaging, and creative.
7. As a class, come to a consensus about the instructions and expectations of this revamped assignment.
8. Ask students to individually reflect on how this activity nourishes problem-solving skills (i.e., how they identified their new vision for the assignment and how they arrived there).

Variation(s)

- After students complete/submit this assignment, have them reflect on how they felt writing as assignment that they helped to design.



Problem-solving



Activities to do with students

Downloadable activities with suggested guidelines that educators can do with students. Activities can be adopted/adapted as needed.

Activity: Poster Sessions

Overview

Students prepare a poster of an idea or issue in their work and present it in a gallery walk where students discuss the topic and solutions. This activity serves to offer a way for students to share problems and solutions using art and creativity.

Review the [Educator Activity Guide](#) before getting started with this activity.

Time

- Under 20 minutes
- 20 minutes to 1 hour
- More than 1 hour
- Over several classes

Modality

- In person
- Online synchronous
- Online asynchronous

Format

- Individual
- In pairs
- Small groups
- Large groups
- Whole class

Resources

- Module notes
- Paper
- Pen/pencil
- Laptop/tablet
- Individual posters



Problem-solving

Instructions

Note: Assignments that ask students to research a topic can also be presented as a poster. The poster can be the assignment itself or students can create a poster as a summary of their written work (e.g., essay, report). Students should complete their posters on their own time using home/personal devices and resources and/or school labs.

1. In an area of your course content that requires a lot of problem-solving, identify some particularly difficult problems and create a list that students can investigate.
2. Assign each student with a different problem or have the students select a problem related to the course content they wish to investigate further.
3. Ask students to create a visual representation of the problem in the form of a poster. Here, students will identify the problem, the research surrounding it, possible solutions, and the implications of the solutions.
4. Have students create these posters inside or outside of class time in either hard copy or digital formats.
5. Invite students to set up and share their posters with the class.
6. Assign half of the class to circulate and observe the posters while the other half presents their problem, solution, and implications. Those circulating stop at individual posters to engage the presenter in a discussion about the issue, the research, the problem, and problem-solving approaches.
7. After a set time (e.g., 15 to 20 minutes), students switch roles. The observers then set up their posters and they can present their problems to the rest of the class as they initiate discussions about the problems, solutions, and implications.
8. Invite class reflection and feedback into how this process of presenting problems through posters supports problem-solving skills, both from the presenter perspective and from the listener perspective.

Variation(s)

- Students can have sit-down conversations in pairs or small groups where they apply their solutions to each other's problems. This extension piece supports creativity while presenting new problem-solving possibilities.

