

7 - Environmental Problem Solving

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Summary

This strategy allows students to identify environmental problems in their community, to choose a problem, to analyze it, to find solutions for it and to get involved in environmental action.



EE Objectives

- Awareness
- Knowledge (of the environment, its problems, and means of action)
- Attitude (environmental sensibility, critical thinking, cooperation, quality of life, internal control centre, etc.)
- Skills (analyzing and posing a problem, finding solutions, making choices, taking action)
- Participation

Description

The problem-solving approach consists of steps related to identifying the problem; to posing the problem and research-related problems; and to choosing, implementing, and evaluating solutions. As a result of the complex nature of environmental problems, the steps to this process are rarely linear. The process tends to be dynamic and composed of back-and-forth loops throughout the approach.

The cyclical problem-solving process is illustrated in the pedagogical model for environmental problem-solving developed by the Littorale et vie research team (2005) (see Figure 1).

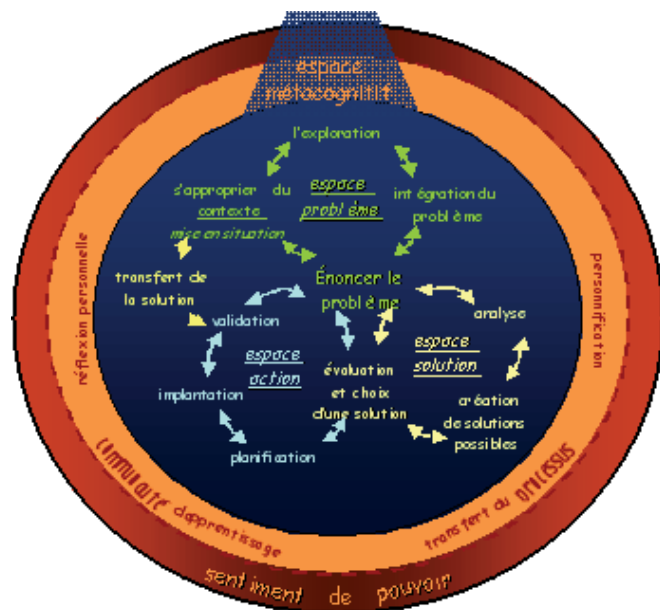


Figure 1. Pedagogical model for resolving environmental problems

The steps to follow for solving environmental problems are as follows

1. Identifying a problem

In this step, the student's role is that of an explorer. The student observes a location, uses his or her senses, and looks for information—all of which allows the student to learn more about his or her environment and possibly pinpoint a problem. In order for the student to interpret a situation as being a problem, the student has to look within for a deficiency, a difficulty, a discomfort, frustration, or a lack of satisfaction. A problem cannot exist without identifiable tension.

Procedure :

- Bring students into the field to observe various environmental phenomena. Draw attention to the life forms, natural landscapes, problems related to health, hygiene, habitat, etc.
- Once back inside, invite students to talk about the problems they observed. To help them list the problems, ask them to name all the things in their environment that bother them. In so doing, the students themselves choose the problem they want to solve.

2. Posing a problem

In the second step, students are asked to pose the problem. Problem posing consists in properly defining the problem situation in order to be able to resolve it (English 1997). During this procedure, students interpret the problem situation using their own words. They rearrange the information related to the problem and reformulate the way the problem is worded several times in order to clarify and present the challenges and objectives of the solution (Stoyanova 2000). Problem posing involves researching and understanding information related to the problem and developing a mental or visual picture of the problem situation (Poirier-Proulx 1999). These pictures can come in the form of a series of words that students use to describe the information in their head. Students can also make a sketch, make lists, take notes, write equations, or draw diagrams.

Techniques to help students become better at problem posing :

There are four important ways to help students become better at problem posing: ask them to examine all aspects of a problem (Where? When? How? Who? How much? Why?); help them research information on the problem; give them the opportunity to create a visual representation of the problem; and have them discuss their way of posing the problem with each other. The following techniques are useful for carrying out these four steps.

- Rhymes and songs
- Write a poem or song that explains the problem.
- Role playing
- Invite students to put themselves in the place of another person in order to see the problem from another perspective (a bus driver, farmer, mayor, teacher, etc.).
- Drawing or gallery method
- Invite students to draw the elements of a problem. Once the drawings are finished, have students look at the drawings of others.
- What I know...
- Make a list of everything known about the problem.
- The six-questions technique

Invite students to complete the following instructions:

1. Express the problem by asking the question "How can I...?"
2. Answer the questions "Who?" "What?" "When?" "Where?" "Why?" and "How?"
3. Examine the answers to each question and use the answers to better pose the problem.
4. Pose the problem several times in one or two sentences.

- Circulate the problem
Each team expresses the problem in a statement and passes it along to another team. Each team must then add to or modify the statement that it receives from the other teams. Finally, the statements are written on the board and discussed so that they can be improved and then selected.
- Stories
Ask students to write a story related to the problem situation.
- A fishbone diagram
Draw an outline of Figure 2 and write the problem inside the circle. Make a list of all the problem's possible causes and write them on the lines. The simpler causes are written close to the head and the more complex causes are written near the tail. Then, once again write the statement expressing the problem in terms of what has been learned.

This activity allows students to:

- list several causes of the problem
- make connections between the causes of the problem

3. Finding solutions

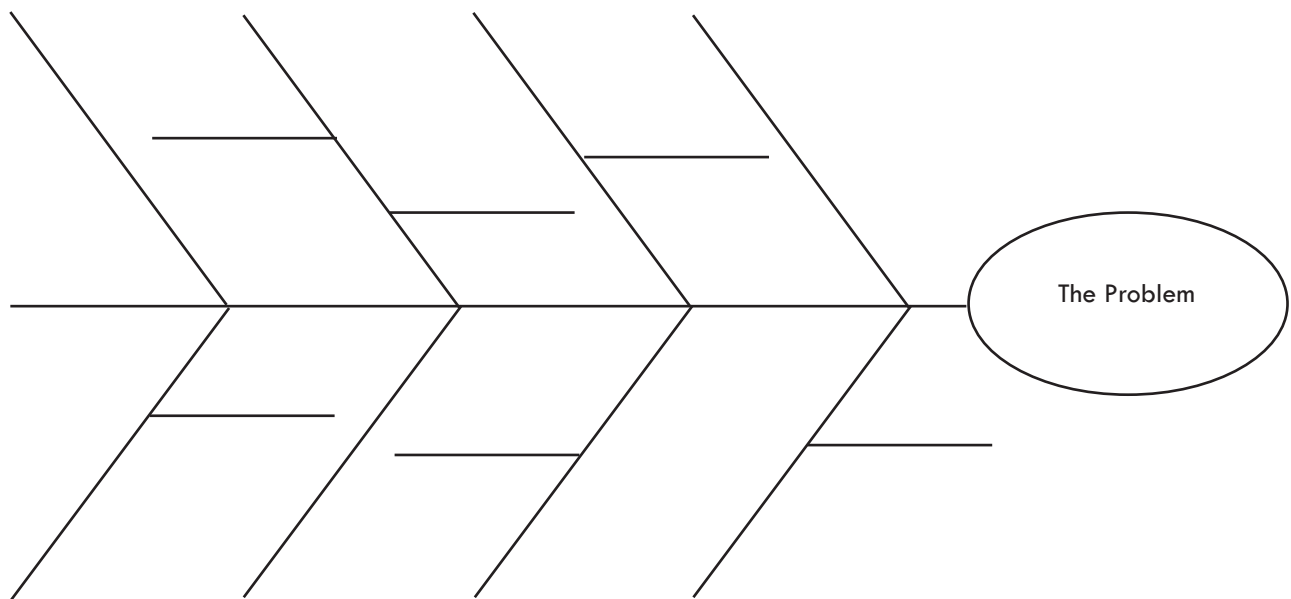
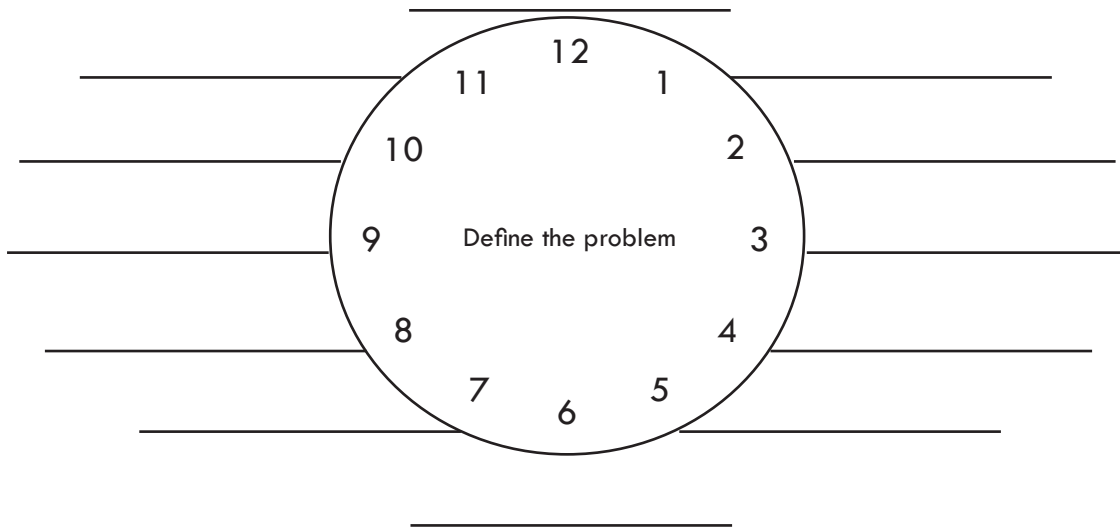


Figure 2 : Fishbone diagram

Students demonstrate their divergence ability (finding many original solutions) and convergence ability (constantly evaluating their ideas to improve them and modify them to fit the problem-solving objective). It is imperative that students be able to interact and exchange ideas so that they can expand on their suggestions. Students should listen and add to the ideas of others. However, students should avoid criticizing the ideas of their peers and should accept ideas that are far-fetched.

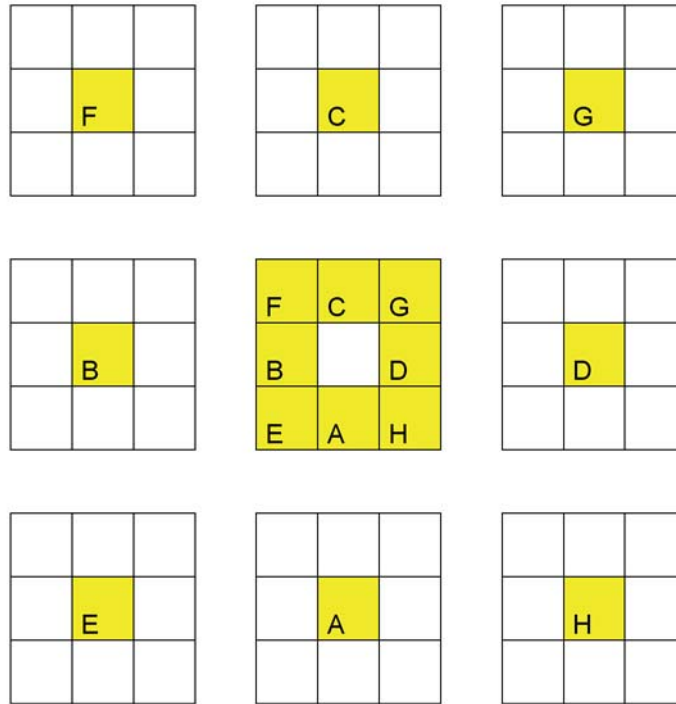
Techniques to help students find better solutions:

- The circle of opportunity
Divide students into teams. Have each team draw a circle and number it like a clock (numbers 1 through 12). Ask students to find 12 aspects of the problem and write these aspects on the clock. Students throw a pair of dice to select the aspect their team will work on first. This allows students to find ideas for each aspect of the problem.
- Ideas bank



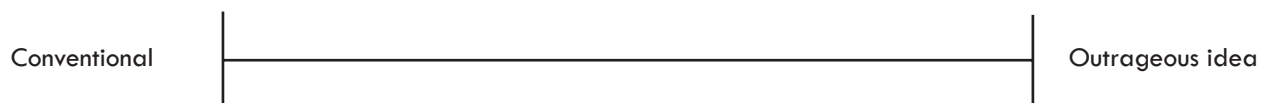
In a box, place ads, phrases, pictures, comic strips and words to draw on as a source of inspiration for ideas. Draw one item at a time from the box and try to link it to the problem. If it doesn't work, draw another item and repeat the exercise

- Brainwriting
Students sit in a circle and each write an idea for solving the problem. Then each student passes their idea to the person sitting next to them, who must then improve on the idea.
- Photography
Bring students outside and have them take pictures that do or do not relate to the problem. Have them share pictures with one another so that they may find new ideas.
- SCAMPER
State the problem in one sentence. Use the acronym SCAMPER to change one part of the statement at a time and elicit new ideas.
 - S: Substitute
 - C: Combine
 - A: Adapt
 - M: Modify or expand
 - P: Put to other uses
 - E: Eliminate or reduce
 - R: Reverse or rearrange
- Lotus Blossom Technique
 1. The problem is written in the centre of the diagram.
 2. Students are asked to think of solutions. These solutions are then placed around the problem.
 3. Using the initial solutions as a starting point, students find other solutions.
- Working in reverse



Reverse the question related to the problem. For example, for the question How can we make trees healthier, you would write How can we make trees more diseased? Then find solutions to the reversed question. Return to the initial problem and draw inspiration from the solutions found for the reversed question in order to find real solutions.

- Creative classification
On the far left side of the continuum, write the most conventional or safest idea for solving the problem. On the far right side of the continuum, write the most unconventional or outrageous idea for solving the problem. Find other ideas and write them between the two.



4. Choosing a solution

This step allows students to assess the effectiveness of each proposed solution. Students ask themselves questions such as Is this a good idea? Is this idea worth pursuing? Will this give us what we're looking for in return? Do we have the resources needed to implement this idea? Then, students make their decision (Oech 1998).

Techniques to help students become better at choosing a solution:

- Stars method
 1. Write all the ideas on the board.
 2. Discuss with students the criteria for making a good choice.
 3. Give each student three stars and ask them to put the stars next to the three ideas they like the most.

5. Action plan

Students decide the steps they must take in order to carry out the action. They put together an action plan.

Techniques to help students become better at planning their action:

- **Comic strip**
One student is chosen to be the artist. With guidance from the class, the student artist draws a series of chronological pictures that make up a comic strip. The first frame of the strip shows the current situation; the last frame shows the desired outcome. Students decide what should happen between these two frames in order to solve the problem. The comic strip can use words, quotes, balloons, and so on. Students have to think of decisions that need to be made and challenges that must be overcome in order to achieve the objective.
- **Descriptive paragraph**
Have teams write a paragraph explaining why the solution they chose is the best and how they plan to implement that solution.

6. Taking action

This step consists in taking action to implement the chosen solution. Students go to the locations and carry out their chosen action.

7. Evaluating the action

This step allows students to evaluate the action they have carried out to solve the problem. Pruneau et al. (2004) suggest relevant questions: Did the action solve the problem? Were there steps that should have been included but were omitted? If yes, which ones?

8. Personal reinforcement

The final step in problem solving allows students to take stock of their experience and analyze their cognitive and metacognitive strategies. Ask students to answer questions such as “What did I learn during this problem-solving process?” “How did I go about posing the problem?” “How did I manage to find solutions?” and “How did I go about taking action?” Encourage students to share their answers to these questions in order to reinforce their metacognitive thinking.

Advantages to problem-solving in education :

- Students learn to form an opinion, and make choices and decisions that will directly affect their lives and those of their families, as well as society as a whole.
- It develops their critical thinking and their evaluation skills through actual, concrete situations.
- It is a way to facilitate the transfer of knowledge to situations outside of school.
- It allows students to reason, summarize, question themselves, evaluate, use their previous knowledge, and constantly visualize the problem.

Examples of problems on which students can work :

- Air pollution caused by traffic or idling near the school
- Redesigning the school playground
- Excessive number of mosquitos in a given location
- Stream sedimentation
- Overconsumption of energy at school and at home
- Polluted streams in the community

Tips

- It is helpful to encourage students to go back and forth over the various problem solving steps (see Figure 1).
- It is necessary to go out into the field several times to observe the problem.
- It is important to allow students to carry out the actions they have chosen.
- Students can have discussions to share their knowledge on the the problem and decide what they need to learn.

Other teaching strategies that can reinforce problem-solving with respect to environmental problems:

- Role playing
- Environmental decision making
- Debates
- Accelerated approach to participatory research
- Education about the future

Useful references

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Canada

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