TECHNOLOGY in Practice

Applications and Innovations

Chapter Overview, Concepts, and Goals
Chapter 3, Clean Up Your Spills!

Chapter Overview

Chapter 3, “Clean Up Your Spills!”, helps students approach and develop strategies for dealing with complex problems. These problems often do not have clear answers because they involve competing constraints. For example, oil spills are complex problems to solve. Solutions involve several technologies. Choosing which technology to use and when to use it does not have a clear-cut answer. The solution depends on several competing constraints such as type of oil, size of spill, proximity to the coast, and cost. Students will analyze these constraints and learn how to explain the choices they make.

In the **Engage** activity, *When Solutions Seem Impossible,* students will read a dialogue between two engineers and think about competing constraints. They share their prior thinking about constraints and how they might drive solutions in opposite directions.

In the **Explore** activity, *Recovery Time,* teams of students make a model oil spill and determine how fast they can remove it compared with the efficiency of removal. They make only preliminary interpretations of the data they collect.

During the **Explain** activity, *Possible versus Impossible,* students read the field notes of the engineer from the Engage activity. These notes show a worked-out example of how to make sense of a recovery rate versus recovery efficiency graph whose data come from the Explore activity. Students use this model to construct an explanation for their data from the Explore activity.

In the **Elaborate** activity, *Simulate and Save,* students read about other oil spill cleanup technologies. Then they use a computer simulation to understand how each technology affects the oil spill. Students apply what they learned from the Explain activity to form an explanation of how each technology works.

Finally, in the **Evaluate** activity, *Choosing a Solution,* teams select a set of constraints, which drives a solution to the oil spill cleanup in a particular direction. Students explain their solution to a group of stakeholders.

Chapter Organizer

Engage—When Solutions Seem Impossible

Key idea:
Real-world problems often involve competing constraints.
Activity:
Students read dialogue between two engineers discussing competing constraints for an oil spill cleanup project.
Linking question:
How can test data help us make decisions about competing constraints?

Explore—Recovery Time

Key idea:
Test data are essential when deciding what is possible and what is impossible.
Activity:
Students test how changes in the recovery rate of oil affects the efficiency of recovery.
Linking question:
How can test data explain what represents a possible and impossible solution?

Explain—Possible versus Impossible

Key idea:
Explaining test results involves making a claim, providing evidence, and giving a reason the evidence supports the claim.
Activity:
Students read field notes from an oil spill engineer and learn how the engineer explains test data from the Engage activity.
Linking question:
How can explanations of one cleanup technology help explain other cleanup technologies?

Elaborate—Simulate and Save

Key idea:
Simulations help us understand how technologies work without going into the field.
Activity:
Students use a simulation to explain the way various oil spill technologies work.
Linking question:
How do I use technology to optimize an oil spill cleanup plan?

Evaluate—Choosing a Solution

Key idea:
Solutions to complex problems often mean presenting workable choices.
Activity:
Students choose a set of oil spill constraints and then develop a recommended cleanup plan to present to stakeholders.

Major Concepts

- Complex problems can be broken down into several smaller problems.
- One strategy to deal with competing constraints is to decide what is possible and impossible.
- Not all solutions have clear answers to problems.
- Solutions to complex problems often involve making choices among competing constraints.

Goals for the Chapter

By the end of this chapter, students will

- think of complex problems as several smaller problems
- learn one strategy to deal with competing constraints
- understand that not all solutions have clear answers
- be able to develop a solution given competing constraints.