ENgagement and Achievement through Computational Thinking

Modeling Abstraction Viewing Guide

Lesson 2

Topic and goals

In this Engagement and Achievement through Computational Thinking (ENACT) Abstraction Lesson video, a teacher models how to integrate computational thinking (CT) strategies into your classroom. Framing, prompting, and highlighting are designed to empower students to take ownership of CT strategies.

The goals of the video are to support you in:

- **framing** a lesson or task that provides students with an opportunity to apply one or more CT strategies.
- **prompting** students (either verbally or using resources) as they work on a problem by applying CT strategies.
- **highlighting** examples of when and how students used CT strategies to complete their work.

Questions to consider when planning:

- What are some strategies my students could use to solve the problems in this lesson?
- How might a CT strategy already be part of or add to what they are already doing?
- How might I recognize when my students are using CT strategies?
- How might I identify when it would be helpful to prompt a student to use CT strategies?

As teachers become comfortable with framing, prompting, and highlighting, students will feel more empowered to take ownership of the CT strategies and integrate them into how they solve math problems.

Context

The Lesson 2 video features an ENACT coach **framing/modeling** how abstraction can be used to create a representation of a word problem. Although the example focuses on dividing supplies into equal groups to explore factors and multiples, the process shown can be applied to any word problem. Encouraging students to pause and create an abstraction helps them focus on making sense of the situation (Rich & Yadav, 2020). This sensemaking supports students in identifying the mathematical ideas they can use to solve the problem. In the video example, abstraction helps students connect the equal-sharing context to the concepts of factors and multiples.

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Video notes: As you view the video, icons (below) will appear, indicating content related to CT strategies, student-focused practices, pedagogy, and/or mathematics. When an icon appears, you may want to pause the video to read the associated notes in exhibit 1.

Computational Thinking

When this icon appears, the focus will be on CT strategies that are being modeled through framing, prompting, and/or highlighting. The focus is on the strategy.

Student Focus

When this icon appears, the focus will be on student-focused practices that are being used: connecting to student experiences, supporting student choice by enabling multiple approaches to problems, valuing student thinking and voice, supporting student collaboration.

Pedagogy

When this icon appears, the focus will be on the teaching techniques that use interactive teaching and student learning, and/or assessing formatively.

Mathematics

When this icon appears, the focus will be on specific math concepts that are needed for solving the problem and connecting them to previous learning, and/or observing student work.

Exhibit 1. Notes for ENACT video: Modeling abstraction

In ENACT Lesson 2, the coach models use *abstraction,* one of ENACT's five computational (CT) practices.

The goals of the video are to support you to:

- Unpack the meaning of abstraction and the purpose of this practice.
- Help students make sense of word problems and make connections to their experiences.
- Modeling uses abstraction to identify and represent key information in a word problem.

Timestamp	Topic	Notes
01:07	 Mathematics	Identify and represent key information in a word problem is an important part of mathematical modeling. This process involves distilling a real-world situation into a simplified mathematical form that students can analyze and use to develop a solution.
01:23	 Computational Thinking	Frame the lesson around computational thinking (CT): The teacher establishes the purpose of the task to help articulate abstraction and questions for making sense of the problem. For this lesson, it may be helpful to focus on the definition on the poster and not the questions.
02:01	 Mathematics	**Make sense of the problem/situation:** This video provides helpful guidance for deciding what to include when representing a word problem. Research over several decades has shown that students' challenges with word problems often stem more from difficulties understanding the context than from gaps in arithmetic skills (Carpenter et al., 1983). Using these questions can help students in making sense of the situation before they begin working with the numbers.

Timestamp	Topic	Notes
02:16	 Student Focus	**Connect to student experiences:** Students can consider these questions in any order but beginning with "What's happening in this problem?" creates an opportunity to link the word problem to situations they already know. When students recognize that the problems in this lesson involve sharing, they may think about times they have shared items with siblings, classmates, or friends. If students offer a different context that feels more familiar or meaningful to them, you can adjust the situation while keeping the focus on the intended mathematical ideas.
03:56	 Student Focus	**Support student choice:** Students suggest other ways to represent the problem, record several of their ideas. As a class, you can then decide which representation to use before moving on. The goal of abstraction is for students to create simple representations that make sense to them and highlight the important information in the problem. The picture shown in the video is not the "correct" or only representation—just one possible example.
05:39	 Pedagogy	**Develop mathematical thinkers:** Students may already have experience using drawings or number sentences to represent word problems, but creating simple representations for more complex, open-ended situations may be new for them. To support their development as mathematical thinkers, invite students to help fill in the more straightforward parts of the representation—such as noting quantities—while you model the aspects that are less obvious.
06:36	 Computational Thinking	**Build CT strategies:** Provide opportunities for students to practice creating simple representations like the one shown in the video. This abstraction process—focusing on important information in a problem—can help students keep the overall goal in mind as they revise their work or adjust their strategies. You might also prompt students with questions such as: *In what other ways could you organize or show the important information in this problem?* or *Is there anything we haven't considered that might be important?*

References

Carpenter, T. P., Lindquist, M. M., Matthews, W., & Silver, E. A. (1983). Results of the third NAEP mathematics assessment: Secondary school. *Mathematics Teacher, 76*(9), 652–659.

Rich, K. M., & Yadav, A. (2020). Applying levels of abstraction to mathematics word problems. *TechTrends*, *64*(3), 395–403. https://doi.org/10.1007/s11528-020-00479-3

This viewing guide is part of a series of training resources related to REL Midwest's ENACT partnership.