

ENgagement and Achievement through Computational Thinking

Structuring Opportunities for Algorithms Viewing Guide

Lesson 10

Topic and goals

In this Engagement and Achievement through Computational Thinking (ENACT) Algorithms 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 examples in this video demonstrate **prompting/structuring** a lesson on how students can develop an algorithm by examining multiple related problems with varying levels of complexity. In the first part, the ENACT coach models how to use these problems to support students in identifying consistent reasoning that can be generalized into an algorithm. In the second part, the coach models how to facilitate a summary discussion focused on the process of developing the algorithm and testing whether it works across multiple problems.

The strategies shown in the video will be most effective if students have prior experience using the order of operations with expressions that do not include grouping symbols or exponents. Students should also be familiar with the fraction multiplication algorithm and have experience solving fraction division problems using reasoning strategies and visual models. The discussion is designed to support algorithm development and will be most meaningful if students have not yet been introduced to the standard invert-and-multiply algorithm for fraction division. Although the video contexts focus on fraction multiplication and division, the general approach to developing, testing, and refining algorithms can be applied to the creation of any algorithm or formula.



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: Algorithms

In ENACT Lesson 10, a coach models how to provide structured opportunities for students to use *algorithms* by foreshadowing the algorithm opportunities early in the lesson and supporting student reflection at the end of the lesson.

The goals of the video are to support you to:

- Use multiple example problems to develop an algorithm.
- Lead a discussion to support reflection on the algorithm development and testing process.

| Timestamp | Topic | Notes |
|-----------|--|--|
| 00:32 |  Mathematics | Support generalization across fraction division problems: Including a variety of examples helps students develop an algorithm that works for all fraction division situations. The problems in the video are intentionally selected to feature fractions, mixed numbers, and whole numbers as both dividends and divisors, allowing students to examine how the reasoning applies consistently across different forms. |
| 01:09 |  Student Focus | Connect to student experiences: Drawing on students' prior knowledge from both school and everyday contexts can help them make sense of algorithms. Providing time for students to think about where they have encountered step-by-step processes supports their participation in the discussion. You may need to offer examples to help clarify their thinking, such as following a recipe or deciding how to get ready for school on time. Using familiar experiences allows more students to contribute ideas and supports engagement with algorithmic thinking. |

| Timestamp | Topic | Notes |
|-----------|--|--|
| 02:21 |  Pedagogy | Support generalization of algorithmic steps: Some students may suggest steps that are specific to a particular problem—for example, multiplying 2 by 3—rather than a general step such as multiplying the numerators. When this happens, prompt students to consider whether the step would apply to every problem. Asking what they are trying to accomplish with that calculation can help students move from a problem-specific action to identifying a more general step that can be used as part of the algorithm. |
| 05:13 |  Computational Thinking | Connect algorithm creation to decomposition: Creating an algorithm to address part of a problem draws on the CT practice of decomposition. As students develop an algorithm for one component of a task, they are effectively breaking the overall problem into smaller, more manageable pieces. Recognizing this connection can help students see how decomposition supports systematic problem solving through algorithmic thinking. |
| 00:11 |  Student Focus | Support student choice: Asking open-ended questions about what students notice or wonder allows them to take different approaches to the problem and share their perspectives. Students' responses also provide insight into their thinking and can surface misconceptions, helping to guide discussion while honoring multiple ways of engaging with the task. |
| 07:18 |  Computational Thinking | Connect pattern recognition to algorithm development: Patterns that appear across related solutions often suggest that a common process is being repeated. Making this connection explicit helps students see how identifying patterns in their work can lead to the development of an algorithm. If students notice or discuss patterns as they work, highlighting this relationship can reinforce how pattern recognition supports algorithmic thinking. |
| 07:29 |  Student Focus | Value student thinking and voice: Using examples shared by students helps center their ideas in the discussion and increase engagement. Building on these examples through clarifying questions and targeted feedback supports deeper understanding while encouraging continued participation and growth. |
| 09:03 |  Mathematics | Support mathematical reflection and reasoning: Research shows that having students monitor and reflect on their problem-solving process can improve mathematics learning. One important form of reflection is asking students to check whether their solution makes sense in the context of the problem, helping them evaluate the reasonableness of their answer. |
| 10:38 |  Student Focus | Connect to student experiences: Drawing on students' prior knowledge helps them recognize that they already have useful ideas for approaching the problem. Making these connections explicit supports engagement and encourages students to apply what they know to new situations. |
| 13:01 |  Mathematics | Clarify mathematical justification of the algorithm: The explanation of why the fraction division algorithm works relies on algebraic manipulation, which may not be accessible to all students. It is included in the video to support teachers in providing a mathematical justification for the invert-and-multiply algorithm if students request an explanation. |

Reference

Woodward, J., Beckmann, S., Driscoll, M., Franke, M., Herzig, P., Jitendra, A., Koedlinger, K. R., & Ogbuehi, P. (2012). *Improving mathematical problem solving in grades 4 through 8: A practice guide* (NCEE 2012-4055). National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. <http://eric.ed.gov/?id=ED532215>

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