



Abstraction

Abstraction is about reducing complexity or identifying general principles that can be applied across situations or problems.

1. Encourage students to focus on the most important information and hide unnecessary detail.
2. Provide opportunities for students to represent problems/phenomena in ways that simplify it.
3. Encourage students to identify principles that can be applied across situations/problems.

Decomposition

Decomposition is about managing complex tasks or situations by breaking them down into smaller, more manageable parts. Students can use decomposition to approach problems that, at first, may seem intimidating.

1. Provide opportunities for students to break down a phenomenon or object into parts.
2. Choose tasks where students can break down the problem in multiple ways.

Pattern

Patterns are everywhere. We see them every day. You can engage students in patterning by having them recognize and form patterns.

1. Ask students to look for and discuss patterns during activities.
2. Provide opportunities for students to generate and describe patterns.

Debugging

Debugging is about finding and fixing errors. Sometimes it is called troubleshooting.

1. Encourage students to “debug” when something doesn’t work as they had expected or planned.
2. Avoid the urge to fix problems for students. Allow them to reason through courses of action for themselves.

Abstraction

1. How can we simplify this problem/task?
2. What information is most important for solving this problem/task?
3. What information can we ignore in solving this problem/task?
4. How can we clearly represent the important information?
5. What lessons can you take away from this problem and apply to other problems?

Decomposition

1. What details do you notice in this problem, phenomenon, or object?
2. How can you use the details to identify parts of this problem, phenomenon, or object?
3. What parts are familiar to you? What parts are unfamiliar?
4. What are the different ways you could break down this problem, phenomenon, or object?
5. Can you break down the parts further into smaller parts?
6. How might breaking down this problem or phenomenon be helpful for solving or understanding it?

Patterns

1. What similarities or patterns do you notice between the problems, phenomena, or objects? For example, how many objects are there? What colors do you see?
2. How can you use the details to identify parts of this problem, phenomenon, or object?
3. How can you describe the patterns?
4. How could you use the pattern to make predictions or draw conclusions?

Debugging

1. Does the result match what you expected?
2. How can you tell whether or not your plan, model, or solution worked?
3. How can you modify your approach to address the problem?
4. How do you know you have fixed the error?