The Crosscutting Concepts: science, children’s literature, and beyond

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Our goal:
Develop the mindset to think and read like a scientist

• Backstory
• What it means to “think and read” like a scientist
• Using children’s literature to develop the scientific mindset
WINTER BARN
WRITTEN AND ILLUSTRATED BY PETER PARNALL
The scientific habits of mind and language: The crosscutting concepts

- Pattern
- Cause and Effect
- Structure and Function
- Scale, Proportion, and Quantity
- Systems and System Models
- Energy and Matter
- Stability and Change
Ah-ha moment: Literature works!

• Develop habits of mind

• All of the crosscutting concepts are literary devices
  • Pattern: genre (historical, science fiction, fable)
  • Cause and effect: plot
  • Structure and function: chapters, paragraphs, writing
  • Systems: setting and characters
  • Scale: timeline (day, decades? Size: family, society?)
  • Energy and matter: characters and events
  • Change and stability: patterns change or are re-established
Pattern as a crosscutting concept AND a literary device
• Systems
• Cause & Effect
• Energy & Matter
• Stability & Change

All of these comprise both crosscutting concepts AND literary devices.
Ah-ha moment: Literature works!

- Develop habits of mind
- All of the crosscutting concepts are literary devices
- Teaching Science with limited time
- Create a framework for reading like a scientist
Shout and whisper books

Tell Me, Tree
All about Trees for Kids
by Gail Gibbons

EZRA JACK KEATS
THE SNOWY DAY
Pattern

What is it?

How do I know one when I see one?

What repeats?
Cause and effect

What is happening?

Why is it happening?

How is it happening?
That’s the mechanism!
Structure and Function

What does it do? (function)

What is its shape? (structure)

What are the physical properties? (structure)

How do the shape and physical properties enable the function?
Scale

Pick a familiar object as your reference point.

Is this new object, bigger, smaller, heavier, faster, or the same as your reference point? Think **Goldilocks!**
Systems and system models

Where does the system begin/end? That is the **boundary**.

What are the parts of the system and how do they interact? These are the **interacting components**.

Use a model to ask a “**what if?**” question, such as, “What if we make a change?”
Energy and matter

What is the system doing?

What is the fuel that is causing something to happen?

Is the matter in the system changed?
Stability and change

Is something happening in the system?

Yes.

Are the boundary or interacting components changing?

No.

The system is in dynamic equilibrium.
Stability and change

Is something happening in the system?

Yes.

Are the boundary or interacting components changing?

Yes. The system is changing.
Stability and change

Is something happening in the system?

No.

The system is in static equilibrium.
The crosscutting concepts and quick start questions to explore them.

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| **Pattern:** How do you know a house when you see one? Zander’s drawing fits the recognizable pattern with windows, a door, and a roof. | How do I know one when I see one? (What repeats?)  
What can I predict?  
What is causing this pattern? |
| **Cause & Effect:** When Zander draws smoke coming out of the chimney (an effect), we know there must be a cause. | What happened?  
Why did it happen?  
How did it happen? (That’s the mechanism) |
| **Structure & Function:** The tall and hollow structure of the chimney serves the function of drawing the smoke away from the house. | What does it do? What is its shape?  
What are the physical properties?  
How do the shape and physical properties enable its function? |
| **Scale, Proportion, & Quantity:** Notice that Zander has drawn a foot above the house which helps us instantly know the scale of the house—it is a dollhouse. | Pick a familiar object and ask:  
What’s your reference point?  
Is this bigger, smaller, heavier, faster, the same as the reference point? |
| **Systems & System Models:** The house in the drawing is a perfect example of a system since it has boundaries and interacting components (windows, door, & roof). We can view this system as a dollhouse or as a model for larger houses. | Where does the system begin/end? That is the boundary.  
What are the parts of the system and how do they interact?  
Use a model to ask “what if…” we made a change? |
| **Energy & Matter:** The foot above the dollhouse implies that something ominous is about to happen to this system when the foot lands on it. Zander shows his understanding that energy and matter are the two primary influences that cause things to happen. | What is the system doing?  
What is the fuel that is causing something to happen?  
Is the matter in the system transformed? |
| **Stability & Change:** In his drawing, the house is stable, but as the foot crushes it, the dollhouse will change. | Is something happening in the system?  
No—the system is in static equilibrium.  
Yes—are the boundary or interacting components changing?  
No—the system is in dynamic equilibrium.  
Yes—the system is changing. |
The crosscutting concepts shout and whisper in both illustrations and language.
Pa turned on his big flashlight and caught the owl just as it was landing on a branch.
Language that *whispers* stability and change in systems

Words that hint *changing systems*

- Tough evening but now we are back on track!
- I just want things to be normal
- You’re in trouble
- Historical moment
- Flood
- Emergency
Her ears buzzed with the sound of the crowd chanting her name.
System:
Where does the system begin and end? That's the boundary.

What are the parts of the system and how do they interact?
These are the interacting components.

Her ears buzzed with the sound of the crowd chanting her name.
Pattern: What is it? How do I know one when I see one? What repeats?

Her ears buzzed with the sound of the crowd chanting her name.
Cause and effect:
What is happening?
Why is it happening?
How is it happening?

Her ears buzzed with the sound of the crowd chanting her name.
Structure and function:
What does it do?
What is its shape?
What are the physical properties?

How do the shape and physical properties enable the function?

Her ears buzzed with the sound of the crowd chanting her name.
Scale:
Pick a familiar object for a reference.

Is this object, bigger, smaller, heavier, faster, or the same as reference?

Her ears buzzed with the sound of the crowd chanting her name.
Energy and Matter:
What is the system doing?
What is the fuel that is causing something to happen?

Her ears buzzed with the sound of the crowd chanting her name.
Stability and change: (Lean on scale!)

Is something happening
In the system?

Her ears buzzed with the sound of the crowd chanting her name.
“A spider can produce several kinds of thread. She uses a dry, tough thread for foundation lines, and she uses a sticky thread for snare lines—the ones that catch and hold insects. Charlotte decided to use her dry thread for writing the new message.”
We’d love to hear from you...

• Visit our gardens!
• Read our books!
• Invite us for workshops!
• Just search for: https://sites.google.com/view/read-like-a-scientist

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