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3-31-2023

## Considering the Crosscutting Concepts

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### Recommended Citation

Atwood-Blaine, Dana, "Considering the Crosscutting Concepts" (2023). *Science Education Update Conference Documents*. 53.

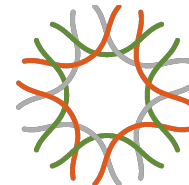
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# Considering the Crosscutting Concepts

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*A metaphor:*

**Understanding  
the NGSS is a**



***“piece of cake”!***



# Why do we think the Crosscutting Concepts (CCCs) important? (*Group Brainstorm*)



# Understanding the NGSS is a piece of cake



Performance Expectation

Baking Tools & Techniques



Science & Engineering Practices

Cake



Disciplinary Core Ideas

Frosting



Crosscutting Concepts

# Understanding the NGSS is a piece of cake



Performance Expectation

Baking Tools & Techniques



Science & Engineering Practices

Cake



Disciplinary Core Ideas

Frosting



Crosscutting Concepts

# Experts and novices organize their ideas differently

- >> Experts use a **conceptual framework**
- >> Novices rely on **surface features**



# Chess experts and novices players were shown pieces randomly arranged on a chess board...



## And an analogy.

Image credit: Aranda, J. (2006, August 29). Fun with representations III – Hidden in plain sight. Retrieved May 23, 2015, from <https://catenary.wordpress.com/2006/08/29/fun-with-representations-iii-hidden-in-plain-sight/>  
National Research Council. How People Learn: Brain, Mind, Experience, and School: Expanded Edition. Washington, DC: The National Academies Press, 2000. doi:10.17226/9853.



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Experts grouped pieces together based on the **strategic moves** that the pieces could make in a game.



	<b>Pieces in initial position</b>
	<b>Castled king with advanced pawns</b>
	<b>Guarding knights</b>
	<b>Standard castle structure</b>
	<b>Attacking queens</b>

Novices only remembered **individual pieces**.

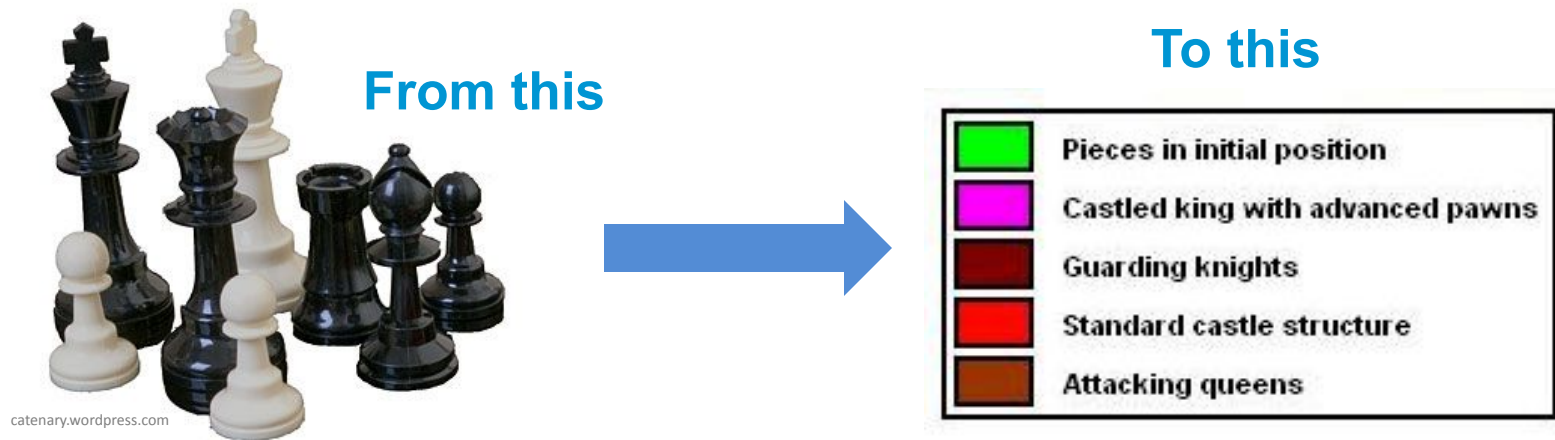


Rooks	Pawns
Knights	Queens
Bishops	Kings

Image credit: Aranda, J. (2006, August 29). Fun with representations III – Hidden in plain sight. Retrieved May 23, 2015, from <https://catenary.wordpress.com/2006/08/29/fun-with-representations-iii-hidden-in-plain-sight/>  
 National Research Council. How People Learn: Brain, Mind, Experience, and School: Expanded Edition. Washington, DC: The National Academies Press, 2000. doi:10.17226/9853.

# One goal of science education is to teach students think more like experts

>> What if we gave students an expert-like conceptual framework to organize their ideas around?



# How will the CCCs help students learn science?

1. A conceptual framework helps students make sense of new content and tackle novel problems
2. Allows students to be more flexible and creative with their science and engineering ideas
3. Helps students to develop their ideas over time



# There are 7 Crosscutting Concepts (CCCs)

1. Patterns
2. Cause and effect
3. Scale, proportion, and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

Now...Speed Dating!



## “Speed Dating” Definitions

Patterns	The CCC of ____ highlights that structures or events are often consistent and repeated.
Cause and effect	The CCC of ____ investigates how things are connected by identifying the reasons behind an occurrence, and what that occurrence results in.
Scale, proportion, and quantity	Different measures of size and time affect a system’s structure, performance, and our ability to observe phenomena.
Systems and system models	The CCC of ____ helps us understand the world by describing how things connect and interact. We can use simple representations to explore these interactions.
Energy and matter	These things are neither created nor destroyed, but may flow into and out of a system and influence its functioning.
Structure and function	The way something is built and the parts that it has determine how it works.
Stability and change	Over time, a system might stay the same or become different, depending on a variety of factors.



# Rotation Stations: Name that CCC!

- Work together!
- Decide which single CCC works best to make sense of the 3-4 phenomena presented at each station.



# Rotation Stations: Name that CCC!

- Why were these examples representative of that particular CCC?
- Other content ideas/phenomena you can think of?
- Will finding classroom connections for these ideas be easy or challenging?
- Do you see any connections or overlap among the CCCs?
- How might the CCCs help integrate science with other subjects?



# Find examples of your CCC in the NGSS:

- » Handout Matrix of Crosscutting Concepts in NGSS
- » Go to [www.nextgenscience.org](http://www.nextgenscience.org)
- » Search for Performance Expectations that include your CCC in the foundation boxes.
- » Discuss possible ways that CCC might be used within that Performance Expectation
- » Share out up to 3 examples





# Vertical Alignment Activity

- Table 1 = Patterns
- Table 2 = Cause & Effect
- Table 3 = Scale, Proportion, & Quantity
- Table 4 = Systems & System Models
- Table 5 = Energy & Matter
- Table 6 = Structure & Function
- Table 7 = Stability and Change



# Questions for Consideration:

1. Do these progressions make sense?  
Was it clear what order the ideas belonged in?
2. What clues helped you figure out the progression?



# Lenses Activity

- Use the CCC that you worked with during the Vertical Alignment Activity
- Use your CCC to explore what you see in the CAS' Shark Lagoon Webcam
- Observe for 2 minutes and then into Groups to discuss



# Lenses Activity

- Discuss these questions with your group and **RECORD** the discussion:
  - *COULD* we connect this to the CCC?
  - *SHOULD* we connect this to the CCC?
  - What might students *LEARN* from viewing this through this CCC lens?



# Shark Lagoon Webcam

Live Reef Lagoon Cam (Lagoon View) | California Academy of Sciences

Watch later Share

|| 🔇 • LIVE

⚙️ HD

🌞

📺

The video player shows an underwater scene with a stingray swimming over a sandy bottom. The interface includes a title, channel name, and various control icons like play, mute, live indicator, settings, HD, and full screen. A sun icon is also visible in the bottom right corner of the video frame.



## Questions to Consider:

- What was it like forcing yourself to examine this phenomenon through a specific lens?
- Did you notice or think about anything you might have missed otherwise?
- How did ideas about what students might learn differ based on the CCC being applied?
- How might you go about deciding which CCC to use when teaching a given piece of content?
- How might students benefit from using different CCCs to explore the same content?

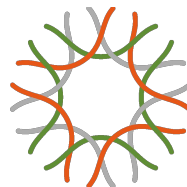


The NGSS highlights “big ideas” and encourages students to make connections among ideas and across disciplines to mirror the way scientists approach the world.

These crosscutting concepts providing a set of lenses with which scientists approach events in the natural world.

These are **lenses that the teacher must make explicit** for students who are learning to acquire the unique way that scientists approach phenomena.





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