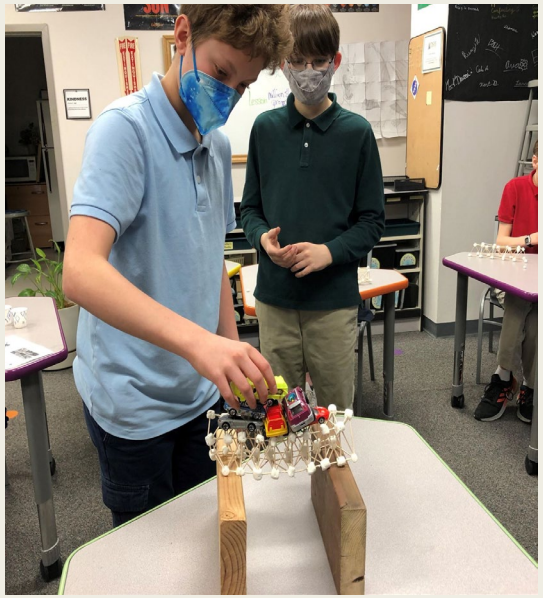
Integrated Science Instruction for Students with Significant Cognitive Disabilities



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Accessible Teaching, Learning, & Assessment Systems

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Warming up: Quick Poll

How do you (or teachers you know) teach science for students with significant cognitive disabilities?

www.menti.com

poll number 7283 9160

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Question 2: Science Instructional Goals

What goals do you have for science instruction for students with significant cognitive disabilities?

www.menti.com

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Thinking About Science Instruction

The [new STEELS standards] … prioritize a shift away from memorization of facts to having students productively participate in scientific discourse and practices, involve students in sustained investigation to support deeper understanding, and recognize that even young children are capable of more sophisticated scientific reasoning than originally thought.

- Pennsylvania Department of Education

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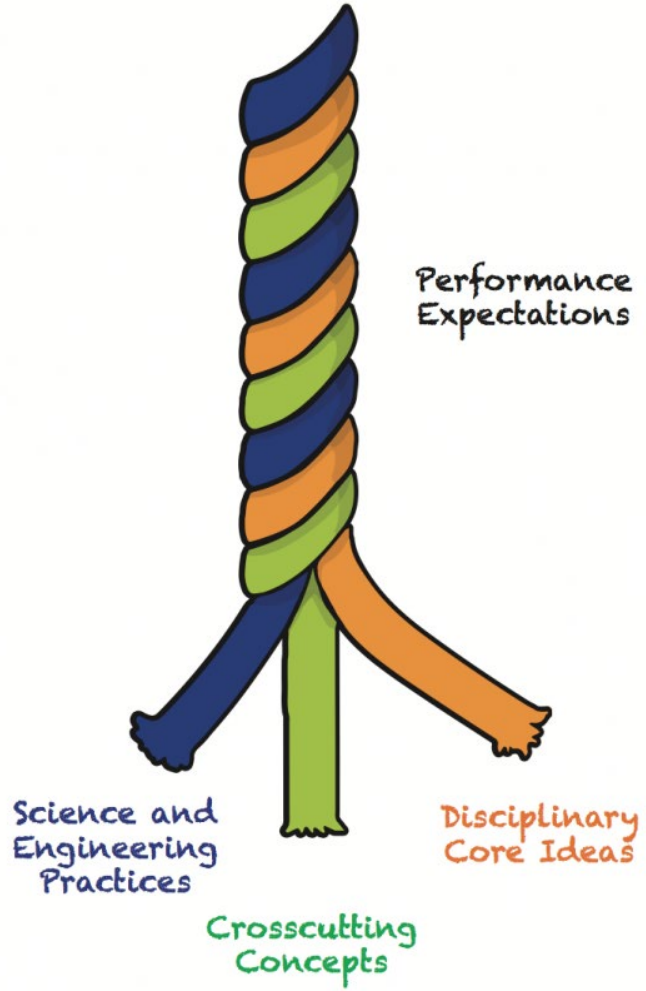
Two Key Ingredients

Science and Engineering Practices (SEPs)

Inquiry

Three-Dimensional Science



- Science and engineering practices
- Crosscutting concepts
- Disciplinary core ideas

All three dimensions are important for meaningful learning that builds across grades

Image source: [Smithsonian Science for the Classroom]

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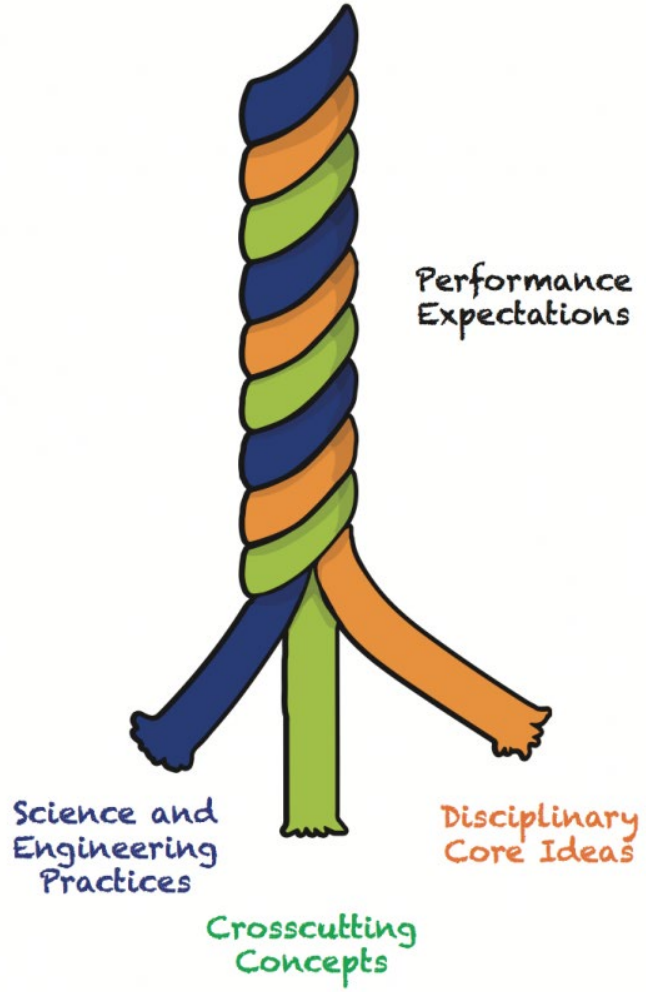
Science and Engineering Practices (SEPs)

- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information
- Asking questions and defining problems

Why Science and Engineering Practices?



- Helps students develop knowledge in the other dimensions
- Build students' curiosity and interest
- Motivates students to keep learning
- Understand the role that science plays in everyday life

Image source: [Smithsonian Science for the Classroom]

Not to be Taught in Isolation

Avoid teaching procedures that are not grounded in concepts

- Use all the dimensions
- Think about the connections to other subjects

Sherri Teaches a Science Lesson

Which SEP is in this lesson?

Do you notice any ELA?

Any math?

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Example Connections: Physical Science

SEP: Planning and Carrying Out Investigations

EE.5-PS1-3: Make observations and measurements to identify materials based on their properties (e.g., weight, shape, texture, buoyancy, color, or magnetism).

- **EE.W.5.7:** Conduct short research projects using 2 or more sources.
- **EE.W.5.8:** Gather and sort relevant information on a topic from print or digital sources into given categories.
- **EE.5.MD.A.1:** Use standard units to measure weight and length.

Example Connections: Earth & Space Science

SEP: Obtaining, Evaluating, and Communicating Information

EE.5-ESS3-1: Use information to describe how people can help protect the Earth's resources and how that affects the environment.

- **EE.RI.5.1**: Identify words in the text to answer a question about explicit information.
- **EE.RI.5.7**: Locate information in print or digital sources.
- **EE.RI.5.9**: Compare and contrast details gained from two texts on the same topic.
- **EE.W.5.8**: Gather and sort relevant information on a topic from print or digital sources into given categories.

Science for All Students

- Adapted SEPs provide some examples of what students could do with the SEP at elementary, middle, and high school levels

- See examples for two SEPs in handout (pages 3-4).

SEP: Planning and Carrying Out Investigations

Elementary	Middle	High
Components of investigations include: carrying out investigations including making observations/measurements and collecting data; identifying results.	In addition to EL, components of investigations include: identifying goal of investigation; planning; controlling variables; producing data; predicting outcomes.	In addition to MS, components of investigations include: identifying independent and dependent variables; evaluating data collection methods.
Investigations can be used to: answer questions; test solutions.	Investigations can be used to: support an explanation or design solution; test a model or a design; compare two different models.	Investigations can be used to: answer scientific questions; provide evidence to support claims; evaluate the performance of a proposed object, tool, or process.
Students can be asked to: with guidance, conduct simple investigations; identify data that answers a question; make predictions based on prior experiences.	Students can be asked to: evaluate appropriate methods and/or tools for collecting data; plan and conduct an investigation using fair tests; identify and produce data that will serve as the basis for evidence.	Students can be asked to: produce data that provides evidence needed to answer a scientific question or test a design solution; select appropriate tools to collect, record, analyze, and evaluate data; evaluate accuracy of data collection methods; revise an experimental design.

Benefits of Integration

- Promote conceptually coherent instruction (Erickson & Koppenhaver, 2020)
- Use similar, familiar materials for different purposes
- Integration can make instructional time more efficient

The Second Ingredient: Science Inquiry

- Promotes conceptually rich instruction
  - Rather than breaking down or isolating skills, students benefit from connections
- Helps students be curious about the world around them
- Provides the same learning opportunities as their peers

Grounding Inquiry in a Phenomenon

- Brings real-world context into science
- Connect to student interests, prior knowledge
- Supports wondering

Choosing a Phenomenon

- ✓ A topic students would care (wonder) about
- ✓ Just challenging enough
- ✓ Complex enough that it can’t be quickly answered
- ✓ Brings in needed ideas and information (context)
- ✓ Students use the SEP

Activity – Case Study Students

Jacoby

- Elementary school
- Loves animals and his aquarium
- Previous learning on using simple models to describe relationships

Rory

- Middle school
- Loves cars and building with Legos
- Previous learning using measurement (weight and length)

Activity

http://tinyurl.com/44zv927f

- What phenomenon would you choose for the lesson, and why?
- What ELA or math concepts related to the SEP could be embedded in the science lesson?
- What activity could the teacher design?

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Activity Debrief

- A few volunteers to share:
  - The phenomenon you chose
  - The connections to ELA and math
  - Ideas for activities

More About Inquiry Cycles

5E Inquiry Cycle

- 5E Model for Science Instruction (Bybee et al., 2006)
- Five Es = five steps in inquiry-based science teaching
  - Engage
  - Explore
  - Explain
  - Elaborate
  - Evaluate

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5E Inquiry Cycle

- **Engage:** Through discussion, students access prior knowledge and make predictions.
- **Explore:** The students investigate their predictions.
- **Explain:** The teacher explains, and students synthesize info and/or observations in the previous phases and apply new knowledge.
- **Elaborate:** The student applies the concept to another phenomenon.
- **Evaluate:** Teacher uses evidence from across the cycle to determine what students learned.

Going from Activity to Inquiry Cycle

- Example from a case study

- Using your examples

Providing Opportunities for All Students

EE.5-LS2-1

- **Target Level:** Create a model that shows the movement of matter (e.g., plant growth, eating, composting) through living things.
- **Precursor Level:** Identify a model that shows the movement of matter from plants to animals (e.g. food chain/food web).
- **Initial Level:** Identify common human foods.

Think about:

- Instructional match for each student
- How to provide learning opportunities for multiple levels in a single lesson
- Plan for formative assessment to notice emerging understandings, alternate conceptions

Questions and Comments

Take-Aways

What is one takeaway you have from this session?

Check out sample inquiry-based lesson plans at

https://bit.ly/5e-resources

Including lessons from today's case studies on food webs, force and motion

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Thank You For Attending!

For more information and resources visit the

5E-SESE website (https://5eproject.atlas4learning.org)

Also check out DLM professional development at

dlmpd.com

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