Towards Effective Science Teaching and Learning for Students With Significant Cognitive Disabilities

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Introductions

• Lindsay Ruhter
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Vignette

• I am teaching photosynthesis to my students with extensive support needs. Is photosynthesis just food for plants? Do plants even need food the way that humans need food? How am I going to teach something this abstract to my students?
Project Overview

• 5E Model Professional Development in Science Education for Special Educators (5E-SESE)

• incorporates three existing, highly successful learning approaches
  • multi-dimensional next-gen science standards,
  • the 5E model of instruction for inquiry-based learning,
  • Universal Design for Learning Principles for accessibility in learning approaches
5E-SESE Model

Merging 3 Learning Constructs to Support Science Instruction in Special Education

5E Science Inquiry Learning Approach

Science and Engineering Practices

Disciplinary Core Ideas

Cross-cutting Concepts

Engagement

Representation

Action and Expression

K-12 Science Framework
Three-Dimensional Standards
- Engage in practices
- Understand core ideas
- Investigate science questions
- Define engineering problems

Universal Design
Principles for Learning
- All-learner access
- Sustain effort and persist
- Learner self-regulation
- Intentionally reduce barriers

#CECLIVE
Improvements to 5E-SESE PD system

• Phase 1 Usability Study in Fall 2019
• Improved user experience (streamlined navigation, broke up large sections of text on screen, more interactive features)
• Improved lesson plan and embedded lesson plan completion within module
Improvements to Design

A tale of two lessons

Some teachers are talking about their plans for teaching EE.S.PS1-2 “Measure and compare weights of substances before and after heating, cooling, or mixing substances to show that weight of matter is conserved.”

Both teachers plan to represent the content tactually, visually, and/or orally to best match student needs. Additionally, both teachers plan for students to make responses and build products using options that best match students’ communication systems (e.g., build posters using photographs of concepts and matched vocabulary; response options using pictures, photographs, symbols, or assistive technology as needed to make choices on a worksheet, describe concepts, identify weights, or make explanations; graphic organizers to make comparisons).

Liz’s lesson

1. Liz asks students to describe the properties of a stick of butter. Liz melts one of the sticks of butter in the microwave and then asks students to describe the melted butter. Liz then asks students, “How do you think the weight of the solid butter compares to the weight of the liquid butter?” Liz records students’ ideas and their reasons for these ideas.
2. Liz’s students test their ideas. Students weigh the butter, melt the butter, and then weigh the melted butter. Students determine if the weight of the butter changed when it melted.
3. Liz asks students if their data supported their initial ideas. Liz helps students reach the conclusion that the weight did not change, and then introduces the science concept of “mass is a property of weight.” She helps students explain why the weight stayed the same using the ideas of conservation and a closed system.
4. Liz asks students the same question about the weight of ice and melted ice. The students make and test their predictions, and explain what happened using the new science concept.
5. Liz’s students create a “before and after” poster that describes what they saw and explains what happened using the new science concept.
Improvements to Interactivity

Introduction

Welcome to the 5E-SESE Physical Science Module:
5E and Physical Science: Guiding Learning Using the Concept of Conservation of Matter

KEY QUESTIONS:
1. How does matter and weight change when substances are heated, cooled, or mixed together?
2. Why does pizza taste so good?
3. How do three-dimensional science standards, Universal Design for Learning, and DLM linkage help assist in planning for high quality science instruction?
4. How can lesson planning transform complex scientific concepts into engaging learning experiences for students?

Click on the play button for a brief video on “The Chemistry of Pizza.” As you view the video, consider the key questions for this module.

https://www.acs.org/content/acs/en/pressroom/reactions/videos/2014/the-chemistry-of-pizza.html

Cookie Crumbles

Imagine you have a whole cookie. You break the cookie into tiny pieces and crumbs. You weigh all of the pieces and crumbs. How do you think the weight of the whole cookie compares to the weight of all the cookie crumbs?

- a. The whole cookie weighs more than all of the cookie crumbs.
- b. All of the cookie crumbs weigh more than the whole cookie.
- c. The whole cookie and all of the cookie crumbs weigh the same.
Improvements to Lesson Plan

Identifying Student Learning Needs

Click on this link to open your saved lesson plan. Complete items #5 and #6 using the information presented above to summarize the linkage levels of EE.5.PS1-2, your students' specific accessibility support needs, and their prior experiences with this physical science content.
Implications for Equity

• UDL principles embedded within inquiry-based models of science teaching removes barriers for all learners, including those learners with significant cognitive disabilities who have historically been denied rigorous opportunities to learn science.
Time to Explore the 5E-SESE PD System!

- Please refer to the 5E-SESE handout to access the link to explore a sample 5E-SESE PD module.

We’d love to hear your feedback! Feel free to use the Chat and Q&A features. Join us on Thursday, March 11th at 4:00 ET.
Thank You!

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