Sequencing Authentic Science Lessons

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Time Frame 50 min

Essential Question(s)

How can we best sequence science lessons to support authentic student learning?

Summary

Participants will determine how to sequence science lessons through the lens of authenticity to increase student engagement. Participants will engage in a non-example of an authentic science learning experience. Following the activity, participants will reflect upon their experience and how it demonstrates the effectiveness of using a research-based approach to instruction, rather than traditional models of science teaching. Participants will investigate the components of several authentic lesson instructional models that utilize a research-based "activity before content" approach, including the 5E model. They will compare the benefits of these instructional models to identify potential applications in their own context. Participants will be provided time at the session to explore the LEARN website to select 5E lessons or strategies for classroom use in the upcoming semester.

Learning Goals

- Experience & reflect upon a non-example of authentic science lesson structure.
- Compare and evaluate several authentic lesson models.
- Explore the LEARN website to select a 5E lesson or strategy that supports research based science instruction to utilize in their own classroom.

Attachments

- Authentic Lesson Reflection Tool 2020 version—Sequencing Authentic Science Lessons.pdf
- Note-Catcher—Sequencing Authentic Science Lessons.docx
- Note-Catcher—Sequencing Authentic Science Lessons.pdf
- Presentation Slides—Sequencing Authentic Science Lessons.pptx
- Science QR Codes—Sequencing Authentic Science Lessons.docx
- Science QR Codes—Sequencing Authentic Science Lessons.pdf
- Vervim in Pharkles Translation—Sequencing Authentic Science Lessons.pdf
- Vervim in Pharkles—Sequencing Authentic Science Lessons.pdf

Materials

- Authenticity reflection tool (attached)
- Note Catcher (Attached; 1 per student)
- Science QR Codes (attached; 1 per student)
- Vervim in Pharkles (attached; 1 per student)
- Vervim in Pharkles Translation (attached; 1 per student)
- Poster paper
- Markers
- Printed station resources
- Sticky notes
- Pharkles Kits (mini DC motor, two wires, D battery)

Engage

Handout the attached **Vervim in Pharkles** handout with quiz questions. Ask participants to silently read along with you as you read the paragraph on **slide 5** out loud. Treat it seriously as if it is any other science reading. Have participants complete the quiz. Review the answers on **slide 6** and celebrate that everyone (or nearly everyone) got 100%.

Tell participants that, based on the quiz results, you are comfortable that everyone understands pharkles, so they are now going to create a model of how a merobite turns. Display **slide 7** and ask them to draw a diagram using proper vocabulary and labels to show how the merobite turns. Encourage them to consult the reading if they need a reminder of the details. Ask a few groups to share their models and how confident they are in their answers.

Now, give each group a pharkle kit and ask them to make their merobite turn. Once they have succeeded, have them redraw their models to demonstrate how the system actually works, still using vocabulary and labels.

Teacher's Note: Pharkle Kits

Each pharkle kit can be stored in a snack- or sandwich-sized plastic baggie and should include: one (1) D battery, two (2) wires, and one (1) mini DC motor. Some mini DC motors, like this one from Nasco Education, come with two wires already soldered to the motor. Be sure to attach a little piece of masking or painter's tape to the motor shaft (the little metal stick protruding from one side of the motor) so it is easier to see when the "merobite" turns.

Review the formal model with them on **slide 8** and reveal the translated vocabulary on **slide 9**. At this time, give participants the **Vervim in Pharkles Translation** handout. If time permits, review the quiz answers on **slide 10**, using the translated information.

Explore

Ask participants to reflect on the following prompt and ask for a few volunteers to share their thoughts: "*How would starting with the activity rather than the reading have changed your learning experience?*" Next, share the quote about vocabulary and science on **slide 11**. Tell participants that prioritizing student experiences over vocabulary in this way can be thought of as an Activity Before Content (ABC) approach (**slide 12**).

Assign the participants into three groups and send them to a station. Display **slide 13** and give instructions for the station activity. At the station, participants will follow the **Science QR Codes** handout to explore one of three instructional approaches that use the ABC format. If the audience is large, divide the participants into six groups (two for each station).

Have participants review the example materials at their station and create a poster using the Window Notes strategy. Then ask each group to briefly share out the information on their posters to the whole group.

Teacher's Note

If you are printing station resources for participants, links that correspond to the QR code sheet can also be found in the **slide 13** notes in the Presentation Slides. Additional resources can be added or substituted as necessary.

Debrief this activity by asking participants to summarize the common characteristics of all three ABC structures (e.g., teacher and student roles, characteristics). Finally, use the Fist to Five strategy on **slide 15** to ask teachers how comfortable they would be teaching an ABC-structured lesson.

Explain

Now that participants are oriented to different models that use the ABC format, hand out or share digitally the **Authenticity Reflection Tool**. Give participants time to read through and think about how the ABC format supports the components of Authenticity. Distribute the **Note Catcher** handout, and encourage them to use it to jot down their notes.

Then, have participants share with a partner or a small group what components of Authenticity they found to be reflected in the ABC models they explored. Depending on time, this can be debriefed in a variety of ways. Two suggested approaches are:

1. Address each ABC structure they explored and ask participants to share out what components they identified (shorter approach). OR
2. Address each component of Authenticity and ask participants to share out where they identified the components in each of the ABC structures (longer approach).

Briefly review what the research says about ABC learning on **slide 17**.

Extend

At this point, participants are transitioning to application of what they've explored so far. Ask if anyone is familiar with the 5E model and show **slide 18**. Give participants a very brief overview of the 5E model (i.e., tell them what the purpose of each E is) as an example of another ABC structure, the one primarily used by the K20 Center. Then give them independent work time to:

- find a 5E lesson on LEARN for the upcoming semester, **or**
- find an instructional strategy on LEARN that supports ABC instruction, **or**
- begin drafting a new ABC lesson or revising a lesson they already have planned

Before moving to the conclusion of the professional development, time permitting, ask for a few volunteers to share what they found or developed during their work time.

Evaluate

To wrap up the session, have participants use sticky notes to complete the I Used to Think, But Now I Know strategy, on **slide 19**, to reflect on their understanding of how best to sequence authentic science lessons. Finish with a brief session evaluation.

Research Rationale

Activity Before Content (ABC) approaches (e.g., the 5E model) to instruction are designed to deepen student understanding of a given concept through learner-centered activities. This approach is grounded in a constructivist view of learning. As such, students take on more responsibility for learning as they construct knowledge by making sense of new experiences with support from their teachers and peers (Bybee, 2015). In traditional lesson models, the teacher is responsible for dispensing information to be learned or retained by the students. In an ABC approach, the teacher acts as a guide: raising questions, providing opportunities for exploration, asking for evidence to support student explanations, correcting misconceptions, and coaching students as they apply new concepts (Bybee, 2014; Bybee, 2015) while students do the intellectual work of sensemaking.

Resources

- Bybee, R. W. (2015). *The BSCS 5E instructional model: Creating teachable moments*. NSTA press.
- K20 Center. (n.d.). Fist to five. Strategies. https://learn.k20center.ou.edu/strategy/68
- K20 Center. (n.d.). I used to think...but now I know. Strategies. https://learn.k20center.ou.edu/strategy/137
- K20 Center. (n.d.). Window notes. Strategies. https://learn.k20center.ou.edu/strategy/189
- Nasco Education Mini DC Motor https://www.enasco.com/p/Miniature-DC-Motor---1-2V---1%2C000-5%2C000-RPM---2mm-Shaft%2BSB53049