Leveraging student experiences to promote equity, relevance, and deep learning

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The Learning Design Group: A curriculum development and research team

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A deep collaboration

The Lawrence Hall of Science + Amplify. = AmplifyScience

Plan for the session

- Setting the stage
- Eliciting and leveraging student ideas and experiences
- Next steps
- Q&A

Use the chat to interact in the session
Use the Q&A to ask the presenter questions
Setting the stage

Scientific Phenomena:
Observable events that occur in the universe and that we can use our science knowledge to explain or predict
NGSS brings new expectations

Topic-based $\longrightarrow$ Phenomena-based

How this often plays out in curricula

<table>
<thead>
<tr>
<th>Topic</th>
<th>Phenomenon</th>
</tr>
</thead>
<tbody>
<tr>
<td>The water cycle</td>
<td>Storms in this area have become more severe</td>
</tr>
<tr>
<td>Sea turtles</td>
<td>Sea turtles are able to survive in a habitat where sharks live</td>
</tr>
<tr>
<td>Light energy and matter</td>
<td>Australia has an elevated skin cancer rate</td>
</tr>
<tr>
<td>Erosion</td>
<td>A cliff's edge is closer to a building than it was 100 years ago</td>
</tr>
</tbody>
</table>
How can we do both?

- figure out specific grade level disciplinary core ideas
- develop an identity as a scientific thinker

Unit storyline

The pathway that supports students in figuring out a specific anchor phenomenon.
Unit storyline

Anchor phenomenon

Prior knowledge

Deep, causal understanding

Unit example

First grade: Light and Sound
Eliciting students’ prior knowledge, personal experiences, and cultural backgrounds

What would a student say? Share your responses in the chat.

Students’ experiences:
- Has anyone ever seen their shadow on a sunny day? What have you noticed?
- Has anyone ever used a flashlight? What have you noticed about the light?
- Has anyone ever been somewhere completely dark? What have you noticed?
- Has anyone ever made or seen shadow puppets? How do you make them?

Students’ ideas:
- Why do you think you can see your shadow on a sunny day?
- How do you think you could make an area of a wall brighter or darker?
- How do you think shadow puppets work?
Eliciting student ideas

Our experiences
- Making shadow bunnies with my sister
- My shadow on the playground looks like me
- I used a flashlight to read my book in the dark
- The shadow of my water glass looks different than the shadow of my hand holding it

What we think we know
- Shadows are the same shape as the thing that makes them
- I can see my shadow when it's really sunny
- Shadows are made from dark material
- You can make a wall brighter by turning on the lights

The unit storyline...

the pathway that supports students in figuring out a specific anchor phenomenon.

...is built on a Learning Progression

The intentional sequence of ideas, along which student learning is expected to progress over a given length of time for a given set of learning goals
Unit storyline built on a learning progression

Anchor phenomenon

Chapter 1

Prior knowledge

Chapter 2

Deep, causal understanding

Chapter 3

How can we ensure students become central to the storyline?

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Educators who practice [culturally responsive teaching] set **rigorous learning objectives** for all of their students and they continually **build helpful bridges** between what students need to learn and their heritage, lived realities, and the issues they care about. In short, culturally responsive teaching is about **weaving together rigor and relevance.**


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**Eliciting and leveraging students’ experiences and ideas**

Leveraging Student Experiences to Promote Equity, Relevance, and Deep Learning
The Learning Design Group at UC Berkeley’s Lawrence Hall of Science
NSTA Engage: Spring 2021
Anchor Phenomenon:
There are brighter and darker areas in the background scenery of a puppet-show.

Leveraging student experiences and ideas along the storyline

Chapter 1

Chapter 2

Chapter 3
Leveraging student ideas along the storyline
Chapter 1: How do we make brighter or darker areas on a surface?

Our experiences
• Making shadow bunnies with my sister
• My shadow on the playground looks like me
• I used a flashlight to read my book in the dark
• The shadow of my water glass looks different than the shadow of my hand holding it

What we think we know
• Shadows are the same shape as the thing that makes them
• I can see my shadow when it’s really sunny
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• You can make a wall brighter by turning on the lights

Leveraging student ideas along the pathway
Chapter 2: How do we make a dark area in a bright puppet show scene?

Our experiences
• Making shadow bunnies with my sister
• My shadow on the playground looks like me
• I used a flashlight to read my book in the dark
• The shadow of my water glass looks different than the shadow of my hand holding it

What we think we know
• Shadows are the same shape as the thing that makes them
• I can see my shadow when it’s really sunny
• Shadows are made from dark material
• You can make a wall brighter by turning on the lights
Leveraging student ideas along the pathway

Chapter 3: How do we make bright, medium bright, and dark areas in a puppet show scene?

- Our experiences
  - Making shadow bunnies with my sister
  - My shadow on the playground looks like me
  - I used a flashlight to read my book in the dark
  - The shadow of my water glass looks different than the shadow of my hand holding it

- What we think we know
  - Shadows are the same shape as the thing that makes them
  - I can see my shadow when it's really sunny
  - Shadows are made from dark material
  - You can make a wall brighter by turning on the lights

Zoom into a chapter
Chapter 2 question: How do we make a dark area in a bright puppet show scene?

Let’s investigate how to make a dark area on a bright surface.

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Gathering multiple sources of evidence

Shadow exploration

Try to make shadows on different surfaces.

Try to make shadows that are different shapes.

Try to make bigger and smaller shadows.
Gathering multiple sources of evidence

Reading *What Made this shadow?*

The blocking model

Why were the walkers able to walk to the other side of the area the first time but **not the second time**?
Making sense of the evidence:
How can we make a dark area on a bright surface?

Leveraging student experiences and ideas
Leveraging student experiences and ideas

Connect to student experiences

How can you use what we’ve figured out so far to explain the bunny shadow you made?

The bunny shadow is on the wall because my hand blocks the light.

Leveraging student experiences and ideas

Building on student ideas

Tran had an idea that the shadow he made on the playground would be the same shape as his body. Can that help us understand blocking?

The light was stopped and didn’t get to the ground only in the places where his body was blocking the light.
Leveraging student experiences and ideas

Point out ideas that have changed

You thought before that **shadows were things that were made of darker materials.** What do you think now?

I think there is no light getting to that place on the ground.

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**Key Concept**

When light is blocked by an object, the surface behind the object looks dark, and we call this a shadow.
Chapter 2: How do we make a dark area in a bright puppet show scene?

Chapter phenomenon

Chapter explanation

What could students likely explain now about the chapter phenomenon?

Leveraging prior knowledge, experiences and cultural connections

Chapter phenomenon

Investigative phenomenon

Multiple sources of evidence

New science ideas

sensemaking

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Eliciting and leveraging students’ experiences and ideas

Figuring out phenomena like a scientist

Students figure out specific grade level disciplinary core ideas and develop an identity as a scientific thinker

Next steps
Eliciting and leveraging students’ experiences and ideas routine

1. **Elicit** students’ experiences and ideas at the **beginning of a phenomenon-based unit**.
   - Record student thinking on two charts
   - Ask questions that elicit students’ prior knowledge, personal experiences, and cultural backgrounds.

2. Familiarize yourself with the build of ideas in a unit and be ready to leverage particular student experiences and ideas along the way.

3. **Leverage** students’ experiences and ideas at key moments. For example:
   - At the **beginning of the chapter**.
   - While students are **gathering evidence** from multiple sources.
   - **During sensemaking opportunities** so students can make connections to relevant experiences and build on ideas.
Questions?

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Thank you for your participation!
Check the chat for a survey link.