Using Artifacts of Student Thinking to Make Instructional Decisions

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Alignment to Learning Forward Standards

•The new education law, Every Student Succeeds Act (ESSA), redefines professional development with a purposeful influence from Learning Forward.
•Learning Forward, a national association recognized as leaders in professional learning, has established standards for professional learning that set a high bar for quality learning experiences.
•This session aligns to the following standard(s) *(please select the standard(s) appropriate for your session; be sure to give a brief description of the standard)*:

- Resources - ***Professional learning that increases educator effectiveness and results for all students*** *requires prioritizing, monitoring, and coordinating resources for educator learning.*
- Learning Designs - ***Professional learning that increases educator effectiveness and results for all students*** *integrates theories, research, and models of human learning to achieve its intended outcomes.*
- Implementation - ***Professional learning that increases educator effectiveness and results for all students*** *applies research on change and sustains support for implementation of professional learning for long-term change.*
- Data - ***Professional learning that increases educator effectiveness and results for all students*** *uses a variety of sources and types of student, educator, and system data to plan, assess, and evaluate professional learning.*

Session Goals

1. **What** does it look like for **students to come to understand** particular **science concepts?**
2. **How** can we learn **how students learn science?**
3. **How** can we learn to **appreciate the range** of ways in which **students make sense** of the natural world?

What if…we have **misconceptions about** student misconceptions?

What if… rather than simply viewing students' intuitive or **partially scientific ideas as misconceptions,** we viewed the diversity of student's ideas as **stepping stones to deeper understanding?**

Consider Facets of Student Learning

Students bring a **diverse range of science**-related ideas to the classroom — **more / less productive**

Not all of students' **nonscientific thinking** should be considered a **"misconception" or error**—some ideas are **stepping stones to deeper understanding**

Facets of Student Learning

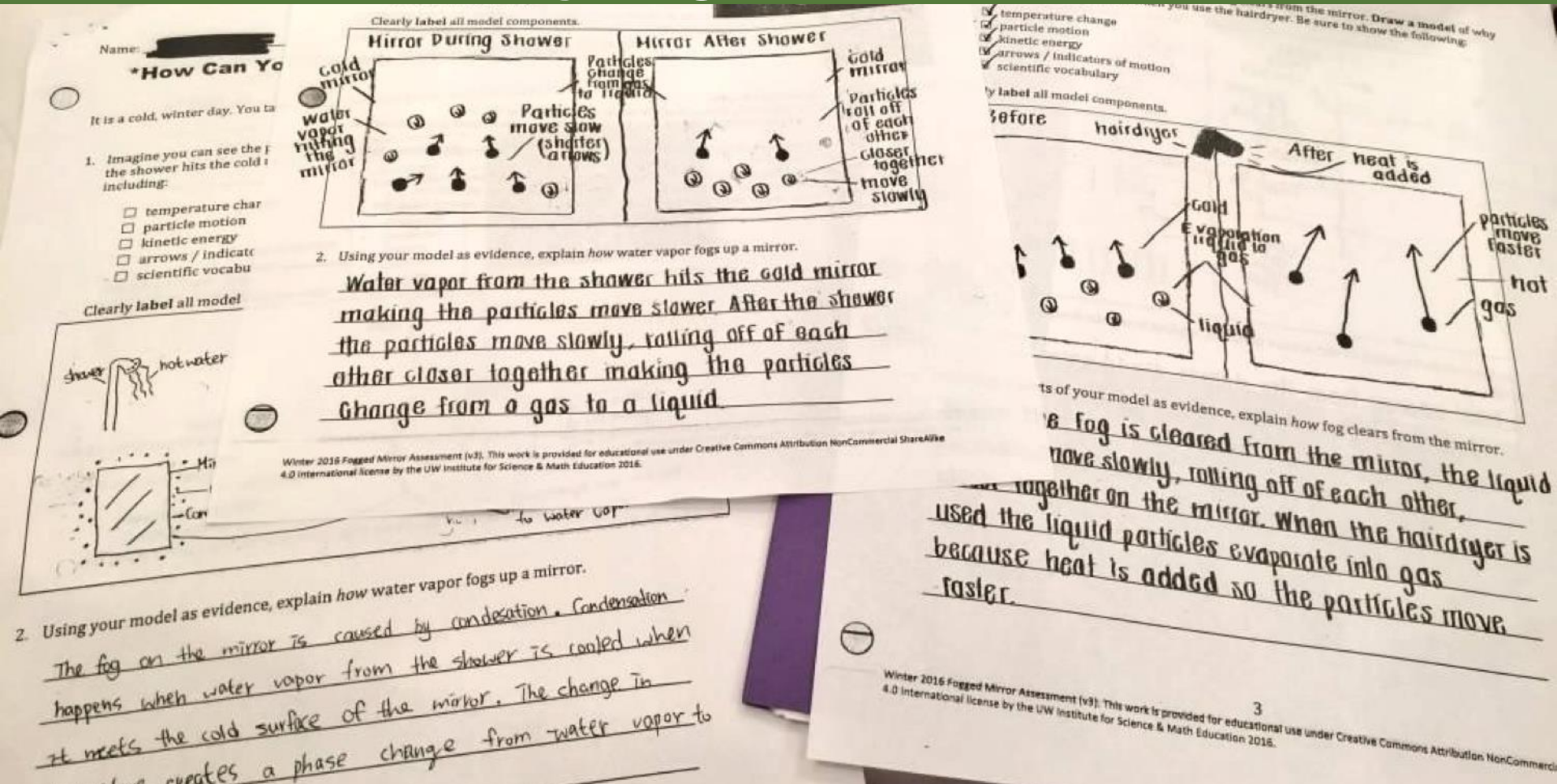
Facets are **“pieces of knowledge”** or “conceptual models” **around a key idea or event** related to the natural world

Facets clusters document the **set of patterns in student thinking** that **show up regularly** for a key idea, event, or topic

Example Facet Cluster: Falling Bodies - Physics

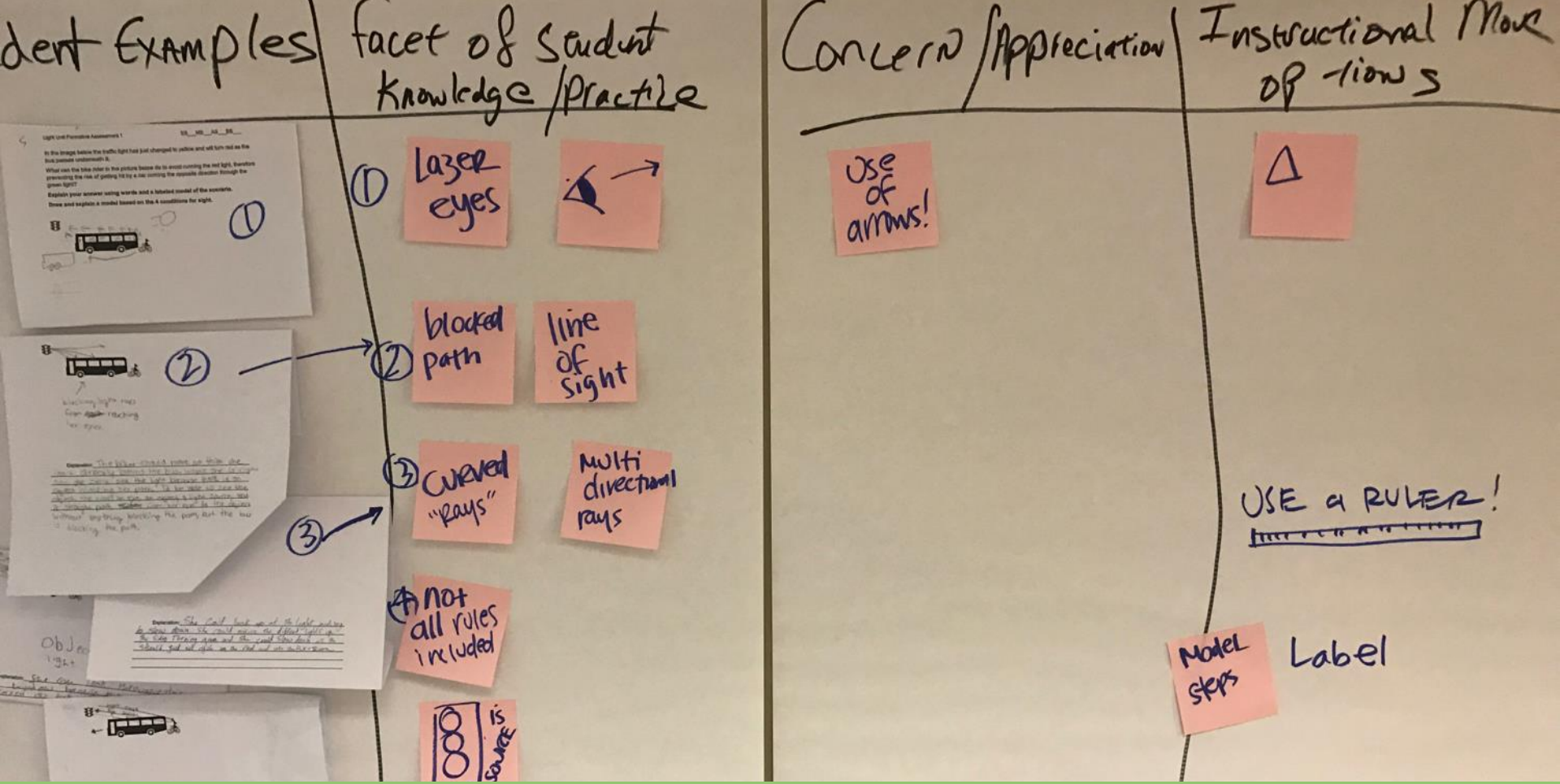
- **344** Medium effects will exist even when there is no motion relative to fluid medium.
- **345** All things fall equally fast regardless of medium effects.
- **346** Vertical fall is at a constant velocity of 10 m/sec.
- **348** Heavier will hold back more (fall slower).
- **348-1** Larger fall substantially slower.
- **349** Heavier falls faster.
- **349-1** Larger falls faster.

Analyzing Student Data



Developing a Facet of Student Learning Chart

Sample Student Response	Frequency	Facet of Student Knowledge/Practice	Concern **or** Appreciation	Instructional Move Options



Facet of Student Learning Chart

How to **Identify** Facets and Responses

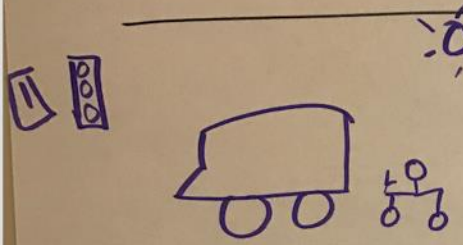
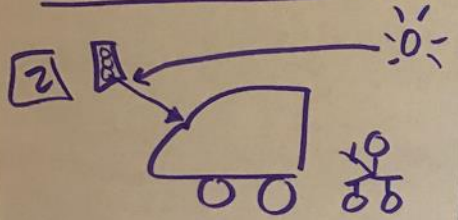
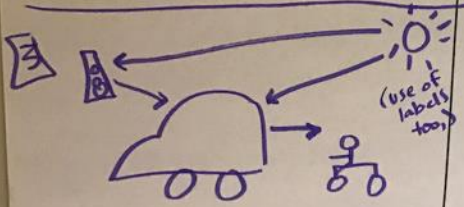
1. Adopt a stance of **generous interpretation** as you closely read student responses:
    - "Why might an intelligent person in this class give this response?"
    - "What do they seem to be thinking?"

2. Try to **get to the "essence" of their thinking** (e.g., the conceptual model "behind" their response).
    - You are mining intellectual treasures.

3. **Optional:** Think about how you would instructionally respond to refine student thinking…
    - What do students experientially or cognitively need?
    - Do they need to combine ideas?

How to **Identify** Facets and Responses

1. Get into small unit assessment teams of **4 to 5 people**
2. **Focus on** responses to **Assessment Questions 1, 2, 5 & 6**
3. As a group, engage in “round robin” facet analysis of all student responses to the subset of items—using “the sticky note method”.
4. After you are done, **sort responses into a few groups** and **give facets names.**
5. **Fill out the rubric** on the poster paper with…
    - Sample student responses
    - Facet Name (for a thematic group)
    - Concern or Appreciation (about what you see)
    - Optional: Instructional Move Possibilities

Bike/Bus Light Student Examples	Facets of Student Thinking	Concern / Appreciation	Instructional Move
1 	· lack of labeled diagram/model (no path of light)	C: No understanding of how light travels C: Lack of modeling conventions	· Reteach
2 	Understanding of · Obstructed ~~light~~ line of sight		
3  (use of labels too)	· Show that you need a light source + line of sight · Modeling understanding (labels/arrows)	A: Use of arrows ~~to~~ in diagram C: Concept of how you see is still weak	· Ready for next step (with ~~more~~ more modeling support)
		A: Conceptual understanding & Modeling application	Even more ready for next step. :)

Formative assessment is **central** to the learning process.

A facet-based assessment practice **can be used to focus instruction** on the **refinement of student thinking.**

Resources: STEM Teaching Tools - Brief #37

- STEM Teaching Tools are very **short briefs** that **highlight ways of working on specific issue** that come up during science teaching.

- **Consider** using them in professional learning community discussions.

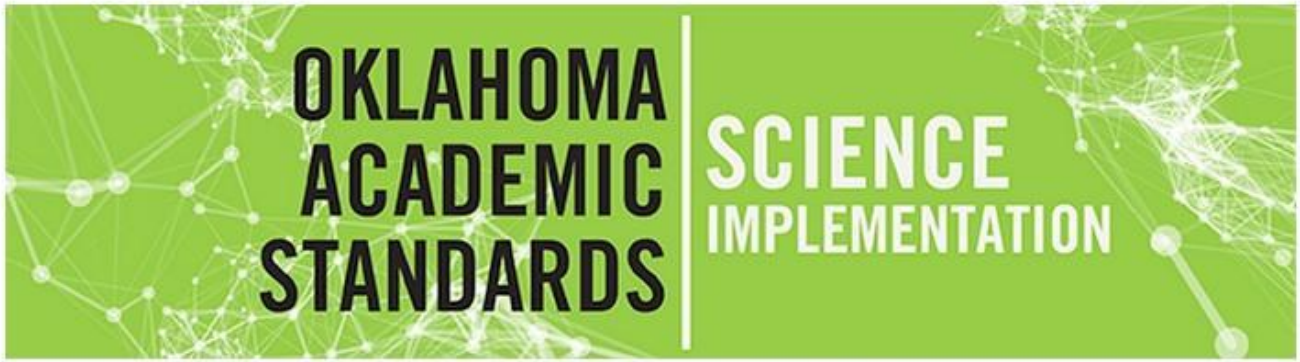
What Is The Issue?

Students bring a range of different ideas for understanding science phenomena, concepts, and representations based on their unique life experiences. Rather than simply viewing students' intuitive or

WHY IT MATTERS TO YOU

Teachers should learn to see patterns in the range of students' thinking about specific science topics and to plan instructional approaches that help students refine their understanding.

Resources: Oklahoma State Department of Education



Welcome to the starting place for information related to the science education of Oklahoma students.

This page is devoted to supporting Oklahoma teachers and school districts with implementation of the Oklahoma Academic Standards for Science.

Science Menu

- Science Home
- Science Implementation
- Oklahoma Science Frameworks
- OKSci PD on Your Plan
- Resources - Three Dimensions for Science

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Reflections

1. **What** does it look like for **students to come to understand** particular **science concepts?**
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