Leveraging Literacy in Science for Grades 9-12

GRADES 9-12

ARKANSAS DEPARTMENT OF EDUCATION
LEADERSHIP SUPPORT SERVICE

ARKANSAS DEPARTMENT OF EDUCATION

Professional Learning

- Explore the definition of disciplinary literacy.
- Establish connections among CCSS, TESS, and Science Standards.
- Learn effective disciplinary literacy strategies to enhance science instruction and learning.
- Consider how to include the effective use of literacy in science instruction.

Guiding Question:

How can incorporating disciplinary literacy in science support the understanding of core ideas?

What is Disciplinary Literacy?

Padlet Activity

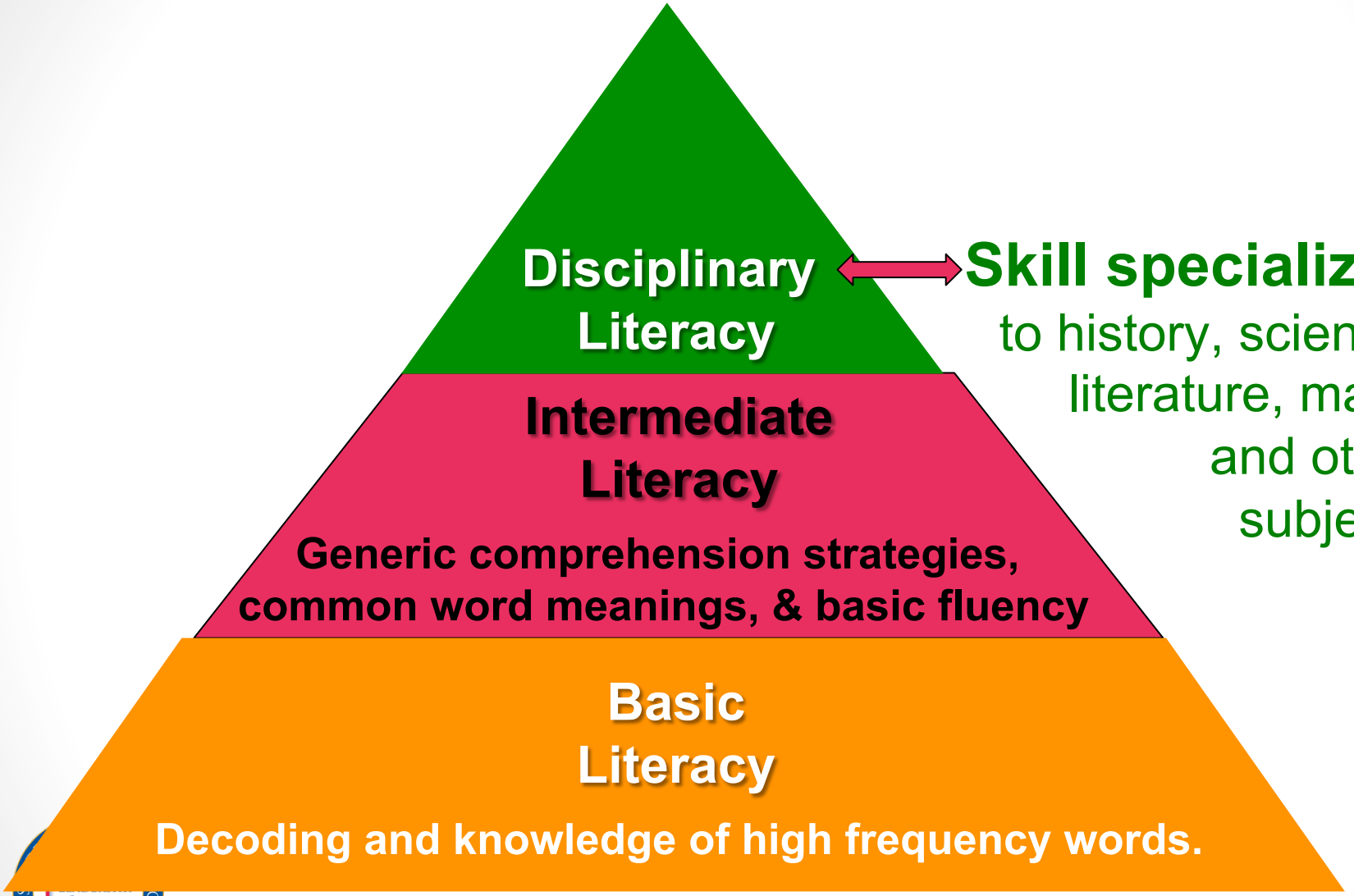
http://padlet.com/vrhame/SciLit

Disciplinary Literacy

- Knowledge and abilities possessed by those who create, communicate, and use knowledge within the disciplines, such as in science
- Unique tools that the experts in a discipline use to participate in the work of that discipline (in this case, science)
- Specialized ways of knowing and doing in a specific field (science)

Timothy Shanahan

What is Disciplinary Literacy and Why Does It Matter?


Disciplinary Literacy
Skill specialized
to history, science, literature, math, and other subjects
Intermediate Literacy
Generic comprehension strategies, common word meanings, & basic fluency
Basic Literacy
Decoding and knowledge of high frequency words.

What is different?

- Creation of knowledge
- Beliefs about knowledge
- Communication practices
- Approaches to literacy

Why Disciplinary Literacy?

- General reading and writing strategies don't go far enough in preparing students for the complex reading and writing tasks required of them for college/career work or to address state literacy standards

Why Disciplinary Literacy?

- In college, students don't just take English courses.
- We know from lots of research that students don't transfer strategies for reading and writing across disciplines, or if they do, they don't take into account disciplinary differences.
  - e.g.—they write an essay test answer in history as a five-paragraph theme, using the first paragraph to create interest in the topic.

Disciplinary Literacy in Science

- Are there words or phrases that have discipline-specific meaning in science?
- Are there writing styles that are unique to the science discipline?
- What is unique about science in terms of reading, writing, speaking, and listening?

Disciplinary Literacy in Science

- How do scientists and engineers use language on a daily basis?
- What types of texts do they turn to or produce as part of their work?
- How are interactions with members of the science field shaped or governed by texts?
- Who are the primary audiences for written work in science?

Characteristics of Disciplinary Literacy in Science

Text Features

- **Purposeful use of passive voice**
- **The cell membrane was damaged when…**

- **Long noun phrases**
- **gene replacement therapy**
- **primate genome sequences**
- **the polymerase chain reaction laboratory technique**

- **Nominalization of verbs**
- **Science-specific--evolution, photosynthesis**
- **General--progression, optimizations, predictions**

- **Information builds**
- **Transformation of information is essential**
- **Vocabulary is purposeful**
- **Vocabulary learning is often built around science processes**

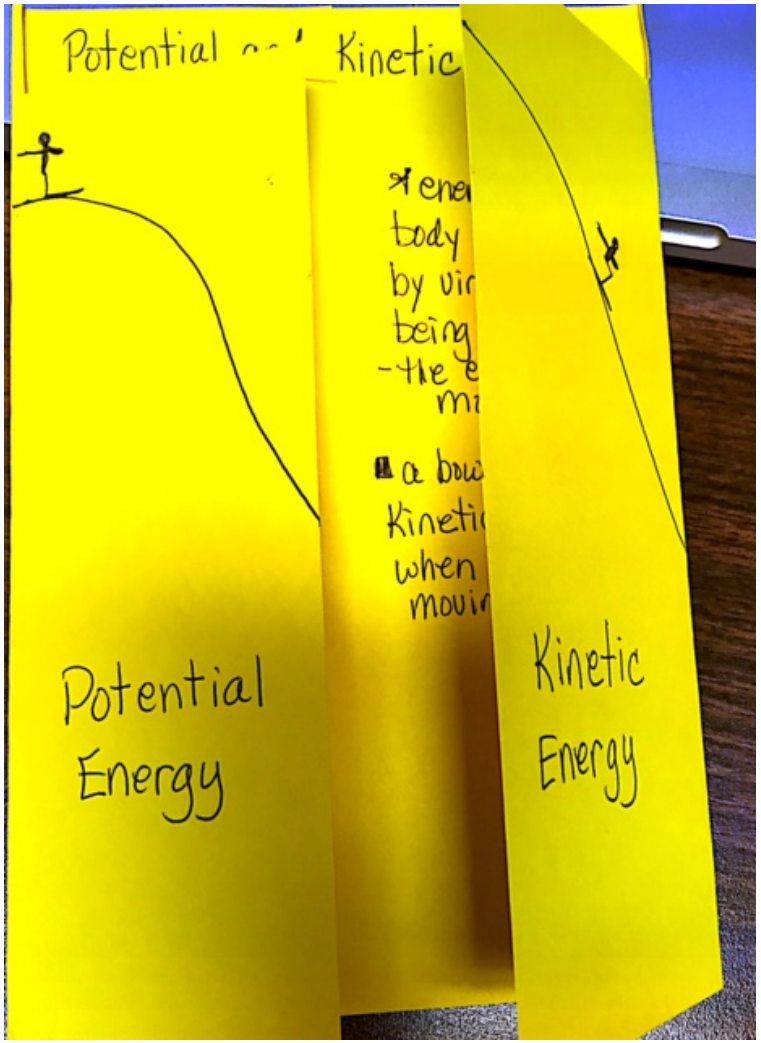
Reading in Science

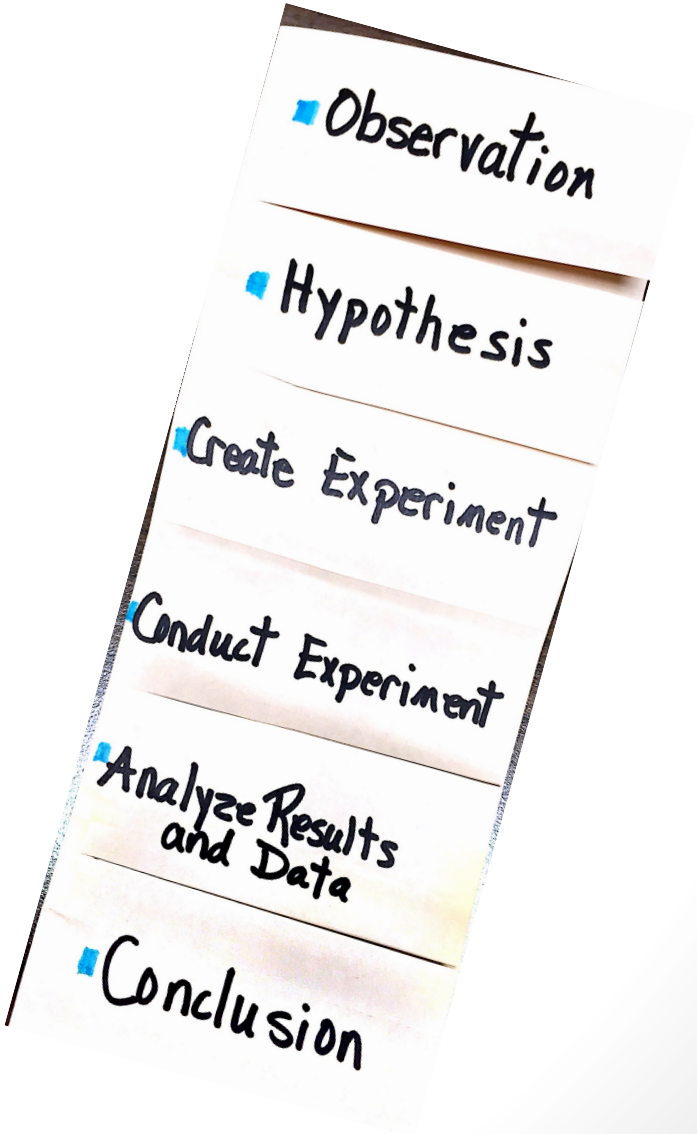
- Involves integrating text and diagrams
- More than just memorizing terms and definitions.

Students must be able to pull the ideas together to explain science processes

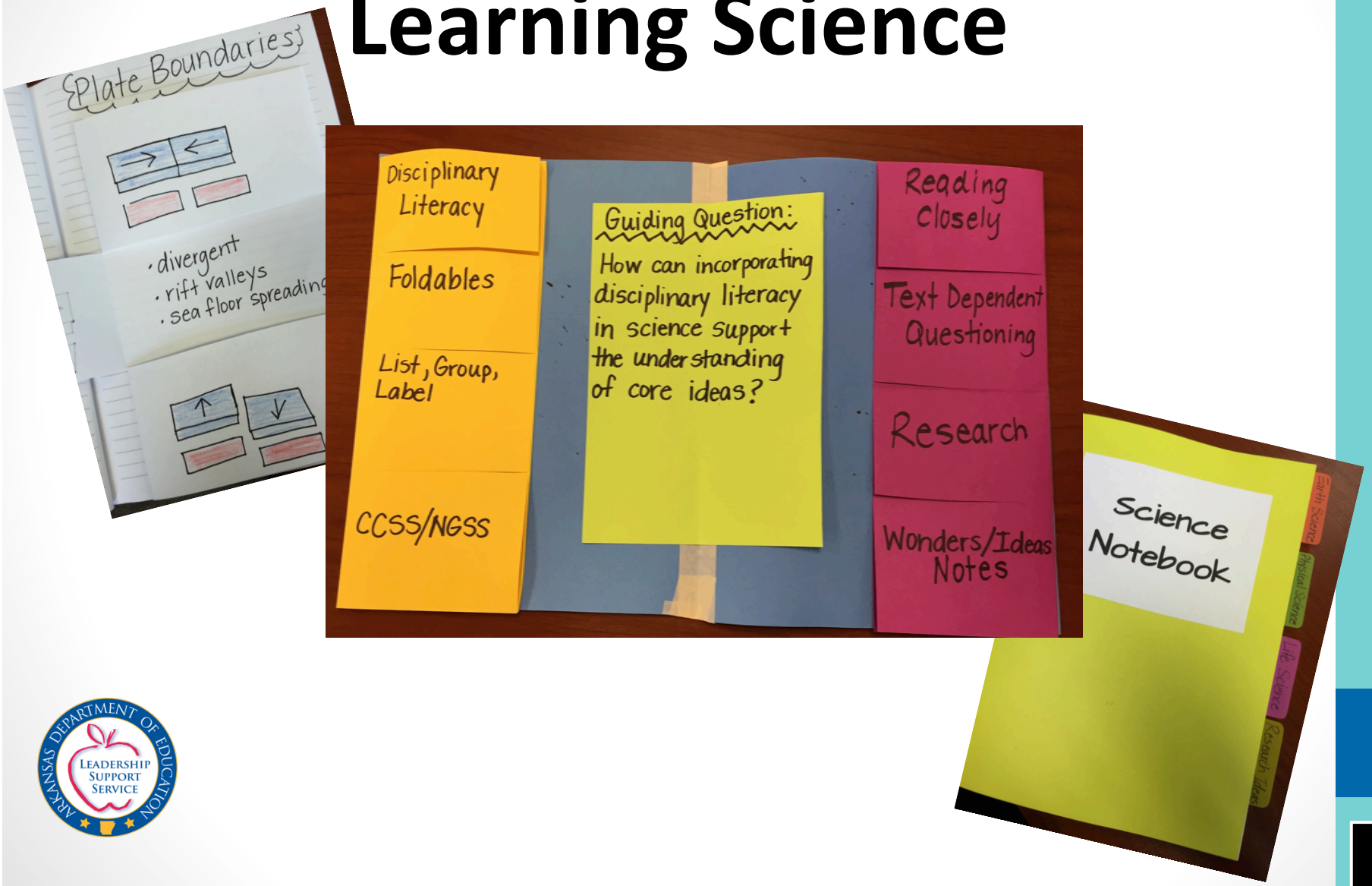
- Concepts and terminology builds
- When reading students should ask:
  - What data supports this concept or theory?
  - What other theories is this concept related to?
  - How does this phenomenon work? What is the scientific process involved?
  - Why does this phenomenon occur?
  - What does it show us?

Foldables


Potential
Kinetic
Potential Energy
Kinetic Energy


Observation
Hypothesis
Create Experiment
Conduct Experiment
Analyze Results and Data
Conclusion

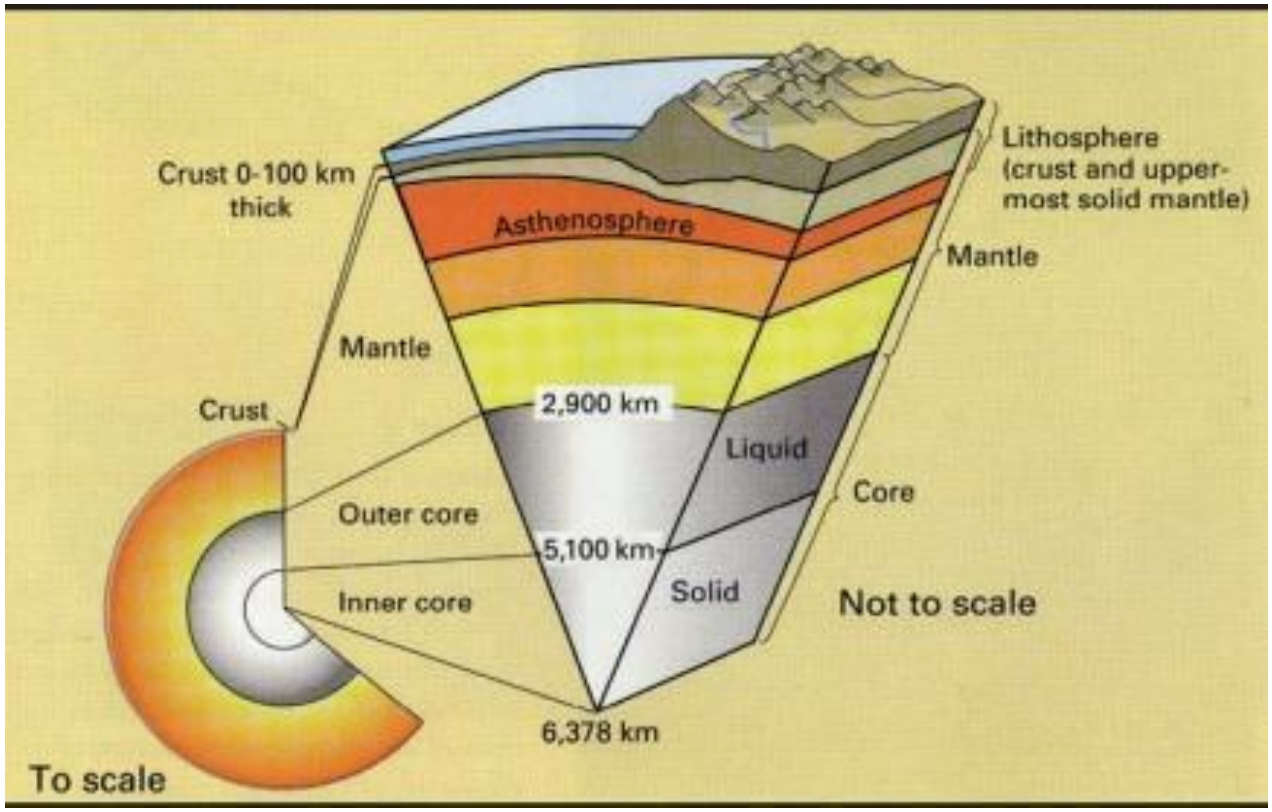
Foldables for Learning Science



Where Do I Begin?

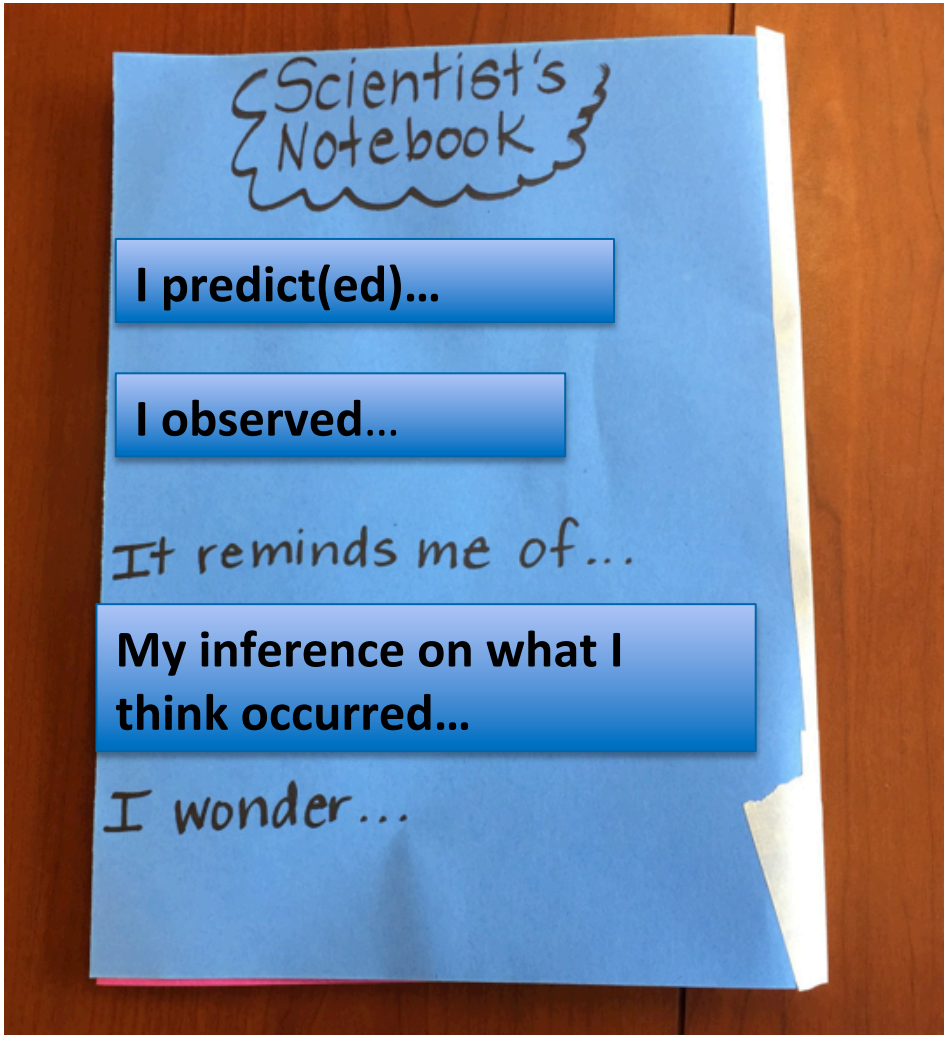
Recording Observations:
Science and Engineering Practice of Asking Questions (science) and Defining Problems (engineering)

Tectonic Plate Simulation



How and why does the earth change over time?

Foldable


Scientist's Notebook
I predict(ed)…
I observed…
It reminds me of…
My inference on what I think occurred…
I wonder…

CCSS

English Language Arts (K-12)

Literacy for History/Social Studies, Science, and Technical Subjects (6-12)

Common Core State Standards for Literacy in Science and Technical Subjects

Grades 9-12

The College and Career Readiness Anchor Standards form the backbone of the ELA/Literacy standards by articulating core knowledge and skills, while grade-specific standards provide additional specificity.

http://www.corestandards.org/ELA-Literacy/

Arkansas' Big Shifts

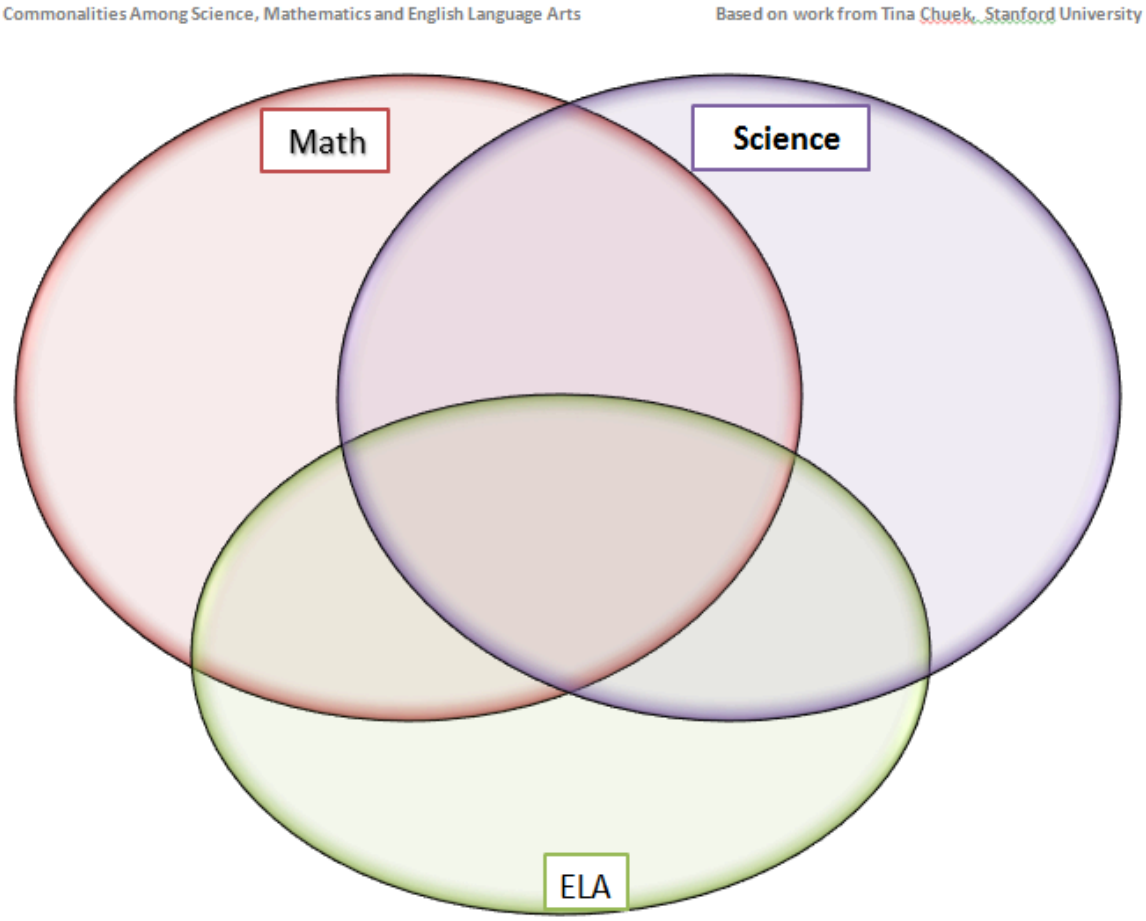
- ✓Appropriate Text Complexity
- ✓Increased Reading of Informational Texts
- ✓***Disciplinary Literacy***
- ✓Close Reading
- ✓Text-dependent Questions
- ✓General Academic and Domain-specific Vocabulary
- ✓Argumentative Writing
- ✓Short and Sustained Research Projects

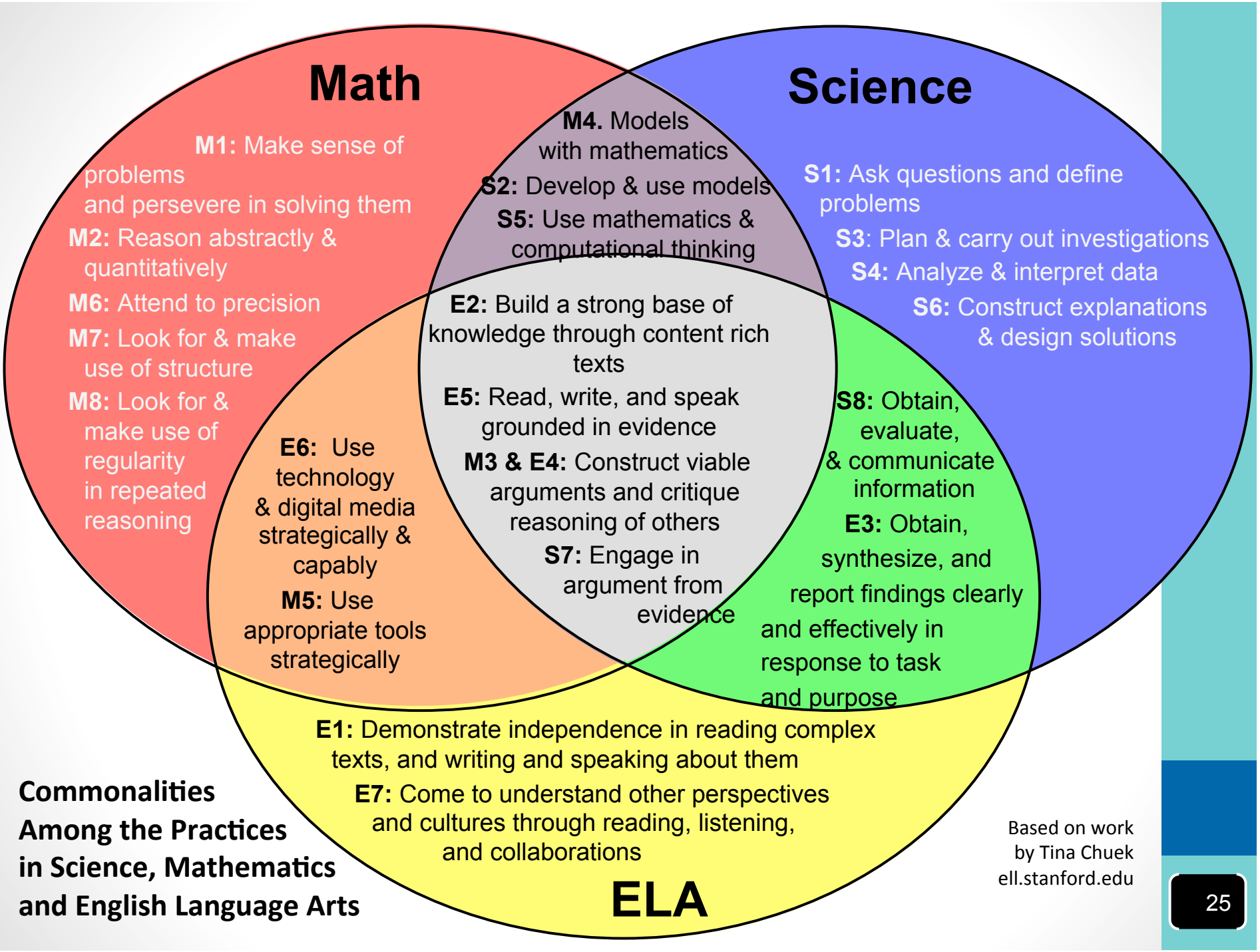
http://ideas.aetn.org/commoncore/strategic-plan

Science and Engineering Practices

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

Comparing and Contrasting Science, Math, and English Language Arts





Commonalities Among the Practices in Science, Mathematics and English Language Arts

Based on work by Tina Chuek
ell.stanford.edu

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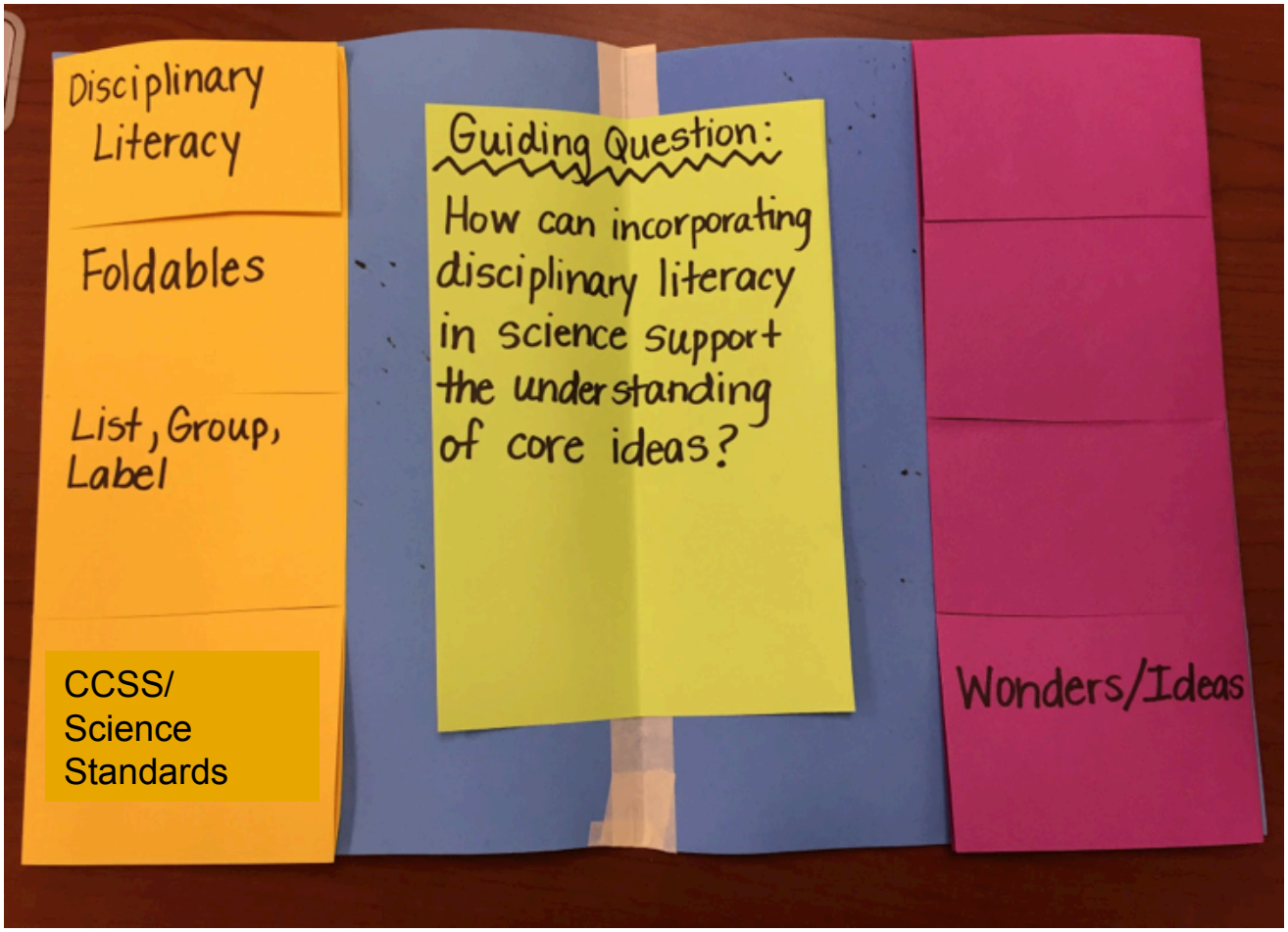
Disciplinary Literacy
Foldables
List, Group, Label
CCSS/ Science Standards
Guiding Question:
How can incorporating disciplinary literacy in science support the understanding of core ideas?
Wonders/Ideas

Guiding Question:

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Reading Closely in Science:

...an instructional routine in which students critically examine a text, especially through repeated reading.

Students examine:

- Key details
- Vocabulary and word choice
- The organization of a text (structure)
- Argument and inferential meaning
- Author's purpose
- How ideas connect to other texts

Purpose of Reading Closely

- To afford students with the opportunity to assimilate new textual information with their existing background knowledge and prior experiences to expand their schema

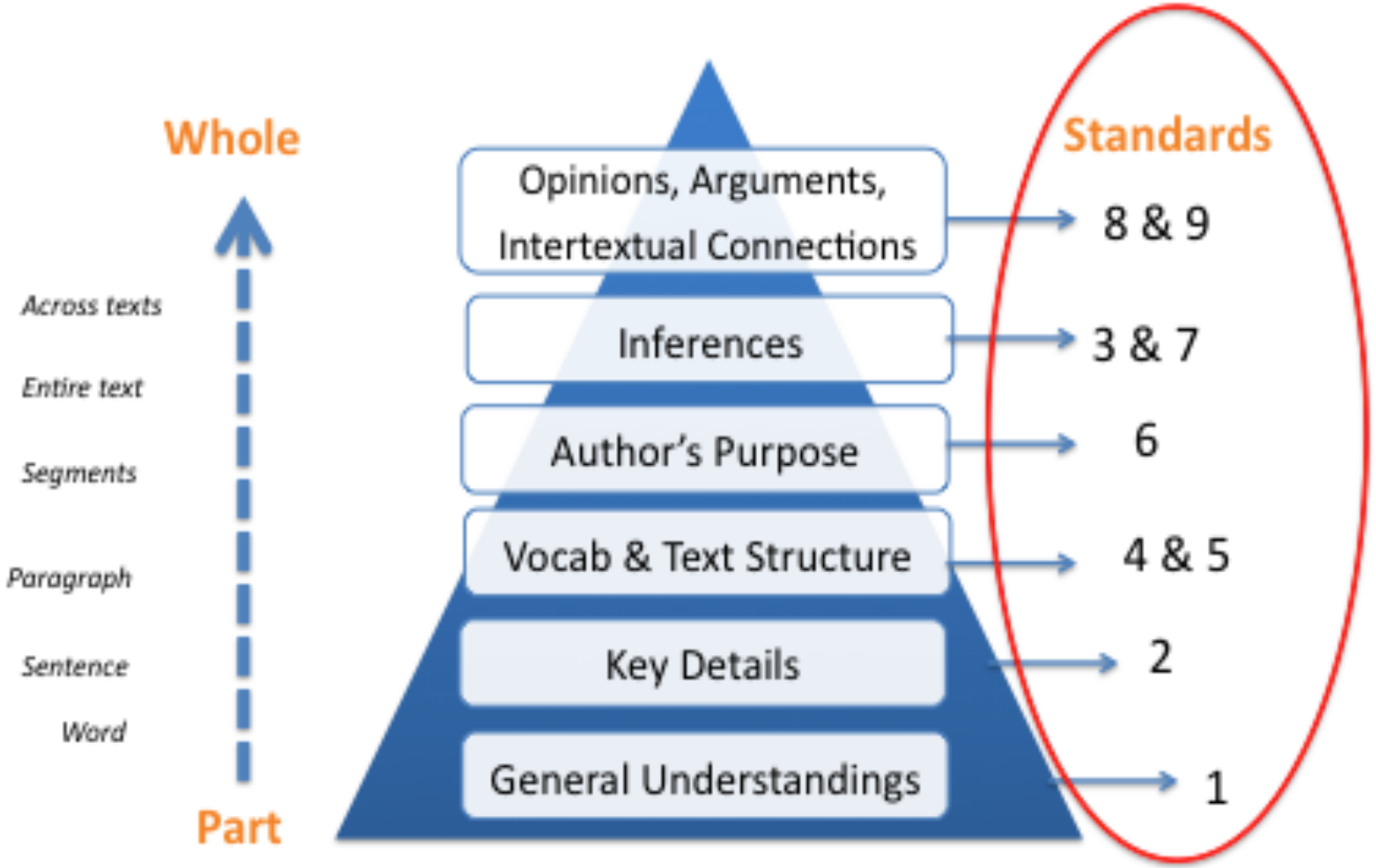
- To build the necessary habits of readers when they engage with a complex text (building stamina and persistence)

Text-Dependent Questions

- CCSS calls for more TDQs because questions that are often asked about texts encourage students to draw on their personal experiences rather than what the text has to offer
- When designing TDQs, ask: Can students answer this question *without* reading the text?
- Other types of questions are not banned, but 80%-90% of questions asked about a text should be text-dependent (Arkansas' Big Shifts)

Doug Fisher and Nancy Frey-*Rigorous Reading*

Progression of Text-dependent Questions



Doug Fisher and Nancy Frey

Professional Article: "Students' Close Reading of Science Texts: What's Now? What's Next?"

Diane Lapp . Maria Grant
Barbara Moss . Kelly Johnson

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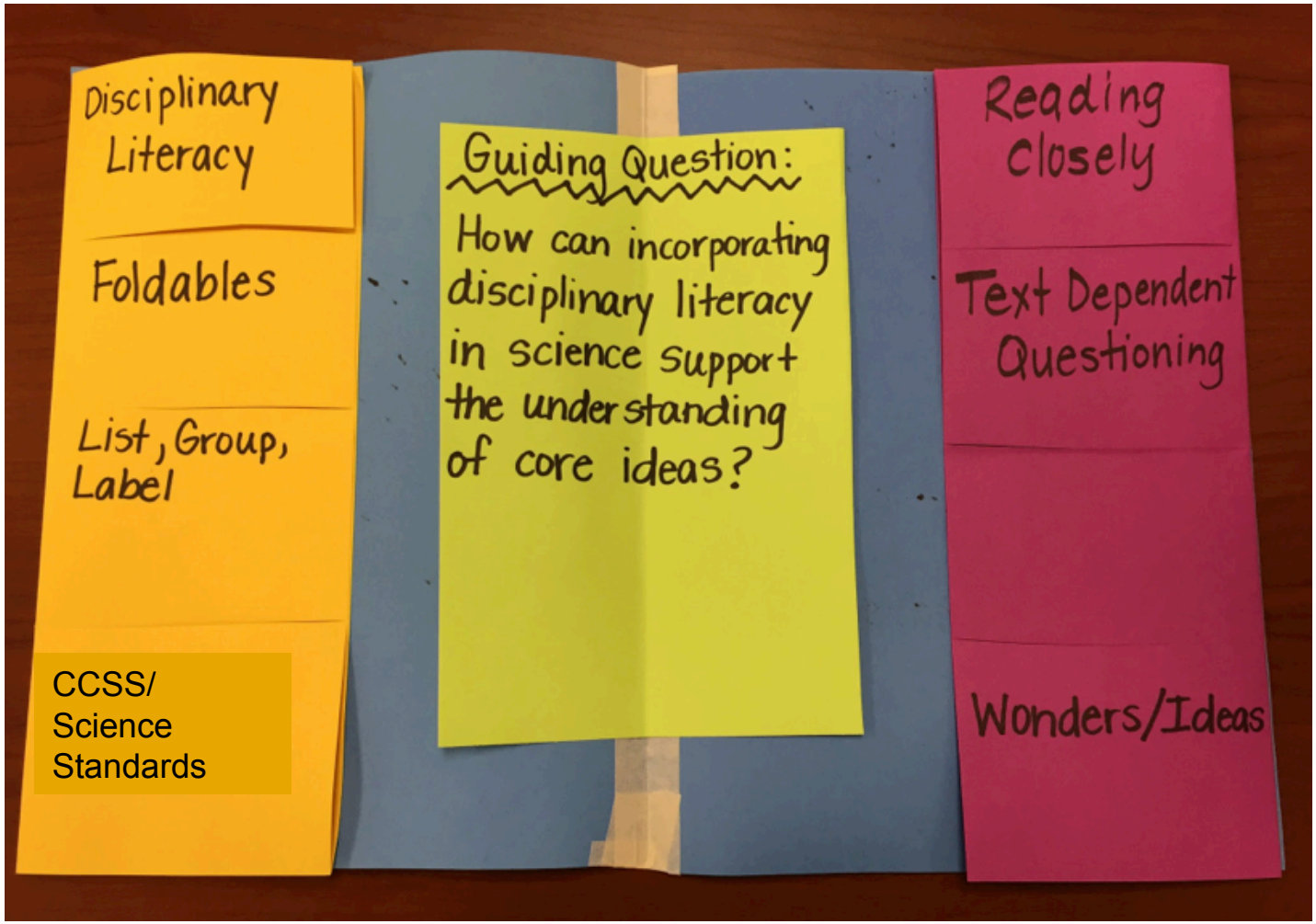
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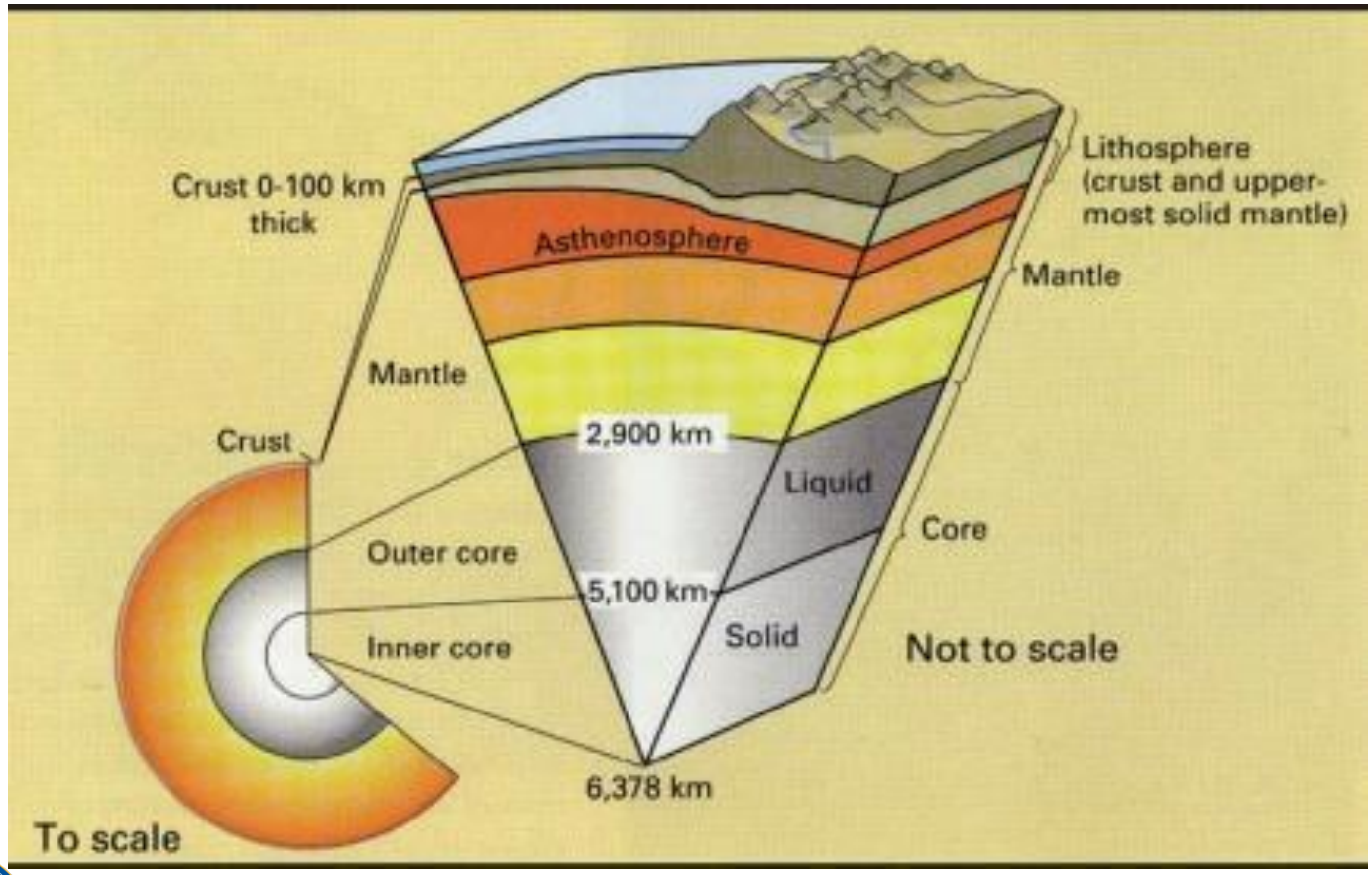
“Destroying and Reconstructing Earth”



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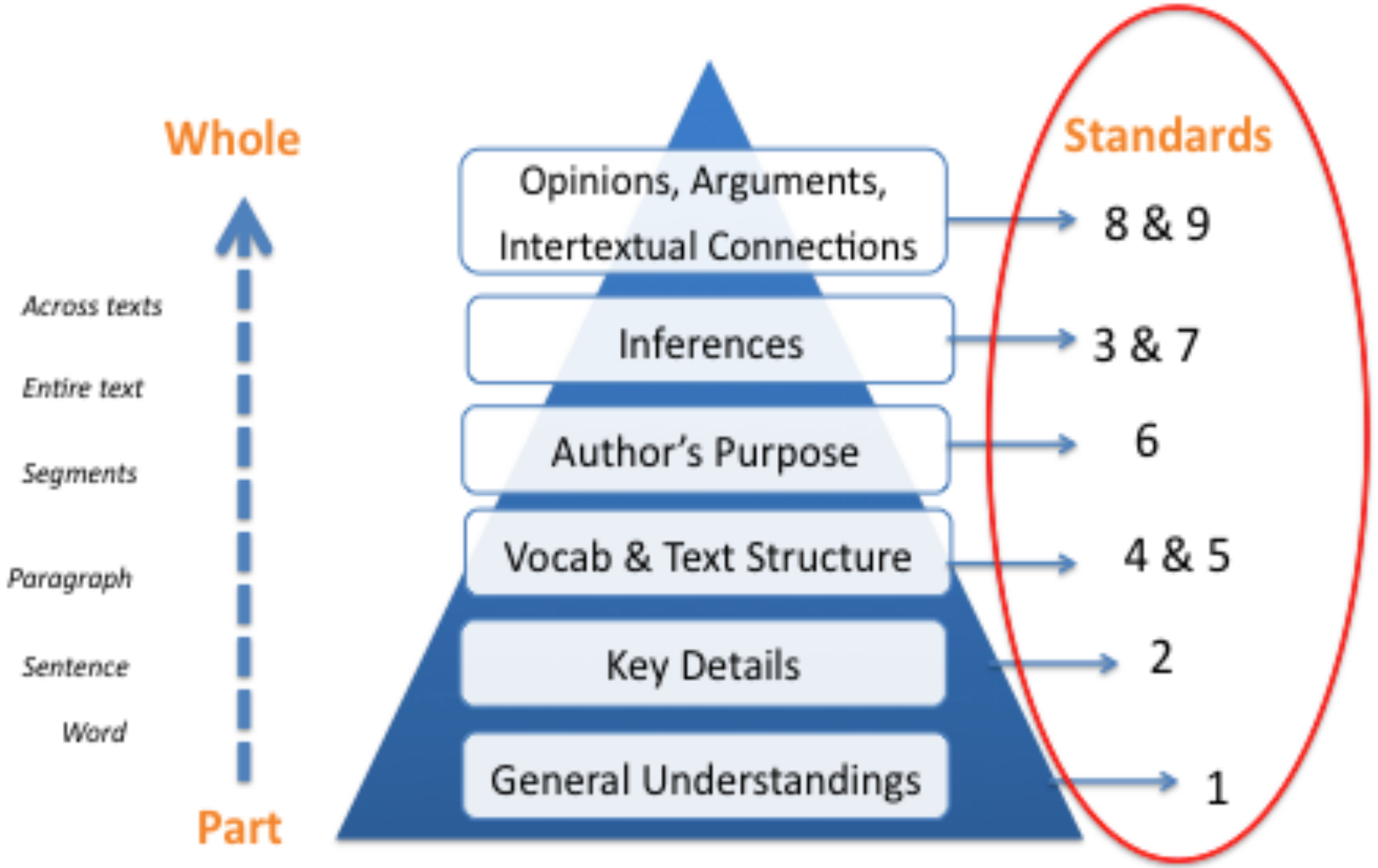
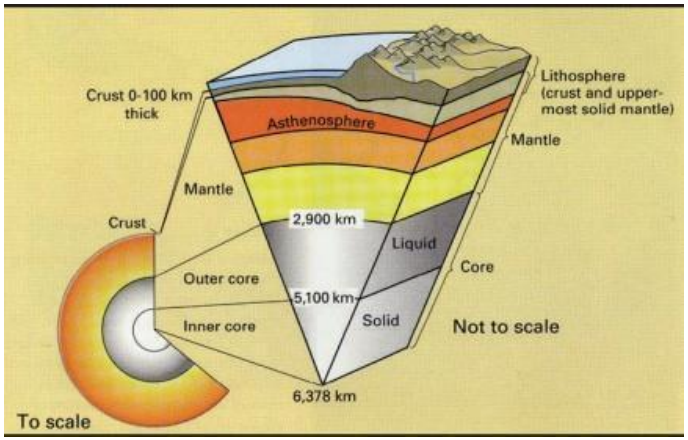


Doug Fisher and Nancy Frey

List, Group, Label

"earthquakes"



Additional Vocabulary Device:
Vocabulary Self-Awareness Charts

Vocabulary Term	*Know Definition*	*Know an Example*	*Don't Know Either Yet*	*Definition*	*Example(s)*
force		✓			pedaling my bicycle
mass	✓	✓		amount of matter in a substance or object	a glass of water, a balloon filled with air, and a rock all have mass
gravitation			✓		

automar

pseudomania

SNIGLETS

superectoped

subaquaphobia

Research to Build and Present Knowledge
Grades 9-12

CCRA.W.7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

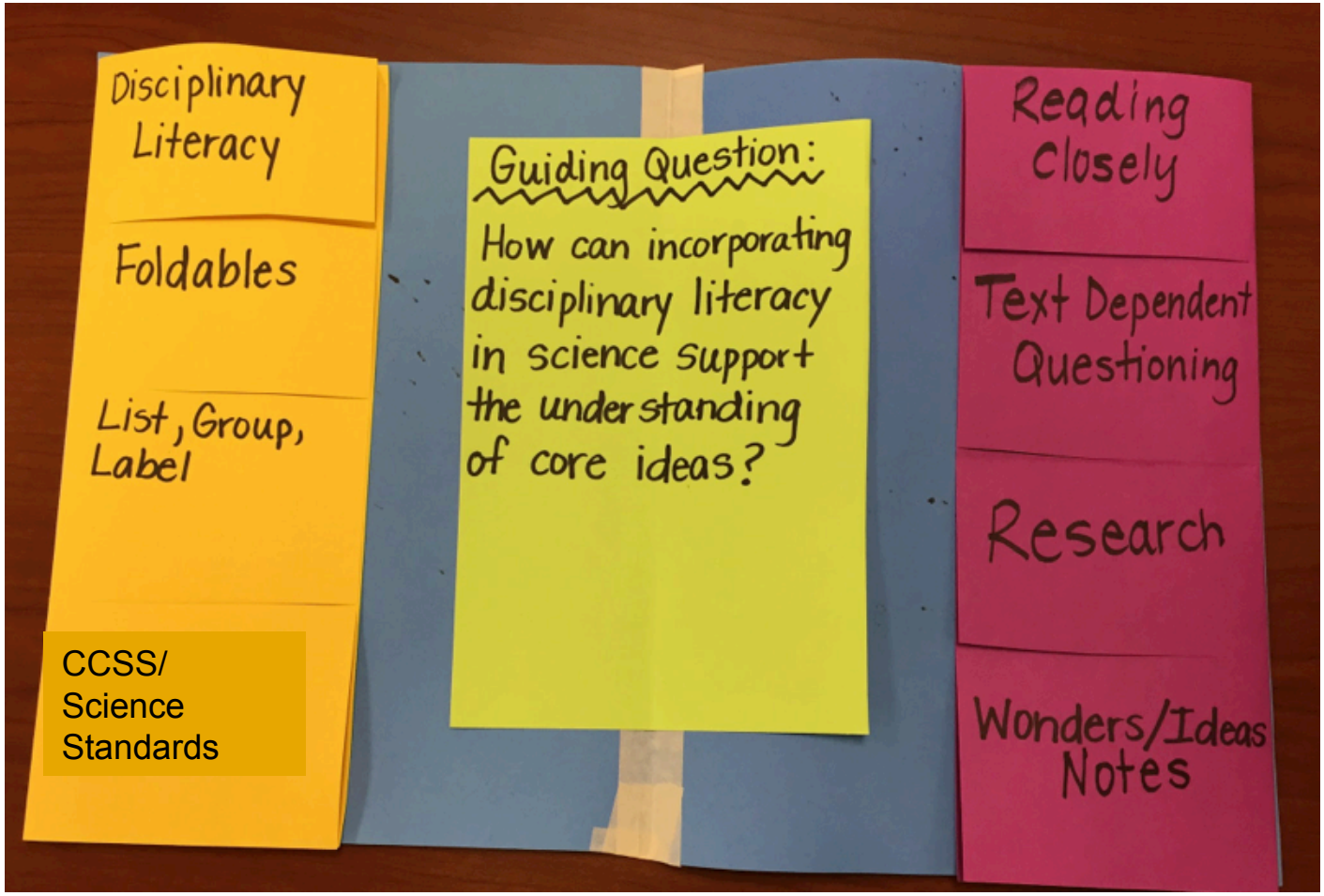
CCRA.W.8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.

CCRA.W.9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

Research Topics

Based on the science article you read earlier and your experience with the simulation, craft a prompt that would expect the students to meet the CCSS research standards?

Foldable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Extend the Learning

How can we support you as you incorporate disciplinary literacy in your classrooms?

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