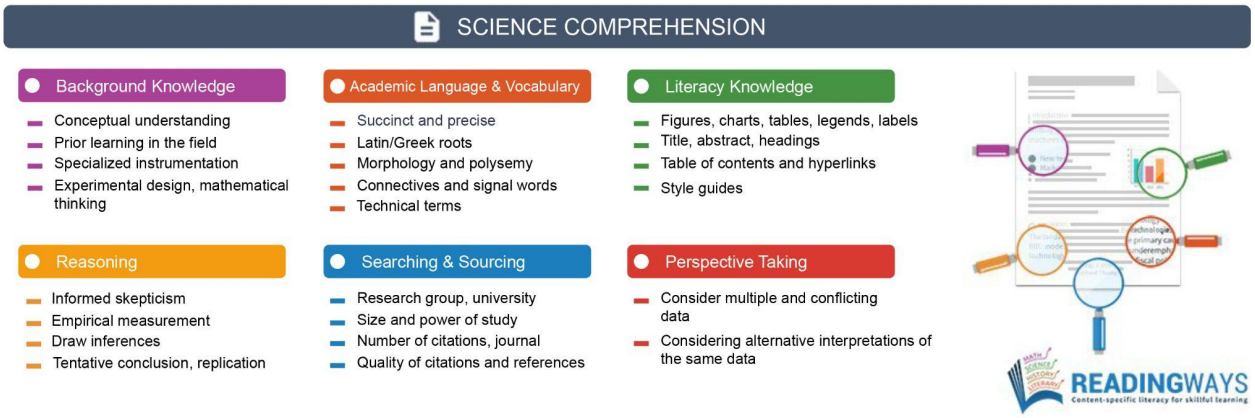
Supporting Science Literacy

Joshua Lawrence's Presentation Handout

The Many Facets of Critical Disciplinary Literacy



Disciplinary Comprehension Strategies

When scientists read, they…

- Assume an objective stance
- Ask "why" and "how" more than "what"
- Rely on data, sketches, charts, and illustrations
- Make connections from known concepts to new concepts
- Determine validity of sources and quality of evidence
- Pay attention to patterns
- Make predictions
- Review and reflect
- Recognize importance of precise scientific vocabulary
- Search for answers
- Look for details and evidence

Lent, R. C. (2015). This Is Disciplinary Literacy: Reading, Writing, Thinking, and Doing... Content Area by Content Area. Corwin Press. https://play.google.com/store/books/details?id=I8BzCgAAQBAJ

ANTICIPATION GUIDE

NATURAL SCIENCE

NAME:

TOPIC: CELLS

Read each statement below. Check the appropriate box to indicate whether you agree or disagree with the statement. After reading the assigned text, indicate whether you still agree or disagree with the statement. Then support your response by writing down information from the text.

Statement/Question	Before reading	After reading	Support in text
1. Plant cells have a cell wall.	☐ Agree ☐ Disagree	☐ Agree ☐ Disagree	
2. Animal cells have a cell wall.	☐ Agree ☐ Disagree	☐ Agree ☐ Disagree	
3. The cytoplasm is the gel-like substance inside the cell.	☐ Agree ☐ Disagree	☐ Agree ☐ Disagree	
4. Ribosomes are only found in the cytoplasm of a cell.	☐ Agree ☐ Disagree	☐ Agree ☐ Disagree	
5. All cells have a defined nucleus.	☐ Agree ☐ Disagree	☐ Agree ☐ Disagree	
6. The cell membrane controls the movement of materials in and out of the cell.	☐ Agree ☐ Disagree	☐ Agree ☐ Disagree	
7. Lysosomes help generate energy for the cell.	☐ Agree ☐ Disagree	☐ Agree ☐ Disagree	
8. All cells have centrioles.	☐ Agree ☐ Disagree	☐ Agree ☐ Disagree	
9. Eukaryotic cells are always multicellular.	☐ Agree ☐ Disagree	☐ Agree ☐ Disagree	
10. All eukaryotic cells have a cytoskeleton.	☐ Agree ☐ Disagree	☐ Agree ☐ Disagree	

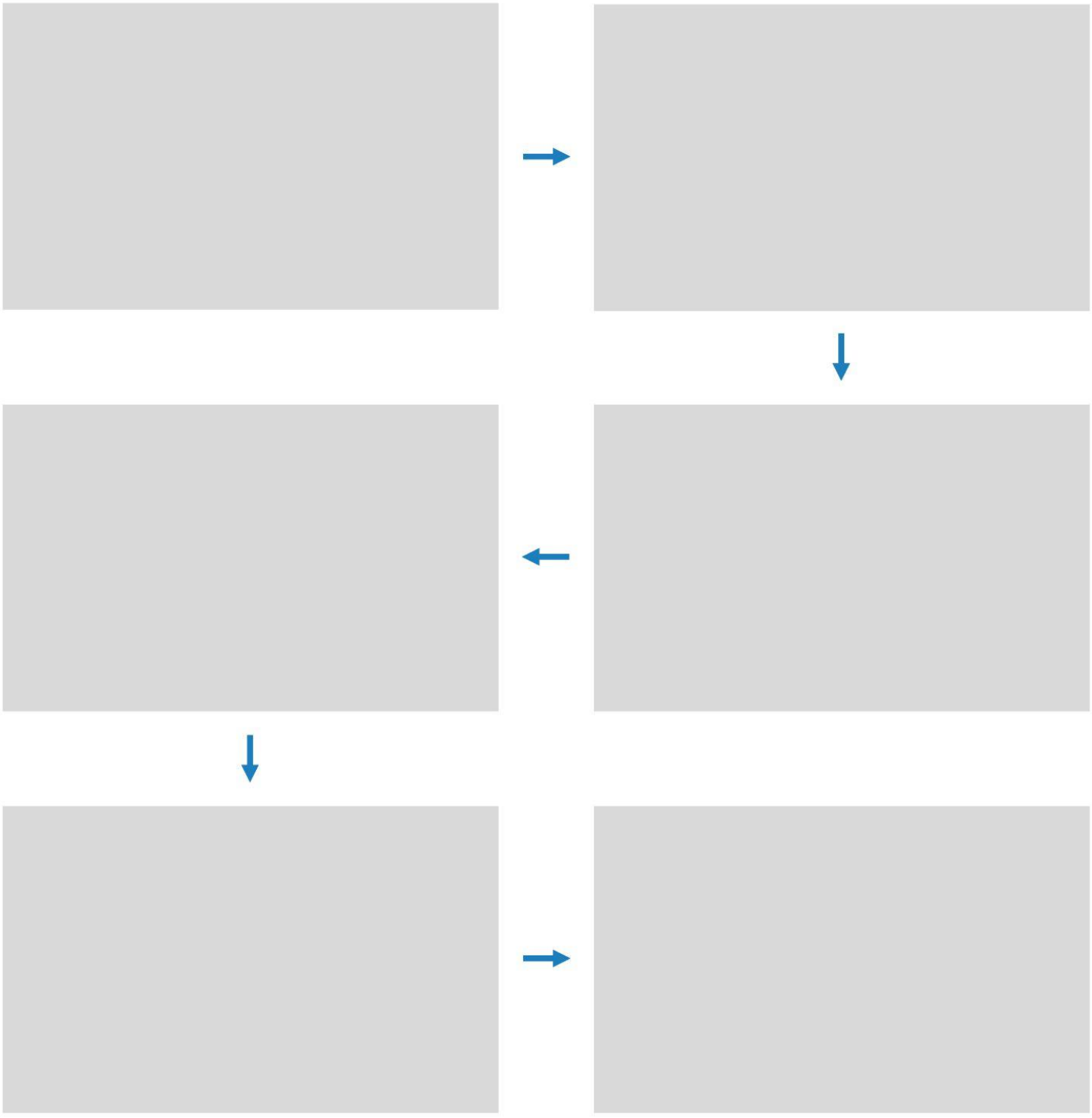
Fisher, D., Brozo, W., Frey, N. & Ivey, G. (2007). *50 Content Area Strategies for Adolescent Literacy*. New Jersey: Pearson Prentice Hall.
Duffelmeyer, R. & Baum, D.(1992). *The extended anticipation guide revisited. Journal of Reading*, 35, 654-656.

SIX STAGE CAUSAL CHAIN

NAME:

TOPIC:

Directions: Use this organizer to illustrate a causal chain and resulting final outcome.



Clark, S. K. (2004). *Successful strategies for reading in the content areas.* Shell Education.

SIX STAGE CAUSAL CHAIN

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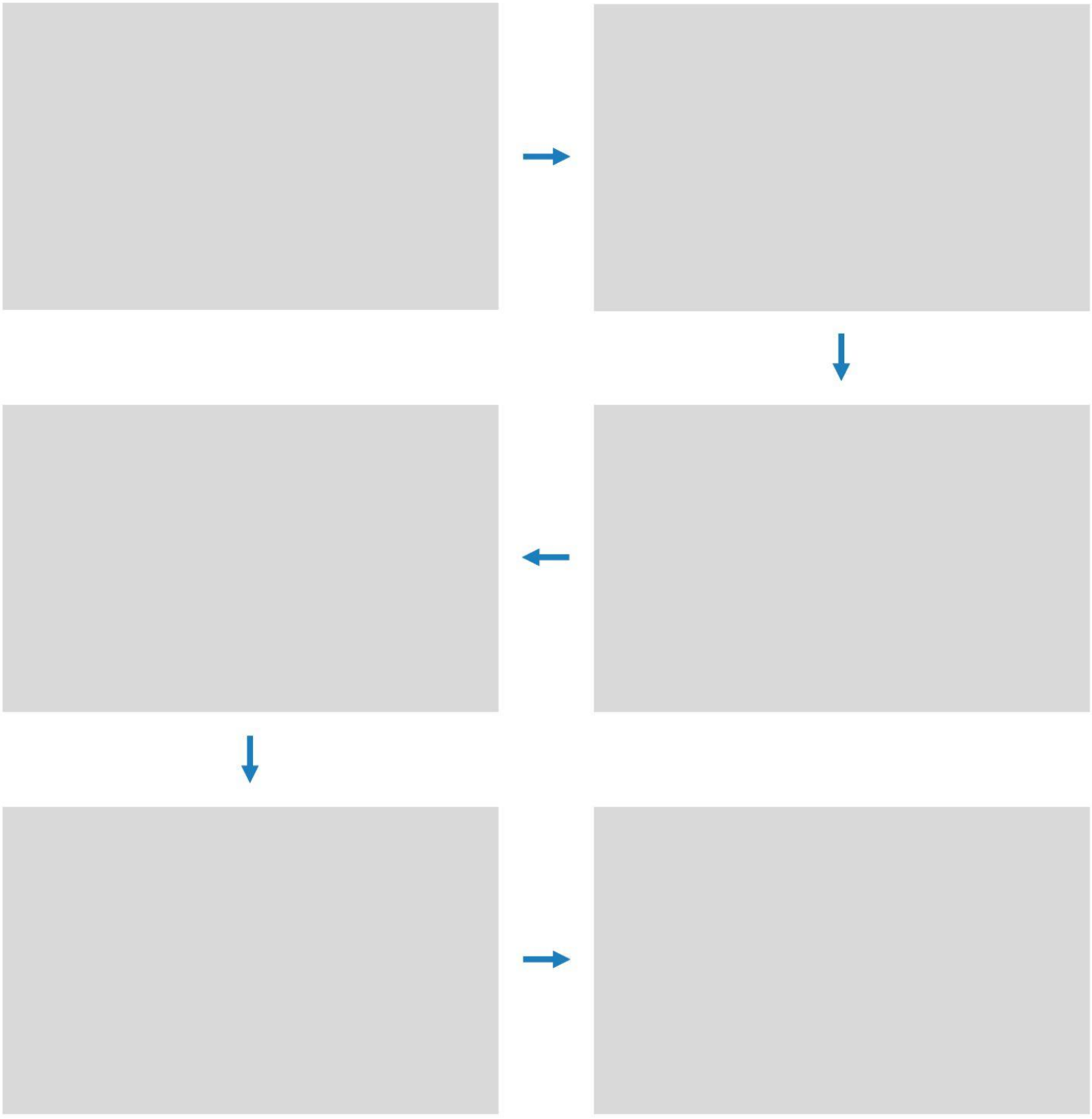
Directions: Use this organizer to illustrate a causal chain and resulting final outcome.



Clark, S. K. (2004). *Successful strategies for reading in the content areas.* Shell Education.

NUCLEAR ENERGY

NATURAL SCIENCE

Order

Compact Fusion → The Sun Fusion → Nuclear Reactor → Vast Power Source

The anchoring text is a video which asks the question how we can harness the power of atomic energy. From there, we move to an article discussion how the sun uses nuclear fusion to produce energy. Then, we transition from fusion to fission to elaborate how a nuclear reactor works to convert the energy from uranium fission to electricity as well as the handling of nuclear waste. Finally, we discuss William L.

Laurence's Pulitzer-prize-winning article that presents the discovery of uranium-235 and coins the term "atomic age." That offers a good contrast from science understanding from 70 years ago and today's technological ideas/advances/goals, as well as provides a historical context for pivotal scientific advancement.

COMPACT FUSION

This video and web page discuss Lockheed Martin's efforts to create a compact fusion reactor that could fit on the back of a truck. The text gives a concise summary of how nuclear fusion works and discusses a few of the engineering challenges that the scientists are dealing with. The video introduces the idea of the "promise of atomic energy," the question of why we do not currently have fusion, and the question of what the challenges of today's nuclear energy infrastructure are. This text is an advertisement, and therefore user-friendly. It also gets the students to think about biases in descriptive texts.

Compact Fusion, Lockheed Martin.

Quantitative measure: Grades 11th-12th, 27% of words not found on Dale-Chall

<https://www.lockheedmartin.com/en-us/products/compact-fusion.html>

THE SUN FUSION AT WORK

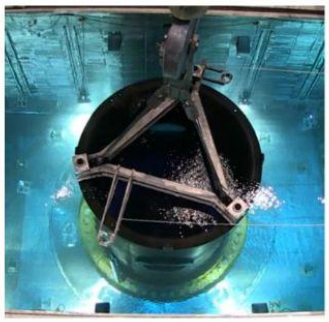
The sun is something that every student is familiar with and may be curious about how it works. This article discusses how the sun functions to provide us with heat, light, and energy. Disciplinary language is included in the article in order to define fission as well as interrelate the structure of the sun to the functions and processes occurring there. Furthermore, it describes how the sun interacts with the earth and how solar energy can be harnessed. That supports the cross-cutting ideas for the NGSS standard as well as transitions to the idea of nuclear reactions resulting in a great amount of energy. This article is included because it is relevant to the students' lives and it supports the content that might be presented in textbooks. The article links to the anchoring text which discusses fusion and helps transition from fusion in the sun to energy usage on earth. Because of the magazine-style writing, the delivery of science ideas is more relatable and easier to understand, even though the language itself may be difficult due to complex vocabulary. The structure of sentences and the formatting of the article with pictures and diagrams helps to make content ideas understandable. While the rating for the article is grades 13-15, this is likely due to disciplinary vocabulary which the students will be supported with learning in the classroom.

The Sun Fusion at Work, Clair Wood.

Quantitative measure: Grades 13-15 (College), 26% of words not found on Dale-Chall.

<http://sctritonscience.com/Proodian2/wp-content/uploads/2014/09/The-Sun.pdf>

HOW A NUCLEAR REACTOR WORKS



This article is very understandable and has a low qualitative difficulty--it is explaining very complex ideas in a straightforward way, complete with diagrams, graphs, and careful explanations. It is well formatted and structured, so it gives a good, accurate, non-biased introduction to nuclear energy--something that is difficult to find in a typical web search. It also discusses radioactive waste and its handling, citing credible sources for facts that are presented. The quantitative difficulty of this text is in the range of high school chemistry students--something that is pretty rare due to disciplinary vocabulary which may inflate the reading level. In the progress of texts, it bridges from fusion to fission and elaborates on the power possible from nuclear reactions. Diagrams explaining the process of how that energy is harvested, allow students to relate the abstract nuclear reaction equations to what is actually taking place in order to produce electricity for our own use.

How a Nuclear Reactor Works, unknown.

Grades 11-12, 25% of words not on Dale-Chall list

VAST POWER SOURCE IN ATOMIC ENERGY

VAST POWER SOURCE IN ATOMIC ENERGY OPENED BY SCIENCE

Relative of Uranium Found to Yield Force 5 Million Times as Potent as Coal

GERMANY IS SEEKING IT

Scientists Ordered to Devote All Time to Research—Tests Made at Columbia

This article was written by the journalist assigned to the Manhattan Project. The journalist writes about the discovery of how to harness electricity from nuclear fission. Some of the more difficult sections of the text are its explanations of how fission works, but that should not be a significant problem because our previous text gives a more user-friendly description of fission. The text adds the historical context of nuclear energy, including the scientists who discovered it and its significance to World War II. Hopefully, the text will help students who have some questions regarding nuclear energy to understand why people were excited about it and why America has so many nuclear power plants. This is the most difficult text in our set due to both technical language and the author's complex writing style. We will have to introduce this text with significant scaffolding and would likely read it together in class.

Vast Power Source in Atomic Energy Opened by Science, William L. Laurence.

Grades 13-15 (College), 26% of words not found on Dale-Chall list.

<https://s3.documentcloud.org/documents/2196648/vast-power-source-in-atomic-energy-opened-by.pdf>

EVALUATION

Overall, this text set does a good job when it comes to linking the abstract science ideas of nuclear chemistry with relatable, real-world examples and applications. In addition, it provides a good range of difficulty and writing styles to help students access the information. On the other hand, three of our four texts are for the large part written expository, though they do include various levels of charts, graphs, and diagrams. The well-incorporated diagrams and models make the texts stronger than if it was either text or images/charts on their own. Finally, we should consider technical vocabulary which some students might find difficult to understand. Additional scaffolding may be necessary.

MICROLABS

Microlabs address a specific sequence of questions in a structured format within small groups, using active listening skills and timed speaking rounds.

Time: Approx. 8 min per question

Material: Set of questions, Timer.

Tips: This works best with a series of no more than four questions. Emphasize the importance of honoring time: both bringing responses to a close when time is called and allowing for silence when a responder does not fill their allotted time.

DIRECTIONS

1. To prep for this activity, prepare a set of structured, sequenced questions. Choose questions that are appropriate to the purpose or focus of the conversation. The questions and their sequence are essential. Consider how one question leads to another and increases reflection and risk.

2. Introduce the strategy.

3. Arrange students in groups of 3.

4. Ask participants to number off within their triad #1, 2, and 3. Read the first question aloud twice. Offer a minute of "think time" to think and/or write in preparation. Be certain to tell the participants in which order they will speak, and you might vary the order of each question.

5. Each person will have one minute to respond to the question when it is their turn. While the person is speaking, the other two in the group will simply listen. When the time is up, the next person speaks, and so on. It is important to keep the rounds' timing consistent and alert the groups with an audible signal.

6. Continue with the rest of the questions. Alternate the order of responses so each student has a chance to go first. For example, begin with person #1, then #2, then #3. On the second question, start with #2, then #3, then #1.

7. Once the activity is complete, debrief.
    a. What did you hear that was significant? What key ideas or insights were shared?
    b. How did this go for you? What worked well, and what was challenging? Why?
    c. How might your conversations have been different had we not used this protocol?
    d. What are the advantages/disadvantages of using this activity? When would you use this protocol?

School Reform Initiative (2017). *Microlabs. https://www.schoolreforminitiative.org/download/microlabs/*