Strategies to Create a Coherent Science Content Storyline

STeLLA STRATEGY G
LINK SCIENCE IDEAS TO OTHER SCIENCE IDEAS

Although each lesson should focus on one main learning goal, students will develop deeper understandings of the learning goal if they understand how it is built from and connected to other supporting science ideas and concepts. Any science ideas introduced in a science lesson should be clearly and explicitly linked to the main learning goal and should help develop (and not distract from) the science content storyline. In addition, there should be a strong science content storyline *across* lessons. The links between science ideas introduced in one lesson and the science ideas in the next lesson should be made visible to students. High-quality links between ideas have the following features:

- Two (or more) science ideas are linked. You should be able to state each idea that is being linked in a complete sentence.
- This strategy is about linking *ideas* together, not about linking ideas to activities or linking activities to activities.
- The ideas being linked are closely matched to the main learning goal for the lesson, or connect science ideas encountered in earlier lessons to the science ideas presented in this lesson.
- The link is made clear, explicit, and comprehensible to students.
- The link is scientifically accurate.
- The link can be made by the teacher and/or by the students.

Different kinds of links can build a strong science content storyline within and across lessons.

Links to previous and next lessons: Each lesson begins with links to science ideas and concepts (not just to activities!) developed in previous lessons. This can be done by referring back to the science content storyline being developed and/or to focus questions addressed in previous lessons. Similarly, the lesson might end with some hint of how the content ideas in today's lesson might be further developed in the next or future lessons.

Examples of linking ideas across lessons (an example from genetics)

Beginning of lesson: Our central unit question is "Why do individuals of the same species all look different? What causes the variations we see in individuals?" So far we learned that traits we see in an individual are the result of proteins. Proteins are made in cells by "reading" a sequence of DNA using this code to put together strings amino acids to create the proteins needed at that particular time. However, there is still some missing information because DNA is located in the nucleus and proteins are constructed in the cytoplasm.

Today we'll try to answer the focus question, "How can the sequence of DNA found in the nucleus account for all the variation we see in proteins a population of organisms?"

End of lesson: We've been exploring how a trait is the result of a protein, and that protein is the result of an organism's genetic information—their DNA. Today we learned how information held in the DNA sequence found in the nucleus can impact which proteins are made in a cell. But, you have likely heard statements such as, “You got your eyes from your mother,” or, “You are so tall, just like your dad.” How does that relate to the appearance of traits? Tomorrow we’ll begin to focus on the mechanisms that explain how you get your DNA from your parents, and why you are still an entirely unique individual.

Links between the supporting ideas and the main learning goal

Supporting ideas and specialized terminology should be clearly linked to the main learning goal. This linking is sometimes done by the teacher. For example, the teacher might use a visual representation such as a diagram or a concept map to clarify the relationships among ideas. However, science-learning research suggests that students will develop deeper understandings if they are challenged to make the connections themselves, with careful probing and guiding by the teacher. For example, students could construct simple concept maps to explain the relationships among key science ideas. Their efforts can be used by the teacher to assess and address missing links in their understandings.

Learning research also suggests that students will find specialized terminology more comprehensible if they first experience a phenomenon and come to understand the basic ideas related to this phenomenon in everyday words. Then later they can attach scientific terminology to an idea or experience they already hold. For example, students first observe differences in the physical features of freshwater and saltwater populations of stickleback fish. They also notice differences in the environment each population live in, particularly differences in the sticklebacks’ predators. Students can be encouraged to think about and discuss how environmental differences impact the likelihood of survival of the individuals in each population, and how this might change the characteristics of a population over many generations. After opportunities to make their own connection between inherited variations and survival, they learn that scientists call the variationss that occur in a higher percentage of individuals in a population because the individuals who have that trait are more likely to survive and pass those traits to new generations are called *adaptations*.

Although it is sometimes considered helpful to frontload, or “preteach,” vocabulary for English language learners, in science teaching, it is more meaningful for students to have the experience first and then be exposed to the specialized vocabulary.

To make sure you are making a link between a science idea and another science idea, ASK YOURSELF questions such as the following:

Am I making a statement that connects two (or more) science ideas? Can I clearly identify the ideas being connected in complete sentences (not just topics)? **AND/OR**

Am I engaging students in finding and making connections between two (or more) science ideas? Can I clearly identify the ideas I expect them to connect in complete sentences (not just topics)? Can *students* identify the ideas?