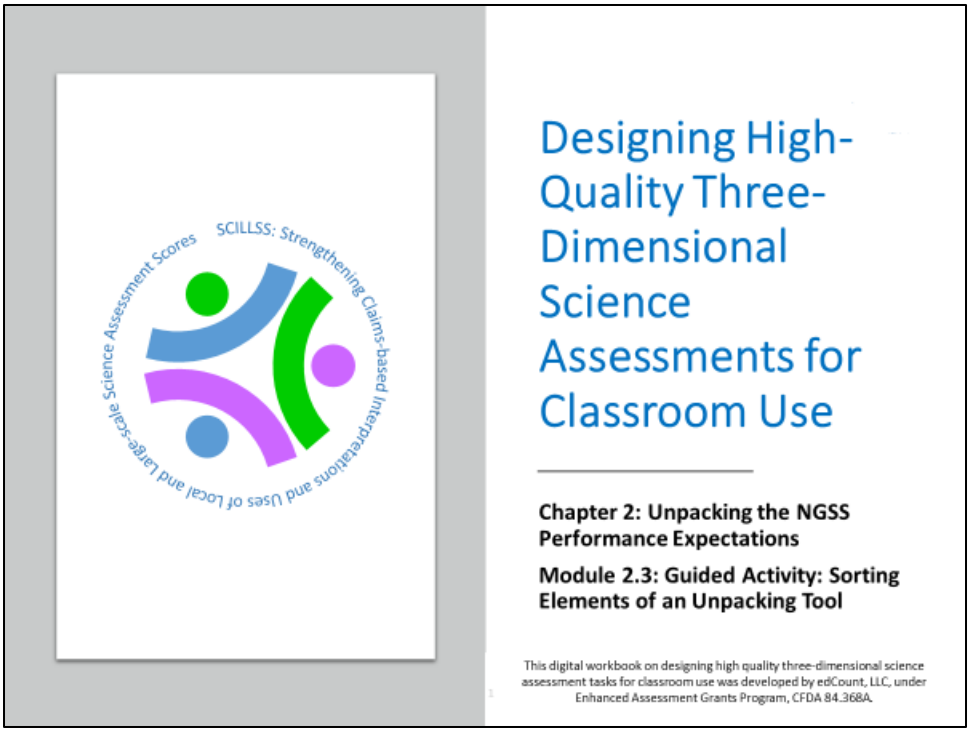
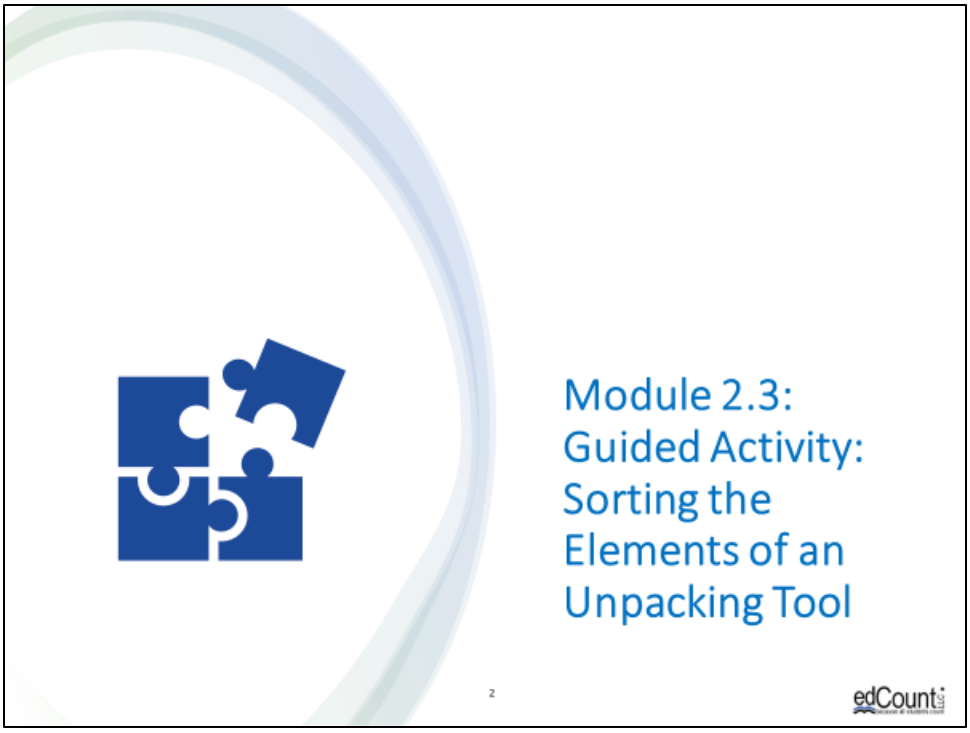


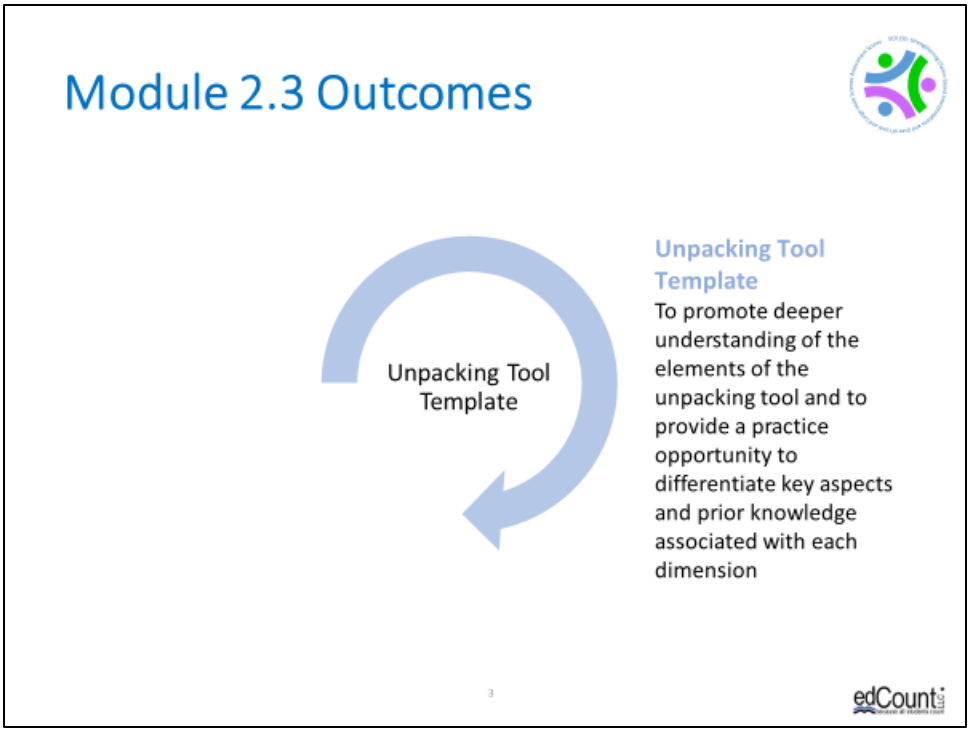

Welcome to the second of four chapters in a digital workbook on designing high-quality three-dimensional science assessment tasks for classroom use. This workbook is intended to help educators design and evaluate high-quality classroom science assessment tasks that provide meaningful information about what students know and can do in science.

This digital workbook was developed by edCount, LLC, under the US Department of Education's Enhanced Assessment Grants Program, CFDA 84.368A.

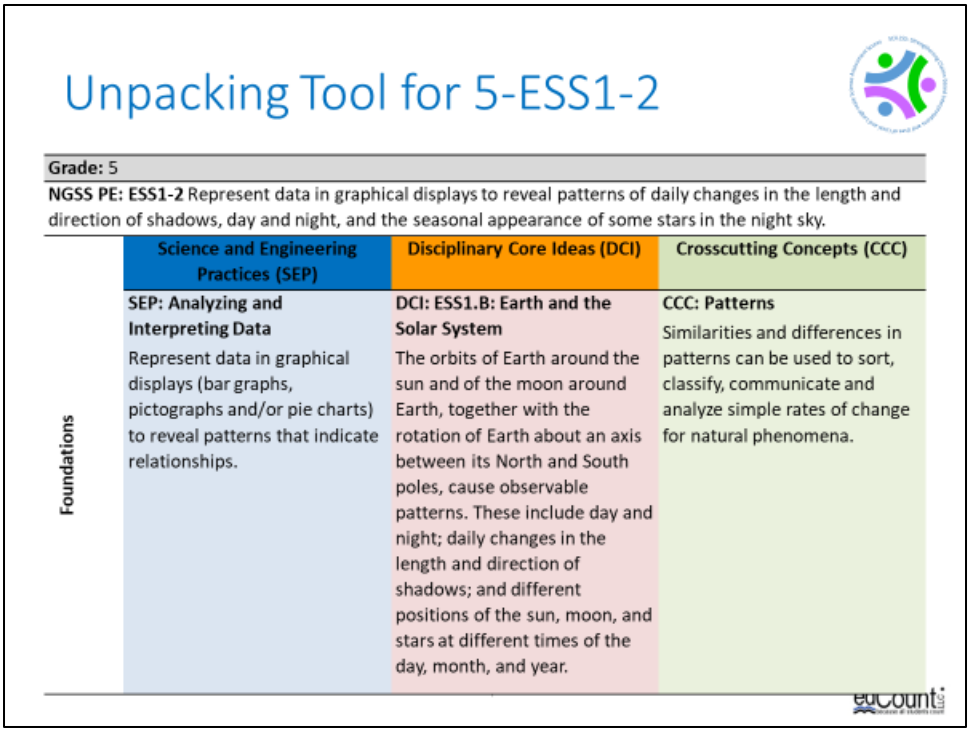



Chapter 2 of this workbook includes a series of six modules. Together, these six modules provide an in-depth exploration of the first phase of principled assessment design: development of the unpacking tool. In this chapter, we describe how to systematically unpack a performance expectation, or indicator, into its multiple components to develop a clear and deep understanding of each dimension and the boundaries of what can be assessed. We provide opportunities for you to engage in interactive activities and explore and use our design template to complete your own unpacking of a three-dimensional science standard.

In this module, we invite you to engage in a guided activity to distinguish between the various elements of an unpacking tool. By completing this activity, our hope is that you will be more deeply grounded in the elements of the tool and, thus, better prepared to complete your own unpacking tool. In later modules, we provide resources, key strategies, and guiding questions to support the unpacking process.




During this guided activity, we will examine statements from a completed grade 5 unpacking tool. For each statement, we will identify whether it refers to the practice, disciplinary core idea, or crosscutting concept. Once we've identified the appropriate dimension, we will then consider whether the statement reflects a key aspect of the performance expectation, a prior knowledge expectation, or a relationship between the CCC and SEP. This activity is designed to help you become better acquainted with and grounded in the three dimensions and the various elements of the unpacking tool.



## Unpacking Tool for 5-ESS1-2

**Grade:** 5

**NGSS PE: ESS1-2** Represent data in graphical displays to reveal patterns of daily changes in the length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

| | Science and Engineering Practices (SEP) | Disciplinary Core Ideas (DCI) | Crosscutting Concepts (CCC) |
|---|---|---|---|
| Foundations | **SEP: Analyzing and Interpreting Data**<br>Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. | **DCI: ESS1.B: Earth and the Solar System**<br>The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year. | **CCC: Patterns**<br>Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. |

For this activity, we focus on the grade 5 performance expectation, *5-ESS1-2: Represent data in graphical displays to reveal patterns of daily changes in the length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.*

If you reference the foundations for this PE, you will notice that for the SEP, we focus on *Analyzing and Interpreting Data*. This practice requires students to *"represent data in graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships."*

For the DCI, we refer to *ESS1.B: Earth and the Solar System*. This core idea states, *"The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year."*

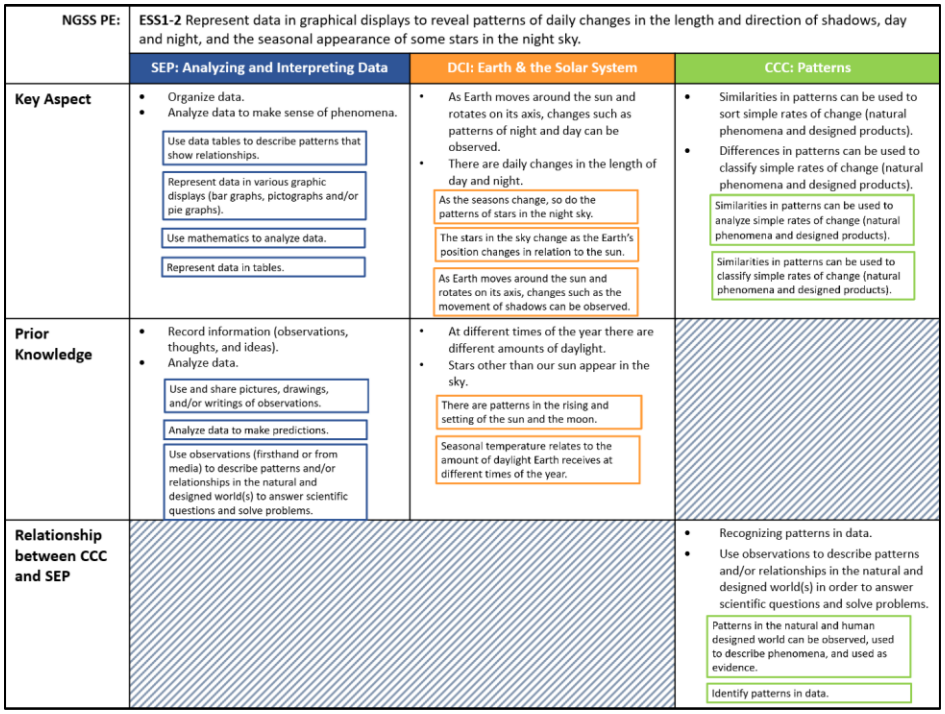
Finally, the crosscutting concept is *Patterns*. At grade 5, students must understand that *"similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena."*

Before we begin our sorting activity, take a moment to consider the intersections of these dimensions. How might students use the practice to demonstrate their understanding of the DCI? How does the crosscutting concept provide a common thread, or theme, that links the dimensions together?

Also, consider each dimension separately. What are students expected to know and be able to do to demonstrate their understanding of the SEP, DCI, and CCC? What prior knowledge should they bring forward from previous learning experiences?

Please pause the presentation to consider these questions. We invite you to refer to the *Framework*, NGSS, and NGSS appendices in the Resources pod for additional information about this performance expectation. When you feel well-oriented to the PE and its dimensions, resume the presentation to begin the activity.


Now that you are well acquainted with the performance expectation and its three dimensions, let's begin our activity by sorting elements of the unpacking tool.



| NGSS PE: | **ESS1-2** Represent data in graphical displays to reveal patterns of daily changes in the length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. | | |
|---|---|---|---|
| | **SEP: Analyzing and Interpreting Data** | **DCI: Earth & the Solar System** | **CCC: Patterns** |
| **Key Aspect** | • Organize data.<br>• Analyze data to make sense of phenomena.<br>Use data tables to describe patterns that show relationships.<br>Represent data in various graphic displays (bar graphs, pictographs and/or pie graphs).<br>Use mathematics to analyze data.<br>Represent data in tables. | • As Earth moves around the sun and rotates on its axis, changes such as patterns of night and day can be observed.<br>• There are daily changes in the length of day and night.<br>As the seasons change, so do the patterns of stars in the night sky.<br>The stars in the sky change as the Earth's position changes in relation to the sun.<br>As Earth moves around the sun and rotates on its axis, changes such as the movement of shadows can be observed. | • Similarities in patterns can be used to sort simple rates of change (natural phenomena and designed products).<br>• Differences in patterns can be used to classify simple rates of change (natural phenomena and designed products).<br>Similarities in patterns can be used to analyze simple rates of change (natural phenomena and designed products).<br>Similarities in patterns can be used to classify simple rates of change (natural phenomena and designed products). |
| **Prior Knowledge** | • Record information (observations, thoughts, and ideas).<br>• Analyze data.<br>Use and share pictures, drawings, and/or writings of observations.<br>Analyze data to make predictions.<br>Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) to answer scientific questions and solve problems. | • At different times of the year there are different amounts of daylight.<br>• Stars other than our sun appear in the sky.<br>There are patterns in the rising and setting of the sun and the moon.<br>Seasonal temperature relates to the amount of daylight Earth receives at different times of the year. | |
| **Relationship between CCC and SEP** | | | • Recognizing patterns in data.<br>• Use observations to describe patterns and/or relationships in the natural and designed world(s) in order to answer scientific questions and solve problems.<br>Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.<br>Identify patterns in data. |

As discussed earlier, the unpacking tool is a design tool that helps educators gain a deep understanding of the dimensions of the PE and identify its assessable components. In addition, unpacking a PE provides a clear focus for instruction and helps educators establish coherence between curriculum, instruction, and assessment.

In this guided activity, you will consider how to unpack the grade 5 PE, *ESS1-2: Represent data in graphical displays to reveal patterns of daily changes in the length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.* You will analyze and sort several statements to determine where they belong in the unpacking tool. For each statement, you will first determine the dimension to which it aligns. Then, you will determine which element it represents, whether it is a key aspect, prior knowledge, or a relationship between the CCC and SEP.

Before we walk through the steps to complete this guided activity, take a moment to review this partially completed unpacking tool. Review the indicated DCI, SEP, and CCC as identified in the NGSS foundation boxes for the selected grade 5 PE. Then, read and consider the placement of the statements in the unpacking tool. Begin to think about the relationship of each statement to the PE, the dimensions, and the elements of the unpacking tool.

Alright. Let's walk through an example of the steps to complete this guided activity. Multiple statements will appear one at a time at the bottom of the screen. First, consider to which dimension it aligns—the DCI, the SEP, or the CCC. Next, consider whether the statement reflects a key aspect, prior knowledge, or relationship between the CCC and SEP. You will be prompted to repeat these steps for each presented statement.

A brief pause is provided between each step to allow time for you to consider each statement. If you need additional time, please pause and resume the presentation as needed. Thanks!

Let's get started.

Here is the first statement: *There are patterns in the rising and setting of the sun and the moon*. DCI, SEP, or CCC? This statement relates to the DCI dimension, *Earth and the Solar System*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element prior knowledge.

Here is the next statement: *Use data tables to describe patterns that show relationships*. DCI, SEP, or CCC? This statement relates to the SEP dimension, *Analyzing and Interpreting Data*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element key aspect.

Here is the next statement: *As the seasons change, so do the patterns of stars in the night sky*. DCI, SEP, or CCC? This statement relates to the DCI dimension, *Earth and the Solar System*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element key aspect.

Here is another statement: *Use and share pictures, drawings, and/or writings of observations*. DCI, SEP, or CCC? This statement relates to the SEP dimension, *Analyzing and Interpreting Data*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element prior knowledge.

Here is the next statement: *Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence*. DCI, SEP, or CCC? This statement relates to the CCC dimension, *Patterns*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element relationship between the CCC and SEP.

Here is the next statement: *Seasonal temperature relates to the amount of daylight Earth receives at different times of the year*. DCI, SEP, or CCC? This statement relates to the DCI dimension, *Earth and the Solar System*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element prior knowledge.

Here is the next statement: *Similarities in patterns can be used to analyze simple rates of change (natural phenomena and designed products)*. DCI, SEP, or CCC? This statement relates to the CCC dimension, *Patterns*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element key aspect.

Here is the next statement: *Analyze data to make predictions*. DCI, SEP, or CCC? This statement relates to the SEP dimension, *Analyzing and Interpreting Data*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element prior knowledge.

Here is another statement: *Identify patterns in data*. DCI, SEP, or CCC? This statement relates to the CCC dimension, *Patterns*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element relationship between the CCC and SEP.

Here is another statement: *The stars in the sky change as the Earth's position changes in relation to the sun*. DCI, SEP, or CCC? This statement relates to the DCI dimension, *Earth and the Solar System*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element key aspect.

Consider this statement: *Represent data in various graphic displays (bar graphs, pictographs, and/or pie graphs*). DCI, SEP, or CCC? This statement relates to the SEP, *Analyzing and Interpreting Data*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element key aspect.

Consider another statement: *Use mathematics to analyze data*. DCI, SEP, or CCC? This statement relates to the SEP, *Analyzing and Interpreting Data*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element key aspect.

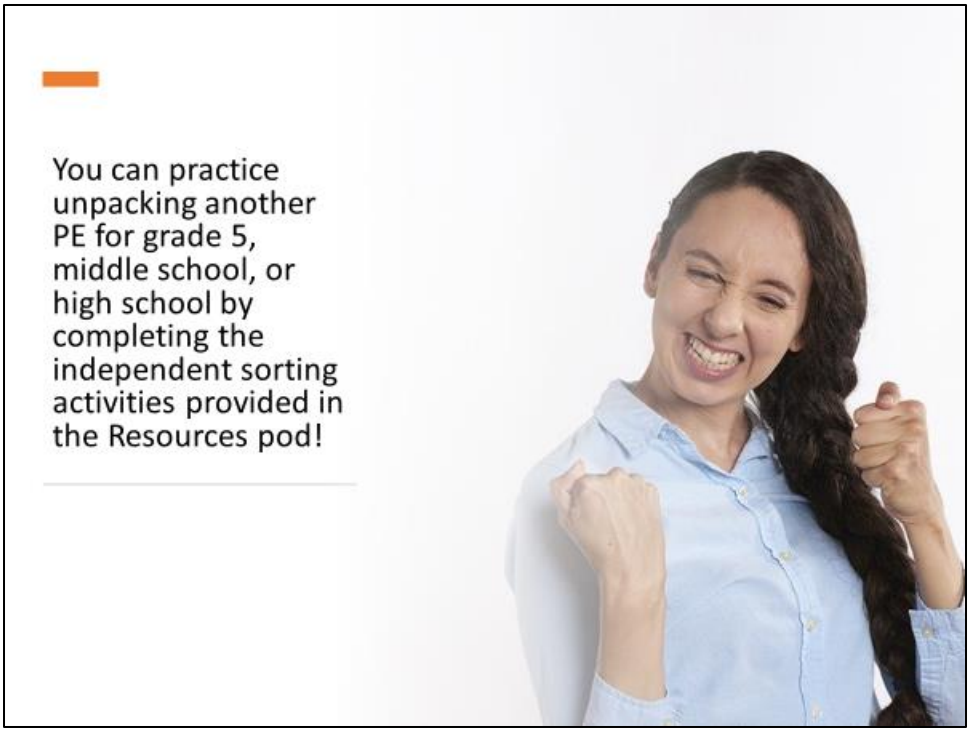
Here is another statement for your consideration: *Use observations (firsthand or from media) to describe patterns and/or relationships in the natural and designed world(s) to answer scientific questions and solve problems*. DCI, SEP, or CCC? This statement relates to the SEP, *Analyzing and Interpreting Data*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element prior knowledge.

Here is another statement for your consideration: *Represent data in tables*. DCI, SEP, or CCC? This statement relates to the SEP, *Analyzing and Interpreting Data*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element key aspect.

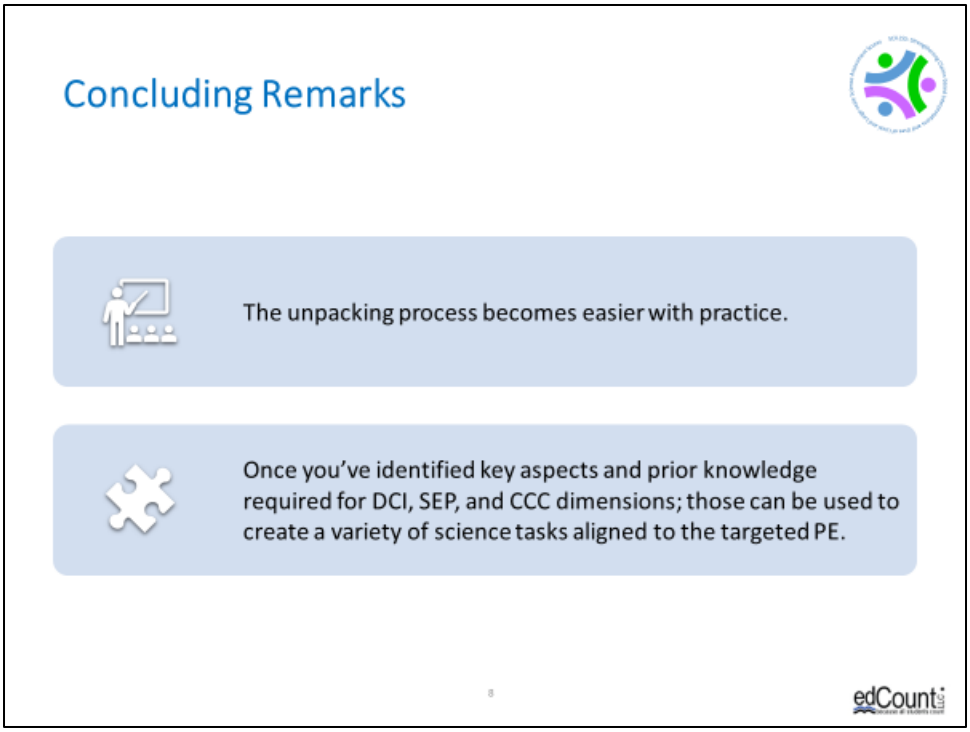
Here is another statement for your consideration: *Similarities in patterns can be used to classify simple rates of change (natural phenomena and designed products).* DCI, SEP, or CCC? This statement relates to the CCC, *Patterns*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element key aspect.

Here is the last statement: *As Earth moves around the sun and rotates on its axis, changes such as the movement of shadows can be observed.* DCI, SEP, or CCC? This statement relates to the DCI, *Earth and the Solar System*. Which element—key aspect, prior knowledge, or relationship between the CCC and SEP? This statement relates to the element key aspect.

Yes! You have completed this guided activity to strengthen your understanding of the unpacking tool and to effectively distinguish between the dimensions and the elements of the tool.

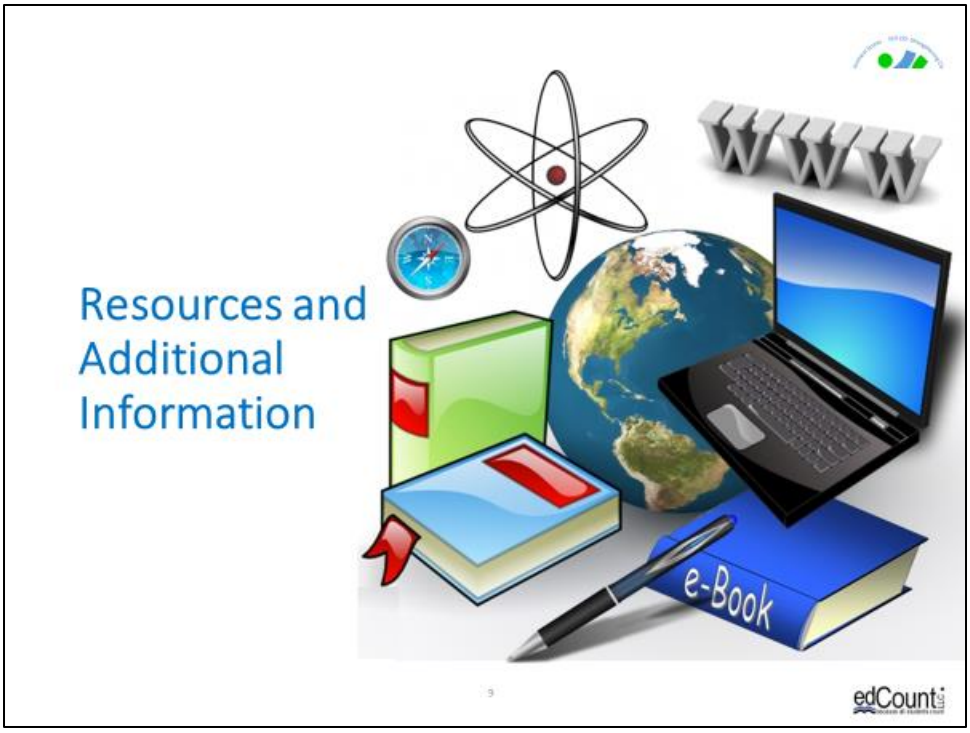



Are you ready for additional practice analyzing and sorting statements of an unpacking tool? If so, you're in luck! Additional sorting activities at the elementary, middle, and high school grade bands are available for download in the Resources pod. We encourage you to complete these activities independently, with a partner, or with a group of colleagues.




Unpacking the dimensions of a PE is hard work, but the good news is that with more practice, it becomes easier, and you begin to create content that can be reused or modified to create a variety of science tasks aligned to the targeted PE.

Now that you have a deeper grounding in the three dimensions and can distinguish between the elements of the unpacking tool, you are nearly ready to give the unpacking process a try! Before you get started, however, we invite you to complete Module 2.4, Resources for Unpacking, where we explore the resources available and explain how they provide information to support the unpacking process.

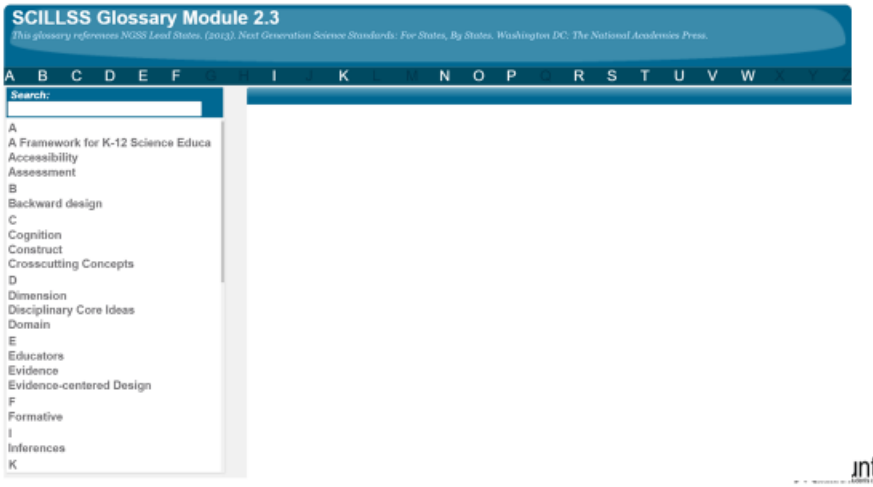



Finally, we offer additional resources that may be helpful to anyone interested in learning more about the concepts presented in this module. A glossary of terms and our reference list follow.

Thank you for your engagement in this second chapter of the SCILLSS digital workbook on designing high-quality three-dimensional science assessment tasks for classroom use.

# SCILLSS Glossary

Please refer to the SCILLSS Glossary for operational definitions of terms used.



# Resources

In the Web Links pod, you can find the following resources:

- A Framework for K-12 Science Education
- Next Generation Science Standards
- Appendix E: Disciplinary Core Idea Progressions
- Appendix F: Science and Engineering Practices
- Appendix G: Crosscutting Concepts

In the Resources pod, you can find the following resources:

- Activity directions (5-PS1-2, MS-PS3-1, HS-ESS2-5, HS-LS4-5)
- Partially completed unpacking tools (5-PS1-2, MS-PS3-1, HS-ESS2-5, HS-LS4-5)
- Completed unpacking tools—activity answers (5-PS1-2, MS-PS3-1, HS-ESS2-5, HS-LS4-5)

# References

NGSS Lead States. (2013). *Next Generation Science Standards: For States, By States. Washington DC*: The National Academies Press.