Five Tools and Processes for Translating the NGSS into Instruction and Classroom Assessment

Tool 1: Using the NGSS to Plan for a Unit of Instruction

Focus: MS-LS2 Ecosystems: Interactions, Energy, and Dynamics*

Introduction

The purpose of Tool 1 is to help teachers develop an understanding of the three dimensions of the NGSS—disciplinary core ideas in science and engineering, science and engineering practices, and the crosscutting concepts in science and engineering—and to use these dimensions to develop a blueprint for designing an instructional unit. Teachers begin this process by thinking about how they currently teach a science topic. They work with an NGSS card deck that has all the elements on a Standards page separated onto individual cards. As a result of the Tool 1 process, teachers end up with a unit blueprint that integrates performance expectations, disciplinary core ideas, science and engineering practices, crosscutting concepts, as well as connections to the nature of science.

Coherent instruction is critical to the success of the NGSS. Due to the depth of understanding required by NGSS performance expectations and the interconnected nature between performance expectations, instruction should leverage opportunities that will lead to a greater understanding of science phenomena. To accomplish these goals, the Tool 1 process includes strategies to bundle performance expectations so that instructional sequences across a unit can build towards several performance expectations and develop connections across disciplinary core ideas in more than one discipline.

If a district or state has developed grade level scope and sequence documents or course maps aligned with the NGSS that provide some guidance in bundling performance expectations, the Tool 1 process can build upon this work and help teachers plan instructional units as well as inform and refine these documents. If bundling of performance expectations has not been done, the Tool 1 process can help teachers begin to consider how to do this around a specific science topic in a specific grand band, such as teaching a unit on ecosystems in middle school. The Tool 1 process focuses on developing a strong conceptual storyline that is anchored in phenomena and enhanced by the different dimensions of the NGSS.

Goals and Outcomes:

- Deepen understanding of the Next Generation Science Standards (NGSS) and increase abilities to plan for coherent instruction based on the NGSS
- Begin to design a unit of instruction and assessments for middle school students focused on ecosystems

***Text in red font found throughout this document is content specific and needs to be modified based on the standards page and NGSS card deck selected to use in the process. Note that if you have multiple groups working on multiple pages/decks, you'll need to modify the slides accordingly and/or create a reading guide for each standards page. This process was designed for secondary teachers. When used with elementary teachers, be prepared to manage their understanding of the disciplinary core ideas.**

Total Time **370 minutes not including breaks (6 hours and 10 minutes or a one-day workshop)**

Part 1 **Introduction** (Slides 1-6) [15 minutes]

Purpose: Set the stage for the focus of the session and begin to build community

Summary: Professional Development (PD) Leaders review the goals and agenda. Participants have an opportunity to connect to one another and to the content of the day through the opening.

Part 2 **Tool 1** (Slides 7-43) [320 minutes or 5 hours and 20 minutes]

Purpose: Access prior knowledge about the science content focus of the session, deepen understanding of the NGSS, and sequence ideas, practices, connections, and common core for a unit of instruction. This work focuses on the standards organized by Disciplinary Core Idea, rather than organized by Topic.

Summary: The pattern for participants through much of Part 2 is to receive a small set of cards, read from one or more of the text resources, and then place the cards in their sequence. There are a few exceptions to this pattern, notably in the first phase where participants consider what they think students should know and later when working with the CCC when they predict which CCC they think will be aligned with their sequence.

a. Introduction to Tool 1 (Slides 7-14) (30 minutes)

b. Tool 1 Part 1: Disciplinary Core Ideas (DCIs) (Slides 15-24) (90 minutes)

c. Tool 1 Part 2: Performance Expectations (PEs) (Slides 25-30) (70 minutes)

d. Tool 1 Part 3: Science and Engineering Practices (SEPs) (Slides 31-33) (45 minutes)

e. Tool 1 Part 4: Crosscutting Concepts (CCCs (Slides 34-36) (45 minutes)

f. Tool 1 Part 5: Connections (Slides 37-40) (30 minutes)

g. Tool 1 Part 6: Common Core (Slides 41-43) (10 minutes)

Part 3 **Review and Complete Tool 1** (Slides 44-47) [35 minutes]

Purpose: Consider the sequences and thinking of others and electronically capture current sequence. Reflect on the experience and increase metacognition.

Summary: Participants review the instructional sequences of others and revise their sequences as needed. They reflect on their experience.

Total Time = 370 minutes (6 hours and 10 minutes)

Materials:

- Tool 1 Electronic Template for capturing Unit Blueprint (each team will need to revise number of columns as needed)
- yellow sticky note pads (3x3: one per person and 4x6: one per group)
- Avery 5388 card stock for **printing the NGSS card decks** for the number of cards/deck and the number of decks needed

PD leader note: *Cards should be printed in color. You can find downloadable NGSS card decks as organized by DCI and by topic for all of the middle and high school standards pages at www.amnh.org/ngss-cards. We suggest that you use the MS-LS2 card deck (DCI organization) to teach the Five Tools and Processes since all of the tool examples are based on the MS-LS2 standards page. The NGSS card decks contain a large number of cards since they include all of the elements on a Standards page arranged by DCI as well as connections to Standards (represented by lighter colors on the cards). The card decks also include all of the connections to Common Core ELA/Literacy and Mathematics Standards. If you intend to use an alternative deck, then be sure you download and print the desired deck of cards.*

- blank Avery Cards for adding PEs, DCIs, SEPs, CCCs as needed
- yellow highlighter (1-2/team)

Handouts

HO 1	Five Tools Graphic
HO 2	Tool 1 Graphic
HO 3	NGSS Reading Guide (MS-LS2)
HO 4	MS-LS2 Standards Page
HO 5	Tool 1 Template Example - Unit Blueprint for MS-LS2

Resources

Text Resources

R 1	*A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (2012) by National Research Council
R 2	*Next Generation Science Standards For States, By States Volume 1: The Standards* (2013) by NGSS Lead States
R 3	*Next Generation Science Standards For States, By States Volume 2: The Appendices* (2013) by NGSS Lead States

PD leader note: *If you use online versions of these resources, you will need to modify page numbers to ensure they are the same as in the PPT slides and HO2 NGSS Reading Guide.*

Other Resources

R 4 Card Sets grouped by type to be distributed as needed (MS-LS2 Ecosystems: Ecology, Energy, and Dynamics)

a. DCIs from the standards page (color code = orange)
b. Connection DCIs (color code = light orange)
c. PEs for DCIs and Connection DCIs (color code = red, light red)
d. SEPs for PEs and PEs for Connection DCIs (color code = blue, light blue)
e. CCCs for PEs and PEs for Connection DCIs (color code = green, light green)

f. Connections for PEs and PEs for Connection DCIs (color code = purple, light purple)

g. Common Core (color code=brown for math; yellow for ELA/Literacy)

Slides

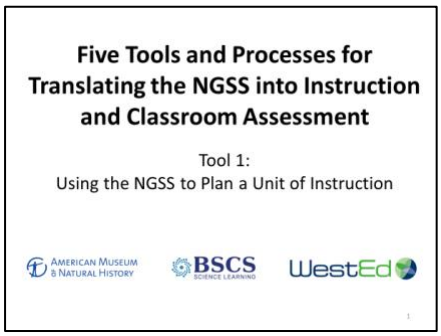
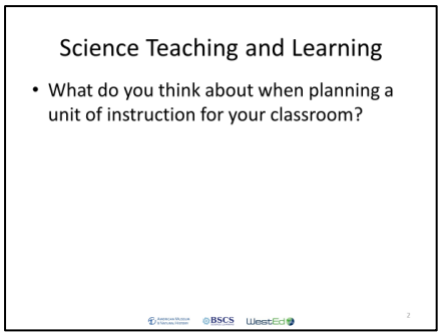
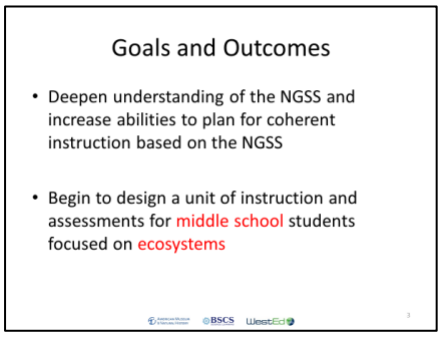
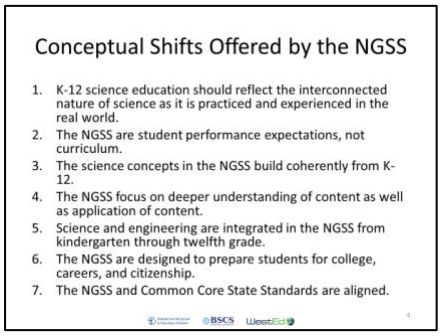
Slide 1	Five Tools and Processes for Translating the NGSS into Instruction and Classroom Assessment
Slide 2	Science Teaching and Learning
Slide 3	Goals and Outcomes
Slide 4	Conceptual Shifts Offered by the NGSS
Slide 5	A Framework for K-12 Science Education
Slide 6	Five Tools and Processes Graphic
Slide 7	Tool 1: Planning for Instruction (Graphic)
Slide 8	Planning for Instruction
Slide 9	Planning for Instruction
Slide 10	Planning for Instruction
Slide 11	Example of a Conceptual Flow
Slide 12	Develop a Conceptual Flow (optional)
Slide 13	Conceptual Flow Graphic (optional)
Slide 14	Example of a Conceptual Flow Graphic about Ecosystems (optional)
Slide 15	Tool 1 Planning for Instruction (Graphic)
Slide 16	Planning for Instruction (Reading)
Slide 17	Planning for Instruction (Reading)
Slide 18	NGSS Standards Page MS-LS2
Slide 19	NGSS Standards Page MS-LS2 (Definitions)
Slide 20	NGSS Standards Page MS-LS2 (Card example)
Slide 21	Disciplinary Core Ideas (DCIs) (First Step)
Slide 22	Disciplinary Core Ideas (DCIs) (Second Steps)
Slide 23	Disciplinary Core Ideas (DCIs) (Third Step)
Slide 24	Big Ideas
Slide 25	Tool 1 Planning for Instruction (Graphic)
Slide 26	Performance Expectations (PEs) (First Step)
Slide 27	Performance Expectations (PEs) (Second Step)
Slide 28	Bundling
Slide 29	Performance Expectations (PEs) (Third Step)
Slide 30	PE Example
Slide 31	Tool 1 Planning for Instruction (Graphic)
Slide 32	Science and Engineering Practices (SEPs) (Part a)
Slide 33	Science and Engineering Practices (SEPs) (Parts b and c)
Slide 34	Tool 1 Planning for Instruction (Graphic)
Slide 35	Crosscutting Concepts (CCCs) (List)
Slide 36	Crosscutting Concepts (CCCs) (Process)
Slide 37	Tool 1 Planning for Instruction (Graphic)
Slide 38	Connections to Nature of Science and Engineering, Technology, and Applications of Science (List)
Slide 39	Connections (Process)

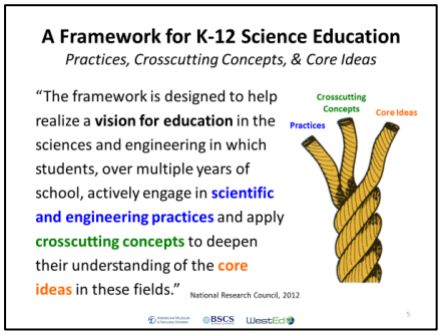
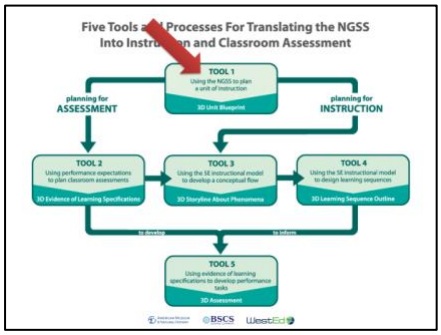
Slide 40	Storyline
Slide 41	Tool 1 Planning for Instruction (Graphic)
Slide 42	Common Core
Slide 43	Tool 1 Planning for Instruction (Graphic)
Slide 44	Gallery Walk
Slide 45	Review and Revise
Slide 46	Tool 1 Example
Slide 47	Reflection

Advance Preparation:

- Communicate with participants prior to the session. Suggest that participants bring a computer to record their product from the session in an electronic template.
- Revise files as needed for the NGSS focus of your session (i.e., edit PPT and NGSS Reading Guide for MS-LS2 or choose a different card deck).
- If you are doing this with elementary teachers, prepare the standards page for their grade level. **PD leader note:** *The Five Tools was developed for secondary science teachers. Be prepared to manage a potential need to develop elementary teachers' understanding of the disciplinary core ideas. It may take them less time to represent their prior knowledge of the standard. Since the card decks are smaller, it will likely take them less time than middle or high school groups to work with the card deck.*
- Establish teams of three to five participants. Ensure adequate table space for working with the card deck.
- Print (in color) and separate cards into sets (1 set/team of participants; group/organize card sets by Tool Part (ex. DCIs, SEPs, CCCs).
- Determine if you want to print copies of the readings listed in HO 3 (NGSS Reading Guide) for each participant or if participants will access the readings electronically. If participants will access the readings electronically, have participants download the PDF documents for the Framework and NGSS volumes 1 and 2 prior to the session. If you decide to print copies of the readings noted in the Reading Guide, you will need to contact National Academies Press for permission.
- Print handouts (1 set/participant). **PD leader note:** *If you are leading all Five Tools, participant binders can be assembled prior to the first session with five tabs, one tab for the handouts for each tool. This will minimize time spent handing out materials in the sessions.*
- Place text resources in stacks on the table for easy access by participants during the session or ensure that participants have access to the electronic versions.
- Transfer electronic Tool 1 template to participants for them to use toward the end of the session or between sessions to capture their "card work."

Part 1 Introduction (15 minutes)

Slide and Time	Facilitation Notes
 Slide 1 (0 minutes)	**Display Slide 1 Five Tools and Processes…** a. Welcome participants to the session.
 Slide 2 (5 minutes)	**Display Slide 2 Science Teaching and Learning** a. Explain to participants that the focus of this session is to use the NGSS to plan for instruction. b. Share the prompt with participants. Provide a moment of private think/write time and then invite participants to share their ideas about how they plan for instruction.
 Slide 3 (2 minutes)	**Display Slide 3 Goals and Outcomes** a. Review the goals and outcomes of the session. Possible narrative for the first goal: *Notice the focus on "planning for instruction" during our session today.* Possible narrative for the second goal: *Notice the focus on "beginning" a process. We'll take a broad-brush stroke to unit planning based on the NGSS and focused on middle school student learning expectations for ecosystems. This is an iterative process.*
 Slide 4 (2 minutes)	**Display Slide 4 Conceptual Shifts Offered by the NGSS** **PD leader note:** If participants have limited familiarity with the NGSS, consider completing a jig-saw of readings and discussion of the Conceptual Shifts. a. Invite participants to review the Conceptual Shifts of the NGSS. b. Refer to Shift #2 and mark that the NGSS do not prescribe curriculum, so we need a process to help us translate the

Slide and Time	Facilitation Notes
	standards into instruction and classroom assessment – that is what our Five Tools and Processes do.
 Slide 5 (1 minute)	**Display Slide 5 A Framework for K-12 Science Education** a. Share that this is an excerpt from *A Framework for K-12 Science Education*. Mark that the Framework was developed by the National Research Council prior to NGSS and was used by Achieve to develop the NGSS b. Forecast that participants will be reading sections from the Framework during the Tool 1 process as the Framework was used to develop the NGSS and serves as the basis for states who have adapted the NGSS for their state standards.
 Slide 6 (5 minutes)	**Display Slide 6 Five Tools and Processes Graphic** a. Distribute **HO1: Five Tools Graphic.** Provide a brief overview of the Five Tools that are a part of this process. Click through the animated slide as you introduce each Tool. Possible narrative: *The Five Tools are represented in this graphic. Tool 1 helps teachers plan for instruction. Tool 2 supports teachers in planning for assessment based on an instructional sequence and the associated performance expectation. Tool 3 introduces teachers to an instructional model to guide the development of a storyline and conceptual flow for instructional sequences aligned with the NGSS. Tool 4 supports teachers in using their instructional resources to plan a coherent sequence of instruction based on the NGSS. Finally, Tool 5 helps teachers develop classroom assessment tasks aligned with the NGSS.* *Our focus in this session will be on planning a unit of instruction. We will begin with Tool 1. Our product by the end of the Tool 1 Process will be a blueprint for a unit that would likely constitute 6-8 weeks of instruction. This will include the outline of the big ideas for 3-5 instructional sequences or "chapters" within that unit.* **Transition:** *Now let's see how Tool 1 might help us better understand the NGSS and make the Conceptual Shifts we just reviewed.*

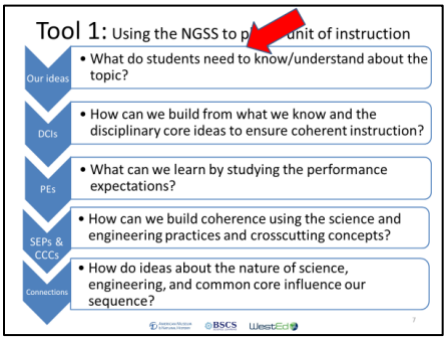
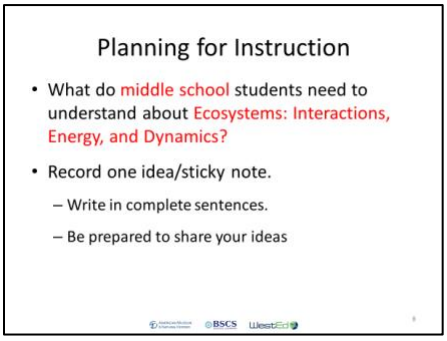
Part 2 Tool 1: Planning for Instruction (320 minutes)

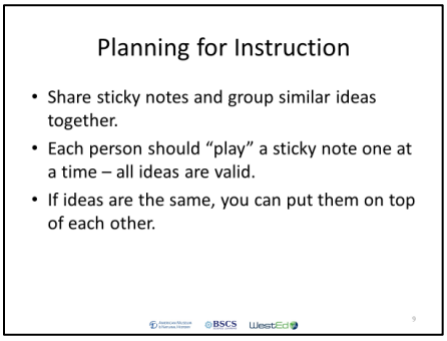
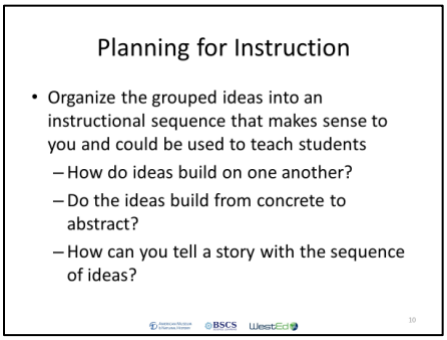
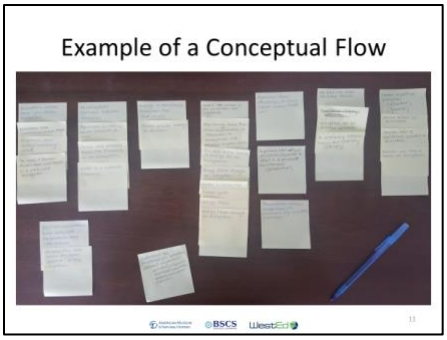
Part 2a. Introduction to Tool 1 (30 minutes)

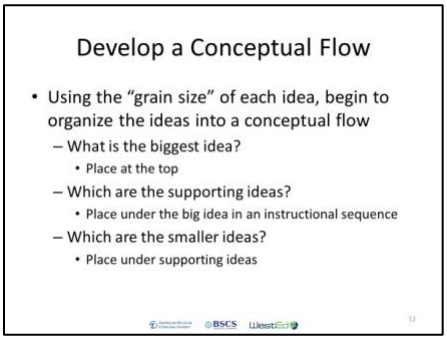
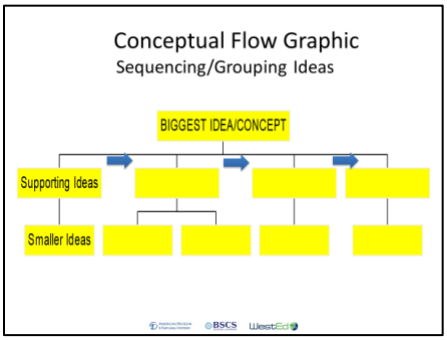
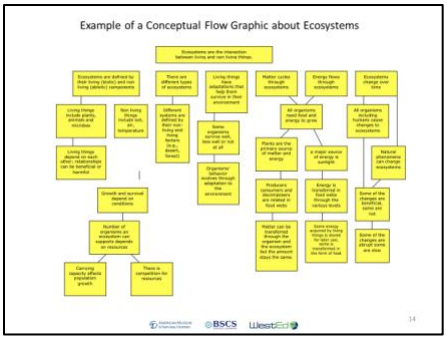
PD leader note*: The purpose of the Introduction to Tool 1 is to engage teachers' prior knowledge and experience. Briefly remind participants again that the research base for all the Tools is grounded in the work presented in How People Learn (Bransford, J. D., Brown, A. L., & Cocking, R. R. (Eds.), 2000). This*

prior knowledge must be engaged and surfaced to provide opportunities to resolve potential differences in teaching practices in light of the NGSS and prior to digging into the text of the NGSS and Tool 1 resources.

We begin the process with a "topic" linked to DCIs. Nothing limits teachers in the opening prompt to staying focused on "content or DCIs." In our pilot of these Tools, no classroom teachers included ideas that would fall into the science and engineering practices dimension. However, more recently, users may include such ideas.

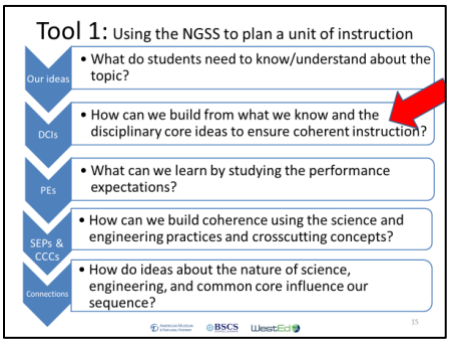
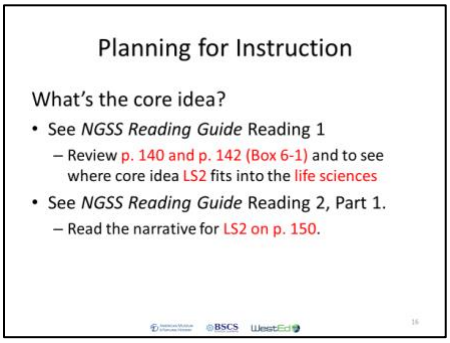
Slide and Time	Facilitation Notes
 Slide 7 (5 minutes)	**Display Slide 7 Tool 1 Graphic** **PD leader note:** Keep participants in groups of 3 (and no more than 4). a. Distribute **HO2: Tool 1 Graphic.** Share that the questions in the graphic that will be answered as we use Tool 1. Be sure to include a brief description of each of the dimensions of the NGSS, the performance expectations, and the connections. Possible narrative: *The three dimensions of the NGSS include the disciplinary core ideas (DCIs), science and engineering practices (SEPs), and crosscutting concepts (CCCs). Tool 1 will allow us to dig into the standards through text readings and dissection of the dimensions and connections, and put them back together in a blueprint that will guide planning for coherent instruction and classroom assessment.* **Transition:** Remind participants that the first question we will answer in Tool 1 is our ideas about what students need to know/understand about the topic. **PD leader note**: Forecast that they will need a large clear area on their tables to work throughout the rest of this session.
 Slide 8 (5 minutes)	**Display Slide 8 Planning for Instruction** a. Provide a few minutes for individual participants to generate and record ideas. Mark that they should record one idea per sticky note and write in complete sentences.

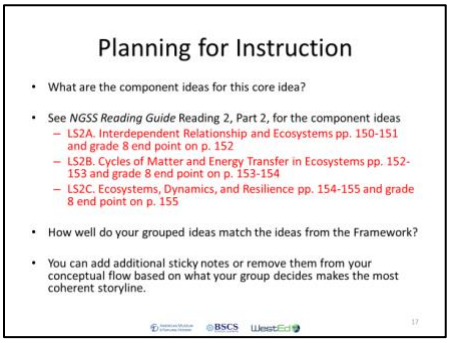
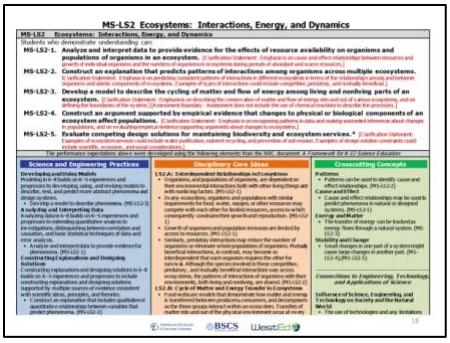
Slide and Time	Facilitation Notes
 Slide 9 (5 minutes)	**Display Slide 9 Planning for Instruction** a. Ask participants to share their sticky notes by taking turns and sharing one at a time. b. Instruct participants to group similar ideas together. Everyone's ideas should be shared and included in the clumping.
 Slide 10 (5 minutes)	**Display Slide 10 Planning for Instruction** a. Share that not only do we need to know what students should learn, but we also need to sequence those ideas for coherence. b. Invite participants to use the questions on the slide to begin to sequence their grouped ideas. Mark that this process will begin to develop a **conceptual flow of the science content** for this unit.
 Slide 11 (10 minutes)	**Display Slide 11 Example of a Conceptual Flow** a. Share with participants that this image represents an example of a conceptual flow and what their product should begin to look like. **PD leader note:** Developing a conceptual flow is a process that engages teachers' prior knowledge and experience with science content. For an in-depth description of Conceptual Flow see *Assessment-Centered Teaching: A Reflective Practice* (2008), DiRanna, et al. and the work of the K-12 Alliance/WestEd. **Transition:** Encourage participants to take a picture of their sticky notes to document their process. Remind them that the NGSS provide guidance for what students need to know and be able to do. We want our work to be informed by (or driven by if you are working in an adoption state) the Framework and the NGSS.

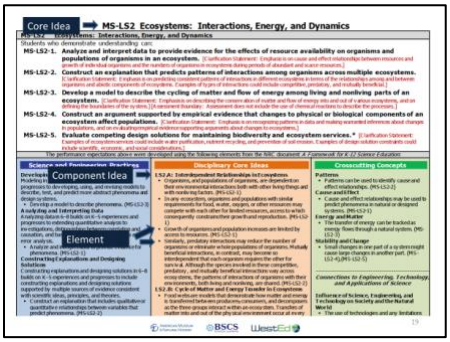
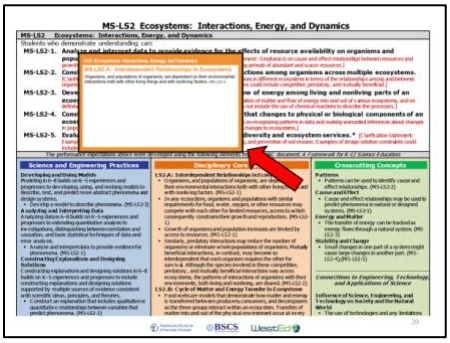
Slide and Time	Facilitation Notes
 Slides 12 (Optional)	**Display Slide 12 Develop a Conceptual Flow (hidden)** **PD leader note**: Slides 12-14 may be used if participants are having difficulty organizing their sticky notes into groupings that show a conceptual flow. a. Use this slide to help participants develop their conceptual flow into a graphic that shows the different grain-size of ideas.
 Slides 13 (Optional)	**Display Slide 13 Conceptual Flow Graphic (hidden)** a. Show how each column in the graphic represents a group of related ideas and that reading horizontally across columns provides coherent sequence that reveals how the ideas link together.
 Slides 14 (Optional)	**Display Slide 14 Example of a Conceptual Flow (hidden)** a. Share that this is an example of a more complete conceptual flow.

Part 2b. Disciplinary Core Ideas (DCIs) (90 minutes)

PD leader note: *The purpose of starting with the Disciplinary Core Ideas (DCIs) is to build from participants' ideas about what students need to know/understand about the topic, develop a common understanding of what the authors of the Framework and NGSS considered about this core idea, and promote conceptual coherence. By digging into readings from the Framework and NGSS prior to using DCI element cards, participants will deepen their understanding of these documents and their role in constructing a coherent unit of instruction.*

Slide and Time	Facilitation Notes
 Slide 15 (1 minute)	**Display Slide 15 Tool 1 Planning for Instruction** a. Share that we are moving from our ideas about ecosystems to developing our understanding of the NGSS core idea, Ecosystems: Interactions, Energy, and Dynamics. **PD leader note**: By considering the DCIs and then the PEs, we work from prior knowledge and build toward greater coherence of instructional sequences. Tool 1 and the entire suite of Five Tools is an iterative process in which the PEs serve a critical role as descriptors of assessment and guides to instruction.
 Slide 16 (15 minutes)	**Display Slide 16 Planning for Instruction** a. Distribute **HO3: NGSS Reading Guide.** Orient participants to the structure and of the reading guide. Mark that, while the Five Tools are a suite of tools and processes to support development of three dimensional, phenomena focused instruction and assessment, they also provide a professional learning opportunity for greater understanding of the Framework and NGSS. In Tool 1, our learning is supported by digging into selected readings from the Framework and NGSS. b. Refer participants to Reading 1. Highlight the purpose of the reading as noted in the Reading Guide. Invite participants to turn to pages 140 - 142 in the *Framework for K-12 Science Education* (2012) to learn more about where core idea LS2 fits into the life sciences. c. Refer to Reading 2, Part 1. Invite participants to turn to page 150 in the Framework to learn more about middle school life science core idea, Ecosystems: Interactions, Energy, and Dynamics. **PD leader note:** If you have printed the readings (see Advance Preparation), distribute the appropriate readings or refer participants to the readings in their binder. Alternatively, support participants in locating the correct pages in the PDF documents.

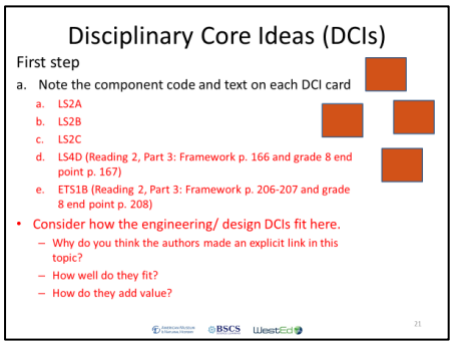
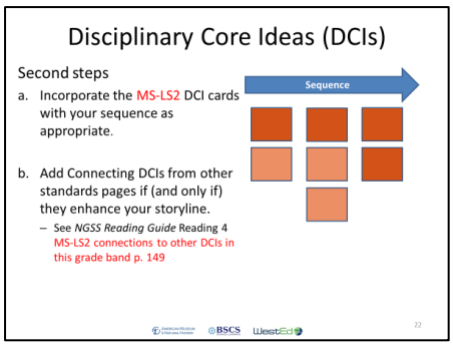
Slide and Time	Facilitation Notes
 Slide 17 (15 minutes)	**Display Slide 17 Planning for Instruction** a. Orient participants to the structure of the Reading 2, Part 2 in the *Framework for K-12 Science Education* (2012). Note that each section includes a description of the core idea followed by a description of each component idea with grade band end points. Refer to the Reading Guide and highlight the purpose for Reading 2 is to increase understanding of the core and component ideas. Note that participants should read only the introductory text for life science core ideas LSA, LSB, and LSC. Share that participants should stop at the beginning of the description of grade band endpoints, then read the Grade 8 endpoints. b. Mark that participants should pay attention to the questions used to help define each core idea. Provide 5 minutes for individual reading. c. Invite small groups to share what they learned from the reading. Provide an additional 10 minutes for small groups to share what they learned from the reading and revise their groupings or sequences. Groups should remove sticky notes that don't match the framework reading and add sticky notes if something is missing from their sequence. d. Encourage groups to take another picture of their table at this point, before cards are added in the next part of the process.
 Slide 18 (2 minute)	**Display Slide 18 Standards Page** a. Elicit participants' prior knowledge by asking them to share what they already know about the standards page. b. Share that representatives from the NGSS lead states used the Framework to develop the NGSS under the guidance of Achieve, Inc. At their most inclusive, the standards are defined by the PEs and foundation boxes. The PEs closely link the SEPs, DCIs, CCC, and Connections to the Nature of Science and Engineering, Technology, and Applications of Science. Note that the numbering of the PEs does not imply order of instruction. Possible narrative: *Notice the title of page: MS-LS2 Ecosystems: Interactions, Energy, and Dynamics. This core idea is the focus of the standards page. The Performance Expectations are listed at the top of the page. Each is identified by a code. Since there are 5 PEs, the codes go from MS-LS2-1 through MS-LS2-5. The foundation boxes include the elements used to develop the PEs. The blue box includes the SEPs; the orange, the DCIs; and the*

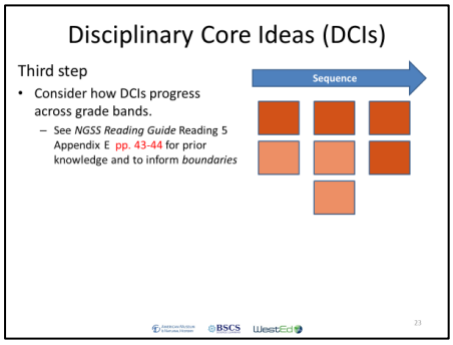
Slide and Time	Facilitation Notes
	green, the CCCs. Notice that connections to nature of science and to engineering, technology, and applications of science for this core idea are shown in the CCC box.
 Slide 19 (1 minute)	**Display Slide 19 Standards Page** a. Distribute **HO4: MS-LS2 Standards Page**. Encourage participants to take notes on the page throughout the session as needed. b. Share that we will use the common language of the authors of the Framework throughout the session today. Disciplinary core ideas include the core ideas, component ideas, and elements. c. Direct participants to Reading 3 and highlight the purpose of this reading is to become familiar with a standards page from the NGSS. Invite participants to review the standards that will be our focus during the session.
 Slide 20 (1 minute)	**Display Slide 20 Standards Page** a. Remind participants that one of the goals and outcomes for this session is to develop a blueprint for several instructional sequences that would make up a unit focused on MS-LS2 Ecosystems: Interactions, Energy, and Dynamics. b. Share with participants that to help take full advantage of the NGSS, we've developed a card set for them to use as begin to design a blueprint for the instructional sequences of a unit. Each card in the set includes text taken directly from a standards page. Note the color coding—orange for DCIs, blue for SEPs, green for CCCs and red for the PEs. Participants will also receive cards for the Connections and Common Core as well as elements from other standards pages. **PD leader note**: Forecast that they will have a table full of cards and sticky notes by the end of the session. Note that the arrangement of cards will likely change throughout the process, so groups may want to take photos of their work periodically.

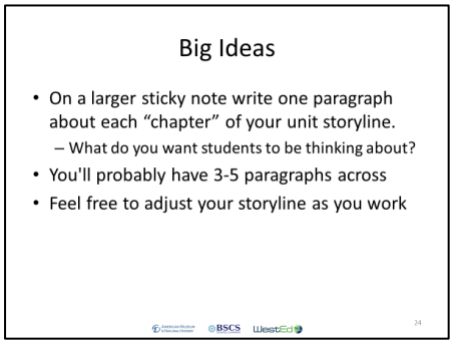
PD leader note: Generally the pattern from this point in the process (2b through 2g) is as follows: 1) participants receive a subset of the cards from an NGSS card deck (i.e., dark orange cards, light orange cards, dark red cards, light red card, etc.), 2) read about the focus of the cards, and then 3) decide where to place the cards in their sequence or not include the cards in their sequence. One notable exception to this pattern is when participants work with CCCs in Part 2e. Prior to receiving cards, participants will predict which CCCs they think will be aligned with their instructional sequences.

PD leader note: One of the goals of using the NGSS to design instruction is to develop a strong and coherent conceptual storyline about the science content to be taught across a sequence of lessons.

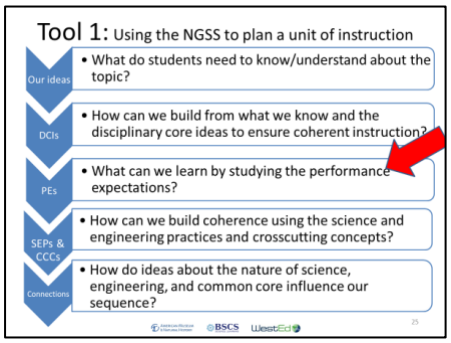
Although the PEs, SEPs, and CCCs are all very important parts of the NGSS, creating a **strong conceptual flow** of science content ideas using the DCIs is needed to develop coherence in instruction. **Conceptual coherence** results in science ideas building upon each other within an instructional sequence and across sequences in a unit to help students construct understanding of science. The Tool 1 process is designed so that participants begin with an initial storyline that is further enhanced by working with the three dimensions of the NGSS. The resulting blueprint for a unit of instruction helps identify the different components of the NGSS that will later be used in Tools 3 and 4 to design a sequence of lessons for an instructional sequence within the unit.

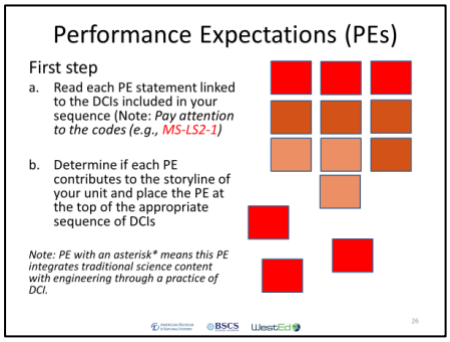
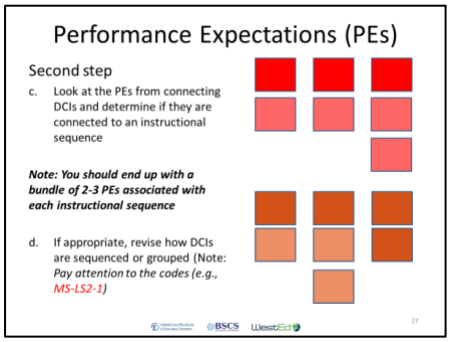
Slide and Time	Facilitation Notes
 Slide 21 (15 minutes)	**Display Slide 21 Disciplinary Core Ideas (DCIs)** a. Share that we will consider how we can use the NGSS to help us think about sequencing ideas in a way to promote coherence in our teaching and students' learning. b. Distribute the dark orange cards from **R4a: DCI cards.** Note the color on the card is orange to match the color of the DCI foundation box. Remind participants that each card represents an element of the component shown in the code. c. Have participants examine the code and text on each card. Mark that in addition to the DCI cards from MS-LS2A-C, there are also cards from MS-LS4D, and MS-ETS1B. Invite participants to scan the pages for LS4D and ETS1B referenced in Reading 2, Part 3 of the Reading Guide. d. Share that not all standards pages include engineering/design core ideas and elements. MS-LS2 includes this important aspect of the NGSS, so participants will need to consider how this core idea fits with other core ideas on this standards page. **PD leader note:** In the second steps, participants will begin to sequence science concepts across a unit of instruction based not only on their ideas, but also on the NGSS. Participants will sequence their ideas on sticky notes and the main DCI cards. They will also consider connections to other component ideas and elements within this grade band from other standards pages.
 Slide 22 (20 minutes)	**Display Slide 22 Disciplinary Core Ideas (DCIs)** a. Model the incorporation of their ideas and DCI cards (elements). Some options include: i. If a yellow sticky note represents a similar idea or a part of the DCI element, put the sticky note on the back of the DCI card. If the yellow sticky note is a "sub-idea" place it on the bottom of the DCI card. ii. Set a yellow sticky note aside if it does not fit in the sequence.

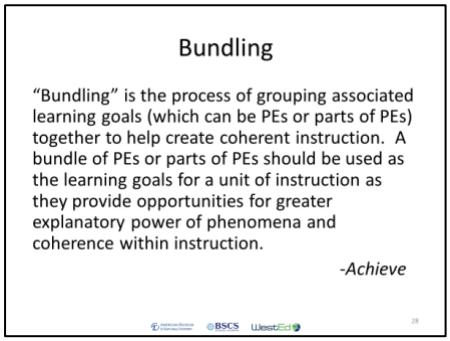
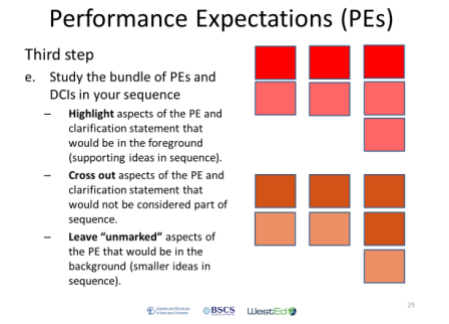
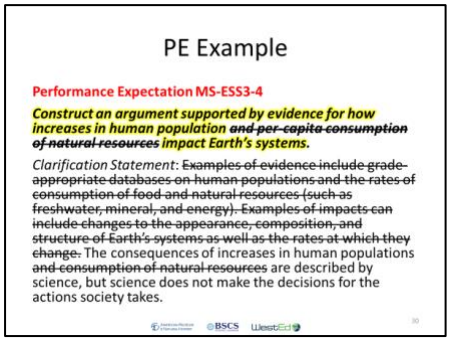
Slide and Time	Facilitation Notes
	iii. Add ideas, in complete sentences, on new yellow sticky notes to fill gaps. **PD leader note**: Make sure you emphasize that we would expect to see participant ideas on yellow sticky notes in their storyline. In other words, each "chapter" in the storyline of the unit should include their science ideas incorporated with the DCI cards. b. Remind participants that the authors of the Framework and NGSS intended to promote strong connections across disciplines. Invite participants to find the footer on the bottom of the standards page (HO5) where they will find codes for Connections to other DCIs in this grade-band. Refer to Reading 4 of HO3: Reading Guide. c. Forecast that participants will think explicitly about elements from Connection DCIs to help promote a more integrated view of learning that is consistent with the NGSS. d. Distribute **R4b: Connection DCI cards**. Mark that the elements from the connection DCIs are represented as "light" orange squares on the slide graphic. Have participants add these elements as appropriate to their sequence. Remind participants that not all the Connection DCI cards will be used; they should focus on those that help build conceptual coherence in their storyline. Blank cards can also be used if a group feels strongly that an important connection DCI should be included to support the storyline. e. Have participants share their rationale for including their selected Connections DCI cards in the storyline of their instructional unit.
 Slide 23 (10 minutes)	**Display Slide 23 Disciplinary Core Ideas (DCIs)** a. Share that the NGSS help us limit our focus at a particular grade band yet consider what comes before and after a given core idea within a learning progression. The purpose of the third step is to consider the progression of DCIs across grade bands to ensure the science ideas stay within the boundaries described in the in the progression. b. Refer participants to Reading 5 of the Reading Guide (HO3). Invite participants to review the progression and check that they have stayed within the boundaries of their grade band. They should also review the progression for other core ideas included in their sequence as well as science ideas that belong in a different instructional sequence. **PD leader note**: Be prepared to share an example of a science idea that should be eliminated based on the progression, such as

Slide and Time	Facilitation Notes
	carrying capacities. This idea is developed in the 9-12 grade band. Note that, depending upon the progress of district and state alignment of instruction with the Framework and NGSS, teachers might need to include ideas from an earlier grade or later grade band. These practical aspects of planning for instruction will be considered more fully in Tool 4.
 Slide 24 (10 minutes)	**Display Slide 24 Big Ideas** a. To check for coherence, invite participants to write brief paragraphs on large yellow sticky notes that summarize the big ideas for each "chapter" or column of DCI cards of the unit. Encourage each table to talk through and unpack the ideas in each column to help them write these paragraphs. **PD leader note:** Some groups will require more support than others; encourage a group that is working successfully to share for them with a struggling group or offer a meta moment to get individuals and teams to think about and share what kinds of things are working for them, or not. **PD leader note:** You may need to remind participants that the blueprint created from Tool 1 will represent a plan for a unit of instruction. (Note: a unit of instruction could be 3-5 different sequences of lessons or "chapters," a whole module, or multiple learning sets—it will constitute several weeks of instruction). At this point in the process, the sequence participants are working on is only at the unit level and "across chapters" Participants are not sequencing within a "chapter" yet. That level of work will come in Tools 3 and 4. A blueprint will represent several weeks of instruction.

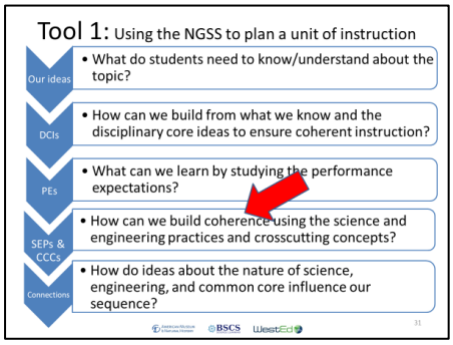
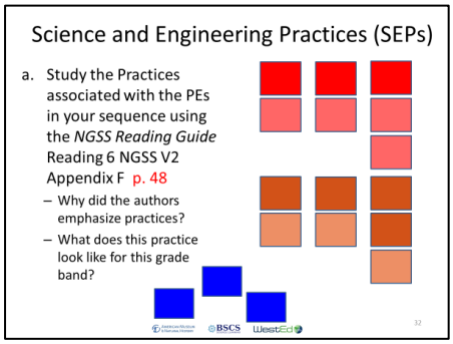
Part 2c. Performance Expectations (PEs) (70 minutes)

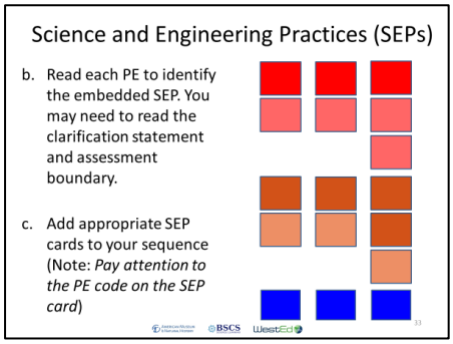
Slide and Time	Facilitation Notes
 Slide 25 (2 minutes)	**Display Slide 25 Tool 1** a. Share that we have own considered our ideas and disciplinary core ideas to begin to develop a coherent science content storyline. Now we move to thinking about how the performance expectations for MS-LS2 can help in the development of a coherent instructional sequence. Possible narrative: *Performance expectations are the hallmark of the NGSS. They are assessable statements of what students should know and be able to do as the result of instruction. PEs guide assessment and "define" learning at the intersection of the*

Slide and Time	Facilitation Notes
	dimensions and serve a critical role in developing instructional sequences. Recall that when we examined the conceptual shifts, we talked about the importance of bundling PEs associated with more than one standards page to promote a more integrated view of instruction and help ensure a coherent experience for students. Our process will help us bundle the PEs of MS-LS2.
 Slide 26 (18 minutes)	**Display Slide 26 Performance Expectations (PEs)** a. Share that we will begin by getting familiar with the PEs that are part of MS-LS2. We will first consider the PEs associated with this topic and then consider PEs that are linked to Connection DCIs. b. Note that the PE cards are represented in red at the top of the graphic on the slide. Distribute **R4c: PE cards** and invite participants to notice to codes on the cards. Note the significance of PEs with an asterisk (engineering PEs). c. Mark that the first step is to focus on PEs associated with MS-LS2. Have participants place one or more dark red PE cards at the top of each instructional sequence or "chapter" that makes up their unit plan, revising their overall sequence as needed. **PD leader note:** If groups ask about wanting to place a PE card into two different sequences, provide them with a blank card.
 Slide 27 (15 minutes)	**Display Slide 27 Performance Expectations** **PD leader note:** This slide is animated to show how the DCI cards might be moved to reflect participants' thinking about how the sequence is informed by the PE statements. a. Share that the second step is to consider PEs that are linked to Connection DCIs, represented with light red cards. Since each DCI is connected to at least one PE, we consider all PEs connected to the DCIs in our sequence. b. Model the process with an example. A group may have used the MS-ESS3.C DCI card in their sequence. The code on the DCI card indicates which PE is aligned to it. The group must consider if this PE and its associated DCI contribute to their storyline. They will repeat this process to consider other connected DCIs and the aligned PEs in the sequence. c. Forecast that, after incorporating the PE cards into their unit, there should be a bundle of 2 – 3 PE's for each instructional sequence and invite participants to add their light red PE cards to their storyline.

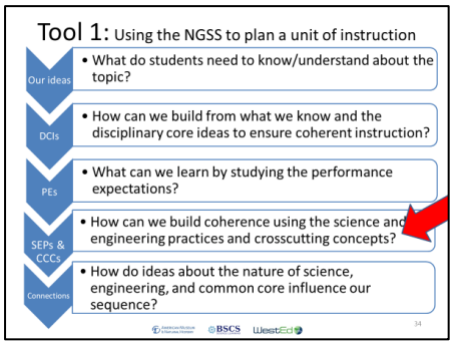
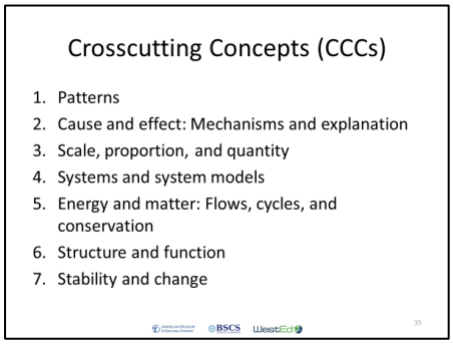
Slide and Time	Facilitation Notes
 Slide 28 (1 minute)	**Display Slide 28 Bundling** a. Share the definition of bundling from Achieve.
 Slide 29 (3 minutes)	**Display Slide 29 Performance Expectations (PEs)** a. Share that, for each bundle of 2-3 PEs, we need to consider how the PE and clarification statement how each PE contributes to the conceptual coherence of their sequence. b. Forecast the process for the third step to identify which parts of the PE are part of the instruction and which parts are not included in the storyline we have developed: i. Highlight parts of the PE and clarification statement that will be in the foreground, supporting the main ideas in the sequence, ii. Cross out parts of each PE and clarifying statement that are not included in the sequence, and iii. Leave unmarked parts of the PE and clarification statement that are in the background, associated with smaller ideas in the sequence. **Transition:** Note that the next slide will provide an example of this process.
 Slide 30 (21 minutes)	**Display Slide 30 PE Example** a. Share that the slide shows an Earth science PE that links to the Connections DCI ESS3.C. The highlighted parts support the storyline and will be in the foreground of instruction. The unmarked parts in the clarification statement are also part of the storyline and would be in the background of instruction. The crossed-out parts would not be part of instruction since they are outside the scope of the storyline. b. Invite participants to examine their bundled PEs for each instructional sequence, highlighting and crossing out the appropriate parts of each PE. Note that groups may continue to revise their sequence based on their unpacking of the PEs.

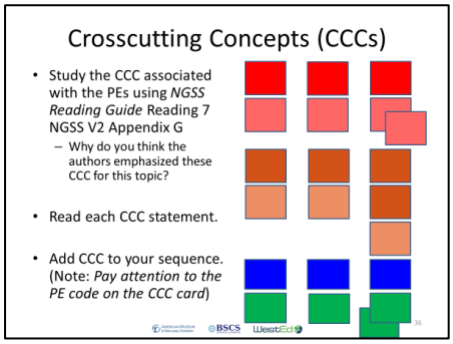
Part 2d Science and Engineering Practices (45 minutes)

Slide and Time	Facilitation Notes
 Slide 31 (2 minutes)	**Display Slide 31 Tool 1** a. Note that, in addition to the DCIs and PEs, the NGSS includes Science and Engineering Practices and Crosscutting Concepts. We need to consider how these important dimensions of the NGSS will be incorporated into our instructional sequences. Possible narrative: *The NGSS intend that assessment of student learning occurs at the nexus of the dimensions. If this is how students will be assessed, then this is how students need to learn. In the next part of this process, we will consider how the SEPs and CCCs fit into and enhance our instructional sequences.* **PD leader note**: This explicit reference to the nature of assessments, particularly high stakes assessments, may raise some issues for your participants. Be sure to think about how you want to handle this conversation. Note that in Tool 2, we take an in-depth look at performance expectations and consider their role in classroom assessment.
 Slides 32 (15 minutes)	**Display Slide 32 Science and Engineering Practices (SEPs)** a. Direct participants to Reading 6 on the Reading Guide (HO3). Share that the purpose of this reading is to study the practices associated with the PEs in the sequence. b. Note the questions on the slide. Invite participants to read the text individually, then discuss the prompts with their group. Ask several groups to share key ideas from their discussion. **PD leader note:** The purpose of the whole group discussion is to begin to familiarize participants with the ways in which the authors of the NGSS describe the practices. The five tools and processes do not include opportunities for enhancing teachers' abilities to use of the SEPs in their classrooms.

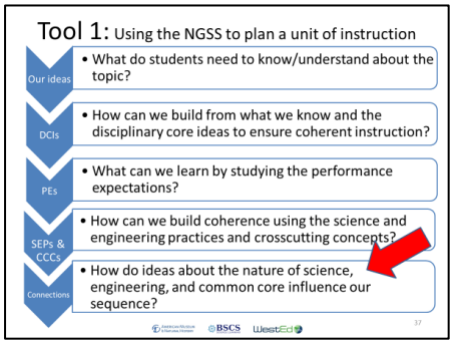
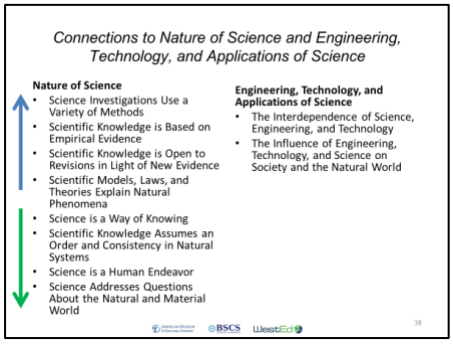
Slide and Time	Facilitation Notes
 Slides 33 (28 minutes)	**Display Slide 33 Science and Engineering Practices (SEPs)** a. Share that, to identify the embedded SEP, participants will need to read each full PE including the clarification statement and assessment boundary. b. Distribute the **R4d: SEPs cards**, noting that the color of the cards is blue. Invite participants to read each card. Using their learning from the reading and the PE codes on each SEP card, participants should add the SEP cards to their instructional sequence as appropriate.

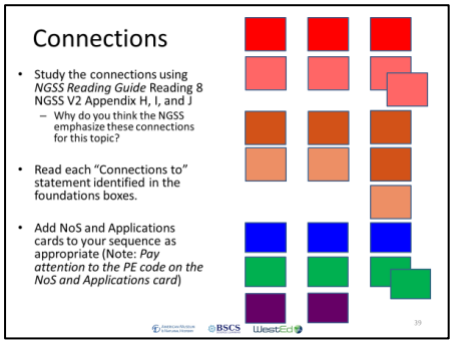
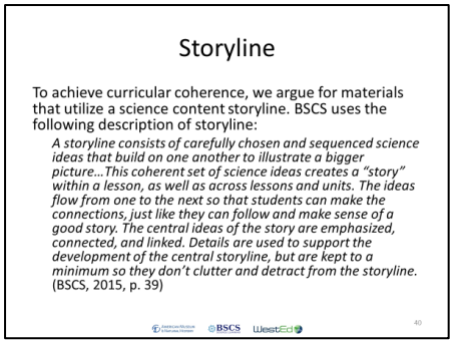
Part 2e Crosscutting Concepts (CCCs) (45 minutes)

Slide and Time	Facilitation Notes
 Slide 34 (2 minutes)	**Display Slide 34 Tool 1** a. Note that our focus will turn to incorporating crosscutting concepts (CCCs) in the next phase of this process. **PD leader note:** The introduction to the CCCs is slightly different from all other card sets. Participants are invited to predict which CCCs will be included in their sequence. This prediction implies that they DO NOT look at the standards page to identify the CCCs included NOR do they get the CCC card set before having an opportunity to make their predictions.
 Slide 35 (3 minutes)	**Display Slide 35 Crosscutting Concepts (CCCs)** a. Note that the authors of the NGSS tried to be very selective about which CCC to highlight for each core idea. Invite each group to talk briefly about which CCC they would expect to be aligned with their instructional sequence Have groups share their predictions of which CCC would be in the foreground of this sequence. b. Use the slide animation to reveal the CCCs that are part of MS-LS2. **PD leader note:** For MS-LS2, participants will likely identify systems and systems models as a foregrounded CCC. However, this CCC is not included in the standards page.

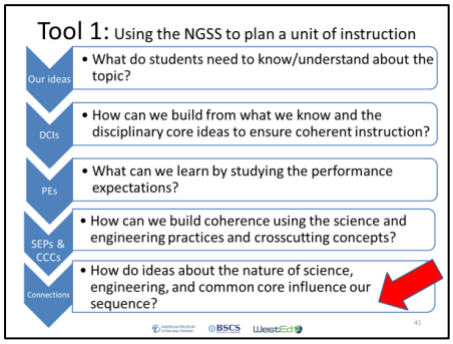
Slide and Time	Facilitation Notes
 Slide 36 (40 minutes)	**Display Slide 36 Crosscutting Concepts (CCCs)** a. Distribute the **R4e: CCCs cards** and invite participants to read each card, noting the color code is green. Invite participants to read each card to identify the CCCs associated with the PEs. b. Share that participants will learn more about the identified CCCs. Refer to Reading 7 from Reading Guide (HO3). Participants should keep the question in mind as they read. Once individuals have finished reading individually, they should discuss the prompt in their small group. Invite several groups to share highlights of their discussion with the whole group. c. Invite participants to add the CCC cards to their instructional sequence, using what they learned from the reading and the PE codes on the CCC card.

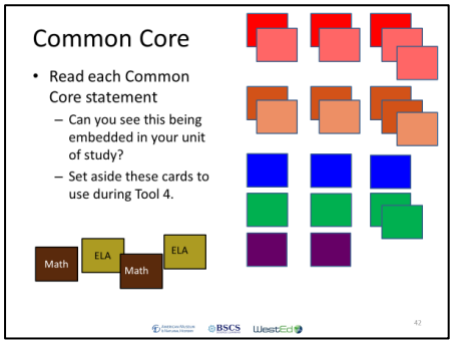
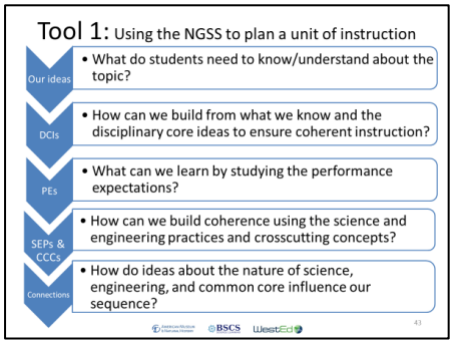
Part 2f Connections (30 minutes)

Slide and Time	Facilitation Notes
 Slide 37 (2 minutes)	**Display Slide 37 Tool 1** a. Share that in this phase of the process, we will consider how ideas about the nature of science and engineering, technology, and applications of science influence our instructional sequence.
 Slide 38 (5 minutes)	**Display Slide 38 Connections to Nature of Science…** a. Share that the possible connections to the nature of science and engineering, technology, and applications of science are listed on this slide. Invite each group to discuss briefly which Connections they would expect to be aligned with their instructional sequence, noting that the authors of the NGSS were very selective about which Connection to highlight for each core idea. b. Mark that the arrows beside the Nature of Science indicate association with either the SEPs or CCCs. The first four bullets are associated with SEPs and would be found in the blue

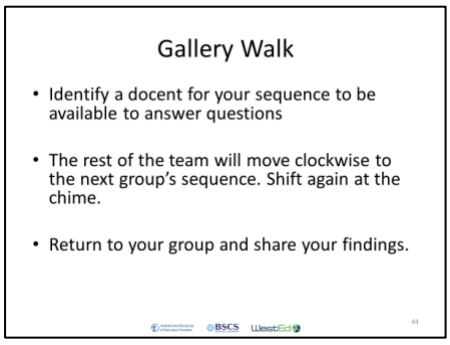
Slide and Time	Facilitation Notes
	foundation box. The last four bullets are associated with CCCs and would be found in the green foundation box.
 Slide 39 (20 minutes)	**Display Slide 39 Connections** a. Distribute the **R4f: Connections cards** and note the color code is purple. Mark that the color choice is not part of the NGSS. Invite participants to read each card to identify which connections are associated with the instructional sequence. b. Invite participants to study the connections using Reading 9 from Appendices H, I, and J in NGSS V2 (HO3). As they read, participants should keep in mind the question: Why do you think the authors emphasized these connections for this topic? After reading individually, groups should discuss the prompt. c. Using what they learned from the reading and the PE codes on the Connections cards, participants should add the Connections cards to their instructional sequence.
 Slide 40 (3 minutes)	**Display Slide 40 Storyline** a. Share that, to achieve coherence in instructional materials, a science content storyline must be utilized. Invite participants to silently read the description of a storyline. b. Invite participants to tell the science content storyline of their unit in their small group. Forecast that they will have an opportunity to view the storyline of other groups after the next phase of the process.

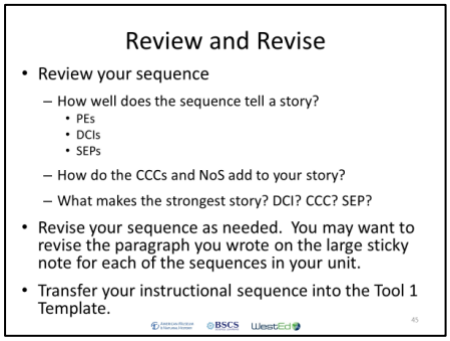
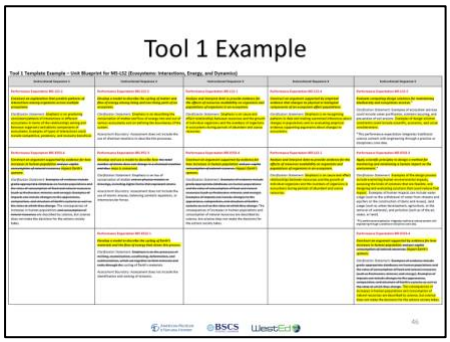
Part 2g Common Core (10 minutes)

Slide and Time	Facilitation Notes
 Slide 41 (2 min)	**Display Slide 41** a. Note that participants will focus on incorporating connections to common core into their instructional sequences in this next phase of the process. Possible narrative: *Many of you have explicit district directives to include the Common Core English Language Arts (ELA) and Math in your daily classroom practice. The NGSS are explicit about including these ideas as well.*

Slide and Time	Facilitation Notes
 Slide 42(5 min)	**Display Slide 42 Common Core** a. Share that at this time we will just look at the Common Core connections without adding them to our sequence. b. Distribute the **R4g: Common Core cards.** Note that the Common Core math cards are brown, and the ELA/literacy Common Core cards are yellow; the color choices are not part of the NGSS. c. Invite groups to read each card, noting the PE codes on the bottom of each card, and discuss the question: Can you see this being embedded in your unit of study? d. Have participants save these cards for their work with Tool 4. **PD leader note:** Be sure to keep these cards for use in Tool 4.
 Slide 43 (3 min)	**Display Slide 43 Tool 1** a. Share that participants have now completed the process associated with Tool 1 and constructed a coherent three-dimensional instructional sequence guided by bundled performance expectations. **Transition:** *Share that, for the past several hours, you have been working primarily in your individual groups and just as great science educators do, some have visited the work and thinking of others. We will advantage of this idea formally over the next few minutes. You will use a Gallery Walk to learn from others and then return to your sequence for one final review. Then you will capture your instructional sequences electronically. We encourage you to take a final photo of your work as well to remind you of the Tool 1 process.*

Part 3 Review and Complete Tool 1 (35 minutes)

Slide and Time	Facilitation Notes
	**Display Slide 44 Gallery Walk** a. Share that participants will use a curated gallery walk protocol. They should identify a docent who will stay at the table. The role of the docent is to respond to questions rather than giving a presentation. The remaining group members will examine other groups' instructional sequences, noting similarities and differences to bring back to the group.

Slide and Time	Facilitation Notes
Slide 44 (10 min)	b. Mark that you will provide 2-3 minutes for each round. At the end of each round participants should move to another group to examine their instructional sequence. c. After several rounds, have participants return to their home groups. Provide 5 minutes for teams to share their findings. **PD leader note:** If groups are working on units of instruction from different subject areas or grade bands, you may omit the gallery walk, particularly if groups are unfamiliar with the content of other groups.
 Slide 45 (10 min)	**Display Slide 45 Review and Revise** a. Invite groups to use what they learned from the gallery walk to revisit their own instructional sequence and discuss the prompts. Groups should make any needed revisions to their sequence and summary paragraphs. b. Forecast that final step in the Tool 1 process is capturing their work in the electronic Tool 1 Template. Teams will do this after the Tool 1 session and before the session for Tool 2.
 Slide 46 (10 min)	**Display Slide 46 Tool 1 Example** a. Distribute **HO5: Tool 1 Template Example - Unit Blueprint for MS-LS2**. Provide time for groups to examine the structure of the template example. Invite participants to share their observations about the template structure with the whole group. Mark the Big Ideas for each instructional sequence at the bottom of each column. b. Have participants compare the organization of their instructional sequence to that of the blueprint noting similarities and differences. Share that they will refer to this template example for Tool 2. **Transition:** *John Dewey said we don't learn through experience, but rather by reflecting on our experiences. This will be the final part of our session today.*

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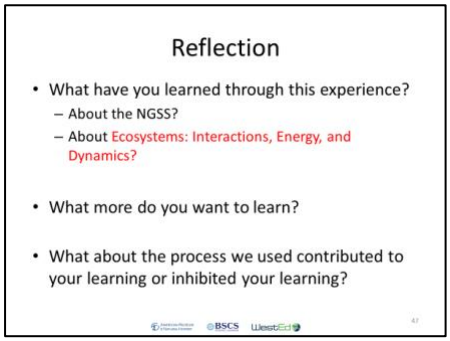 Slide 47 (5 min)	**Display Slide 47 Reflection** a. Invite participants to respond individually to the reflection questions and be prepared to share their ideas. Invite several participants to share their ideas with the whole group. b. If applicable, share logistical information about future Five Tools sessions and work to be completed between sessions. c. Thank participants for their thoughtful work throughout the session.