Advancing Tools and Processes for Next Generation Science

Model B: Planning for Instruction
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. However, if you are doing this with elementary teachers, plan to share the standards page for their grade level.**

Prerequisite: Participants should have experienced the *Introduction to NGSS and the Five Tools and Processes* session.

Part 1 **Introduction** (Slides 1-5) [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 6-47) [325 minutes or 5 hours and 25 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 6-15) (45 minutes)

b. Tool 1 Part 1: Disciplinary Core Ideas (DCIs) (Slides 16-26) (90 minutes)

c. Tool 1 Part 2: Performance Expectations (PEs) (Slides 27-32) (60 minutes)

d. Tool 1 Part 3: Science and Engineering Practices (SEPs) (Slides 33-35) (45 minutes)

e. Tool 1 Part 4: Crosscutting Concepts (CCCs (Slides 36-38) (45 minutes)

f. Tool 1 Part 5: Connections (Slides 39-44) (30 minutes)

g. Tool 1 Part 6: Common Core (Slides 42-44) (10 minutes)

Part 3 **Review and Complete Tool 1** (Slides 45-47) [20 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 = 360 minutes (6 hours)

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 or 4x6) for each group.
- Avery 5388 card stock for **printing the NGSS card decks** for the number of cards/deck and the number of decks needed. Cards should be printed in color. You can find downloadable NGSS card decks 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 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.

- Blank Avery Cards for adding PEs, DCIs, SEPs, CCCs as needed
- Highlighter (1/team)

Handouts

HO 1	Five Tools Graphic: Model B: Planning for Instruction
HO 2	NGSS Reading Guide (MS-LS2)
HO 3	Tool 1 Graphic
HO 4	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. DCIs for Engineering/Design (color code = orange)
c. Connection DCIs (color code = light orange)
d. PEs for DCIs and Connection DCIs (color code = red, light red)
e. SEPs for PEs and PEs for Connection DCIs (color code = blue, light blue)
f. CCCs for PEs and PEs for Connection DCIs (color code = green, light green)
g. Connections for PEs and PEs for Connection DCIs (color code = purple, light purple)
h. Common Core (color code=brown for math; yellow for ELA/Literacy)

Slides

Slide 1	Advancing Tools and Processes for Next Generation Science
Slide 2	Science Teaching and Learning
Slide 3	Goals and Outcomes
Slide 4	Conceptual Shifts Offered by the NGSS

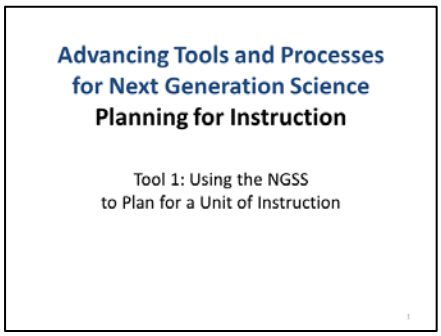
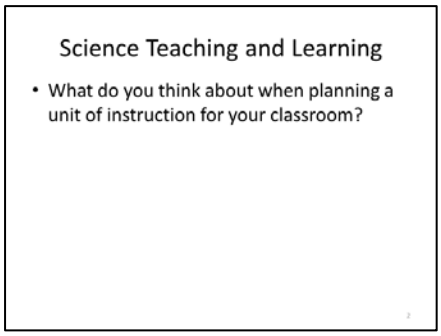
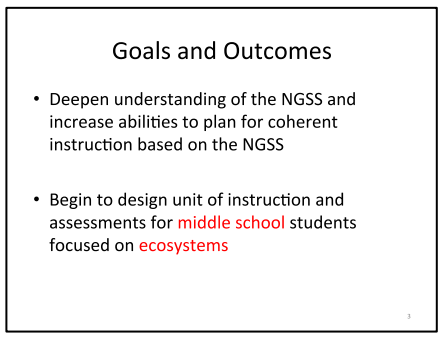
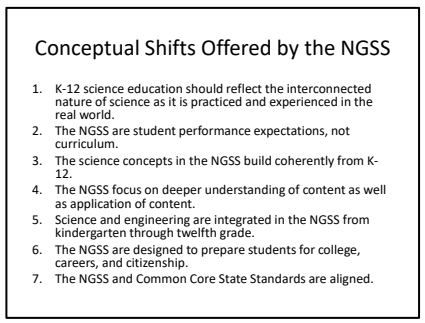
Slide 5	Five Tools and Processes Model B Graphic
Slide 6	Tool 1: Planning for Instruction (Graphic)
Slide 7	Planning for Instruction
Slide 8	Planning for Instruction
Slide 9	Planning for Instruction
Slide 10	Planning for Instruction
Slide 11	Example of a Conceptual Flow
Slide 12	Facts and Concepts
Slide 13	Develop a Conceptual Flow
Slide 14	Conceptual Flow Graphic
Slide 15	Example of a Conceptual Flow Graphic about Ecosystems
Slide 16	Tool 1 Planning for Instruction (Graphic)
Slide 17	Framework for K-12 Science Education
Slide 18	Tool 1 Blueprint Example
Slide 19	Planning for Instruction (Reading)
Slide 20	Planning for Instruction (Reading)
Slide 21	NGSS Standards Page MS-LS2
Slide 22	NGSS Standards Page MS-LS2 (Definitions)
Slide 23	NGSS Standards Page MS-LS2 (Card example)
Slide 24	Disciplinary Core Ideas (DCIs) (First Step)
Slide 25	Disciplinary Core Ideas (DCIs) (Second Steps)
Slide 26	Disciplinary Core Ideas (DCIs) (Third Step)
Slide 27	Big Ideas
Slide 28	Tool 1 Planning for Instruction (Graphic)
Slide 29	Performance Expectations (PEs) (First Step)
Slide 30	Performance Expectations (PEs) (Second Step)
Slide 31	Performance Expectations (PEs) (Third Step)
Slide 32	PE Example
Slide 33	Bundling
Slide 34	Tool 1 Planning for Instruction (Graphic)
Slide 35	Science and Engineering Practices (SEPs) (Part a)
Slide 36	Science and Engineering Practices (SEPs) (Parts b and c)
Slide 37	Tool 1 Planning for Instruction (Graphic)
Slide 38	Crosscutting Concepts (CCCs) (List)
Slide 39	Crosscutting Concepts (CCCs) (Process)
Slide 40	Tool 1 Planning for Instruction (Graphic)
Slide 41	Connections to Nature of Science and Engineering, Technology, and Applications of Science (List)
Slide 42	Connections (Process)
Slide 43	Tool 1 Planning for Instruction (Graphic)
Slide 44	Common Core
Slide 45	Tool 1 Planning for Instruction (Graphic)
Slide 46	Gallery Walk
Slide 47	Review and Revise
Slide 48	Reflection

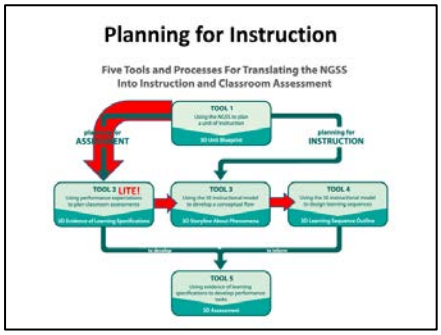
Advance Preparation:

- 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 (ex. edit PPT and NGSS Reading Guide for MS-LS2)
- If you are doing this with elementary teachers, prepare the standards page for their grade level.
- Print (in color) and separate cards into sets (1 set/3-4 participants; group/organize card sets by Tool Part (ex. DCIs, SEPs, CCCs).
- Print all 3 Handouts (1/participant).
- Ensure adequate space for the card sort and work in groups of 3 (no more than 4).
- 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 (1 minute)	1. Display **Slide 1 (Advancing Tools and Processes for Next Generation Science**). Welcome participants to the session.
 Slide 2 (5 minutes)	2. Display **Slide 2 (Science Teaching and Learning)**. Explain to participants that the focus of this session is to use the NGSS to plan for instruction. 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)	3. Display **Slide 3 (Goals and Outcomes).** Review the goals and outcomes of the session. a. Read the first goal. Possible narrative: *Notice the focus on "planning for instruction" during our session today.* b. Read the second goal. Possible narrative: *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.*
 Slide 4 (2 minutes)	4. Display **Slide 4 (Conceptual Shifts Offered by the NGSS)**. Remind participants that during the *Introduction to NGSS and the Five Tools and Processes* session, they reviewed the Conceptual Shifts of the NGSS. Referring to Shift #2, participants can recall that the NGSS do not prescribe curriculum so we need a process to help us translate the standards into instruction and classroom assessment – that is what our Five Tools and Processes do.

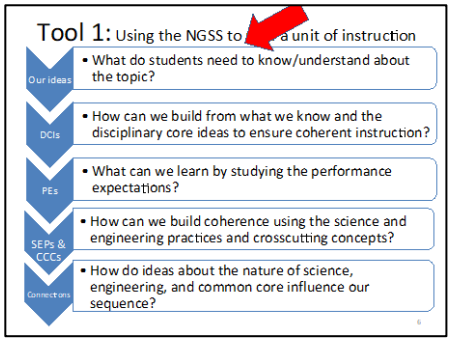
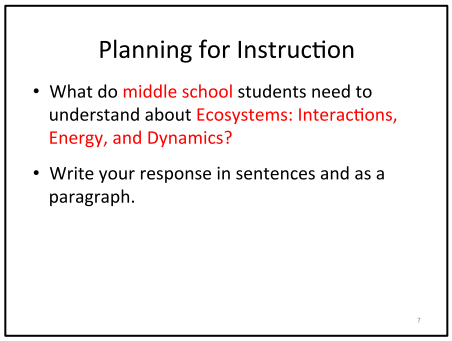
Slide and Time	Facilitation Notes
 Slide 5 (5 minutes)	5. Display **Slide 5 (Five Tools and Processes Graphic).** Distribute **HO1: Five Tools Graphic for Model B.** Provide a brief overview of the 5 Tools that are a part of this process. Click through the animated slide as you introduce each Tool. *The 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. Note that because the focus of our work is planning a unit of instruction, we will use Tools 1, 2 (a shortened version), 3 and 4.* *Our focus 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 several weeks of instruction. This will include the outline of the big ideas for 3-5 different 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.*

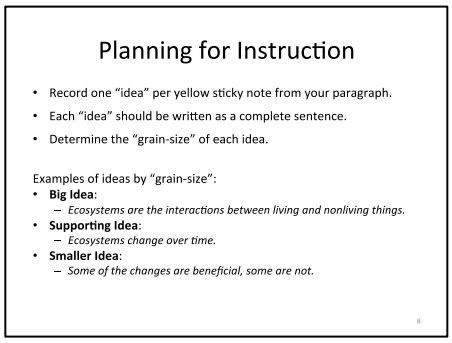
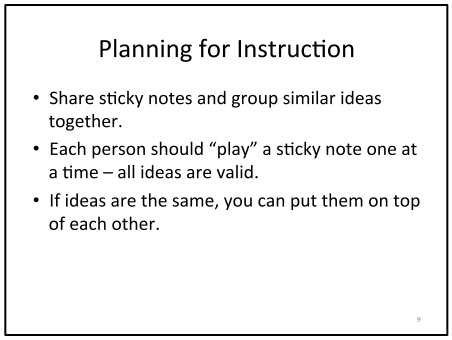
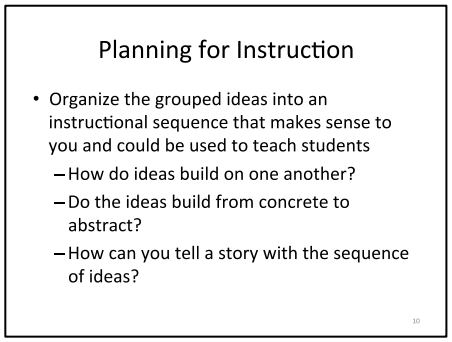
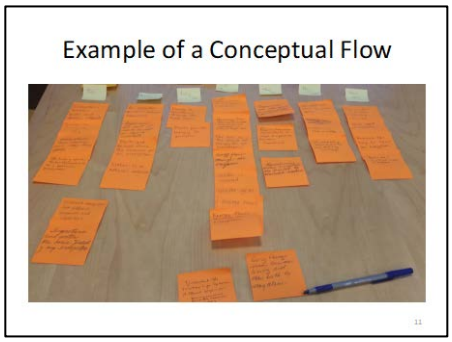
Part 2 Tool 1: Planning for Instruction (325 minutes)

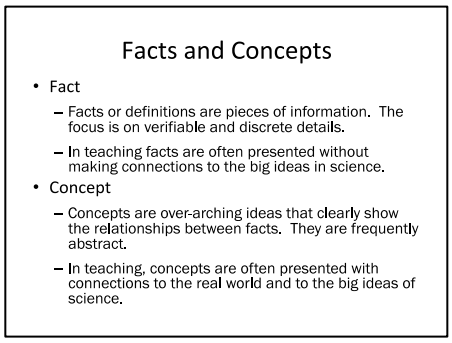
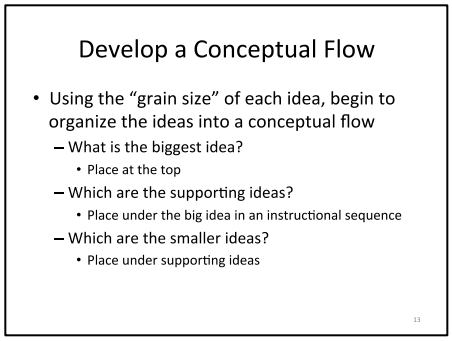
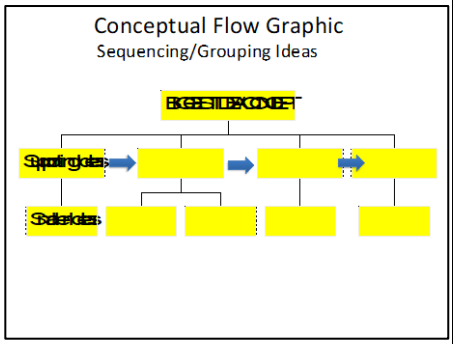
Part 2a. Introduction to Tool 1 (45 minutes)

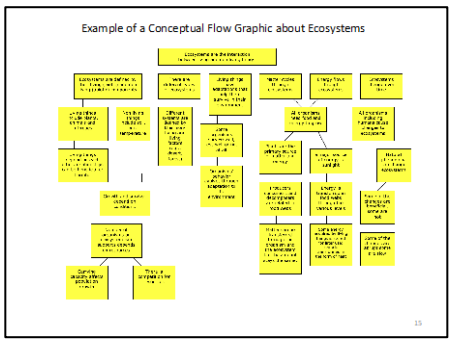
PD Leader Note*: The Introduction to Tool 1 is to engage teachers' prior knowledge and experience. Briefly remind participants again that the research base for all of the Tools is grounded in the work presented in How People Learn (2000). This prior knowledge must be engaged and surfaced to provide opportunities to resolve potential differences in teaching practices in light of 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," however in our pilot of these Tools, no classroom teachers included ideas that would fall into the science and engineering practices dimension. Based on this evidence and what we know about learning from How People Learn (2000) and other research, we decided to begin the overall process with DCIs rather than PEs. You'll note that we move to PEs early in the process.

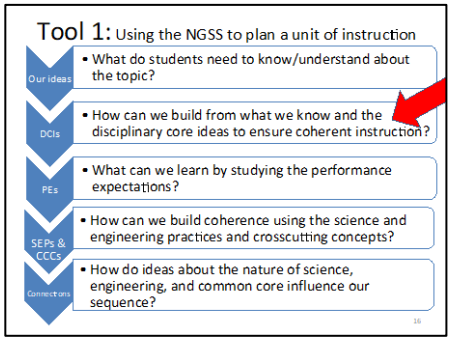
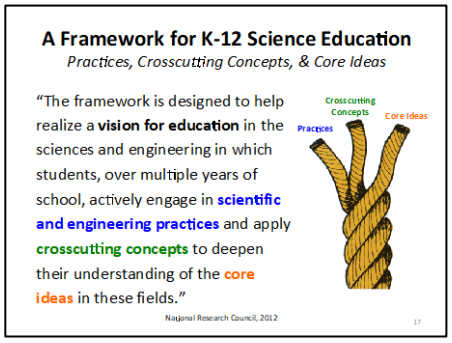
Slide and Time	Facilitation Notes
 Slide 6 (5 minutes)	6. Keep participants in groups of 3 (and no more than 4). Display **Slide 6 (Tool 1 Planning for Instruction).** Share the questions in the graphic that will be answered as we use Tool 1. Be sure to include a brief description of each of the dimensions 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). The DCIs are what is traditionally thought of as science content. The science and engineering practices are similar to the abilities to do scientific inquiry in the 1996 NSES and habits of minds in the AAAS Benchmarks (1993). Some might refer to them as skills, but the NGSS encourages us to think about these practices as ways of knowing and developing understanding. The CCCs are similar to the unifying concepts in the 1996 NSES or themes in the AAAS Benchmarks (1993). Engineering is inherent in all three of these dimensions and this inclusion represents a significant shift in our thinking about the focus of science education. The authors of the NGSS have also included explicit connections to the nature of science and to engineering, technology, and the applications of science as well as to the Common Core. The key idea here is that the NGSS promote the integration of the dimensions to offer students a deeper understanding of the whole of science and the applications of science and engineering.*
 Slide 7 (5 minutes)	7. Remind participants of the first question in the Tool 1 graphic (what are "our ideas" about what students need to know), then display **Slide 7 (Planning for Instruction).** Provide a few minutes for *individual* participants to generate and record ideas. Ask participants to write in complete sentences and write their response as a paragraph. **PD Leader Note:** If you have elementary teachers in your group, they should write the paragraph about what their students need to know and be able to do. However, they will not write sticky notes. After writing their paragraph, share the appropriate standards page for their grade band. They should then compare what they wrote in their paragraph to the information on the standards page. They should then begin working with their appropriate card deck.

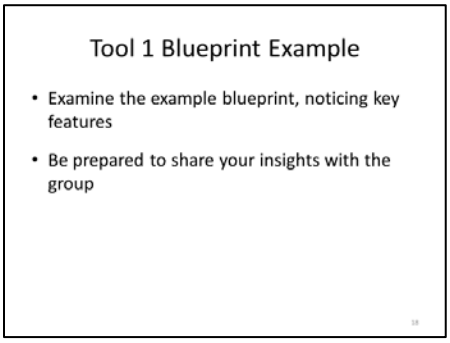
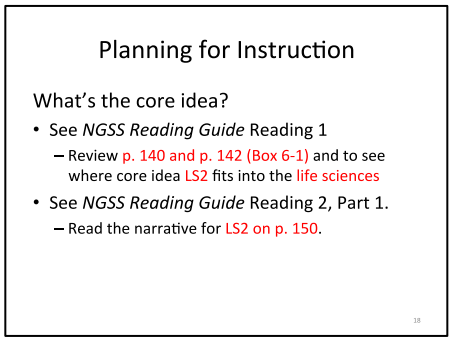
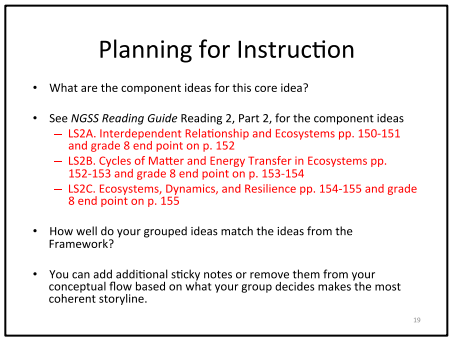
Slide and Time	Facilitation Notes
 Slide 8 (5 minutes)	8. Display **Slide 8 (Planning for Instruction)**. Ask participants to record ideas from the paragraph on sticky notes, one idea per sticky note, using complete sentences. After participants have had some time to generate their own ideas, it might be useful for them to consider the "grain-size" of their ideas. This could be useful during the next two parts of the process as they begin to develop a "conceptual flow" for the unit using these ideas. The second part of the slide shows examples of different ideas about ecosystems to illustrate what grain-size means.
 Slide 9 (5 minutes)	9. Display **Slide 9 (Planning for Instruction)**. Ask participants to share their sticky notes by taking turns and sharing one at a time. Instruct participants to group similar ideas together. Everyone's ideas should be shared and included in the clumping.
 Slide 10 (5 minutes)	10. Display **Slide 10 (Planning for Instruction).** Note that not only do we need to know what students should learn, but we also need to sequence those ideas for coherence. Invite participants to use the questions on the slide to begin to sequence their grouped ideas. This process will begin to develop a **conceptual flow of the science content** for this unit.
 Slide 11 (10 minutes)	11. Use **Slide 11 (Example of a Conceptual Flow*)** to show an example of a conceptual flow with the sticky notes to help provide participants with a visual of what their product should begin to look like. *The **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.

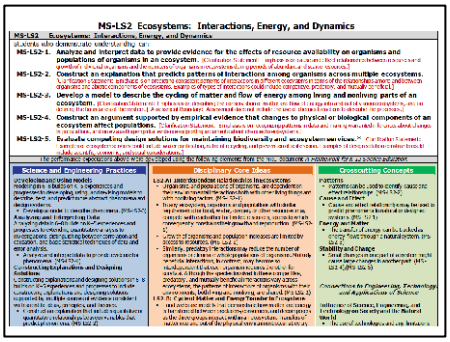
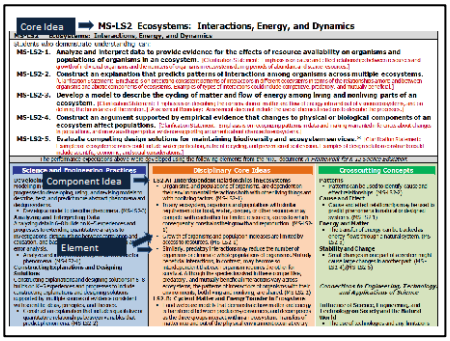
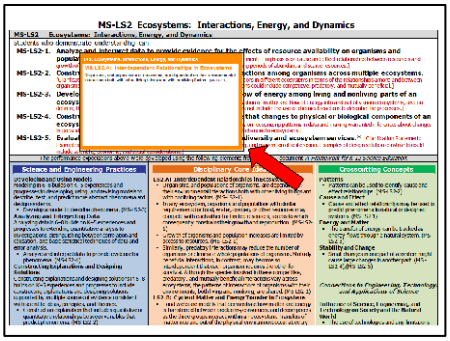
Slide and Time	Facilitation Notes
 Slide 12	12. Display Slide 12 to prompt participants to think about which of their sticky notes are facts and which are concepts.
 Slides 13 (10 minutes)	13. Display **Slide 13 (Develop a Conceptual Flow)** to help participants develop their conceptual flow into a graphic that show the different grain-size of ideas.
 Slides 14 (Optional))	14. **Use Slide 14 (Conceptual Flow Graphic)** as an optional slide to 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. **PD Leader Note**: At this point, you need <u>to prepare for a step later in the session</u>. You need to examine grouped ideas and sequences to identify a team to come back to during Part 2, Slide 24 to provide an example of how participants will incorporate their sequenced/grouped ideas and the DCI cards. For example, you need to look for a team that has a "set of ideas" on yellow sticky notes that *matches a DCI card*. You will use this group's ideas and the DCI card to show how to incorporate the two sets of ideas. Alternatively, you need to look for a team with an idea that is very different from the DCI cards and suggest how they would incorporate this idea into their sequence. Participants should take a picture of all their sticky notes to document their process. Remind participants 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

Slide and Time	Facilitation Notes
	are working in an adoption state) the NGSS. Distribute **R1 (Framework)** and **HO2 (NGSS Reading Guide).**
 Slides 15 (Optional)	15. **PD Leader Note**: Slide 15 (Example of a Conceptual Flow Graphic about Ecosystems) is optional and provides an example of a more complete conceptual flow. This is only meant to be an example and can be used if participants are not clear about what the finished product looks like.

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

Slide and Time	Facilitation Notes
 Slide 16 (1 minute)	16. Display **Slide 16 (Tool 1 Planning for Instruction).** Note 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**: *In the development of Tool 1, we decided to consider the DCIs and then consider the PEs. In this way we work from prior knowledge and build toward greater coherence of instructional sequences. We see Tool 1 and the entire suite of 5 Tools as an iterative process in which the PEs serve a critical role as descriptors of assessment and guides to instruction.*
 Slide 17 (1 minute)	17. **Slide 17** is an excerpt from beginning section of *A Framework for K-12 Science Education*. Use this slide to remind participants that the Framework was developed by the National Research Council prior to NGSS and was used by Achieve to develop the NGSS. Display **Slide 17** that explains the vision of the *Framework for K-12 Education* in the sciences and engineering through the three dimensions of NGSS: scientific and engineering practices, crosscutting concepts, and disciplinary core ideas. Participants will be reading sections from the Framework during the Tool 1 process. These overview slides are meant to provide a rationale for why we are reading from the Framework in this process given it was used to develop the NGSS. Again, using these slides is optional based on the prior

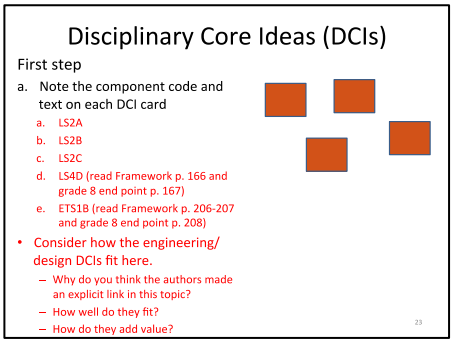
Slide and Time	Facilitation Notes
	knowledge your participants have about the Framework and its role in developing the NGSS.
 Slide 18 (5 minutes)	18. Display **Slide 18 (MS_LS2 Blueprint)**. Distribute **HO 3: Template Example**. Invite participants to example the sample blueprint, noticing key features of the document. Invite participants to share the key features they noticed. As participants share, highlight the following features: • Bundling of Pes • Use of connecting DCIs, SEPs, and CCCs • The product of using the card deck is represented electronically
 Slide 19 (15 minutes)	19. Display **Slide 19 (Planning for Instruction).** Distribute **HO2 (NGSS Reading Guide)** and refer to readings 1 and 2 and **R 1 (Framework).** Invite participants to turn to pages 140 and 142 in the *Framework for K-12 Science Education* (2012) to learn more about where core idea LS2 fits into the life sciences. Then invite participants to turn to page 150 to learn more about middle school life science core idea, Ecosystems: Interactions, Energy, and Dynamics.
 Slide 20 (15 minutes)	20. Display **Slide 20 (Planning for Instruction).** Orient participants to the structure of the section in the text in **R1 (Framework)**, 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 **HO2 (NGSS Reading Guide)** and note that for our purposes here, participants should read only the introductory text for life science core ideas LSA, LSB, and LSC. Have participants stop at the section that begins a description of the end points. Have participants pay attention to the questions used to help define each core idea. The page numbers are identified on the slide. Provide 5 minutes to read each of the selections and an additional 10 minutes for small groups to share what they learned from the reading and revise their groupings or sequences. Participants should pull sticky notes off if they don't match the framework reading and add sticky notes if something is missing. They may want to take another picture of their table at this point, before cards are added in the next part of the process.

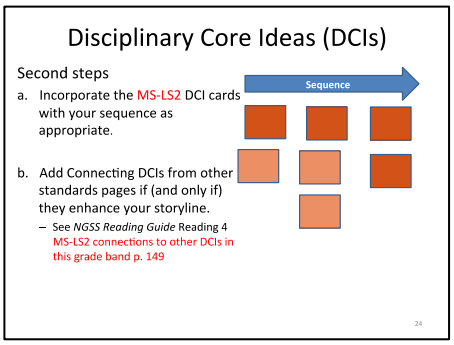
Slide and Time	Facilitation Notes
 Slide 21 (1 minute)	21. Note that representatives from the NGSS lead states used the Framework to develop the NGSS under the guidance of Achieve, Inc. At their most inclusive, the standards are defined by the PEs and foundation boxes. The PEs closely link the SEPs, DCIs, CCC, and Connections to the Nature of Science and Engineering, Technology, and Applications of Science. The numbering of the PEs does not imply order of instruction. Display **Slide 21 (Standards Page)**. Ask participants to review what they already know about the standards page. 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 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 22 (1 minute)	22. Display **Slide 22 (Standards Page)**. Share the language used by the authors of the Framework and the language that will be used throughout the session today. Disciplinary core ideas include the core ideas, component ideas, and elements. Distribute **R2 (NGSS V. 1)** and invite participants to turn to pp. 70-71 to review the standards that will be our focus during the session - see **HO2 (NGSS Reading Guide)** reading 3.
 Slide 23 (1 minute)	23. Remind participants that *one* of the goals and outcomes for today is to develop a blueprint for several instructional sequences that would make up a unit focused on MS-LS2 Ecosystems: Interactions, Energy, and Dynamics. Share with participants that to help them take full advantage of the NGSS, we've developed a card set for them to use as they craft their plans for instructional sequences. Display **Slide 23 (Standards Page).** 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.

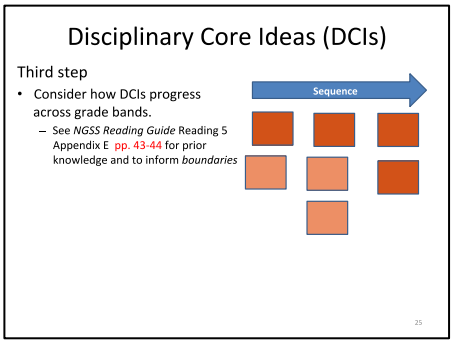
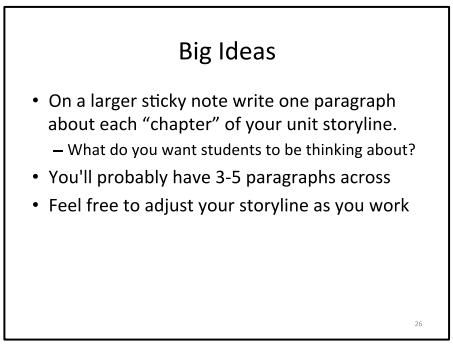
Slide and Time	Facilitation Notes
	PD Leader Note: You might forecast that they'll have a table full of cards and sticky notes by the end of the session.

PD Leader Note: Generally the pattern from this point in the process (2b through 2g) is for participants to 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.), read about the focus of the cards, and then 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 CCC in Part 2e. Prior to receiving cards, participants will predict which CCCs they think will be aligned with their instructional sequences.

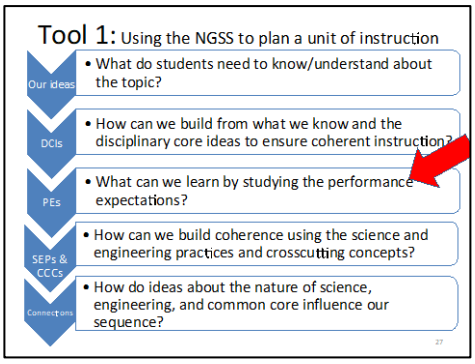
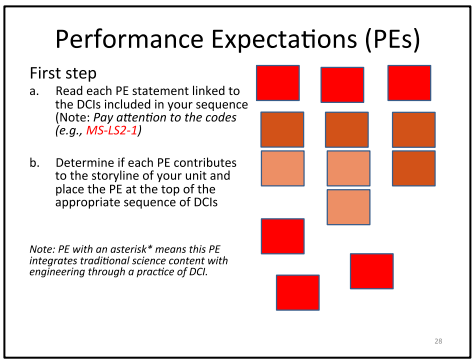
One of the goals of using the NGSS to design instruction is to develop a strong storyline about the science content to be taught through a sequence of lessons. Although the PEs, SEPs, and CCCs are all very important parts of the NGSS, creating a **strong conceptual flow** of science content ideas using the DCIs is needed in order to develop coherence in instruction. **Conceptual coherence** is how science ideas build upon each other within a sequence and across instructional sequences in a unit to help develop student 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 an instructional unit helps identify the different components of the NGSS that will later be used in Tools 3 and 4 to design a sequence of lessons.

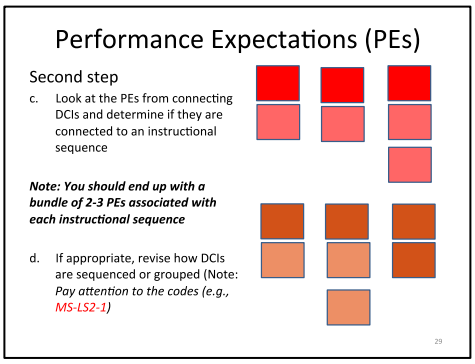
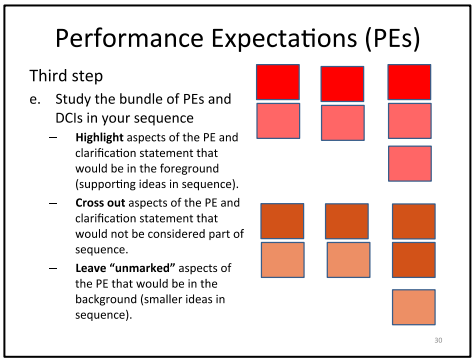
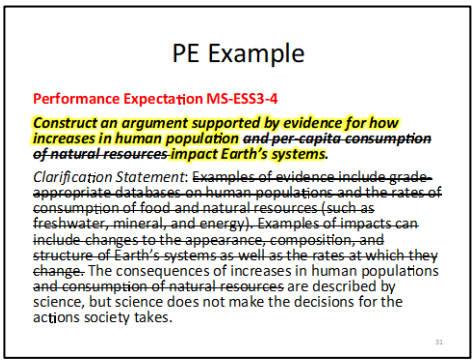
Slide and Time	Facilitation Notes
 Slide 24 (15 minutes)	24. Share with participants that we will look at how we can use the NGSS to help us think about sequencing ideas in a way to promote coherence in our teaching and students' learning. Distribute the **R4a (DCI card set)** and display **Slide 24 (Disciplinary Core Ideas (DCI))**. Note that the color on the card is orange to match the color of the DCI foundation box. Review the instructions the page. a. Have participants refer to the LS2 code and text on each card and invite them to scan the pages from the **R1 (NRC Framework)** for LS4D and ETS1B. b. Provide instructions for the first step of the task and distribute **R4b (Engineering/Design DCIs)**. Note that not all standards pages include engineering/design core ideas and elements. MS-LS2 includes this important aspect of the NGSS, so participants need to consider how this core idea fits with other core ideas on this standards page.

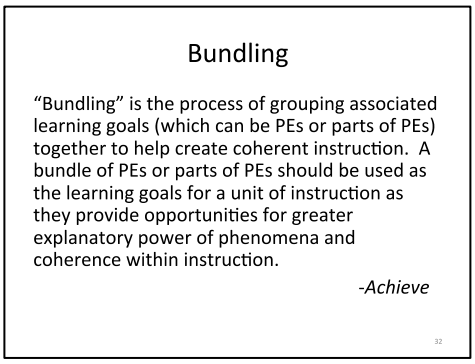
Slide and Time	Facilitation Notes
 Slide 25 (20 minutes)	**PD Leader Note:** In the second steps participants will begin to sequence the science concepts across a unit of instruction based not only their ideas, but also on the NGSS. Participants will sequence using their ideas on sticky notes and the main DCI cards. They will also consider connections to other component ideas and elements within this grade band from other standards pages. 25. Display **Slide 25 (DCIs).** Provide instructions for the second step of the task. a. 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 Tool 3. Model the incorporation of their ideas and DCI cards (elements) using the group identified earlier. Some options include: i. Place a DCI card (element) by putting the sticky note on the back of the card if it is a similar idea or a component of the DCI element on the card or placing it on the bottom of a DCI card if it's a "sub-idea." ii. Set a yellow sticky note aside if it does not fit. iii. Add ideas to fill gaps by writing ideas in complete sentences on a new yellow sticky note. **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 intend to promote strong connections across disciplines. Participants will be asked to think explicitly about elements from Connection DCIs (the card deck will include DCIs from other science disciplines in order to help promote a more integrated view of learning that is consistent with the NGSS). Refer to **HO2 (NGSS Reading Guide)** reading 4 and **R2 (NGSS V. 1).** Invite participants to find the footer on the bottom of each standards page where they will find the page number for the Connections. In this case, they'll find page

Slide and Time	Facilitation Notes
	149 in the footer of pp. 70-71. Distribute **R4c (Connection DCIs)** cards connected to this core idea and have participants add these elements as appropriate to their sequence. The elements from the connection DCIs are represented as "light" orange squares on the slide graphic. Have participants share their rationale for including DCI cards in the storyline of their instructional unit. Remind participants that not all of the Connection DCI cards will be used and that they should focus on those that help build conceptual coherence in their storyline. Blank cards can also be used here if a group feels strongly that an important connection DCI.
 Slide 26 (10 minutes)	26. Display **Slide 26 (DCIs).** Refer to **HO2 (NGSS Reading Guide)** reading 5 and **R3 (NGSS V. 2).** Note 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. In the third step, invite participants to review the MS-LS2 progressions and check to make sure that they have stayed within the boundaries described in the progression. They should also review progressions for any other core ideas included in their sequence. Ask participants to think about science ideas that belong in a different instructional sequence. **PD Leader Note**: Be prepared to share an example of a science idea that might be incorporated into a sequence that should be eliminated based on the progression. For example, a group may have included something about carrying capacities. This idea is to be developed in the 9-12 grade band. Note that given the early nature of this work, teachers might need to include ideas from an earlier grade band or anticipate that students come with more school experience related to an idea that comes in a later grade band. These practical aspects of planning for instruction will be considered more fully as part of Tool 4.
 Slide 27 (10 minutes)	27. Display **Slide 27 (Big Ideas)**. In order to check for coherence, participants should write brief paragraphs for each "chapter" or column of DCI cards and sticky notes that summarize the big ideas or gist of that sequence in the unit. Walk around to each table and encourage groups to talk through or unpack the ideas in each column to help them write these paragraphs. Some groups will require more support than others; encourage a group that is working successfully to share their work with a struggling group.

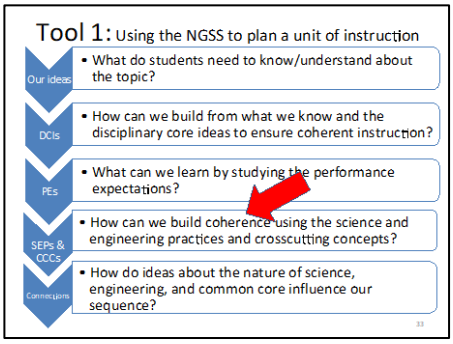
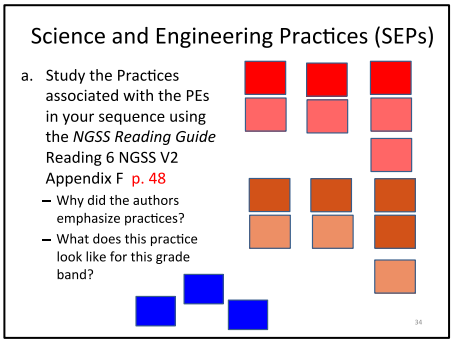
Part 2c. Performance Expectations (PEs) (60 minutes)

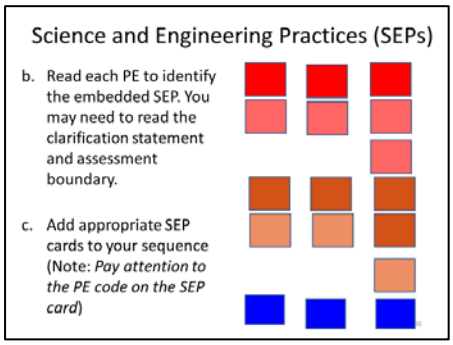
Slide and Time	Facilitation Notes
 Slide 28 (2 minutes)	28. We've considered our ideas and disciplinary core ideas. Now we move to thinking about PEs. Display **Slide 28 (Tool 1 Planning for Instruction)** and remind participants of where we are in the process. Possible narrative: *Performance expectations are the assessable statements of what students should know and be able to do* (NGSS V. 1 p. xxiii). *PEs are the hallmark of the NGSS. PEs guide assessment and "define" learning at the intersection/nexus of the dimensions. The PEs define what we want students to know and be able to do as the result of instruction. As such, the PEs serve a critical role in developing our instructional sequences. Remember, when we examined the conceptual shifts, we talked about the importance of bundling PEs to help ensure a coherent experience for students. Our process will help us bundle PEs.* Share with participants that we will begin by getting familiar with the PEs that are part of MS-LS2. We will consider the PEs associated with this standards page, but also PEs that are linked to the DCIs we pulled from other science topics that contributed to a coherent storyline. Remember, the NGSS promote a more integrated view of instruction that bundles PEs associated with more than one standards page.
 Slide 29 (20 minutes)	29. Display **Slide 29 (PEs).** Share with participants 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. Remember, the NGSS promote a more integrated view of learning science. Share all the instructions for incorporating the PEs into their instructional sequence and then invite them to work on their sequence. a. **First step** is to focus on PEs associated with MS-LS2. Participants will place one or more PE cards at the top of each instructional sequence or "chapter" that makes up their unit plan (as shown in the graphic) and revise their overall sequence as needed. Alternatively, participants may place their PE cards at the bottom of their sequence of DCIs to represent how the PE would drive assessment. The PE cards are represented in red at the top of the graphic on the slide. Note the significance of PEs with an asterisk (engineering PEs). If groups ask about wanting to place a PE card into two different sequences, provide them with a blank card.

Slide and Time	Facilitation Notes
 Slide 30 (15 minutes)	30. Display **Slide 30(PEs)** to show how the DCI cards might be moved to reflect how participants' thinking about the sequence is informed by the PE statements. a. **Second step** is to consider PEs that are linked to Connection DCIs. Each DCI is connected to at least one PE so our goal here is to consider <u>all PEs connected to the DCIs in our sequence</u>. Distribute **R4d (PEs).** Participants should note the code on the PE card as well as the red color. As an example, participants may have used the MS-ESS3.C DCI card in their sequence. Therefore, they need to pull the PE card for MS-ESS3.C. This code will tell them which PE is aligned to it. Participants must consider if this PE contributes to their storyline. Repeat this process to consider other connected DCIs and the aligned PEs in the sequence. Provide instructions for participants to revise the sequence or grouping of DCIs to improve their storyline
 Slide 31 (23 minutes)	31. Display **Slide 31 (PEs)** to provide instructions for "deconstructing" the PEs. For each bundle of 2-3 PEs, we need to identify which parts of the PE are part of the instruction and which parts are not in the storyline that you have developed.
 Slide 32	32. **Slide 32** (PE Example) is an Earth science PE that links to a connection 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. a. **Third step** is to highlight (foreground), leave unmarked (background), or cross out parts of each PE and clarifying statement to show how each PE contributes to the conceptual coherence of their sequence. **The next slide provides an example that can help clarify this process and a definition of bundling from Achieve.**

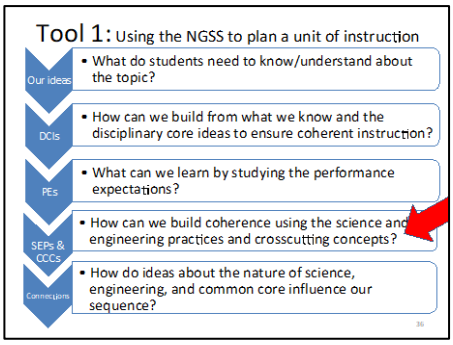
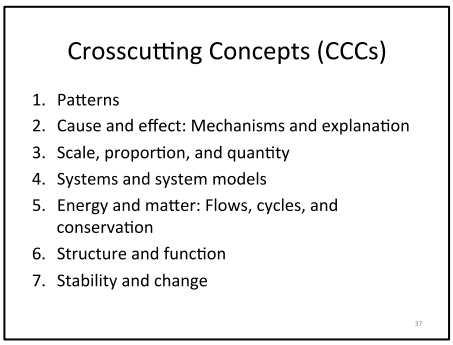
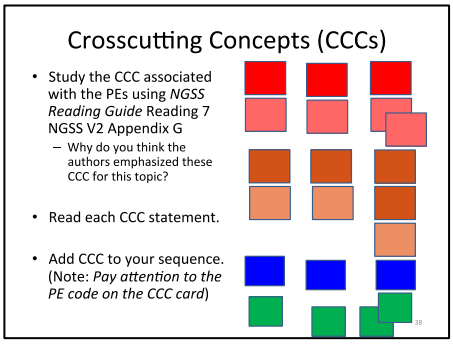
Slide and Time	Facilitation Notes
 Slide 33	33. To help participants think about bundling, display **Slide 33 (Bundling)** with a definition from Achieve. The example is taken from a PE that is associated with a connection DCI for MS-LS2. It provides an example of how to deconstruct a PE.

Part 2d Science and Engineering Practices (45 minutes)

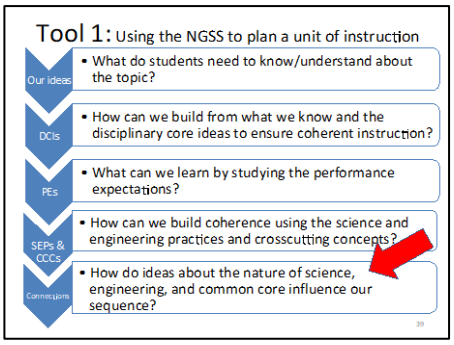
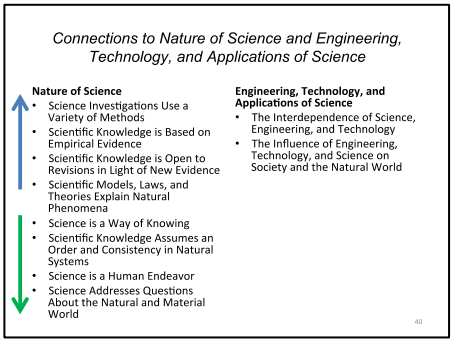
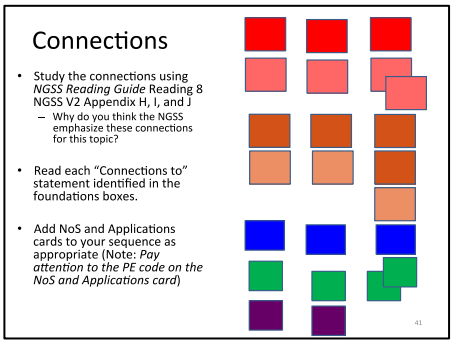
Slide and Time	Facilitation Notes
 Slide 34 (2 minutes)	34. Note that in addition to the DCIs and PEs, the NGSS includes Science and Engineering Practices and Crosscutting Concepts and we need to consider how these important aspects of the NGSS will be incorporated into out instructional sequences. Display **Slide 34 (Tool 1 Planning for Instruction)** to orient participants to where we are in the process. Possible narrative: *The NGSS fully intend that student learning experiences occur at the nexus of the dimensions. If this is how students will be assessed, then this is how students need to learn. In this next part of the process, we will consider how the SEPs and CCCs fit into our sequences.* **PD Leader Note**: This explicit reference to the nature of assessments, particularly high stakes assessments, may raise some issues for your participants. We know these issues exist and are in the minds of our teachers. Be sure to think about how you want to handle this conversation. Note that through Tool 2, we take an in-depth look at performance expectations and consider their role in classroom assessment.
	35. Display **Slides 35-36 (SEPs).** Provide instructions for the next part of the process. a.

Slide and Time	Facilitation Notes
Slides 35-36 (43 minutes)	
 Slides 35-36 (43 minutes)	To identify the embedded SEP, participants will need to refer to the SEPs chart (used in the Introduction) and read each full PE including the clarification statement and assessment boundary. 36. Once they've identified the embedded practices, participants will learn more about them. Refer to **HO2 (NGSS Reading Guide)** reading 6 for page numbers in Appendix F of **R3 (NGSS V. 2)**. They should keep the questions on the slide in mind as they read. If time permits, lead a whole group 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. Distribute the **R4e (SEPs)** card set and note the color code = blue. Invite participants to read each card. Using what has been learned from the reading and the PE codes on the SEP card, participants will add the SEP cards to their instructional sequence as appropriate. The SEP cards are represented in blue on the slide graphic.

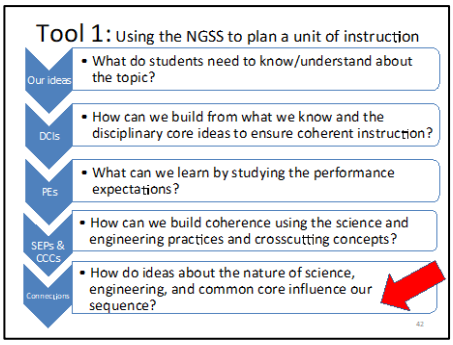
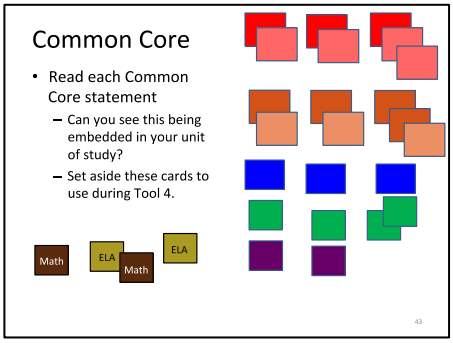
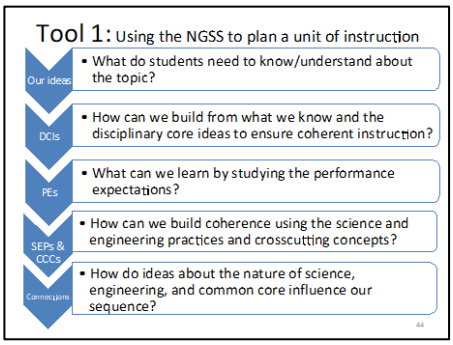
Part 2e Crosscutting Concepts (CCCs) (45 minutes)

Slide and Time	Facilitation Notes
 Slide 37 (2 minutes)	37. Display **Slide 37 (Tool 1 Planning for Instruction)**. Note the focus on incorporating crosscutting concepts (CCC) in this next phase of the process. **PD Leader Note:** The introduction to the CCC is slightly different from all other card sets. We invite participants to make a prediction of which CCCs will be included in their sequence. This prediction implies that they DO NOT look at the standards page to identify those included NOR do they get the card set before having an opportunity to make their predictions.
 Slide 38 (3 minutes)	38. Display **Slide 38 (CCCs).** Invite each small team to talk briefly about which CCC they would expect to be aligned with their instructional sequence noting that the authors of the NGSS tried to be very selective about which CCC to highlight for each core idea. Have participants predict which CCC would be in the foreground of this sequence. (For example, for MS-LS2 participants will likely identify systems and systems models as an expected CCC. However, this CCC is not included in the standards page.)
 Slide 39 (40 minutes)	39. Display **Slide 39 (CCCs).** Provide instructions for incorporating CCC into participants' instructional sequences. a. Distribute the **R4f (CCC card set)** and invite participants to read each card. Note the color code = green. b. Once they have identified the embedded CCCs, participants will learn more about them. Refer to **HO2 (NGSS Reading Guide)** reading 7 from Appendix G in **R3 (NGSS V. 2**). Participants should keep the question on the slide in mind as they read. c. Using what they learned from the reading and the PE codes on the CCC card, participants will add the CCC cards to their instructional sequence as appropriate. The CCC cards are represented in green on the slide graphic.

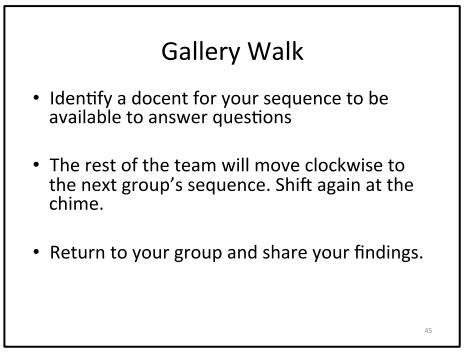
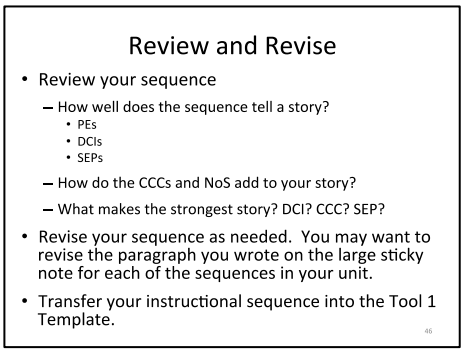
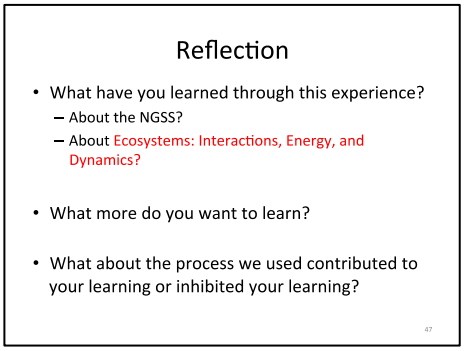
Part 2f Connections (30 minutes)

Slide and Time	Facilitation Notes
 Slide 40 (2 minutes)	40. Display **Slide 40 (Tool 1 Planning for Instruction)**. Note the focus on incorporating into their instructional sequences connections to the nature of science and engineering, technology, and applications of science in this next phase of the process.
 Slide 41 (5 minutes)	41. Display **Slide 41 (Connections**). The possible connections to the nature of science and engineering, technology, and applications of science are listed on this slide. Invite each small team to talk briefly about which Connections they would expect to be aligned with their instructional sequence noting that the authors of the NGSS tried to be very selective about which Connection to highlight for each core idea. **PD Leader Note:** The arrows on the slide indicate association with either SEPs or CCCs. The first four bullets in Nature of Science are associated with SEPs and would be found in the BLUE foundation box. The last four bullets are associated with CCCs and would be found in the GREEN foundation box.
 Slide 42 (23 minutes)	42. Display **Slide 42 (Connections).** Provide instructions for incorporating Connections into participants' instructional sequences. a. Distribute the **R4g (Connections)** card set and note the color code = purple. Note: The color choice is not part of the NGSS. Invite participants to read each card. b. Once participants have identified the connections, participants will learn more about them. Refer to **HO2 (NGSS Reading Guide)** reading 9 from Appendices H, I, and J in **R3 (NGSS V. 2**). As they read, participants should keep in mind the question in the sub-bullet: Why do you think the authors emphasized these connections for this topic? a. Using what they learned from the reading and the PE codes on the Connections cards, participants will add the Connections cards to their instructional sequence as appropriate. The Connections cards are represented in purple on the slide graphic.

Part 2g Common Core (10 minutes)

Slide and Time	Facilitation Notes
 Slide 43 (2 min)	43. Display **Slide 43 (Tool 1 Planning for Instruction)**. Note the focus on incorporating into their instructional sequences connections to common core in this next phase of the process. Possible narrative: *Many of you have explicit district directives to include the Common Core in your daily classroom practice. The NGSS are explicit as well.*
 Slide 44 (5 min)	44. Display **Slide 44 (Common Core)**. Explain to participants that at this time we will just look at the Common Core connections without adding them to our sequence. a. Distribute the **R4h (Common Core)** card set and invite participants to read each card with the question on the slide in mind. b. Participants should note the PE codes on the bottom of each card. In the graphic on the slide, notice that the highlighting of the math Common Core cards in brown and the ELA/literacy Common Core in yellow: the color choices are not part of the NGSS. **Participants should save these cards for when they get to Tool 4.** **PD Leader Note:** Be sure to keep these cards for use in Tool 4.
 Slide 45 (3 min)	45. Display **Slide 45 (Tool 1 Planning for Instruction)**. Note that we have completed the process associated with Tool 1. ***Transition:*** *For the past several hours, you've been working primarily in your individual teams and just as great science educators do, some have visited the work and thinking of others. We want to take advantage of this idea formally over the next few minutes. You'll take a walk to learn from others to look for similarities and differences and then return to your sequence for one final review. We also want to capture your instructional sequences electronically. We hope you'll take a photo of your work as well to remind you of the gist of the process—not that you are likely soon to forget!*

Part 3 Review and Complete Tool 1 (20 minutes)

Slide and Time	Facilitation Notes
 Slide 46 (10 min)	46. Display **Slide 46 (Gallery Walk)** and provide instructions for the gallery walk. Provide about 2-3 minutes for each round. Remind docents that they are there to respond to questions rather than to give a presentation. Remind the walkers that they will need to bring ideas back to their docent. Provide 5 minutes for the team 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' work.
 Slide 47 (8 min)	47. Display **Slide 47 (Review and Revise).** Invite teams to use what they learned to consider their own instructional sequence and make any revisions to their gist statements for each sequence. Once they have revised their sequence as needed, teams can capture their ideas in the electronic Tool 1 Template. It is recommended that teams use time outside of the Tool 1 session, before the session for Tool 2, to do this. Distribute **HO4 (Tool 1 Template Example - Unit Blueprint for MS-LS2)**. Have participants compare their organization to the blueprint. Share differences and commonalities. Share that they will need this handout for Tool 2. **Transition:** *I think it was John Dewey who said that we don't learn through experience, but rather we learn by reflecting on our experiences and that's the final part of our session today.*
 Slide 48 (2 min)	48. Display **Slide 48 (Reflection)** and invite participants to jot a few notes in response to the reflection questions and be prepared to share one idea. Gather a few ideas from the group.