

Advancing Tools and Processes for Next Generation Science

Model B: Planning for Instruction

Tool 4: Using the 5E Instructional Model to Design Learning Sequences

Introduction

In Tool 4, teachers use the storyline and conceptual flow based on the 5E model in Tool 3 and start to outline an instructional sequence. They apply each stage of the 5Es—engage, explore, explain, elaborate and evaluate—and think about what the teacher does and what the students do in each lesson of the instructional sequence, while continuing to focus on the three dimensions of the NGSS. Remember, the Tool 3 process is grounded in developing conceptual coherence through using the 5E Instructional Model. In Tool 4, teachers refine the 5E alignment of their instructional sequence by using Analysis Guides for each phase of the 5Es to “keep” or “tweak” activities so they support the three dimensions. Teachers consider existing resources and activities to inform the design of their instructional sequence and gain a deeper level of alignment with NGSS. Teachers also develop key questions for each activity focused on phenomena and the ideal student responses. The Tool 4 process helps teachers focus on the coherence and integrity of their sequence by examining how the activities they incorporate or adapt are consistent or inconsistent with the different phases of the 5E instructional model.

Goals and Outcomes:

- Develop a shared vision for science teaching and learning informed by the NGSS
- Deepen understanding of how Conceptual Flow, Storyline about Phenomena and the 5E Instructional Model support Three Dimensional Learning
- Use instructional materials and results of work with Tools 1, 2 Lite, and 3 to outline lessons for one 5E sequence that supports implementation of the NGSS

Prerequisite:

Participants should have experience using Tools 1- 3

Time and Purpose

- Part 1 Introduction** (Slides 1-4) [5 min]
Purpose: Provide an opportunity for participants to connect to one another and to the content of the day
- Part 2 Revisit Ms. Rivera and her Instructional Sequence** (Slide 5-9) [80 min]
Purpose: Consider coherence and alignment of instruction by using Tool 3 Conceptual Flow and Storyline with the 5E Instructional Model, and connecting the 5E instructional model to three-dimensional phenomenon-focused learning.
Summary: Participants revisit the Teacher B Scenario and the charts they created during their work with Tool 3. They consider how the storyline of the lessons builds student understanding of the three dimensions of the NGSS. They review what the teacher is doing and what the students are doing in each lesson in order to reinforce their understanding of alignment with each phase in the 5E Model.
- Part 3 Tool 4 Example** (Slides 10-14) [60 min]

Purpose: Checking for alignment with NGSS and the 5E Instructional Model.

Summary: Participants compare Ms. Rivera's Tool 4 Example with what they charted and co

ded for each lesson. They practice using an Analysis Guide on an activity.

Part 4 Design a Learning Sequence Using Tool 4 and the Analysis Guides (Slides 15-17) (155 min)

Purpose: Identify, analyze, and revise activities to match specific phases of the BSCS 5E Instruction Model.

Summary: Participants are provided time to review activities aligned with their developed conceptual flow from Tool 3 and the BSCS 5E Instructional Model. They capture their work in the electronic Tool 4 Template.

Total Time = 300 min (5 hours)

Materials:

Tool 4

- Tool 4 Electronic Template
- 3x3 Sticky notes: orange, blue, green and purple (one set of each color per group)
- Markers
- Connections to Common Cards from Tool 1 deck (yellow for ELA/Literacy and brown for Mathematics).

Handouts

- HO 1 5E Instructional Model: Teachers and Students
- HO 2 Tool 4 Example Template
- HO 3 Analysis Guides for 5E Instructional Model
 - a. Engage
 - b. Explore
 - c. Explain
 - d. Elaborate
 - e. Evaluate
- HO 4 Disruptions in Ecosystems Activity 1.2

Resources (Optional for this session)

- 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

Charts

- Charts from Tool 3 Session: Teacher B Scenario

Slides

- Slide 1 Advancing Tools and Processes for Next Generation Science
- Slide 2 Planning for Instruction: Model B Graphic
- Slide 3 Goals
- Slide 4 How Will We Accomplish These Goals?
- Slide 5 Ms. Rivera
- Slide 6 Tool 4
- Slide 7 Linking to the NGSS
- Slide 8 Alignment with the 5E Model
- Slide 9 Connection to Tool 3
- Slide 10 Tool 4
- Slide 11 Ms. Rivera’s Tool 4 Example
- Slide 12 Steps for Completing Tool 4
- Slide 13 Using Analysis Guides
- Slide 14 Using Analysis Guides
- Slide 15 Steps for Completing Tool 4
- Slide 16 Share your Work
- Slide 17 Reflection

PD Leader Resources (NOT used by participants)

- *Assessment-Centered Teaching: A Reflective Practice* (2008), DiRanna, Osmundson, Topps, Barakos, Gearhart, Cerwin, Carnahan, & Strang, Corwin Press, Thousand Oaks, CA.
- The BSCS 5E Instructional Model: Origins and Effectiveness (pp. 113-184) in BSCS | Measuring Our Success: The First 50 Years of BSCS
<http://www.bscs.org/estore/bcs-measuring-our-success-first-50-years>

**Advance
Preparation**

- Communicate with participants prior to the session. Suggest that they bring a computer so they can access their Tool 1 Unit Blueprint, their Tool 2 EoLS, and their Tool 3 Storyline and Conceptual Flow.
- Print and copy Handouts.
- During Tool 1, participants were told to set aside their Connections to Common Core cards (for ELA/Literacy and Mathematics). In this session the cards to work with are from the MS-LS2 card deck. If participants used another card deck for Tool 1, they should bring the additional Common Core cards to this session as well.
- Be sure you have the following:
 - Participants' marked up copies of Teacher B Scenario from Tool 3 as well as their charts from each lesson in the scenario displayed in the room.
 - Participants' instructional materials and other resources

Part 1 Introduction (Slides 1-4) [5 min]

Slide and Time	Facilitation Notes
<div style="border: 1px solid black; padding: 10px;"> <p style="text-align: center;">Advancing Tools and Processes for Next Generation Science Planning for Instruction</p> <p style="text-align: center;">Tool 4: Using the 5E instructional model to design learning sequences</p> </div> <p>Slide 1 (1 min)</p>	<p>1. Display Slide 1 (Five Tools & Processes for NGSS)</p> <p><i>Facilitation Note: Begin the session with participants in their working groups from the previous session - it is best if you have 7 groups working on the Lessons from Tool 3.</i></p> <p>Welcome participants to the session.</p>
<div style="border: 1px solid black; padding: 10px;"> <p style="text-align: center;">Planning for Instruction</p> <p style="text-align: center;">Five Tools and Processes For Translating the NGSS Into Instruction and Classroom Assessment</p> </div> <p>Slide 2 (1 min)</p>	<p>2. Display Slide 2 (Planning for Instruction: Model B Graphic)</p> <p>Briefly remind participants of the project and focus of the Five Tools and Processes, and introduce Tool 4 as the focus of the session today.</p>
<div style="border: 1px solid black; padding: 10px;"> <p style="text-align: center;">Goals</p> <ul style="list-style-type: none"> • Develop a shared vision for science teaching and learning informed by the NGSS • Deepen understanding of how Conceptual Flow, Storyline about Phenomena and the 5E Instructional Model support Three Dimensional Learning • Use instructional materials and results of work with Tools 1, 2 and 3 to outline lessons for one 5E sequence that supports implementation of the NGSS </div> <p>Slide 3 (1 min)</p>	<p>3. Display Slide 3 (Goals)</p> <p>Review the Goals of the session with participants.</p>

Slide and Time	Facilitation Notes
<div> <p>How Will We Accomplish These Goals?</p> <p>Use Our Storyline about Phenomena and Conceptual Flow</p> <p>Use the 5E Instructional Model</p> <p>to design an instructional sequence aligned to the NGSS DCIs, SEPs, CCCs, and Connections</p> </div> <p>Slide 4 (2 min)</p>	<p>4. Display Slide 4 (How will we accomplish these goals?)</p> <p>Provide a frame for the session. Provide link to goals and previous Tools. This slide is animated.</p> <p><i>Possible narrative:</i> The goal is to design a coherent instructional sequence aligned with one part of your work from Tools 1 and 2 and based on a combination of Conceptual Flow, Storyline and the 5E Instructional Model we studied together in Tool 3.</p> <p>So how will we pull together all these ideas? As we work today, we'll revisit Ms. Rivera's classroom and end the session by using Tool 4 to help us. Keep in mind that our intention is to have you analyze the alignment and coherence of her sequence that you worked on in Tool 3 so you can apply that thinking to your work.</p>

Part 2 Revisit Ms. Rivera and her Instructional Sequence (Slide 5-9) [80 min]

Slide and Time	Facilitation Notes
<div> <p>Ms. Rivera</p> <ul style="list-style-type: none"> • What do you think Ms. Rivera considered as she planned for instruction and during instruction? </div> <p>Slide 5 (5 min)</p>	<p>5. Display Slide 5 (Ms. Rivera)</p> <p>In a Think-Pair-Share, ask participants to recall Ms. Rivera's scenario (provide HO to anyone who doesn't have theirs) and the charts they created in the last session and discuss the prompt on the slide.</p> <p>Chart the group's ideas and use their ideas in to build on in the next slide.</p>
<div> <p>Tool 4</p> <p>Slide 6 (5 min)</p> </div>	<p>6. Display Slide 6 (Tool 4). The purpose of this slide is to show an overview of the components of Tool 4.</p> <p>Explain that Tool 4 has two parts. Part 1 and Part 2. Participants will investigate throughout the session how Ms. Rivera used these two parts of Tool 4 to plan her instruction. Where possible, link to participants' ideas from Slide 5.</p> <p>Share with participants that in Part 1 of Tool 4, Ms. Rivera identified foundational ideas, such as the NGSS dimensions and PEs addressed in the sequence and resources.</p> <p>This slide is animated. Then in Part 2, she developed used her conceptual flow from Tool 3 to serve as the "backbone" for</p>

Slide and Time	Facilitation Notes
	<p>instruction – considering what students are doing and what the teacher is doing for her lessons.</p> <p>She used the conceptual flow to select appropriate activities from her resources (including her instructional materials) in the 5E sequence to develop a coherent storyline for learning.</p> <p>We'll begin with a focus on Part 2 of the Tools and dissecting Ms. Rivera's work by focusing on the charts we created in Tool 3 (point to charts on wall).</p>
<div style="border: 1px solid black; padding: 10px;"> <p style="text-align: center;">Linking to the NGSS</p> <ul style="list-style-type: none"> • As a group, review the lesson you charted from Ms. Rivera's 5E sequence • Use colored sticky-notes to code for evidence in your chart of NGSS alignment <ul style="list-style-type: none"> – DCIs (orange) – SEPs (blue) – CCCs (green) – Connections to NOS and ETAS (purple) </div> <p>Slide 7 (30 min)</p>	<p>7. Display Slide 7 (Linking to the NGSS).</p> <p>Remind participants that instruction should align with the NGSS.</p> <p>Ask groups to follow the prompts on the slide. Allow participants to do a gallery walk after they code. Share out some "noticings."</p>
<div style="border: 1px solid black; padding: 10px;"> <p style="text-align: center;">Alignment with 5E Model</p> <ul style="list-style-type: none"> • Read over the handout to learn about what is consistent and what is inconsistent with the 5E model. Review what the teacher is doing and what the students are doing. • Go back to your chart and underline key words or phrases that signal the "E" the lesson is aligned with. </div> <p>Slide 8 (30 min)</p>	<p>8. Display Slide 8 (Alignment with the 5E Model)</p> <p>Distribute HO1 (5E Instructional Model: Teachers and Students). Give participants a couple of minutes to look over the handout (both sides).</p> <p>Share with participants that we want to look for key language that helps us identify alignment with each phase of the 5Es. Tell them to revisit their chart again; this time instead of coding for NGSS language, they should look for signals that help them identify the phase ("E").</p> <p>Note: Participants may need to go back into the Teacher B scenario text and add some language to their chart.</p>
<div style="border: 1px solid black; padding: 10px;"> <p style="text-align: center;">Connections to Tool 3</p> <ul style="list-style-type: none"> • Remember the phenomenon. • Review the storyline and anchoring events for the instructional sequence. • Remember each activity included a guiding question <p>All of these ideas will help select or adapt activities as you complete Tool 4</p> </div> <p>Slide 9 (10 min)</p>	<p>9. Display Slide 9 (Connection to Tool 3)</p> <p>As a whole group, revisit the Tool 3 Template Example. Remind participants of the phenomenon. Review the storyline column with anchoring events. Remember that each activity included a guiding question to help scaffold the learning process over the 5E instructional sequence. All of these ideas will help participants select or adapt activities as they complete Tool 4.</p>

Part 3

Tool 4 Example

(Slides 10-14) [60 min]

Slide and Time	Facilitation Notes																																
<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Tool 4</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 20%;">Part 1</th> <th colspan="3">Part 2</th> </tr> <tr> <th>Title</th> <th>What teachers are doing</th> <th>What students are doing</th> <th>Science Concepts</th> </tr> </thead> <tbody> <tr> <td>Key Resources</td> <td></td> <td></td> <td></td> </tr> <tr> <td>SEP, DCI, CCC</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Connections</td> <td></td> <td></td> <td></td> </tr> <tr> <td>PEs</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Prior Knowledge</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Common Student Ideas</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p style="text-align: right; margin-right: 20px;">NGSS</p> </div> <p style="margin-top: 10px;">Slide 10 (5 min)</p>	Part 1	Part 2			Title	What teachers are doing	What students are doing	Science Concepts	Key Resources				SEP, DCI, CCC				Connections				PEs				Prior Knowledge				Common Student Ideas				<p>10. Display Slide 10 (Tool 4). Distribute HO2 (Tool 4 Template Example).</p> <p>Share with participants that they should look over the front matter of Ms. Rivera’s Tool 4 (Part 1).</p> <p>Ask participants to share out where they think Ms. Rivera found the information to complete each section of Part 1.</p>
Part 1	Part 2																																
Title	What teachers are doing	What students are doing	Science Concepts																														
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Common Student Ideas																																	
<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Ms. Rivera’s Tool 4 Example</p> <ul style="list-style-type: none"> Find the section of Ms. Rivera’s Tool 4 Example that your group charted Review the Connections to Common Core cards for ELA/Literacy and Mathematics you set aside during Tool 1 How does your chart compare to what Ms. Rivera wrote in Tool 4? </div> <p style="margin-top: 10px;">Slide 11 (15 minutes)</p>	<p>11. Display Slide 11 (Ms. Rivera’s Tool 4 Example).</p> <p>Review the directions on the slide with participants. Based on the Ms. Rivera lesson each group charted, instruct each group to find the corresponding section for the same lesson in the Tool 4 Example.</p> <p>Participants should review the Connections to Common Core cards for ELA/Literacy and Mathematics that were first shared during Tool 1 and set aside until now. Identify the ELA/Literacy and Mathematics connections cards that align with the PEs for this instructional sequence.</p> <p>Note: Look for Common Core cards aligned with MS-LS2-2. There are five ELA/Literacy cards and one Mathematics card that align.</p> <p>Tell the participants to compare their charts with the Tool 4 Example.</p>																																
<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Steps for Completing Tool 4</p> <ol style="list-style-type: none"> 1. Brainstorm/Identify activities/prompts/ investigations from your instructional materials. 2. Use the Analysis Guides to decide to keep, tweak, or delete activities/prompts/ investigations to support your NGSS aligned conceptual flow 3. Enter your work electronically on Tool 4 </div> <p style="margin-top: 10px;">Slide 12 (2 min)</p>	<p>12. Display Slide 12 (Steps for Completing Tool 4)</p> <p>Review the steps for completing Tool 4 with participants. Remind them that they need to keep in mind alignment with both NGSS and the 5E Instructional Model.</p> <p>Share with participants that BSCS has developed Analysis Guides for each “E” in order to help us check for alignment. We will practice using one together.</p>																																

Slide and Time	Facilitation Notes
<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Using Analysis Guides</p> <ul style="list-style-type: none"> • Identify <ul style="list-style-type: none"> – What activities/prompts/investigations do I have related to the concept and “E”? • Analyze <ul style="list-style-type: none"> – How well does the “current” activity • Revise <ul style="list-style-type: none"> – Can I use the resource in the development of my 5E instructional sequence? <ul style="list-style-type: none"> • Keep it • Tweak it • Get rid of it – How will I use the resources for this phase of the 5E instructional sequence? </div> <p>Slide 13 (10 min)</p>	<p>13. Display Slide 13 (Using Analysis Guides)</p> <p>Provide an overview of the process used in each Analysis Guide represented by Identify, Analyze, and Revise:</p> <p>Identify-brainstorm or find activities and prompts that could be used in instruction;</p> <p>Analyze-determine the worthiness of the activity or prompt for instruction and ideas/evidence to inform revisions to the activity</p> <p>Revise-modify the activity or prompt as needed to better align with the NGSS learning.</p> <p>Remind participants that design is an iterative process and they will likely revise their concept statements, activities, and even conceptual flow as they continue to work.</p> <p>Distribute HO3 (Analysis Guides). Orient participants to the pages for each E, using the Explore as an example. Share with participants that:</p> <ul style="list-style-type: none"> -all of the guides follow the same format -there are two major analysis for each phase: page 2 has questions that determine the characteristics of the activity that would determine its worthiness of further analysis; page 3 has questions to analyze the depth of student thinking required by the activity -guides include prompts to revise the activity to align with the 5Es and the NGSS
<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">Using Analysis Guides</p> <ul style="list-style-type: none"> • Identified “E”-- Explore • Identified Concepts <ul style="list-style-type: none"> – Food webs can represent patterns of feeding relationships among organisms in an environment. – Cause and effect relationships represented in a food web may be used to predict phenomena. • Sample Activity • Work in your group using the Explore Analysis Guide to determine if you would keep, tweak or get rid of the activity • Share your thinking </div> <p>Slide 14 (28 min)</p>	<p>14. Display Slide 14 (Using Analysis Guides).</p> <p>Distribute HO4 (Disruptions in Ecosystems Activity 1.2).</p> <p>Participants should turn to the Explore section of their Analysis Guide. Share with participants that this is the activity Ms. Rivera used for her first Explore lesson in her 5E instructional sequence.</p> <p>Give participants time to use the Explore Analysis Guide to analyze and discuss the activity.</p>

Part 4 Design a Learning Sequence (Slides 15-17) (155 min)

Slide and Time	Facilitation Notes
<div style="border: 1px solid black; padding: 10px; margin-bottom: 10px;"> <p style="text-align: center;">Steps for Completing Tool 4</p> <ol style="list-style-type: none"> 1. Brainstorm/Identify activities/prompts/ investigations from your instructional materials. 2. Use the Analysis Guides to decide to keep, tweak, or delete activities/prompts/ investigations to support your NGSS aligned conceptual flow 3. Enter your work electronically on Tool 4 </div> <p>Slide 15 (120 min)</p>	<p>15. Display Slide 15 (Steps for Completing Tool 4)</p> <p>Remind participants of how Ms. Rivera’s activities and prompts were aligned with the “E” and the concept for that phase. She had to consider her storyline about phenomena and her conceptual flow aligned with the NGSS to think about what the students and what she would be doing for each lesson. Then she had to go through a process to identify/brainstorm activities, analyze them to see if they fit her needs, and then revise them to better align. Participants will go through a similar process.</p> <p>Explain that participants now have 2 hours to complete the process for their 5E sequence.</p> <p>Ask groups to identify/brainstorm activities from their instructional materials that are aligned with their conceptual flow and the appropriate “E.” Remind them to keep in mind the Connections to Common Core ELA/Literacy and Mathematics as necessary.</p> <p>Suggest that groups work on charts to keep their thinking public. When they have completed their thinking, they can enter the information electronically into Tool 4.</p> <p>Walk around and monitor table discussions. If necessary, remind participants to</p> <ul style="list-style-type: none"> • Review their PE, Evidence of Learning Specs, and DCIs, CCCs, and SEPs from their Tool 1 Template • Access their instructional materials <p>Note: Once participants work through an Analysis Guide for each E, they should summarize their activities in the Tool 4 Template. For example, once participants have decided to use an activity from their instructional materials, they should capture common misconceptions identified in the top part of the Tool 4 Template. They should capture their ideal student responses in the “What students are doing” column in the appropriate Phase of the Tool 4 Template.</p>

Slide and Time	Facilitation Notes
<p style="text-align: center;">Share your Work</p> <ul style="list-style-type: none"> • Partner with another group and share what you have been working on. • Before sharing, let the other group know specifically what you might want feedback on. <p>Slide 16 (30 min)</p>	<p>16. Tell participants that they will now have an opportunity to check in with another group in the room. Display Slide 16 (Share your Work).</p> <p>Pair up groups to share with each other. If groups have struggled, an alternative option is to have one group present to everyone.</p>
<p style="text-align: center;">Reflection</p> <ul style="list-style-type: none"> • What is one thing you want to remember about aligning instruction with the NGSS? • What is one thing you want to remember about using the Analysis Guides to plan instruction? <p>Slide 17 (5 min)</p>	<p>17. Display Slide 17 (Reflection)</p> <p>Congratulate groups on finishing Tool 4. Ask them to reflect on the process.</p>

Planning for Use of the Five Tools and Processes

At this point, it is important to allow time for participants to develop a plan on how to continue their work with the Five Tools. As you conclude the work on Tool 4, remind them that the purpose of this professional learning experience was to help them develop understanding of the process for developing a unit of instruction that is aligned with three-dimensional teaching and learning. Allow time for groups to develop an action plan for continuing their work. If there are teams that can continue working together in professional learning communities (PLCs), encourage them to spend this time planning when and how they will work. If the participants will not be working together in the future, consider allowing individual planning time or time to discuss ideas with others who are in similar positions. This can help them develop their ideas for sharing the process with others.