**NGSS 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.

**Goal and Outcome:**
- 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

**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.  
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 coded 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 Teacher/Student |
| 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 |
| HO 5 | BSCS Activity 1.2 |

**Resources (Optional for this session)**

| 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: Five Tools & Processes for NGSS
- Slide 2: Five Tools and Processes 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)
- 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/bscs-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. They should also bring instructional materials and resources they references in their Tool 3 templates.
- 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]

Purpose: Provide an opportunity for participants to connect to one another and to the content of the day.

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<thead>
<tr>
<th>Slide and Time</th>
<th>Facilitation Notes</th>
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</table>
| Slide 1 (1 min) | **1. Display Slide 1 (Five Tools & Processes for NGSS)**  
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.  
Welcome participants to the session. |
| Slide 2 (1 min) | **2. Display Slide 2 (Five Tools and Processes Graphic)**  
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. |
| Slide 3 (1 min) | **3. Display Slide 3 (Goals)**  
Review the Goals of the session with participants. |
### Part 1

#### How Will We Accomplish These Goals?
- Use our Storyline about Phenomena and Conceptual Flow
- Use the 5E Instructional Model
to design an instructional sequence aligned to the NGSS DCIs, SEPs, CCCs, and Connections

### Facilitation Notes

4. **Display Slide 4 (How will we accomplish these goals?)**

Provide a frame for the session. Provide link to goals and previous Tools. This slide is animated.

_Possible narrative:_ The goal is to design a _coherent_ instructional sequence aligned with one part of your work from Tools 1 and 2 and based on your Conceptual Flow, Storyline and the 5E Instructional Model we studied together in Tool 3.

As we work today, we’ll begin by revisiting Ms. Rivera’s classroom. Keep in mind that our intention is to have you analyze the alignment and coherence of her sequence so you can apply that thinking to your work later in the session.

### Part 2

#### Revisit Ms. Rivera and her Instructional Sequence

(Slide 5-9) [80 min]

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| Slide 5 (5 min) | 5. **Display Slide 5 (Ms. Rivera)**

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.

Chart the group’s ideas and use their ideas in to build on in the next slide. |

| Slide 6 (5 min) | 6. **Display Slide 6 (Tool 4).** The purpose of this slide is to show an overview of the components of Tool 4.

Explain that participants will investigate throughout the session how Ms. Rivera used Tool 4 to plan her instruction. Where possible, link to participants’ ideas from Slide 5.

Share with participants that in Part 1 of Tool 4, Ms. Rivera listed the NGSS addressed in the sequence and considered things like resources, prior knowledge and common student ideas.

Then in Part 2, she developed used her conceptual flow from Tool 3 to serve as the “backbone” for instruction – considering what students are doing and what the teacher is doing for her lessons. |
<table>
<thead>
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<tbody>
<tr>
<td>She used the anchor phenomena and conceptual flow to select appropriate activities from her resources (including her instructional materials) in the 5E sequence to develop a coherent storyline for learning.</td>
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<tr>
<td><strong>Slide 7 (30 min)</strong></td>
<td>7. Display <strong>Slide 7 (Linking to the NGSS)</strong>. Remind participants that instruction should align with the NGSS. Ask groups to follow the prompts on the slide. Allow participants to do a gallery walk after they code. Share out some “noticing.”</td>
</tr>
<tr>
<td><strong>Linking to the NGSS</strong></td>
<td></td>
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</tbody>
</table>
| • 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  
  – DCIs (orange)  
  – SEPs (blue)  
  – CCCs (green)  
  – Connections to NOS and ETAS (purple) |  |
| **Slide 8 (30 min)** | 8. Display **Slide 8 (Alignment with the 5E Model)**  
Distribute HO1 (5E Teacher/Student). Give participants a couple of minutes to look over the handout (both sides). 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”). Note: Participants may need to go back into the Teacher B scenario text and add some language to their chart. |
| **Alignment with 5E Model** |  |
| • 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. |  |
| **Slide 9 (10 min)** | 9. Display **Slide 9 (Connection to Tool 3)**  
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. |
| **Connections to Tool 3** |  |
| Tool 3 helped you develop the storyline. Tool 4 will help you develop the instructional sequence that will help you teach that storyline.  
As you use Tool 4,  
• Keep the phenomenon in mind at all times.  
• If an idea is not related to the phenomenon, it is distracting.  
• Do not include activities or ideas just because they are “interesting.”  
• Review the storyline often.  
• Include guiding questions for each activity. This will help you and your students stay focused. |  |
Part 3  Tool 4 Example (Slides 10-14)  [60 min]

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<td>Slide 10 (5 min)</td>
<td>10. Display <strong>Slide 10 (Tool 4)</strong>. Distribute HO2 (Tool 4 Template Example). Share with participants that they should look over the front matter of Ms. Rivera’s Tool 4 (Part 1). Ask participants to share out where they think Ms. Rivera found the information to complete each section of Part 1.</td>
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<tr>
<td>Slide 11 (15 minutes)</td>
<td>11. Display <strong>Slide 11 (Ms. Rivera’s Tool 4 Example)</strong>. 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. 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. Note: Look for Common Core cards aligned with MS---LS2---2. There are five ELA/Literacy cards and one Mathematics card that align. Tell the participants to compare their charts with the Tool 4 Example.</td>
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<tr>
<td>Slide 12 (2 min)</td>
<td>12. Display <strong>Slide 12 (Steps for Completing Tool 4)</strong>. 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. 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.</td>
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**Ms. Rivera’s Tool 4 Example**
- 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?

**Steps for Completing Tool 4**
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
13. Display **Slide 13 (Using Analysis Guides)**

Provide an overview of the process used in each Analysis Guide represented by Identify, Analyze, and Revise:

**Identify**-brainstorm or find activities and prompts that could be used in instruction;

**Analyze**-determine the worthiness of the activity or prompt for instruction and ideas/evidence to inform revisions to the activity

**Revise**-modify the activity or prompt as needed to better align with the NGSS learning.

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.

Distribute **HO3 (Analysis Guides)**. Orient participants to the pages for each E, using the Explore as an example. Share with participants that:

- 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

14. Display **Slide 14 (Using Analysis Guides)**.

Distribute **HO4 (Disruptions in Ecosystems Activity 1.2)** to half the group, and **HO5 (BSCS Activity 1.2)** to the other half. Participants should turn to the Explore section of their Analysis Guide. Share with participants that these are the activities Ms. Rivera considered for her first Explore lesson in her 5E instructional sequence.

Give participants time to use the Explore Analysis Guide to analyze and discuss the activity with their expert group. Then return to mixed small groups so that both activities are represented and share about their experience.
### Part 4  Design a Learning Sequence Using Tool 4 and the Analysis Guides (Slides 15-17) [155 min]

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| **Steps for Completing Tool 4** | 15. Display **Slide 15 (Steps for Completing Tool 4)**
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.

16. Explain that participants now have 2 hours to complete the process for their 5E sequence.
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.

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.

Walk around and monitor table discussions. If necessary, remind participants to

- Review their PE, Evidence of Learning Specs, and DCIs, CCCs, and SEPs from their Tool 1 Template
- Review their EoLS from Tool 2 for their sequence
- Access their instructional materials
- Note that once they 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.

| Slide 15 (120 min) | }
17. Tell participants that they will now have an opportunity to check in with another group in the room. Display **Slide 16 (Share your Work).**

Pair up groups to share with each other. If groups have struggled, an alternative option is to have one group present to everyone.

<table>
<thead>
<tr>
<th>Share your Work</th>
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<tbody>
<tr>
<td>• Partner with another group and share what you have been working on.</td>
</tr>
<tr>
<td>• Before sharing, let the other group know specifically what you might want feedback on.</td>
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</table>

**Slide 16 (30 min)**

<table>
<thead>
<tr>
<th>Reflection</th>
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<tbody>
<tr>
<td>• What is one thing you want to remember about aligning instruction with the NGSS?</td>
</tr>
<tr>
<td>• What is one thing you want to remember about using the Analysis Guides to plan instruction?</td>
</tr>
</tbody>
</table>

18. Display **Slide 17 (Reflection)**

Congratulate groups on finishing Tool 4. Ask them to reflect on the process.

**Slide 17 (5 min)**