Three-Dimensional Science Instructional Planning Template User's Guide

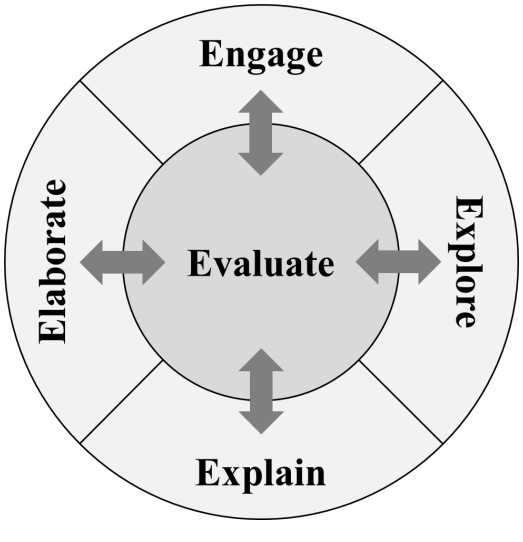
Science is a way of understanding the physical universe using observation and experimentation to explain natural phenomena. Science also refers to an organized body of knowledge that includes core ideas to the disciplines and common themes that bridge the disciplines. As science educators we must take a three-dimensional approach in facilitating student learning. By addressing content (Disciplinary Core Ideas, DCIs), science and engineering practices (SEPs), and crosscutting concepts (CCCs), students can have relevant and evidence-based instruction that can help solve current and future problems.

This document is intended to support teachers in their instructional planning to meet the South Carolina College- and Career-Ready Science Standards 2021 (Science Standards) Performance Expectations (PEs). The instructional planning templates provided in this resource do not supersede a district's instructional model or planning requirements. Instead, these are meant as a scaffold for teachers when thinking about planning for three-dimensional science instruction. These are flexible documents that can be edited, as needed, to best suit the needs of teachers, schools, and districts across South Carolina.

The Instructional Planning Templates follow the BSCS 5E Instructional Model (Bybee, et al., 2006). This model was selected for these templates as it is the most commonly utilized instructional model across the State Adopted Instructional Materials for the Science Standards. The 5 phases (Engage, Explore, Explain, Elaborate, Evaluate), or "Es," of the model facilitate conceptual change in learners' scientific understanding. Similar to other learning cycle practices, effectiveness is supported by the following tenants (Bybee, et al., 2006):

- All phases of the model must be included in instruction, and the explore phase must come before the explain phase.
- The specific instructional format may be less important than including all phases of the model, but the doing of science (in the exploration phase) is more effective for many students, provided it is followed by discussion (explanation).
- Student attitudes toward science instruction are more positive when they are allowed to explore concepts through investigation before discussing them.

The 5E Instructional Model is not necessarily a linear process, although that is often the simplest way to scaffold instructional planning templates. A more accurate model is presented below.



Effective incorporation of all 5Es takes time, and often will happen across multiple class meetings. Thus, to best implement this model of instruction, it is helpful to think of "lessons" as the culmination of the learning process, not necessarily the block of time during the instructional day identified for science instruction. This template also includes a 6th "E", Extension, to allow for planning of enrichment, reflection, and/or remediation opportunities as needed.

Table 1. The BSCS 5E Instructional Model: Teacher and Student

5Es	What the Teacher is doing…	What the Student is doing…

Engage	• create interest
	• generate curiosity
	• elicit responses that uncover what students know or think about the phenomenon
		• generate questions such as
		  ○ why did this happen?
		  ○ what do I already know about this?
		  ○ what do I need to figure out to explain this?
		• express interest

Explore	• encourage students to work collaboratively without direct instruction • observe and listen to students as they interact • ask probing questions to redirect student investigations when necessary • allow time for students to grapple with phenomena/problems	• think freely but within limits of the investigation • form/revise predictions and claims • test predictions and claims • try alternatives and discuss them with peers • record observations and ideas
Explain	• encourage students to explain concepts and definitions in their own words (after Explore) • require evidence (justification) and clarification from students • formally provide definitions, explanations, and/or model components • use students' prior experiences as basis for explaining concepts	• explain possible claims/solutions to peers • listen to peers' and other claims/solutions • question peers' and other explanations • listen to/comprehend explanations offered by teacher • refer to prior experiences • use recorded observations in explanations/claims

Elaborate	• strategies from Explore also apply here
	• expect students to use formal model components, definitions, and/or explanations
	• encourage students to apply and extend the concepts and skills in novel situations
	• remind students about existing data and evidence
	  ○ what do you already know?
	  ○ why do you think …?
		• apply model components, definitions, explanations, and/or skills in novel but similar situations
		• use prior information to
		  ○ ask questions
		  ○ propose solutions/claims
		  ○ make decisions
		  ○ design investigations
		• draw reasonable conclusions from evidence
		• record observations and claims
		• check for understanding with peers

Evaluate	• observe students as they apply new concepts and skills
	• assess student knowledge and/or skills
	• collect evidence that students have changed/grown in their thinking
	• allow students to assess their own learning
	• ask open-ended questions
	  ○ why do you think …?
	  ○ what evidence do you have?
	  ○ what do you know about [x]?
	  ○ how would you explain [x]?
		• answer open-ended questions using
		  ○ observations
		  ○ evidence
		  ○ previously accepted explanations
		• demonstrate understanding of the concepts and/or skills
		• self-evaluation of progress and knowledge
		• ask related questions to drive future investigations

3-Dimensional Instructional Planning Template

Grade/Content/Course: This is already filled out in the grade/content templates. Link to the Performance Target document provided.	**Phenomenon:** This is where you can write in a brief description or link to the phenomenon for this instructional plan.	**Lesson length (# of class meetings)** _____ 5E "lessons" are rarely completed in a single class meeting, so it is often more helpful to think of lesson length in terms of class meeting numbers.

Brief Lesson Description: This is a space for you to record a brief description of your lesson. Could include information like where this lesson falls in your instructional sequence, teacher-needed background information for the SEPs, DCIs, or CCCs, overview of how this lesson builds toward a bundle of aligned PEs, etc. There is more detailed lesson information on the next page.

Specific Learning Outcome(s): This is a space to record your specific learning outcome(s) for this lesson. Best practice is to write your learning outcome(s) as lesson-level Performance Expectations, following the general format of the Science Standards. Every outcome should begin with practice (what are students DOING, SEP) then followed by content (what are students LEARNING, DCI) and crosscutting concept. The SCDE Instructional Resources Page has Vertical Articulations for each dimension, this can be a useful starting place in selecting the specific lesson-level learning students need to achieve. These are hyperlinked in the boxes for each dimension.

Narrative / Background Information

Prior Student Knowledge: How does this learning connect to students' prior learning in your course? What have they learned/encountered before your course in academic and non-academic settings? How will you scaffold experiences for students who have more limited prior knowledge?

Intentionally Developed Science & Engineering Practice(s):	**Intentionally Developed Disciplinary Core Idea(s):**	**Intentionally Developed Crosscutting Concept(s):**
This is where the SEPs are already listed for ease of alignment. These are "checkboxes" so you can check off which specific SEPs students are working toward in this instructional plan. Remember, students need rich experience with multiple SEPs to achieve the end of instruction goals (PEs) as outlined in the Science Standards. Each item includes a hyperlink to the Vertical Articulation for that SEP.	This is where the DCIs are already listed for ease of alignment. The DCIs listed here are <u>specific</u> to the grade/course/content listed at the top of the template. These are also checkboxes in the editable versions. Each item includes a hyperlink to the Vertical Articulation for that DCI.	This is where the CCCs are already listed for ease of alignment. These are "checkboxes" so you can check off which specific CCCs students are working with in this instructional plan. Remember, students need rich experience with multiple CCCs to achieve the end of instruction goals (PEs) as outlined in the Science Standards. Each item includes a hyperlink to the Vertical Articulation for that CCC.

Possible Preconceptions: This is a space to record possible preconceptions students have about each of the dimensions addressed in this lesson. This is more than just misconceptions, or incorrect understandings of scientific ideas. Often, students have a rudimentary scientific understanding before they encounter learning in the classroom. It is important to make note of these preconceptions so that learning can be scaffolded to help students achieve a more scientific world view.

INSTRUCTIONAL PLAN – 5E Model This template follows the 5E model. Some suggestions/starting points are included in the boxes. One consideration is to think through what students are doing/saying and what facilitators are doing/saying during each phase.

ENGAGE: Opening Activity – Access Prior Learning / Stimulate Interest / Generate Questions:

EXPLORE: Lesson Description – Materials Needed / Probing or Clarifying Questions:

EXPLAIN: Concepts Explained and Terminology Defined:

Terminology:

ELABORATE: Applications and Extensions:

EVALUATE:

Formative Monitoring (Questioning / Discussion/Informal Data Collection):

Summative Assessment (Quiz / Project / Report):

EXTEND: Enrichment/Reflection/Remediation

Links to Templates

- Kindergarten
  - Word Document (download)
  - Google Doc (force copy)
- First Grade
  - Word Document (download)
  - Google Doc (force copy)
- Second Grade
  - Word Document (download)
  - Google Doc (force copy)
- Third Grade
  - Word Document (download)
  - Google Doc (force copy)
- Fourth Grade
  - Word Document (download)
  - Google Doc (force copy)
- Fifth Grade
  - Word Document (download)
  - Google Doc (force copy)
- Sixth Grade
  - Word Document (download)
  - Google Doc (force copy)
- Seventh Grade
  - Word Document (download)
  - Google Doc (force copy)
- Eighth Grade
  - Word Document (download)
  - Google Doc (force copy)
- Biology 1
  - Word Document (download)
  - Google Doc (force copy)
- Biology 2
  - Word Document (download)
  - Google Doc (force copy)
- Anatomy and Physiology
  - Word Document (download)
  - Google Doc (force copy)
- Chemistry
  - Word Document (download)
  - Google Doc (force copy)
- Physics
  - Word Document (download)
  - Google Doc (force copy)
- Earth and Space Science
  - Word Document (download)
  - Google Doc (force copy)

References

Bybee, R.W., Taylor, J.A., Gardner, A., Van Scotter, P., Powell, C., Westbrook, A., and Landers, N. (2006). *The BCSC 5E Instructional Model: Origins and Effectiveness*. BCSC. Colorado Springs, CO.

Bybee, R.W. (2014). The BSCS 5E Instructional Model: Personal Reflections and Contemporary Implications. *Science and Children*. Retrieved from https://www.nsta.org/journals/science-and-children/science-and-children-aprilmay-2014/guest-editorial-bscs-5e