

Carbon TIME Professional Development Module 4

The final portion of the [Carbon TIME Professional Development Course of Study](#) includes two components: support for teachers while they are teaching *Carbon TIME* units in their schools and Module 4, focusing on working with teachers to reflect on and learn from their teaching experience, as well as a dive into other *Carbon TIME* tools and resources.

Professional support networks are an opportunity for the coaching stage of teachers' cognitive apprenticeship, through teachers' participation in professional learning communities and classroom instructional observations.

Professional Development Module 4 Goals

Carbon TIME Professional Development Course of Study Goals				
	Goal 1: Understanding Three-Dimensional Learning and Carbon TIME Curriculum	Goal 2: Preparing to Teach Carbon TIME Units	Goal 3: Learning from Classroom Experiences and Student Work	Goal 4: Creating and Sustaining Supportive Professional Communities
Time to enact (or apply) what teachers have learned in Modules 1, 2, (and 3) to Classroom Practice				
Things to do while teaching unit(s)				
<p>Teaching Practice assessing and scaffolding students' three-dimensional engagement with phenomena.</p> <p>Work on Teaching Practice enacting plans and using tools in classrooms.</p> <p>Collect data, including examples of classroom discourse and student work, to analyze and discuss.</p>				
Time to reflect and make modifications				
Digging Deeper Sessions	Coaches teachers toward developing more sophisticated and specific understandings of the 3-dimensional engagement around natural phenomena.	Coaches teachers as they use their combined knowledge to plan for intentional revisions in their teaching practice.	Coaches teachers as they learn from their teaching experiences and student discourse, work products, and assessment data.	Provides an opportunity for teachers to work together to determine ways in which to improve science teaching and learning in their local context.

Module 4 Introduction and Overview

This module includes four sessions, each exploring a particular aspect of *Carbon TIME* in greater depth: unit reflections, classroom discourse, studying student work, and three-dimensional assessment. Teachers use examples and data collected while they were teaching *Carbon TIME* units for additional coaching and reflection, as well as exploring Educator Resources available in the *Carbon TIME* library, some of which were not linked in the first three modules.

Digging Deeper Sessions	Reflecting on Teaching (3 hours)	Rigorous and Responsive Classroom Discourse (3 hours)	Studying Student Work (3 hours)	Purposes of Carbon TIME 3D Assessments (3 hours)
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Activities for Module 4, Reflecting on Teaching

- Use a [Teacher Target Performance Tool](#) (available in Professional Development Module 3) to engage teachers in a reflective discussion of a completed *Carbon TIME* unit, including activity chunks; student target performances; assessing tools and strategies; and scaffolding tools and strategies.
- Use a **4-quadrant chart** to reflect on unit teaching experiences: Successes; Challenges; Suggestions; Questions.

- Have teachers use sticky notes or colored markers to reflect and share. Then discuss together as a group about overall reflections on teaching the completed unit, and how these take-away's can inform teaching future *Carbon TIME* units.
- **Use other reflective prompts** to engage teachers in a discussion of how students' knowledge and practice changed over the course of the unit, and how this can inform future instruction.
 - *What did you notice about how your students' knowledge and practice concerning [the unit's driving question] changed over the course of the unit?*
 - *How did students' ideas change? How did their engagement in science and engineering practices change? How did their use of crosscutting concepts – using the rules of matter and energy conservation and scale – change?*
 - *How can you use these noticings to plan instruction for the next Carbon TIME unit? For the next time you teach this Carbon TIME unit?*
- **Discuss Carbon TIME as a toolkit** (not a script) for supporting students' three-dimensional engagement with phenomena.
 - Use the [Cognitive Apprenticeship Educator Resource](#) to explore the learning theory used in *Carbon TIME* unit design; cognitive apprenticeship is an approach to meaningful learning of difficult practices.
 - Use the [Carbon TIME Instructional Model](#) to identify and review general cognitive apprenticeship phases in *Carbon TIME* units.
 - Use the [Strategies for Sustaining Rigor and Responsiveness in Carbon TIME](#) Educator Resource to identify essential features of *Carbon TIME* lessons.
 - Use the specific Unit Instructional Model and Storyline Chart (available through the “IM & Storyline” tab of the Unit Homepage or in the [Unit-Specific Resources section](#) of the *Carbon TIME* Library) as well as the Unit Sequence (available through the “Unit Sequence” tab) to identify and review specific cognitive apprenticeship phases in one *Carbon TIME* unit.
 - Use these to reflect on teaching choices, including the use of repeating activities and/or 1-turtle and 2-turtle activities, as well as within-activity options such as Exit Tickets, optional readings, etc.
 - Discuss together:
 - What instructional choices supported your students' three-dimensional engagement with phenomena?
 - What choices might you make differently as you use the unit toolkit again?

Activities for Module 4, Rigorous and Responsive Classroom Discourse

Rigorous and responsive classroom discourse is at the center of teaching for environmental science literacy.

1. Read and discuss [Strategies for Sustaining Rigor and Responsiveness in Carbon TIME](#).
2. Select a *Carbon TIME* activity around a Process Tool involving a complete *Carbon TIME Discourse Routine*.
 - a. Prepare for in-person instructional observations by peers or prepare to record classroom discourse through audio or video recordings, depending on local permissions and resources. Preparing transcripts of classroom discourse (even just a few minutes) can support the review and study described here.
3. Prepare for, engage in, and reflect on classroom-discourse-related discussions using tools such as the [Carbon TIME Discourse Reflection Tool](#) and the [Protocol for Critical Friends Groups around Carbon TIME Classroom Discourse](#).
 - a. Prepare: Complete the Preparation Column of the [Carbon TIME Discourse Reflection Tool](#): *What was the goal of the discussion? What key ideas arose? Identify a central question or dilemma that you'd like to discuss with your colleagues.*

- b. Prepare: Review the [Protocol for Critical Friends Groups around Carbon TIME Classroom Discourse](#). A protocol is a set of directions to follow when having a group conversation around classroom discourse. Protocols are helpful in focusing teacher talk around review and probing questions; your school, district, or professional community may have other protocols to use, as well.
 - c. Engage: Plan for about 30 minutes of discussion per teacher. Use the [Protocol for Critical Friends Groups around Carbon TIME Classroom Discourse](#).
 - d. Engage: During (or immediately after) the engagement, the teacher presenter should record important points from the discussion in Column 2 – Feedback Column of the [Carbon TIME Discourse Reflection Tool](#).
 - e. Reflect: After the group conversation, the teacher presenter should complete Column 3 – Reflection Column of the [Carbon TIME Discourse Reflection Tool](#).
4. The [Talk and Writing Educator Resource](#) provides additional information about specific language that teachers can use during instructional talk and writing in ways that coordinate with *Carbon TIME* unit design around the *Carbon TIME* Instructional Model.
 5. The [Teachers Make a Difference in Carbon TIME Educator Resource](#) provides specific examples of what teachers in classrooms with high student learning gains are actually doing and saying.
 - a. Review these examples in comparison with your own classroom discourse and experiences.

Activities for Module 4, Studying Student Work

Studying student work provides insight into students' ideas and supports teachers in assessing and then scaffolding students' three-dimensional performances.

1. In advance, save selected student work from the unit in order to study students' roles as explainers or investigators.
 - a. Focus on students as Explainers by collecting a few students' Expressing Ideas and Questions Tools; Explanations Tools; Explaining Other Examples; Functions for all.
 - b. Focus on students as Investigators by saving a few students' Predictions & Planning Tools; Evidence-Based Arguments Tools; Explaining Other Examples, Part A.
2. Teachers can independently review and reflect on student learning using a variety of approaches.
 - a. Select one student whose thinking and engagement as an explainer or investigator changed over the course of the unit.
 - i. What are the student's ideas on [Activity/Tool] at the beginning of the unit?
 - ii. What are the student's ideas on [Activity/Tool] at the end of the unit?
 - iii. Describe where in the student's work you see evidence of an increase in the level of sophistication (a change from informal to scientific language).
 - iv. What do you think supported this student's learning?
 - v. What instructional strategies could further advance this student's understanding?
 - b. Select and compare two students' thinking and engagement at the end of the unit, either using a final explanations sample (Explaining Other Examples) or a final investigations sample (Explaining Other Examples, Part A).
 - i. What is student A's ideas on [Activity/Tool] at the end of the unit?
 - ii. What are student B's ideas on [Activity/Tool] at the end of the unit?
 - iii. Compare responses from Student A and Student B. What is similar about their thinking?
 - iv. Compare responses from Student A and Student B. What is different about their thinking?

- v. What instructional strategies could further advance these students' understandings?
3. Teachers can review and discuss student work together using shared (de-identified) student work samples and the [Carbon TIME Studying Student Work Tool](#) or other tools that support teachers in identifying and considering students' ideas.
 - a. Use 3-5 samples of de-identified student work (digital or paper) from *Carbon TIME* Process Tools; we suggest the Explanations Tools or final explanations (Explaining Other Examples).
 - b. Complete the [Carbon TIME Studying Student Work Tool](#) individually to identify the students' learning progression levels; evidence of understanding; gaps in understanding; and instructional strategies that might advance student understanding. Then, share and discuss ideas as a group.
4. Review the *Carbon TIME* Students' Learning Progressions Reading (located in the [Unit-Specific Resources section](#) of the *Carbon TIME* Library) for a unit-specific overview of the *Carbon TIME* learning progression research on which the curriculum is based. Learning progressions are descriptions of the informal and then successively more sophisticated (scientific) ways that students reason about phenomena.
5. Professional support networks of teachers with more *Carbon TIME* teaching experience (for example, in their second year or beyond), may be ready to dig *even* deeper into studying and reflecting on student work by engaging together around a conversation protocol that supports teacher participant engagement in a shared learning experience.
 - a. Use the [Protocol for Carbon TIME Studying Student Work Conversations](#).
 - b. Prepare: Identify an area of interest to study and collect student work. After reviewing student work, identify a purpose for the study. Use the [Carbon TIME Studying Student Work Conversations Teacher Preparation worksheet](#) for suggestions.
 - c. Engage and Reflect: Plan on 50 minutes of discussion for each teacher sharing student work samples. Follow the [Protocol for Carbon TIME Studying Student Work Conversations](#). The Teacher and Participants will need [Carbon TIME Studying Student Work Conversations Participant Tools](#).

Activities for Module 4, Carbon TIME Assessment Purposes

Carbon TIME assessment purposes include accountability, insight into students' ideas, and students' self-assessment, all centered around *Carbon TIME*'s three-dimensional target performances and assessments.

1. Use the [Purposes of Assessment in Carbon TIME Educator Resource](#) to read about using *Carbon TIME* tools for three major assessment purposes.
 - a. Use the table on the second page – Designed Purposes of *Carbon TIME* Assessment Tools and their Discourse Routines – to notice how these assessment purposes can be met at different stages throughout a unit.
 - b. Select a unit and discuss unit assessment purposes together. For example, identify places in a unit where students have opportunities for self-assessment and discuss.
2. Use the [Three-Dimensional Learning in Carbon TIME Educator Resource](#) (also listed in Module 1) to review the *Next Generation Science Standards*' three dimensions in *Carbon TIME*, as well as students' three-dimensional roles as Questioners, Investigators, and Explainers. See the [PD Module 1 PowerPoint](#) (with notes) – from PD Module 1 – to support connections between the NGSS and *Carbon TIME*.
 - a. Identify the three dimensions in one or more of the *Carbon TIME* Process Tools (Expressing Ideas & Questions Tool; Predictions and Planning Tool; Evidence-Based Arguments Tool; Explanations Tools). This [STEM Teaching Tools NGSS Bookmark](#) may be helpful to use for this kind of “large-grain-size” dimensional analysis.

- i. What are the Science and Engineering Practices (SEPs)? *What are students doing?*
 - ii. What content – Disciplinary Core Ideas (DCIs) – are students using? *What do students know?* or *What are students figuring out?*
 - iii. What Crosscutting Concepts (CCCs) are students using? *What rules and principles are students using in their thinking and reasoning?*
- b. Identify the three dimensions in a *Carbon TIME* unit pre/posttest item cluster. Pre/posttests for each unit are available through the *Carbon TIME* [Assessment site](#).
- i. Use the Assessing the pretest and Grading the posttest documents to support your work and also to explore common and goal student responses.

Returning to Module 1

As described in the [Carbon TIME Professional Development Module 1](#), we recommend regularly revisiting the PD Course of Study's Driving Question: *How do I support my students in three-dimensional engagement with natural phenomena, in order for them to achieve environmental science literacy?*

- Have teachers review and update their ideas and questions.
- See the [Using a Driving Question Board Educator Resource](#) for support.