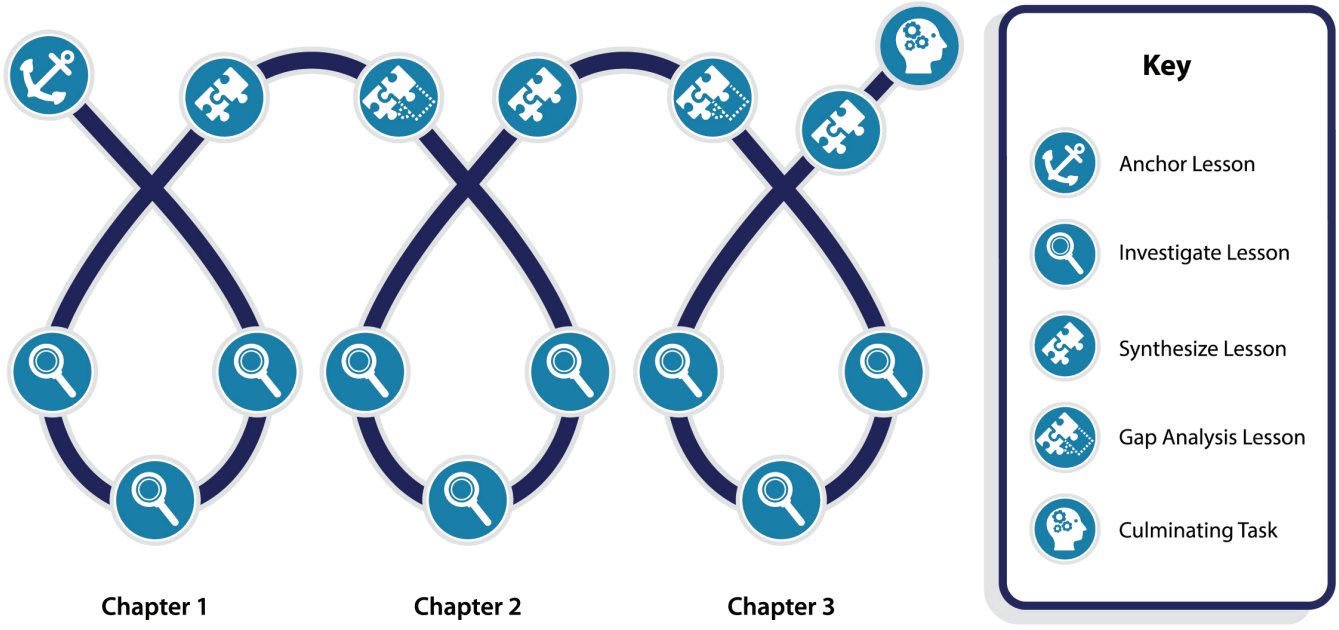
ANCHORED INQUIRY LEARNING

Lesson Types and Unit Structure

Every Anchored Inquiry Learning (AIL) unit is composed of lessons that are sequenced in a predictable pattern. These types of lessons are reminiscent of other problem-based and inquiry-based approaches in science, but a new feature of AIL is how we sequence the lessons in a way that leads to richer and deeper learning over multiple inquiry cycles. This focus on sequencing lessons into multiple inquiry cycles is reflected in other NGSS instructional models, such as the OpenSciEd model, Next Generation Science Storylines project, and Inquiry Hub.

An AIL unit begins with an Anchor Lesson and ends with a Culminating Task Lesson. Throughout the unit, students engage in multiple inquiry cycles (loops) consisting of Investigate Lessons. The Synthesize Lessons and Gap Analysis Lessons are key moments in the instructional sequence when students recognize progress made and remaining limitations in understanding. Thus, Synthesize Lessons occur at the culmination of an inquiry cycle, while Gap Analysis Lessons coincide with the launch of a new chapter to re-engage students with a new aspect of the anchoring phenomenon or problem.



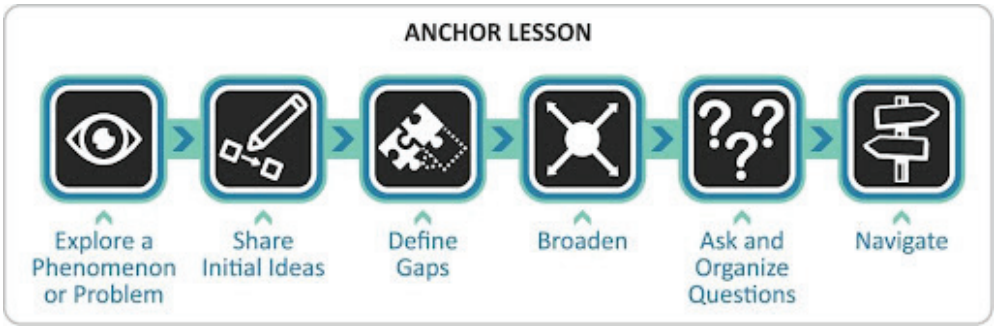
Let's look more closely at each kind of lesson in this model to see how the AIL Routines are used in the lesson and how your instructional practices may look different when you start to use AIL in your classroom.

Anchor Lesson

An anchoring phenomenon is a real-world phenomenon, design challenge, or socioscientific issue that provides the context for the unit. It is introduced at the beginning of the unit and consistently returned to throughout the unit. The anchoring phenomenon lesson ("anchor" for short) motivates a "need to know" and sparks student interest and curiosity about the anchoring phenomenon and related phenomena. The lesson should create a sense of puzzlement for students that leads them to ask questions. The Anchor Lesson is also an opportunity for you to get a sense for what students already understand about the phenomenon that can be leveraged throughout the unit.

Anchor Lesson Routines. While every Anchor Lesson may be a bit different, there is a set of routines useful in setting up the learning experience. These include

- Exploring a phenomenon or problem
- Sharing initial ideas from what we already know
- Defining gaps in what we understand to motivate further investigation
- Drawing upon or broadening prior experiences and knowledge
- Asking, organizing, and answering questions
- Navigating between activities and lesson to maintain coherence and continuity



What do you and your students do in the Anchor Lesson?

What Students Do	What Teachers Do
» Engage in observation and experiences with the phenomenon, design challenge, or socioscientific issue. » Develop initial models, explanations, or design solutions leveraging prior knowledge, experiences, and what students know about related phenomena. » Identify gaps in understanding and areas of agreement and disagreement. » Ask questions and/or define problems and articulate the evidence needed to answer these questions.	» Give students an experience with the phenomenon, design challenge, or socioscientific issue. » Elicit students' prior knowledge that they can bring to the study of this new phenomenon by helping them develop an initial model, explanation, or solution. » Help students to identify and connect to related phenomena or problems. » Use students' initial models to problematize that there is more to investigate to better explain the phenomenon or design a solution. » Help students to articulate productive questions, organize these questions, and link the questions to specific kinds of evidence that would be helpful for answering them.

Investigate Lessons

Investigate Lessons engage the class in shared experiences that provide a common base through which students can explore their current conceptions about a natural phenomenon or engineering problem. In these lessons, students generate or gather evidence that can be used to develop explanations or design solutions, add to models, engage in argumentation or communication, and generate new questions. They apply new ideas to related phenomena as a way to generalize the idea further.

Investigate Lesson Routines. While every Investigate Lesson may be a bit different, there is a set of routines useful in setting up the learning experience. These include

- Navigating between activities and lesson to maintain coherence and continuity
- Gathering evidence, which includes planning and carrying out evidence-gathering tasks
- Generating an explanation, model, argument, or solution from evidence
- Generalizing science ideas we've figured out to explain related phenomena
- Reflecting on our learning progress and process

What do you and your students do in an Investigate Lesson?

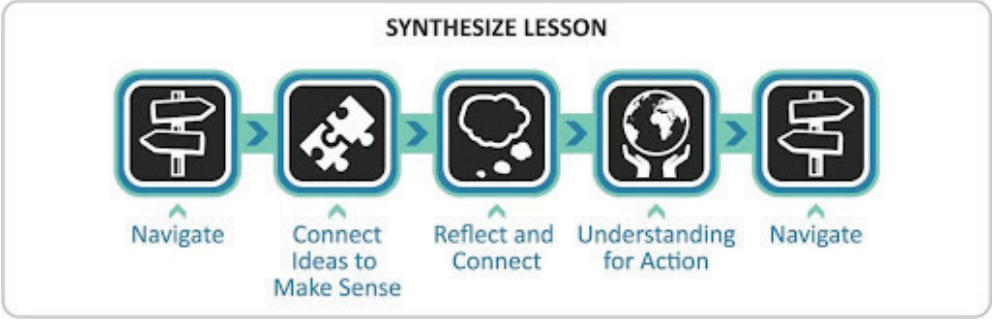
What Students Do	What Teachers Do
» Conduct investigations to test predictions and hypotheses. They form new predictions and hypotheses from the evidence. » Record observations and ideas from investigations and use them in explanations and when designing solutions. » Construct new knowledge as a result of experiences that allow them to add to or revise their understanding of the phenomenon or problem. » Ask new questions based on the evidence collected in investigations. » Apply ideas to new phenomena to see if they explain or don't help to explain those phenomena.	» Encourage students to work together without direct instruction from the teacher (promotes culture of academic discourse); teacher facilitates student-to-student discourse. » Observe and listen to students as they interact. » Ask probing questions to redirect students' investigations. » Provide time for students to puzzle through problems and act as a consultant for students. » Encourage students to explain concepts in their own words. » Facilitate student discussions focused on sensemaking and using evidence from the investigation. » Ask for justification (evidence) and clarification from students. » Use students' previous experiences as the basis for explaining concepts. » Provide guidance, when necessary, on best practices with lab safety and data collection and organization.

Synthesize Lessons

Synthesize Lessons happen at key moments in instruction when the class has figured out several important science ideas to explain the anchoring phenomenon or problem. These lessons focus on consensus building among students, helping them to make connections between ideas and using their emerging knowledge to revise an explanation or model of the phenomenon or to propose or revise solutions.

Synthesize Lesson Routines. The hallmark of the Synthesize Lessons is the engagement in collaborative sensemaking and consensus building. Therefore, these lessons ask students to engage with the following kinds of routines:

- Navigating between activities and lesson to maintain coherence and continuity
- Connecting ideas to make sense, which may involve
  - generating an explanation, model, argument, or solution from evidence and/or
  - generalizing science ideas we've figured out to explain related phenomena
- Reflecting on our learning progress and process
- Applying understanding to plan for or carry out actions towards solutions (optional, depending on the unit focus)



What do you and your students do in a Synthesize Lesson?

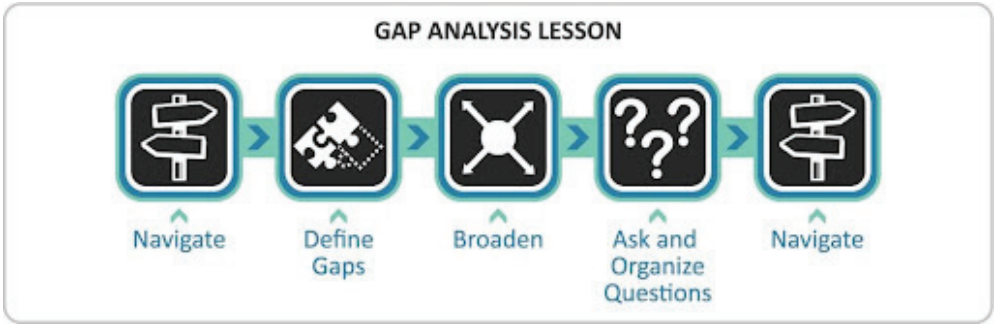
What Students Do	What Teachers Do
» Revise and refine their models, explanations, or solutions to include new or different ideas that help them explain the phenomenon. » Engage in refinement of ideas using evidence-based argumentation. » Construct an explanation for the phenomenon or problem or aspect of the phenomenon or problem.	» Navigate and motivate the students into and out of the lesson. » Observe and listen to students as they interact. » Facilitate evidence-based discourse and guide the students toward consensus. » Ask for justification (evidence) and clarification from students. » Ask questions to encourage students to connect what they are learning to the anchor. » Help students identify where there are areas of agreement or disagreement. » Facilitate a representation of the class's shared thinking. » Encourage students to ask more questions and acknowledge what they still need to learn to fully explain the phenomenon.

Gap Analysis Lessons

A Gap Analysis Lesson gives students an opportunity to recognize limitations in their own understanding and motivates the need for additional information or evidence. In many ways, these lessons act similarly to an Anchor Lesson because they spark an additional "need to know." Therefore, these lessons tend to coincide with the beginning of a new inquiry cycle to re-engage students with a new aspect of the anchoring phenomenon or problem.

Gap Analysis Lesson Routines. Given the similarity to Anchor Lessons, some of the same routines often appear in this kind of lesson, including

- Navigating between activities and lesson to maintain coherence and continuity
- Defining gaps in what we understand to motivate further investigation
- Drawing upon or broadening prior experiences and knowledge to expand our thinking
- Asking, organizing, and answering questions



What do you and your students do in a Synthesize Lesson?

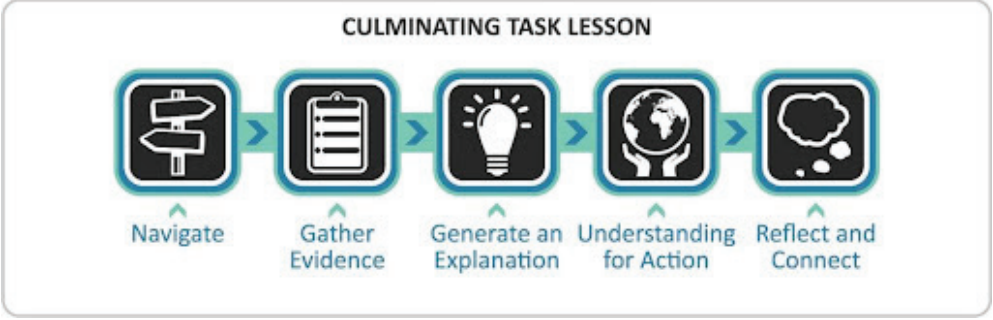
What Students Do	What Teachers Do
» Evaluate the adequacy of their existing knowledge to explain a phenomenon or problem. » Examine data or information that reveals gaps in their understanding or that raises new questions for investigation. » Assess what ideas they are not sure about and pose questions that can be investigated further. » Evaluate what parts of their existing knowledge can help explain a phenomenon.	» Create space for students to assess what it is they understand and what they do not. » Help to focus students on an aspect of the phenomenon or problem that cannot be fully explained by students' existing understanding. » Foster additional student questioning and document any new data or information students suggest they would need to answer the new questions they have. » Use awareness of the target disciplinary core ideas and what students have figured out and what is left to be learned to advance students' thinking. Use awareness of crosscutting concepts as a lens to advance students' thinking. » Help to redefine the class's new shared mission given what students have figured out and what they still need to investigate further.

Culminating Task

The Culminating Task Lesson allows students to use their revised model, explanation, or design ideas to explain a relevant and meaningful related phenomenon or to propose a solution to a relevant and meaningful problem associated with the unit societal issue.

Culminating Task Lesson Routines. Depending on the complexity of the task, the routines in this kind of lesson may vary. They could include

- Navigating between activities and lesson to maintain coherence and continuity
- Exploring a phenomenon or problem (optional)
- Gathering evidence, which includes planning and carrying out evidence-gathering tasks
- Generating an explanation, model, argument, or solution from evidence
- Applying understanding to plan for or carry out actions towards solutions (optional)
- Reflecting on our learning progress and process



What do you and your students do in the Culminating Task Lesson?

What Students Do	What Teachers Do
» Engage with a task that allows them to propose solutions or solve a problem related to the anchoring phenomenon or problem or a related phenomenon or problem. » Connect science to a meaningful context in their lives or a shared concern. » Broaden beyond science to consider other social, historical, or cultural factors that may influence decision-making. » Reflect on the role of science in helping in decision-making about meaningful issues.	» Facilitate the application of science ideas and/or a model to an authentic context that is relevant to students. » Help students identify the science ideas most useful in the task ahead. » Engage students in additional investigations to gather evidence and build new ideas necessary for the task. » Introduce students to additional factors, beyond science, that may be important or relevant to their work. » Encourage students to work together without direct instruction from the teacher (promotes culture of academic discourse). » Facilitate student-to-student discourse and observe and listen to students as they interact. » Ask probing questions to redirect students' investigations and design work. » Facilitate a sharing of students' solutions, designs, and/or explanations, and possibly evaluation processes, for them. » Prompt students to reflect on and celebrate their new understanding and the progress accomplished in the unit.