# Summary Tables

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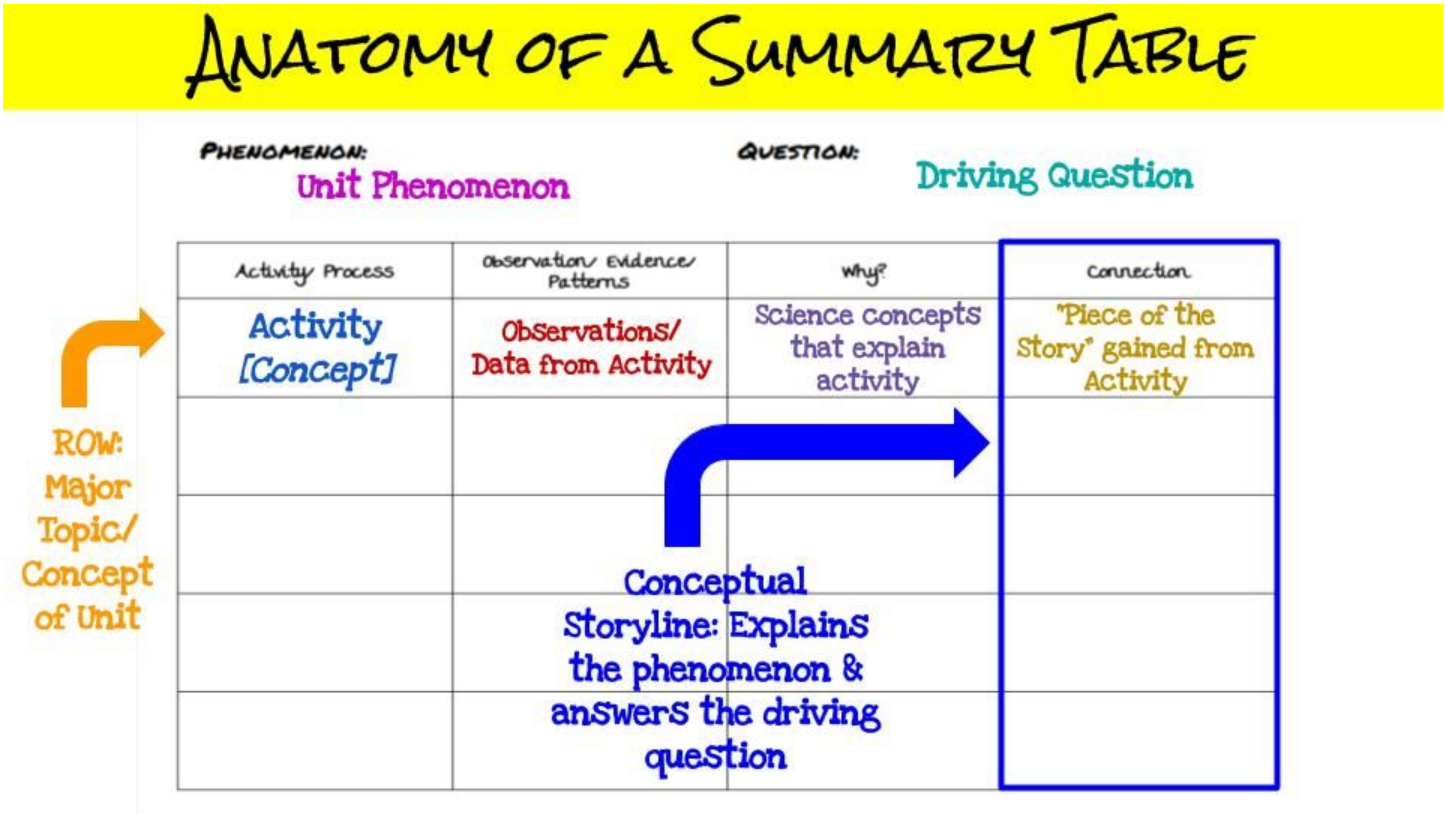
## Overview

When I first started my transition to phenomenon-based units in my classroom, I realized my own connection to the phenomenon was not explicit in my instruction, and therefore was not explicit for my students. I would finish a four-week unit, revisit the phenomenon and my students had no recognition of it. My next attempt with a phenomenon-based unit included using the phenomenon every day; eventually, my students became so sick of the phenomenon that it no longer served its purpose. I needed a strategy to make the connection to the phenomenon explicit for my students as well as explicit in my planning. The tool that now serves that purpose in my classroom is a summary table. My journey with summary tables began with the work of Ambitious Science Teaching and has evolved with use in my classroom.



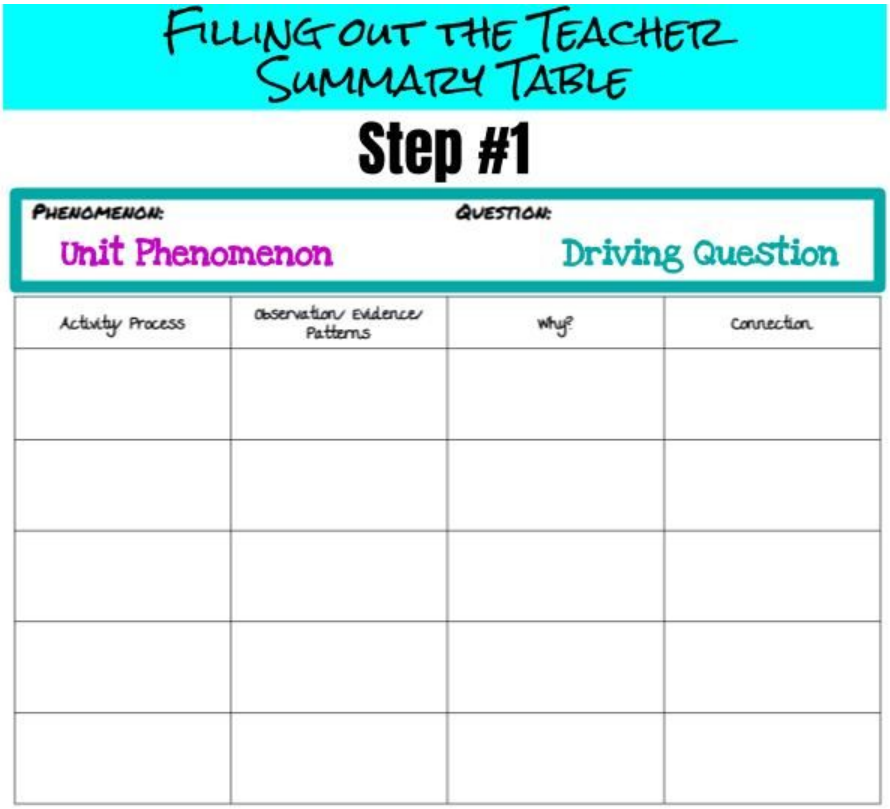

In my classroom, a summary table has four columns and five rows. Each row is for a major topic or concept in a unit. In a given unit, there are between three and five major concepts.

The first column is for the activity and the concept being taught. The second column is for observations, data, or evidence identified in the activity. The third column is for the science behind the concept; this is the content important for the concept. Finally the fourth column is for the connection to the phenomenon. Each row or concept acts as a piece of the story that explains the phenomenon and/or answers the driving question. Together, each row's connection column creates a conceptual story line for the unit.

## Tool for Teacher Planning

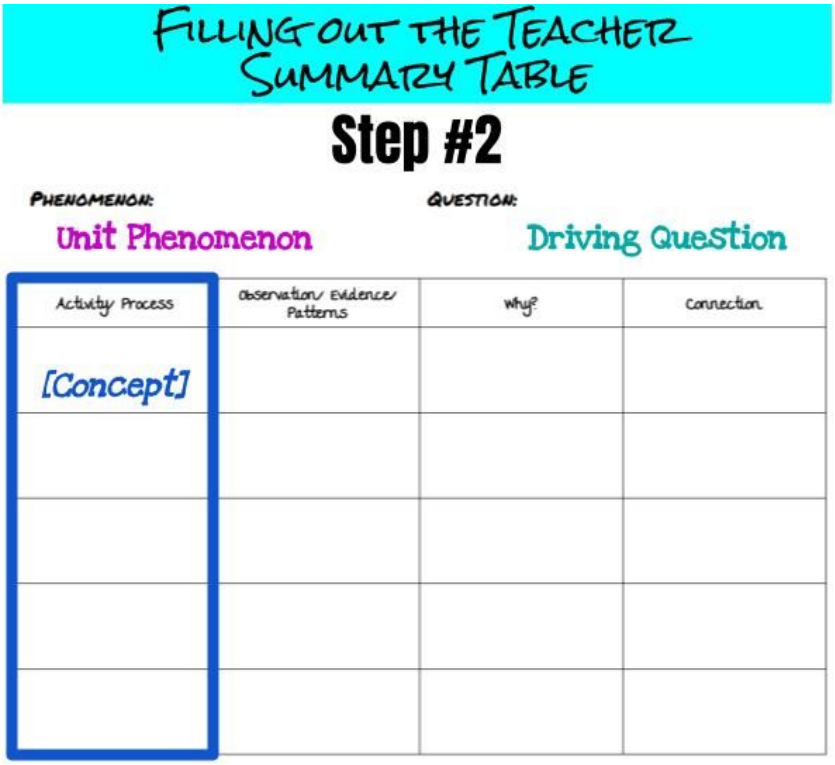
In my classroom, summary tables provides the structure for me to plan and develop a phenomenon-based unit. The summary table allows me to ensure my unit contains the necessary content and ensures that I am periodically connecting the content back to the phenomenon. The completed summary table is a constant reference for myself to keep what I teach consistent with what is expected, according to the performance expectations.

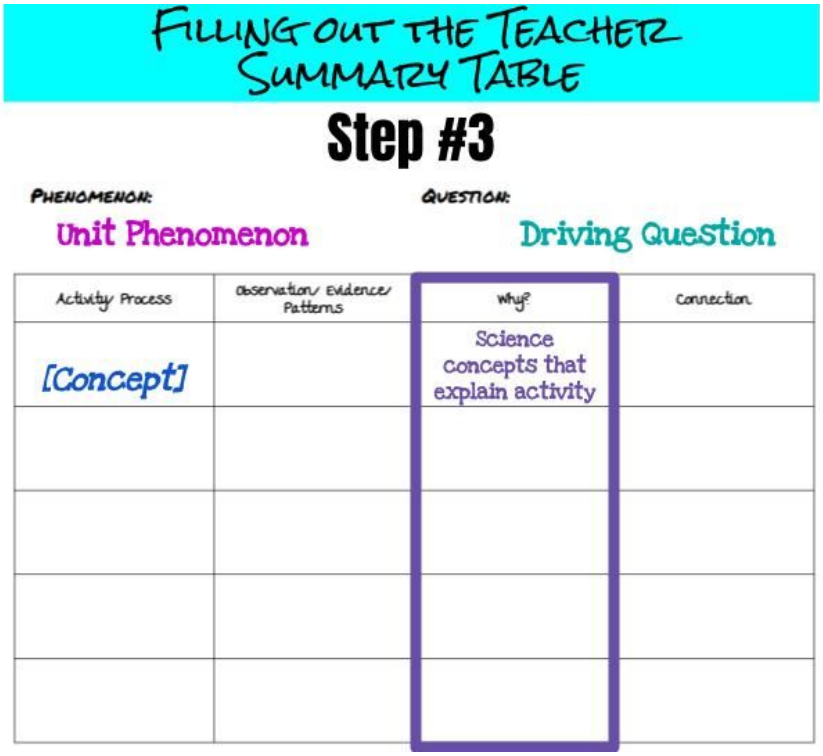
**General Procedure for a Summary Table Planning:**




1. **Identify the unit level phenomenon and the driving question for the unit:** Before teaching a unit, I first start by reading through the performance expectations for the unit and identifying the overarching theme or topic. The first step of planning for the unit is to identify a unit phenomenon and develop a driving question. The unit phenomenon is the anchoring phenomenon for the unit; the explanation of this phenomenon should address all aspects to be taught in the unit. The driving question is the "big question" of the unit. At times, the driving question may be developed first, and the phenomenon can be found to match. The ideal driving question for the unit is 3-dimensional, including not only content, but also a SEP and a CCC.

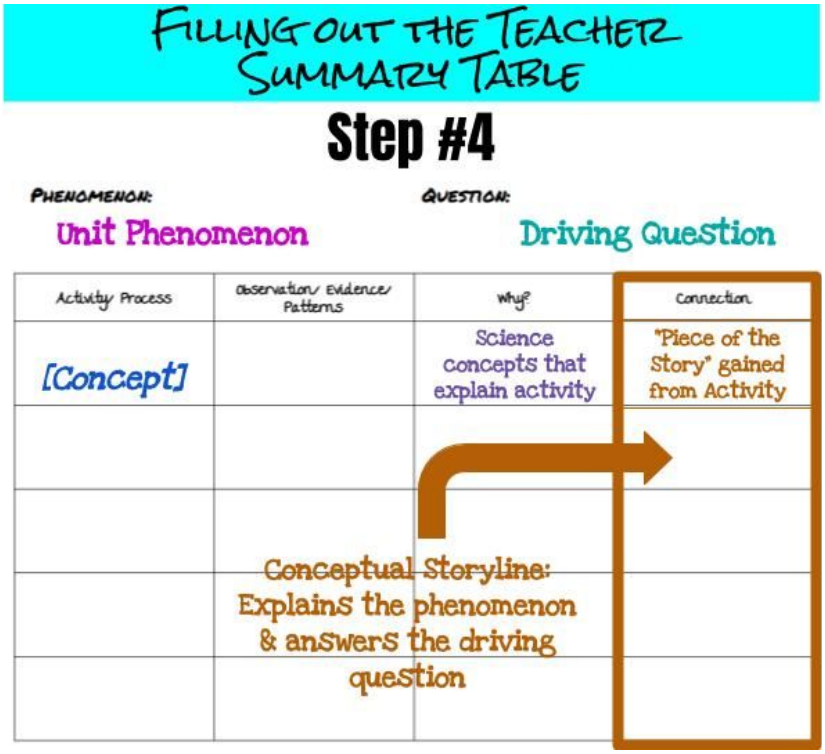
2. **Identify the major concepts taught in the unit:** The next step is to identify the major concepts to be taught during the course of the unit. I identify these major concepts through the performance expectations and the evidence statements. In a given unit, I have between three and five major concepts- no more. The major concepts do not encompass all of the content presented in a unit but do include all of the content to be assessed. The major concepts are placed in brackets in the bottom of the activity boxes. The concepts are placed in the order that they are taught during the unit.

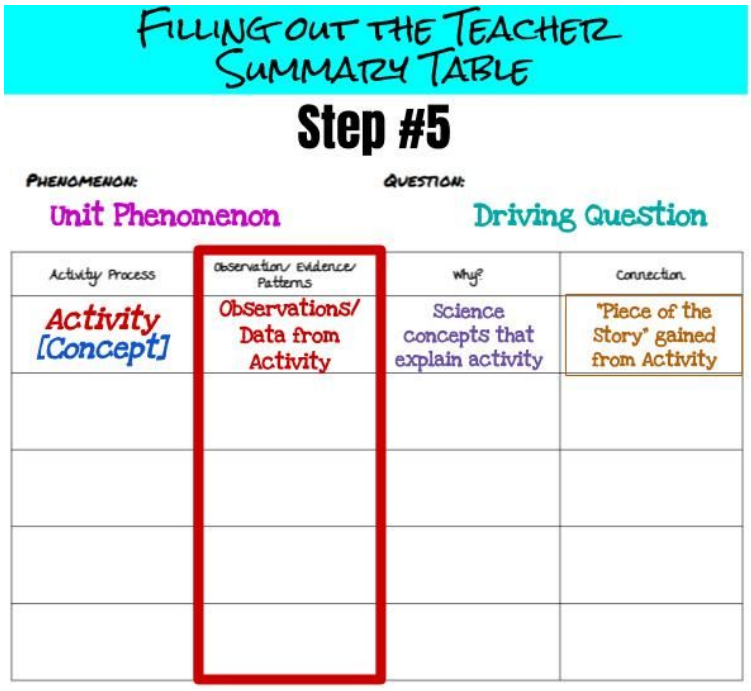



3. **Complete the Why? column by identifying content behind each of the major concepts:** After identifying the major concepts to be taught during the course of the unit, I determine what needs to be taught about each of these major concepts. I determine the depth and scope for each concept by looking at the evidence statements for the performance statements assessed in the unit. The "Why?" column serves two roles in the teacher summary table. First, it forces the teacher to think through what content the student needs to understand in order to demonstrate mastery of the concept according to the standards. Second, the "Why?" column requires the teacher to think about the importance of this concept… the "so what". By the time I get to planning a single lesson during a unit, I have already mapped out what the students need to understand in order to successfully complete the performance expectations for the unit.

4. **Construction of a conceptual storyline by completion of the Connection column** The next step in the process of completing a teacher summary table is to complete the Connection column. Each concept belongs in the unit because it is part of the the explanation of the phenomenon. The concepts work together to tell a story. To complete the Connections column, for each concept, identify how the concept helps to explain the phenomenon. As you read down the connection column, the each row should build on the one before it. By the end of the summary table, the connection column creates the conceptual storyline for the unit. The column explains the phenomenon and answers the driving question.




5. **Plan a 3-dimensional lesson for each major concept.** The final step in the process of completing a teacher summary table is plan lessons to teach the concepts. For each of the major concepts, I work to plan at least one 3-dimensional lesson that will trigger high student engagement. Normally this lesson is a hands on simulation, experiment or otherwise involves some sort of manipulation. The name of this activity is listed in the Activity column above the concept being taught. Note that the activity planned on the summary table is not the only activity that teaches the concept. Each concept is taught through at least three different activities during the course of the unit- only one of these activities makes it onto the summary table. In the Observations column, I identify the major evidence or observations a student might take away from the activity. These are the things that I will focus the students on during the course of the activity.

A completed example of a teacher planning summary table for a middle school gas laws unit can be found here. This is the teacher version of the summary table that is used as an example in the Student Tool section below.

## Tool for Students

In my classroom, summary tables are an important tool for student sensemaking and are an integral piece of a unit structure. The summary table is first used when the phenomenon is introduced and then again after every major concept that is covered. A 45 minute class period is set aside to complete each new row of the summary table. This means in a given unit, there are approximately five days dedicated to filling out the summary table. At the end of the unit, the summary table acts as a running record of all of the important concepts of the unit, and it becomes the study guide for the summative assessment. In my classroom, students are allowed to use the summary table on the summative assessment.

A student summary table has two sides- a "My Thoughts" and a "Class Thoughts". In the lesson execution, I always follow the pattern of individual time, partner time, and whole class time. The individual provides students with the time and space to work through the content and creates individual ownership of the student's learning. The partner time provides students with the time and space to discuss their understanding and adjust based on the understanding of a peer. By the time we move to a whole class consensus, every student has written thoughts and can actively participate in the discussion. To facilitate the class consensus building, I use the strategies for productive talk.

During the individual time, I walk around the room with a stamp. The stamps are silly shapes, animals, sports symbols, etc. As the students work, I circle the room, reading what the students are writing and provide them with a stamp. The summary table day for a major concept is one of the most important formative assessment checkpoints for my understanding of my students' progression. In my classroom, I stress that the "My Thoughts" side is about my students sharing their current thinking; it is not about writing the perfect answer. This can be a struggle for many students. Providing the stamps works as encouragement to write the student's best understanding. Use of the stamps also forces me to look over each student's understanding to pinpoint areas of understanding and areas in need of more development.

Since we cycle between the individual "My Thoughts" side and the class consensus "Class Thoughts" side, the summary table works as a self-assessment tool for my students, as well. If a student's individual thoughts vary greatly from the class consensus, this student's level of understanding is different than what is necessary for success in the unit. Work on the summary table occurs after the completion of a major concept; and, while we might touch on the topic again and all of the subsequent concepts build on the previous concepts , the summary table wraps up the instruction on the topic. When the student self-assesses his or her understanding during a summary table day, this provides the student the opportunity to address his or her gaps in understanding before the summative assessment. This leads to increased student success throughout the unit and on the summative assessment.

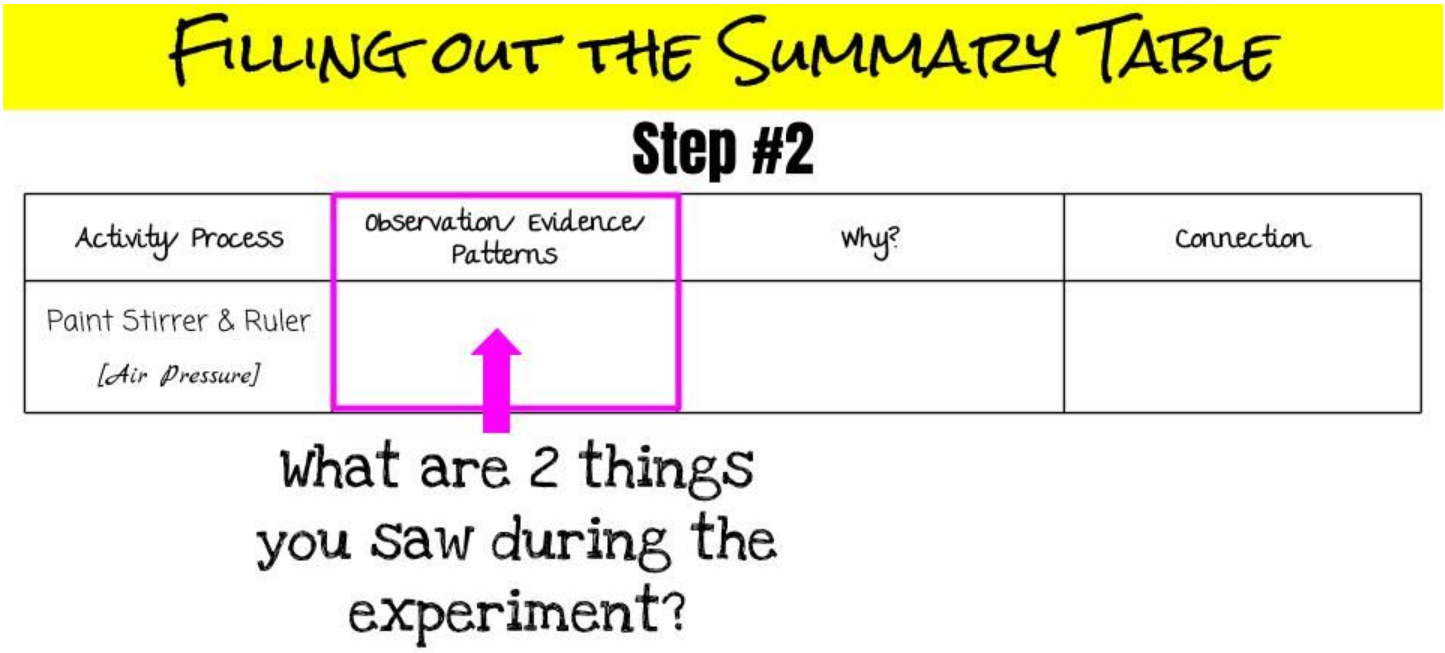
**General Procedure for a Summary Table Lesson:**

* The example provided in this procedure is the final concept, or the last row of the summary table, in a middle school unit on gas laws. The students have already completed the first four rows of the student summary table. The activity for the example is when a paint stirrer is broken using a newspaper.

1. **Completion of the Activity/ Process Column:** Students copy both the activity and the concept on both sides of the summary table.

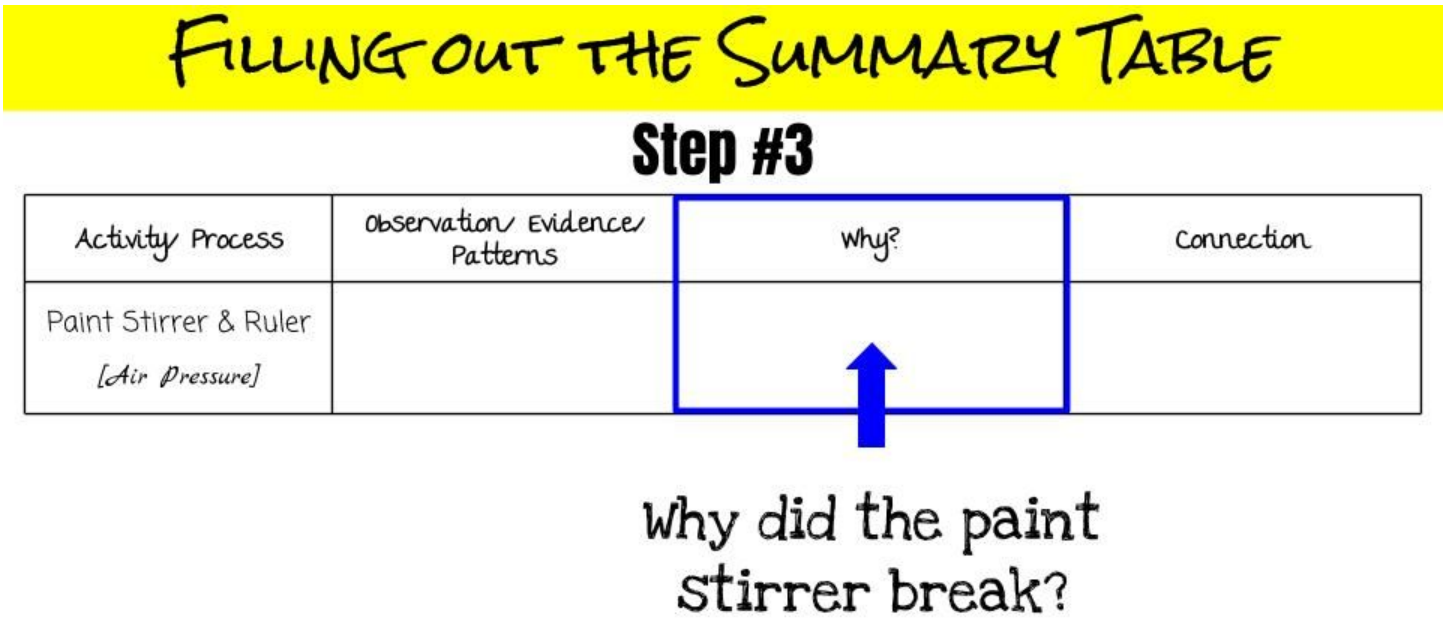

The inclusion of both the activity and the concept are important. The activity recorded in the summary table is not the only activity used to teach the concept. This is the activity that will be most memorable for the student and is usually a hands-on activity or lab. The purpose of recording the activity in the summary table is to ground the content in experience. This increases students' recall of the content and provides students with a reference when recalling information. The science concept is also written in the summary table. By recording the concept in the summary table, the students are able to use the concepts, not just the activity names, when discussing material from the unit.

2. **Completion of the Observations/ Evidence/ Patterns Column:** First, students make observations from the activity on the "My Thoughts" side. Students then share their thoughts with a partner and add to the box on the "My Thoughts" side. Finally, students flip the paper over and, as a class, develop a class consensus for observations for the activity.



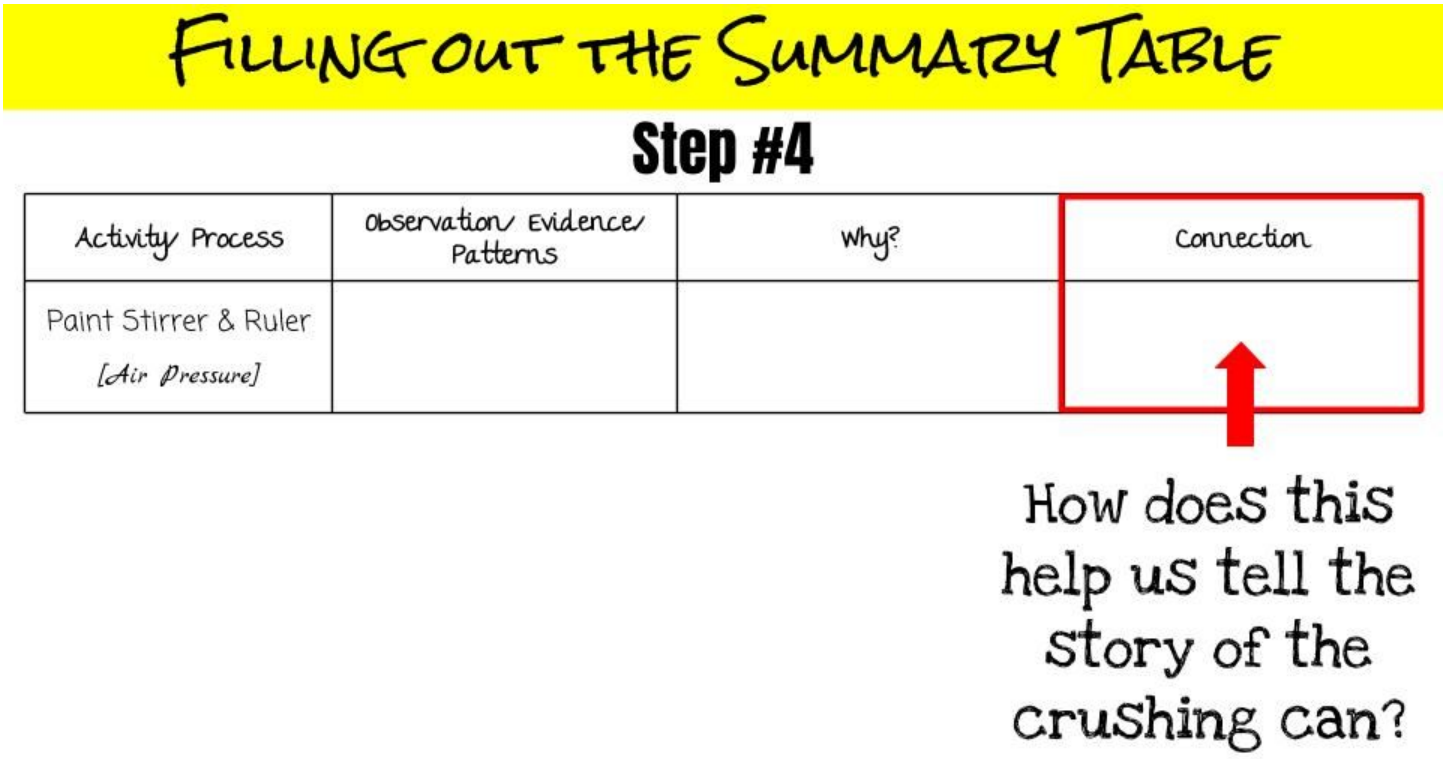

Normally, I provide students with a prompting question to help students complete the Observation/ Evidence/ Patterns box. Depending on the activity, students might record evidence gathered from the activity, draw what they saw during the activity, create a graph of data from the activity, or students might simply make statements of things that they observed. This provides a perfect opportunity to discuss what constitutes evidence and what the difference is between observations and conclusions. With most of my classes, I look for students to make two to three observations about the reference activity.

3. **Completion of the Why? Column:** First, students work to explain the science behind the activity on the "My Thoughts" side. Then, students share their thoughts with a partner and add to the box on the "My Thoughts" side. Finally, students flip the paper over and, as a class, develop a class consensus the Why? column for the activity.




Similar to the Observations column, I normally provide students with a prompting question to help students complete the Why? box. Depending on the activity, students might simply answer the question of why the results of an experiment happened. I might provide students with a diagram or a few key terms to use to explain the science behind the major concept of the row. In essence, the Why? box is the science content that explains the major concept.

4. **Completion of the Connections Column:** First, students work to how the science concept helps explain the phenomenon on the "My Thoughts" side. Then, students share their thoughts with a partner and add to the box on the "My Thoughts" side. Finally, students flip the paper over and, as a class, develop a class consensus the Connections column for the activity.




Following the same system, I normally provide students with a prompting question to help students complete the Connection box. The purpose of the connection box is to have students relate the major concept back to the phenomenon. Throughout the unit, I explain to my students that we are simply telling the story of what is happening in our phenomenon. Each major concept provides another piece of the story. And, by the end of the summary table (completion of the unit), the students will be able to tell the entire story of the phenomenon.

**Using Summary Tables to Scaffold Student Development of Argumentation:**

Summary tables provide a scaffold for student development of the claim, evidence, reasoning (CER) structure of a scientific argument both at the individual lesson level and at the unit level.


Each time students complete a row of the summary table, they are engaging in the understanding of both the evidence and reasoning components of a scientific argument. Depending on the activity, a statement of the outcome of the activity (ex: the paint stirrer broke when hit by my hand) becomes the claim. As students complete the Observations box, students are identifying evidence to support the claim. As students complete the Why? box, they are explaining the science behind the evidence, an important component of reasoning.

Upon the completion of the unit, the entire summary table becomes the basis for a scientific argument. The answer to the driving question, that explains the phenomenon is the claim. The Activity column and the Observations column work together as evidence. Essentially, I ask my students "What evidence do you have from class to prove the existence of these scientific concepts?" Finally, the Why? column and the Connection column together become the reasoning. Two important components of the reasoning section of a CER are the science concepts behind the evidence and how the evidence connects together to support the claim. These two columns together provide those components.