Kata in the Classroom
Instructions

THE COACHING/REFLECTION QUESTIONS - *A Scientific-Thinking Dialogue*

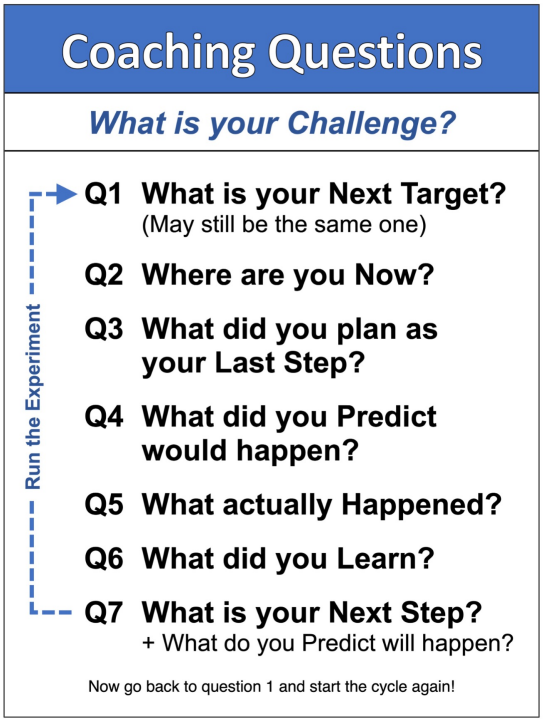
The Coaching/Reflection Questions are a short, structured series of questions that mirror a scientific-thinking pattern. Use them as a scaffold to:

- Help a team practice a scientific-thinking approach for working toward goals.
- As a guide for reflecting on experiments and consolidating effective behaviors.
- Encourage iterative thinking and help establish a collaborative learning environment.
- Give you insight into how a team is thinking so you can give appropriate feedback.

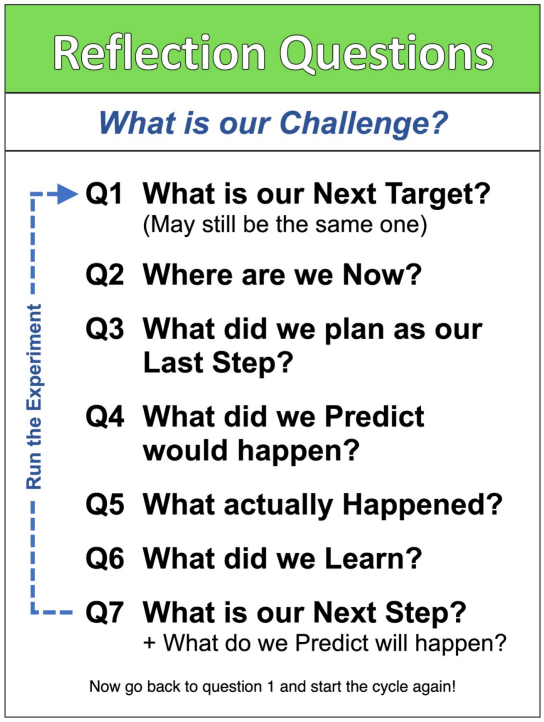
The Coaching Questions are an outline for how to tell the story of your experiments. They are well matched to the Experimenting Record, and those two routines are often used together. The questions are about process, not solutions. You're not telling the team what solution to pursue. Using them regularly helps with the development of a versatile thinking habit.

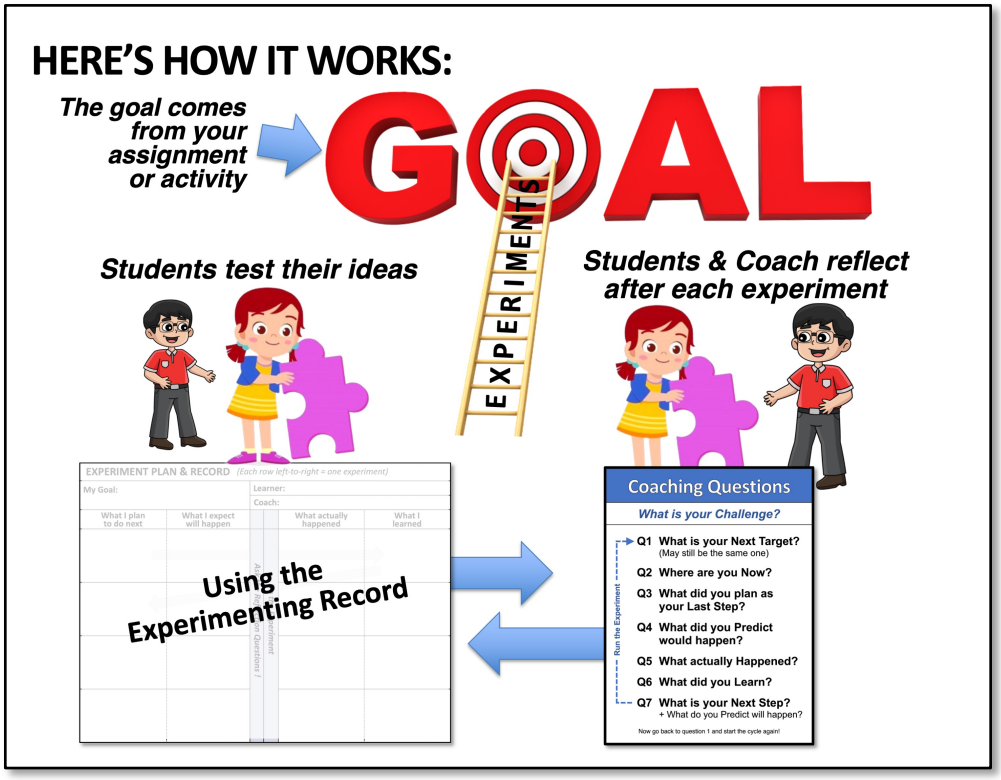
The questions are often printed on reference cards, and posted in the classroom for easy reference. The questions are:

Questions for the educator to ask student teams



Questions for student teams to ask themelves





The Coaching/Reflection Questions and the Experimenting Record are often used together.

How to Use the Coaching/Reflection Questions

Think of asking the questions as short pauses done throughout the students' practicing, to reflect on the team's last step, review their plan for the next step, and give feedback, as necessary, on their approach. Ask the questions after a student team has taken a step, or at any reflective moment.

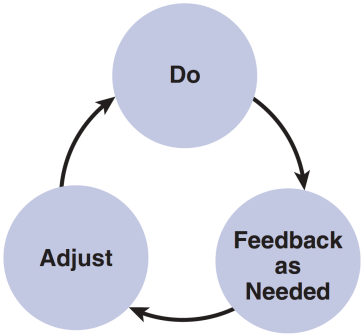
What you want to get to as you go through the questions is identifying and agreeing on the team's next step. Not a list of steps, just the very next one. Once that next step is clear, the reflection is nearly done. The team records its plan and prediction on the left side of their Experimenting Record and can proceed with taking that step.

It is perfectly acceptable for the team's next step to be small, as long as their test is conducted soon. Teams can make good progress with small but frequent steps, because the length of time spent speculating is reduced, Small steps gives students the leeway to make some mistakes and learn.

At the beginning, ask the questions exactly as written on the card, to build familiarity with the pattern so it becomes second nature. Of course, you can ask additional clarifying questions to trigger or probe the team's thought process, get more detailed information, and help identify the current threshold of knowledge. The sequence of questions is scripted, but your feedback depends on what you learn about the student team's current thinking.

Once you have listened to the students respond and gotten a sense for their current thinking, you might give a corrective input tailored to the needs at that point in time. Note that you don't have to give corrective feedback every time, that's your judgement. The Coaching/Reflection Questions are not about audit and compliance. It's about a reciprocal, collaborative relationship that creates a learning experience for both of you. Each effort to listen and give feedback is practice for the educator, and each effort to act on the educator's feedback is practice for the students.

There is no need to overload the student with more than one or two points of feedback, because reflection takes place frequently. Think about the one thing you think the student team should practice next. Rinse, repeat.



The cycle of feedback and adjustment

It takes a little practice master the thinking patterns behind the Coaching/Reflection Questions, and you might look for opportunities to practice them beyond your student coaching cycles. For example, to strengthen your familiarity with the pattern you could try using them during meetings or other conversations. As your coaching skill grows, you'll be able to better discern where your students are in their thinking and what kind of feedback will help them most.

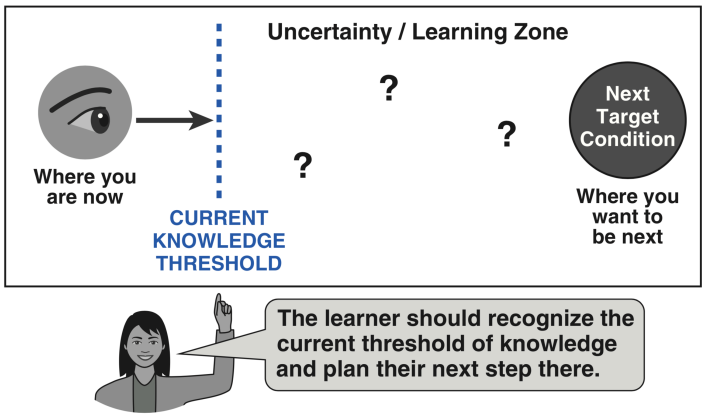
Watch for the Student's *Threshold of Knowledge*

Notice that the Coaching/Reflection Questions are nested: each answer provides the context for the next question. At any point in asking the questions, when the team's answers become vague or imprecise it may be a sign that you've found the current *threshold of knowledge*.

A knowledge threshold is the point where we move from facts into assumptions, and that's often where the next experiment should be done. As you ask the questions, pay attention to whether or not the student team has a good understanding related to the current question before moving to the next question.

When a student team reaches a point where it doesn't know and its answers become vague (they may not say outright, "I don't know," so you may need to sense it), go directly to question 7 and ask: *"What is your next step to find out?"* Additional questions for you to ask might be, *"What do you need to learn next?"* and *"How could we find that out?"*

Once the current knowledge threshold has been found, have the team pull out their Experimenting Record, plan their next step, write down their prediction, and do the experiment. This reinforces the principle that we advance through testing, not conjecture.



Have your students experiment at their knowledge threshold

Develop an ear for when a team is responding imprecisely with generalizations, assumptions, opinions, or speculation. These can be clues that the team may have reached a knowledge threshold and needs to run a test. With practice, your students may start to see knowledge thresholds all around them, and may even begin to recognize them as a normal part of life that shows us what we need to work on.

Why Practice Using the Coaching/Reflection Questions?

- **To help convey a scientific-thinking meta habit.**

- **To help you develop your students' scientific-thinking skills.**
  The sequence of questions are prompts that help you see how a student is currently thinking, which enables you to give feedback that keeps them practicing a scientific approach.

- **To identify the student's current knowledge threshold.**
  The questions help uncover where the student's current understanding ends, and ensure the student is designing a good next experiment that helps them see further.

- **To practice how to tell the story of experiments.**

- **To help develop yourself as a coach of scientific thinking.**
  Using the questions regularly helps you refine your own coaching skills and strengthens your ability to guide others in developing this mindset.

NOTES & TIPS FOR PRACTICE IN YOUR CLASSROOM:

Don't Take Over the Problem Solving, Help the Student Practice the Problem-Solving Process

You're not asking the questions to direct the student team to particular solutions (though it can feel that way to the students), but to guide them on scientific-thinking procedure. The solutions the students come up with should spring from what they learn through their process of experimentation.

Once you have listened to the learner's responses, you can be directive about their procedure for the next step going forward. You're guiding how they think and proceed, not what solutions they should pursue. (That said, there are occasions where you might help a student get unstuck by suggesting, *"Maybe you could try..."*)

It's normal to wrestle with the boundary between coaching and telling. It can be hard to keep from jumping in with your own thinking about potential solutions, and to avoid asking questions that lead the student toward your ideas. Keep in mind that the Coaching/Reflection Questions are about getting the student to practice thinking scientifically for themselves. *"Let's see what happens and what we learn,"* can be a good thing to say to keep the focus on experimentation and learning, rather than jumping to presumed solutions.

The Role of Encouragement

At the beginning, practicing often feels awkward, slow, unnatural, stiff, uncomfortable, and difficult. These feelings are actually a good sign, because they indicate the students is learning something new.

For a beginner it's important to derive confidence from periodically feeling that he or she is successfully moving closer to the next target and getting better at the process of scientific thinking. Each small win builds the student's confidence and reinforces the belief that they can achieve their goals. For developing a sense of self-efficacy, the small wins along the way may actually be more important than is achieving the target goal.

This makes your corrective feedback and encouragement, done right, important elements of coaching. Give specific praise that emphasizes new learning and growth, not just effort. For example, you might say something like: *"I think you're getting the hang of this."*

This work is licensed under a Creative Commons Attribution License. Anyone can use, adapt, and distribute it, as long as they credit *Kata in the Classroom*.