IDEAS WANT TO BE TESTED

Work like a scientist to achieve your goals!

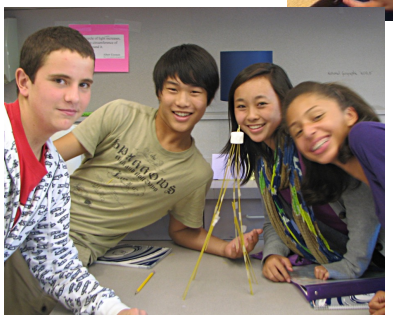
Many classroom activities and assignments can also become practice in practical scientific thinking when you add a simple practice pattern to those activities. This file gives you a way to do that.

Example Activities & Assignments

To which you can add this scientific pattern

- ✓ Writing a report
- ✓ Building something
- ✓ A team competition
- ✓ Solving a puzzle
- ✓ Learning a skill
- ✓ Preparing a presentation
- ✓ Score higher on the next test
- ✓ A physical challenge

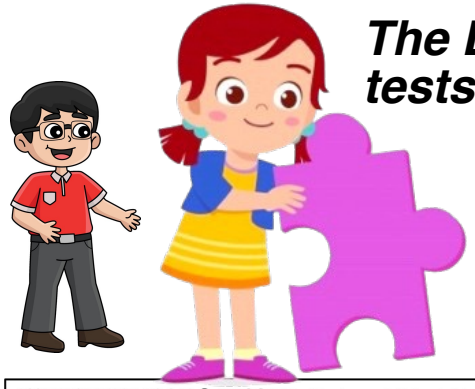
…and many more!



Here's how it works

GOAL

The Learner tests ideas



Learner & Coach reflect after each experiment

EXPERIMENT PLAN & RECORD *(Each row left-to-right = one experiment)*

My Goal:		Learner:			
		Coach:			
What I plan to do next	What I expect will happen	Ask the Reflection Questions !	Do the Experiment	What actually happened	What I learned

The Learner experiments toward a goal, using the experimenting form to plan and record one experiment at a time.

Reflection Questions ↓ In this order

Ask these 2 questions every time, because they're the frame for the rest.

- ➢ What are you trying to do?
- ➢ What's the current obstacle?

It's important that your learner works within a sense of direction. Ask by when they want to achieve their goal. You may need to get the learner to set a smaller / nearer goal.

Guide your learner to focus on one obstacle at a time, using experiments to test ideas. Obstacles = what to work on.

If data is being collected, help your learner draw it in a run chart.

These questions correspond to the learner's Experimenting Form

- ○ What was your last step? What did you expect?
- ○ What actually happened?
- ○ Did you learn something useful?
- ○ Based on that, what's your next step? What do you expect to happen?

The learner should have a sense of *testing* ideas, rather than *implementing* ideas. Keep the ideas that work.

Looking at the Learner's Experimenting Form:
1) Review their last step and what happened
2) Discuss their plan for the next step

Help your learner plan their next step based on what they learned from their last step. Avoid random steps.

Encourage your learner to test as simply and quickly as possible.

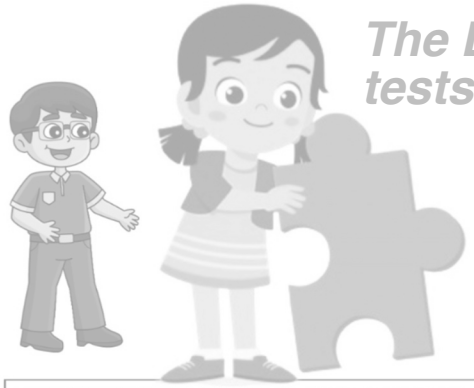
Sometimes you'll need to modify the goal based on what is being learned along the way.

When can we see what you learn from that next experiment? _____

What we expect to happen ← Learning → What actually happens

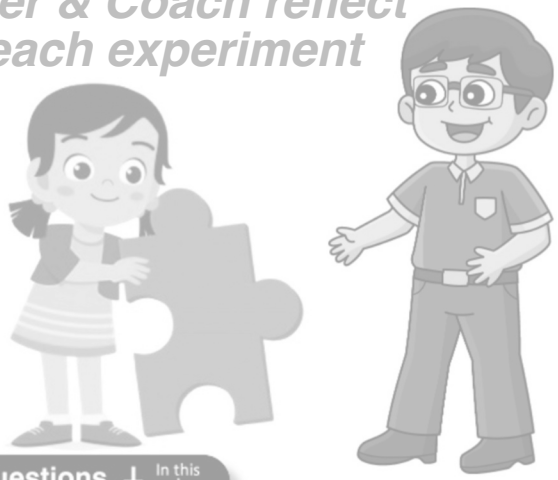
The Coach asks the reflection questions after each experiment.

The goal comes from your assignment or activity



The Learner tests ideas

Learner & Coach reflect after each experiment



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The Coach asks the reflection questions after each experiment.

EXPERIMENT PLAN & RECORD *(Each row left-to-right = one experiment)*

My Goal:

Learner:

Coach:

What I plan to do next	What I expect will happen			What actually happened	What I learned
		Ask the Reflection Questions !	*Do the Experiment*		

For the coach, to ask of the learner:

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Optional reference card for the learner:

MY SCIENTIFIC KATA

- ❑ **What am I trying to achieve?**
- ❑ **What's my current obstacle?**
- ❑ **What was my last step?**
  What did I think would happen?
- ❑ **What actually happened?**
- ❑ **What did I learn?**
- ❑ **Based on that, what's my next step?**
  And what do I expect to happen?

- Tips -

Scientific thinking = building knowledge through cycles of (A) predicting what will happen next, (B) observing what actually happens, and (C) adjusting our understanding and next step based on what we learned from the difference. Rinse, repeat.

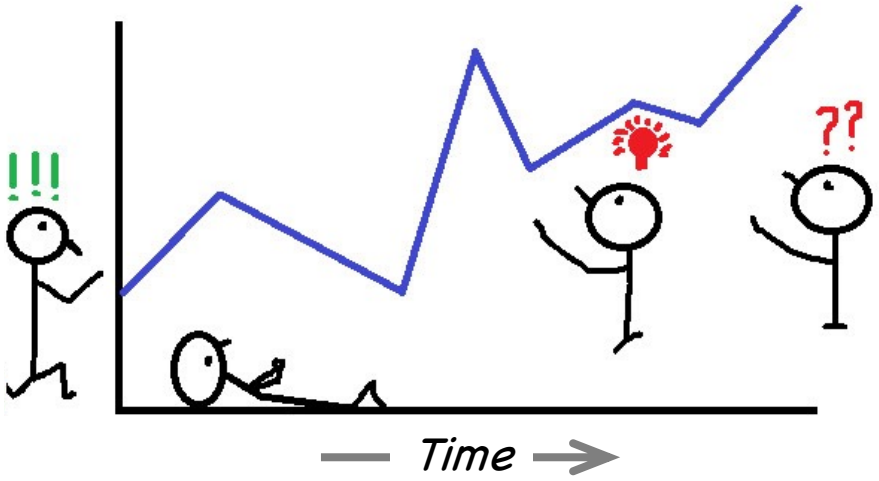
- To become everyday scientific thinkers it is important for students to recognize, through practice, that:
  - Our ideas need to be tested no matter how certain we may feel.
  - Differences between what we think will happen and what actually happens can be a useful source of learning and adjustment that help us reach a goal.

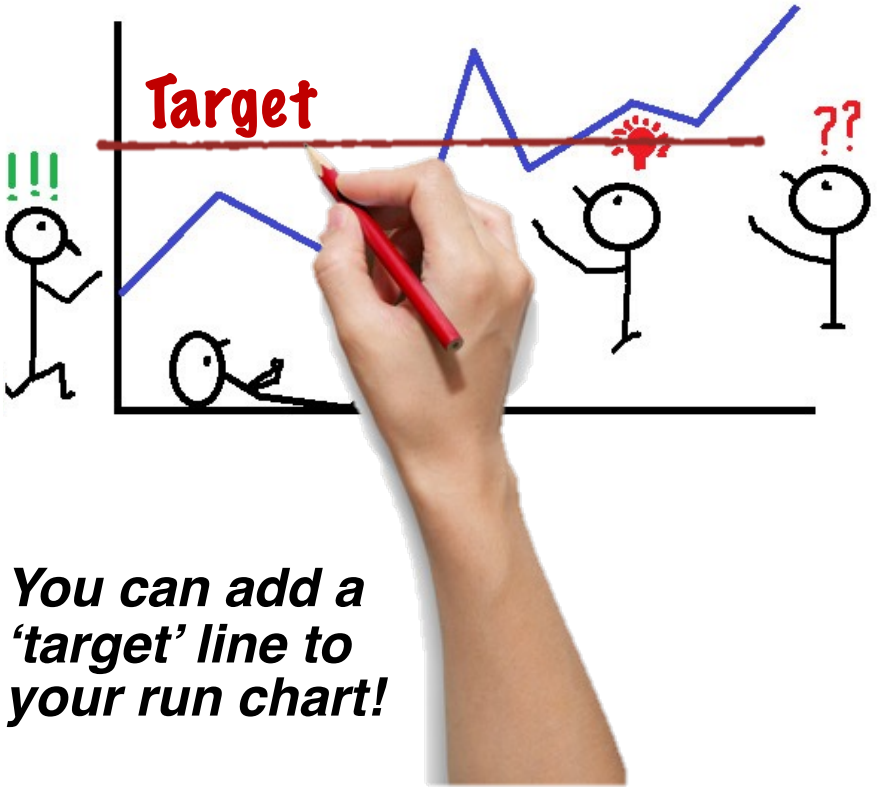
- ***Cycles*** of testing are important for reaching goals. Try to get in at least three cycles of **Experiment → Reflect → Next Experiment** with each assignment or activity.

- To do enough experimenting cycles, each experiment cycle should be short. Conducting several short experiments is often more instructive than one long experiment.

Tip: Got data? Put it in a Run Chart!

Plot data points over time and connect them with a line





You can add a 'target' line to your run chart!

- Tips -

You can ask deepening questions during reflection

As the educator you are the coach to the students and student teams who are experimenting toward their next target condition. (Though once your learners get the pattern you can have them coach one another.)

Depending on how the students answer the reflection questions, you might ask some deepening questions to help them clarify their thinking. Here are some examples:

What do you know?
How do you know it?

What do you need to know?
How can you learn it?

Note that if you add this practice pattern to 10 different activities over the school year, with at least 3 experimenting rounds per activity, then your students will get 30 or more practice repetitions of a scientific-thinking pattern. *Not bad!*