An Experimonkey Science Printout for Kids

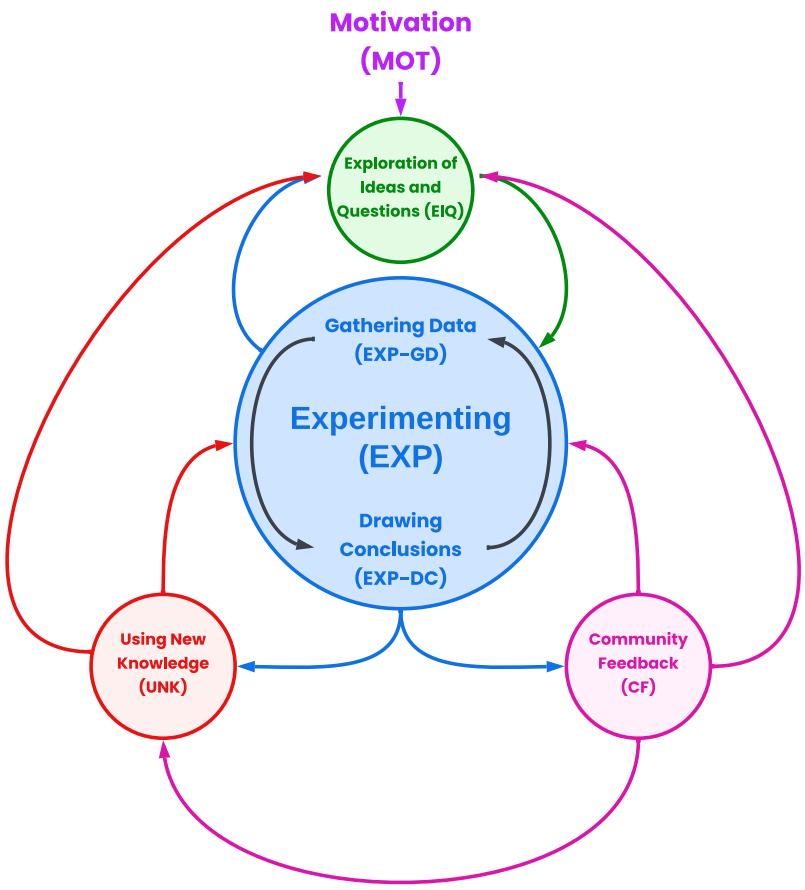
A Better Scientific Method

Scientific discovery is much cooler than a simple cookbook recipe. Let's stop treating it like one and learn about how scientists make discoveries in the real world.

Picture this: you're in the kitchen trying to whip up the world's greatest banana bread. You've got your cookbook open, but quickly realize you need to add your own special touches to make it truly delicious. Then, a family member comes in, tastes the batter and says, "Hmm, you know what I've discovered makes baked goods extra delicious? Some walnuts."

More Than a Cookbook Recipe

When you read about the "Scientific Method" in textbooks, sometimes it seems just like that simple cookbook recipe. In reality, scientific discovery is much more exciting, with plenty trial and error, repetition, review and input from other scientists, and even unplanned discovery, or *serendipity*—just like the perfect banana bread. Rather than a set of steps, it's more like an endless cycle, with steps leading back into one another or into different steps entirely!



It All Starts with Motivation (MOT)

Motivation is a reason for doing something, anything! Scientific motivation comes in many forms, such as a desire to solve a problem, a need to improve human health or technology, or simply curiosity. It might even fall out of the sky and hit you on the head, like an apple (or a banana). Whatever route it takes afterward, the process of scientific discovery starts with motivation.

Banana bread example: I like banana bread. How can I bake the best banana bread ever?

Exploration of Ideas and Questions (EIQ)

When scientists have the motivation to learn something new about the universe, their next step is to start making observations, asking questions, doing research, and brainstorming ideas with the scientific community. This helps put scientists on the right track to developing experiments or other ways to test their ideas.

Banana bread example: What makes banana bread so tasty? Definitely bananas for starters. Let's see what online recipes have to say on the subject.

Experimentation: Gathering Data, and Drawing Conclusions (EXP)

Testing ideas with data is at the heart of scientific discovery. After exploring their topic, scientists use the ideas they've developed to come up with procedures to gather additional data, often through experimentation. Scientists then analyze this data, make conclusions, and develop futher ideas they can test.

Gathering Data **(EXP-GD)**

To begin gathering data, scientists come up with a **hypothesis**, kind of like an educated guess about how one specific thing, the **independent variable**, affects another thing, the **dependent variable** (it *depends* on the independent variable). This step is important, because hypotheses give scientists something concrete they can put to the test. By changing nothing except the independent variable, or **controlling** the other variables, scientists can see more clearly how the independent variable affects the dependent variable.

Banana bread example: Maybe I can bake a few different loaves, using categories like texture and banana-flavor as data I can record. My hypothesis is that if I control the other ingredients and only add more banana (the independent variable), the banana-flavor will increase (the dependent variable), and the banana bread will taste better overall. I could also go back and look at which recipes contain the most banana.

Drawing Conclusions **(EXP-DC)**

After gathering data, it's time to analyze it. Does the data support the original hypothesis or not? Sometimes the greatest discoveries come from data that totally opposes the original hypothesis! Scientists think about how this data can be used to draw conclusions or use it as inspiration to design new ways to gather additional data.

Banana bread example: Okay, even though adding banana improves banana-flavor, the texture is a lot worse. Maybe I should have my family taste the loaves too. My family says walnuts make banana bread better, maybe I should think of some other ingredients to change.

Community Feedback (CF)

In the real world, scientists publish **scientific reports** or papers, detailing their research, the data they've discovered through experiments, and their conclusions. Their peers, other scientists and often experts in their fields, read through these reports for mistakes, or even try the experiments themselves. This is called **peer review** and it is one of the most important parts of science. Without it, mistakes could be missed or reports might be **biased**, which means that scientists, often without meaning to, can make conclusions that they might want to be true.

Banana bread example: Now that I have a recipe I'm proud of, I'm going to post it online and see what other bakers around the world think of it! Hmm, someone says the cinammon level isn't quite right...

Using New Knowledge (UNK)

After testing ideas and drawing conclusions or receiving feedback from other scientists, the world can start to benefit from any new discoveries. New technologies might be created, everyday problems might be solved, we'll understand our universe better, or a scientist might find new motivation from the work.

Banana bread example: People are rating my recipe 5 stars online! Now the entire world will never have to go without amazing banana bread, and maybe someone else will come up with an even better recipe!