

# Guide to Experimental Design

(adapted from <http://moscowsciencefair.org>)

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*Every good scientist needs a place to start. This is a guide to conducting a science investigation which includes the components of a good science experiment (for students choosing to design their own experiments). The sentence starters will help you to think like a scientist. Good scientists carefully record all their observations and ideas. They are also careful to support their results with those observations.*

## **RESEARCH QUESTION**

First think of an idea that interests you. Then come up with a question you are trying to answer. What are you trying to find out? *What...*, *How...*, *Does...* are good beginnings.

## **BACKGROUND RESEARCH**

You should research your idea using at least 2 different sources. Sources might include: journals, books, the internet, and even an interview with an expert. Be sure to list your sources in your presentation.

*For younger scientists, the research can simply be reading a children's book, exploring, or talking to an adult. Have them check out books on science at the school library!*

## **BIBLIOGRAPHY**

Team 4 students are encouraged to include a bibliography citing all resources used in their experiment. These resources may also include interviews with scientists or other adults.

## **PREDICTION/ HYPOTHESIS**

Write what you think will happen using what you already know (or think you know). This is not just a guess; it is based on what you know (or suppose) about how the world works.

*If I do ... then... will happen because...*

*I think ... because...*

Be sure to include "because." This is your chance to explain why you made your prediction, and it is important to think about it again at the end of you experiment.

**Example:** *I think that hot water placed in a metal cup will stay warmer than hot water placed in a plastic cup because metal cups get hot and plastic ones don't.* (Predictions do not need to be correct; they are simply what you think will happen.)

## **PROCEDURE**

You are designing this experiment. Be sure to include all the steps you followed to conduct the experiment. This procedure should be clear enough that your classmates could repeat your experiment and get the same results using your procedure.

## **DATA**

Record the data or information you collect in a way that will make sense to you such as tables, charts, drawings, graphs, pictures, or written observations. Keep a notebook of all your data and observations. A notebook is a chance for you to record what you discover as well as your thoughts and notes. Bring it with you to the Science Fair in case you need to look up something to answer a question. (Chances are, not all the data you record will be presented on your poster.)

## **RESULTS**

This is the data you present. You have recorded your data—now you will summarize it and compile it into a results section. Present all important data tables; use graphs to make your results visual; include drawings and photographs. Be sure to include titles and labels for diagrams and pictures. Measurements should be specific and accurate. Don't forget to label your units for all measurements!

## **CONCLUSION/REFLECTION**

This is where you tell the world what happened in your experiment. It is usually written as a paragraph, but for the youngest scientists, just writing (or drawing) what you learned is great!

*Originally I thought... Now I learned...*

*The evidence (supported/did not support) my prediction that... I discovered that...*

What new questions do you have to extend your learning?

*I (we) liked/did not like..... because...*

*This reminds me (us) of..... because...*

*I (we) still wonder...*

## **FOR THE YOUNGEST SCIENTISTS:**

Have fun exploring science. Early elementary students LOVE to make predictions and explain their reasoning. Adapt the steps above to your child. Use drawings and photographs. Let them write their own text, it is not as neat as typing, but they are more involved and practice writing in addition to science. More than anything, we want you to have fun and get excited about science.