

What is the Scientific Method?

The Scientific Method is a process used to find answers to questions about the world around us.

Is there only one Scientific Method?

No! There are several different variations and versions of the scientific process. However, they all begin with a question to be answered based on observations of the world around us and provide an organized method for conducting an experiment or analyzing models/techniques/theories/technologies.

Experiment

- Question
- Research
- Hypothesis
- Materials
- Procedure
- Results & Analysis
- Conclusion

Innovation

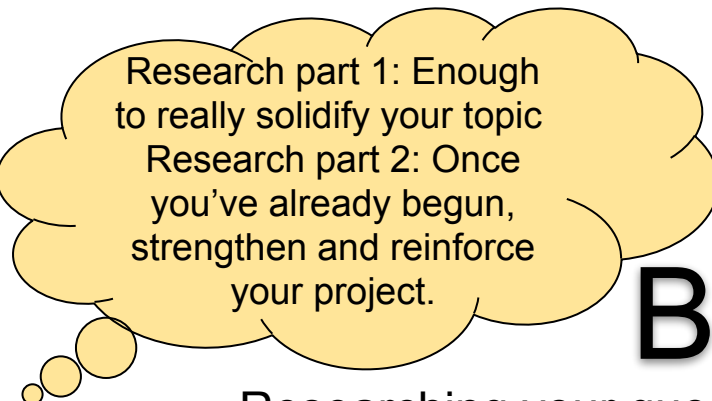
- Question
- Research
- Materials
- Procedure
- Evaluation & Analysis
- Conclusion

Question

A brief statement of the scientific question to be examined.

What do you want to know or explain?

Example: Why are there so many potholes?



Research part 1: Enough to really solidify your topic
Research part 2: Once you've already begun, strengthen and reinforce your project.

Background Research

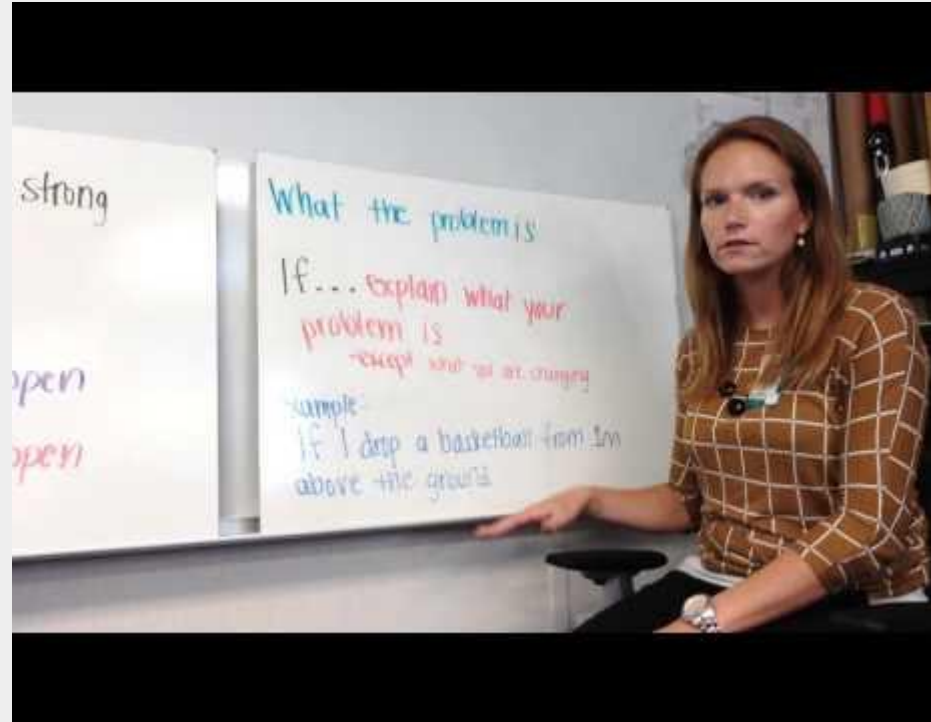
Researching your question lets you know if others have done this same experiment/design before and if so, what their data suggests. If they had a widely accepted conclusion, you may want to try a different angle with your experiment/design or test a different variable.

What should be included in my research?

- Any history of previous research/findings of similar experiments or designs
- Findings from primary sources (interviews, conversations with experts)
- Findings from secondary sources (book, magazine, online articles, etc.)
- Keywords explained
- Any formulas or equations

Hypothesis

- This is an educated guess about the outcome of your experiment and is written before you do the experiment.
- A hypothesis should be written as an “if/then/because” statement



Materials

A list of all
equipment/substances used
along with their quantities

Example:

500 g of chicken feathers

2 kg of asphalt

Two 750 ml plastic containers

15 mL measuring spoon

Procedure

- A detailed list or description of the steps you followed during your experiment/design.
- Diagrams or pictures can be very helpful in this section.
- The steps should be detailed enough for another scientist to be able to repeat the process exactly.
- A typical experiment should have 3 repeated trials for increased accuracy of results

Tips and additional information should follow the instruction, and be included as part of the overall step.



All steps are numbered and in sequential order.



All steps begin with an action verb.



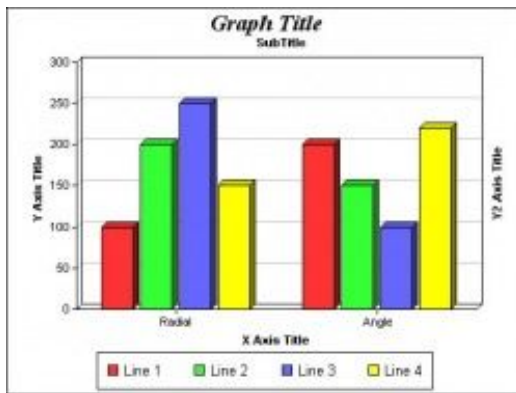
Direct the reader to repeat steps when changing the manipulated (independent) variable.



- 1) Gather all materials.
- 2) Construct K'NEX racer per the attached directions.
- 3) Mark a starting line on the floor with the electrical tape.
- 4) Measure out 1.5 meters on the floor starting at the starting line.
- 5) Mark a finishing line on the floor with the electrical tape.
- 6) Measure the distance between the starting and finishing lines. The distance should be measured in centimeters. Record the distance on the recording sheet.
- 7) Lift up K'NEX racer, wind the rear axle around for six complete revolutions.
- 8) Place front axle of K'NEX racer atop starting line.
- 9) Set chronometer to zero. Say "get set..., go!"
- 10) Press the timer button to start the chronometer and simultaneously release the pressure (squeeze) on the K'NEX racer.
- 11) Press the timer button to stop the chronometer once the front axle crosses the finish line.
- 12) Record time to the nearest hundredth of a second on the recording sheet.
- 13) Calculate the acceleration traveled by the K'NEX racer on the recording sheet. Acceleration is determined by subtracting the initial velocity (speed, V_i) from the ending velocity (speed, V_e), and then dividing by the total time it took to travel the 150 centimeters. $(\text{Final Velocity} - \text{Initial Velocity}) \div \text{Time}$
- 14) Move onto the next surface.
- 15) Repeat steps 3-12 for each of the remaining surfaces.
- 16) Collect / Clean up all materials.

Results

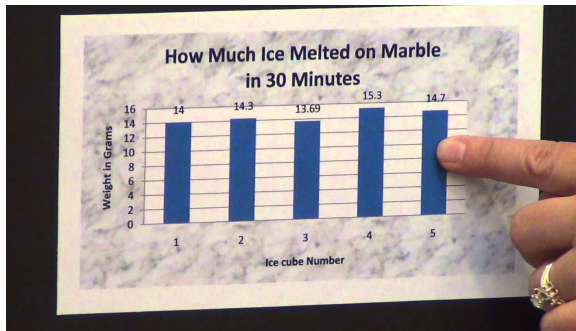
- Here is where you present your data
- Usually presented in neat and organized tables, graphs and/or images
- All calculations used and appropriate labels are included
- Be sure to include all units of measurement
- If applicable, place the independent variable (the variable you are manipulating) on the x-axis (horizontal) and the dependent variable (the variable you are measuring) on the y-axis (vertical)



Movie	Tally	Total
1st Favourite		
2nd Favourite		
3rd Favourite		
4th Favourite		
5th Favourite		

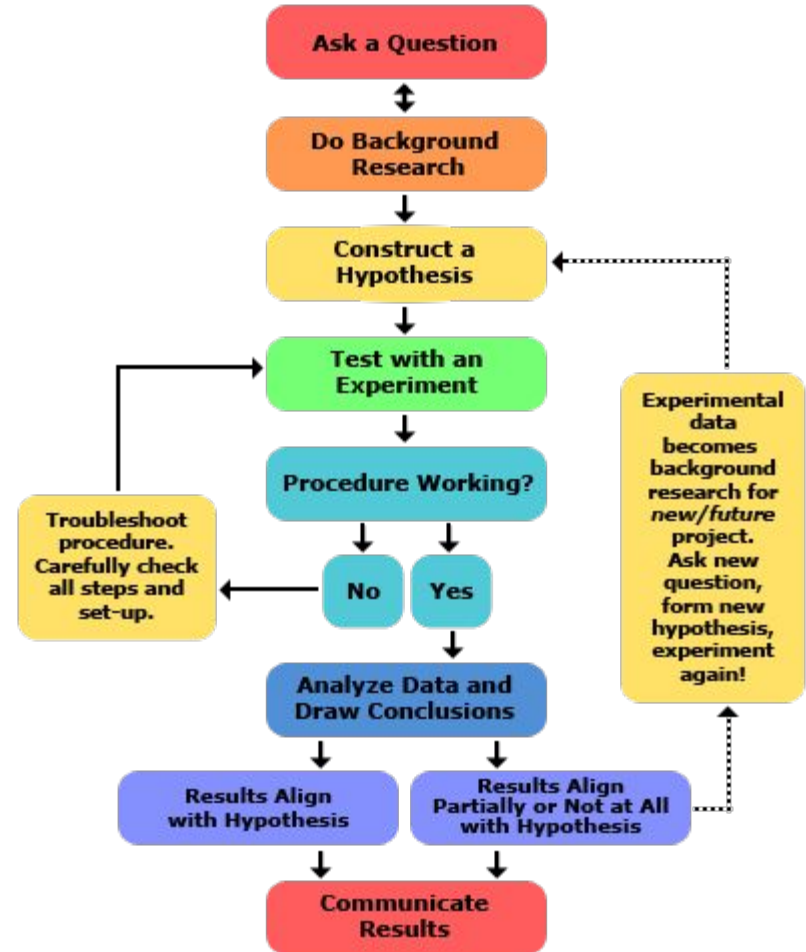
Trial	Block #1	Block #2	Block #3	Block #4
#1	15 cm	10 cm	60 cm	10 cm
#2	40 cm	13 cm	20 cm	10 cm
#3	10 cm	39 cm	184 cm	16 cm
Average	21.2 cm	20.2 cm	88 cm	12 cm

Testable Question	TITLE	Data Analysis
Hypothesis		
Materials Used	Data/Results	Conclusion
Procedure	<ul style="list-style-type: none"> • Graphs • Data tables • Pictures 	



Analysis

- Here is where you analyze your data and the results of your experiment
- Be sure to summarize what happened in your experiment and how those results relate to your hypothesis
- This should be a very detailed comparison between your results and your hypothesis
- The Analysis is closely related to the observations and results portion of your project and often overlap. The results and observations are typically the graphs and numbers recorded, while the analysis lends itself more to the written breakdown of those results: The explanation of what the numbers mean.



Conclusion

This should be a detailed paragraph that answers the initial question and hypothesis based on the observations, results, and analysis.

Avoid personal feelings and emotions

The paragraph should

1. Summarize the data used to draw conclusions and not include any guesses
2. Discuss any real world applications/connections
3. Reject or accept the hypothesis based on the data