Richmond Hill Science Council & S.P.A.R.K. Virtual Science Fair

Official Guidelines & Criteria

Writing a Research Proposal ---------- P1-4

Conducting/Documenting an Experiment-- P5-7

Poster & Video Guidelines ---------- P8

Evaluation Criteria ---------- P9-10

What is Research?

Researching is the creative and systematic work undertaken to increase the stock of knowledge by collecting, organizing, and analyzing evidence to deepen the understanding of a topic or issue

What is a Research Proposal ?

- A research proposal explains the process for an experiment.
- It explains:
    - What you want to study
    - How you would test your idea
- For this challenge, your report should be 2-3 pages long.

Abstract (3-6 sentences)

An abstract is a short summary of your entire project. It should briefly explain what you are studying, what you observed or learned (including information you found online), and why your question is interesting or important.
A strong abstract:

- Introduces the topic of your project
- Clearly states your research question
- Mentions key ideas or information you learned from online sources
- Explains the goal or importance of the project

Your abstract should be written in full sentences and be easy to understand.
Do not include long details or step-by-step instructions.

Research Question

The research question is the main question your project is trying to answer. It should be clear, specific, and testable. Your question should focus on one main factor and explain what you are studying and what you are measuring or observing.

A strong research question:
Is written as one complete sentence
Can be answered using observations, data, or an experiment
Is not too broad or too vague

Example sentence starters:
How does ___ affect ___?
What happens to ___ when ___?

Background

The background section explains what you already know about your topic and what you learned from observing or researching it online. This is where you show that you tried to understand your topic before designing your project.

A strong background:
Describes what you observed in real life or learned in class
Explains key ideas you learned from websites, videos, or books
Uses your own words to summarize information
Helps explain background information to your Research Question

DO NOT copy and paste information from the internet. Focus on the most important ideas that helped you understand your topic.

Hypothesis

A hypothesis is your prediction about what you think will happen in your project. It should be based on what you observed and what you learned from online research.

A strong hypothesis:
Clearly states what you think will happen
Explains why you think it will happen
Apply information you learned in the background section to make an educated guess
Sentence starter you can use:
If ___, then ___, because ___.



Proposed Method

The proposed method explains how you would test your idea. It should describe what you plan to change, what you plan to keep the same, and how you will measure or observe results. Your method should be fair, safe, and realistic.

A strong proposed method:
Explains the steps of the experiment in order
Shows how online research helped you design a fair test
Identifies variables you will change and control
Describes how results will be measured or observed
Write in full sentences and focus on your plan, not the final results.

Data Collection & Analysis

This section explains how you would record your results and how you would make sense of them. It should show that you understand how data helps answer your research question.

A strong data collection and analysis section:
Describes what data you will collect (numbers, measurements, or observations)
Explains how the data will be organized, such as in a table or chart
Describe columns/rows, axis titles (if applicable)
Shows how online learning helped you understand fair testing or data reliability
Explains how you would compare or analyze results

Use clear sentences and focus on how the data helps answer your question.

Challenges or Limitations (Optional)

This section asks you to think about problems you might face if you were to carry out your project. Scientists do this to plan better experiments.
A strong response:
Identifies at least one possible issue or limitation
Explains briefly why it could be a problem
Shows that you are thinking ahead

Examples of issues: Difficulty controlling variables / Limited tools or materials / Measurement errors
You do not need to solve the problem. Just explain what it might be.

Potential Applications (Optional)

This section explains how what you learned could be useful in real life or connected to other ideas. It is optional and meant to show extra thinking and curiosity.

A strong potential applications section:
Connects your topic to everyday life, technology, or science
Explains how the idea could be used or explored further

Is realistic and based on what you learned. You may use words like could, might, or may. This section does not need to be long.

References (MLA Format)

References is a short list of the sources you used for your background. It should clearly show where your information came from, so your reader can check it and so you are not making up the science.

Conducting & Documenting the Experiment

Safety Precautions

- Wear appropriate personal protective equipment, including safety goggles, a lab coat, and closed-toe shoes.
- Tie back long hair and secure loose clothing before beginning the experiment.
- Handle chemicals, glassware, and laboratory equipment carefully and only as instructed.
- Never eat, drink, or touch your face while working in the laboratory.
- Dispose of chemical waste, broken glass, and other materials in their designated containers.
- Immediately report any spills, accidents, broken glass, or injuries to the teacher.
- Wash your hands thoroughly with soap and water after completing the experiment.

1. Identify Purpose of the Experiment

Before beginning, clearly identify what the experiment is intended to investigate. State the main question or problem that the experiment will address. The purpose should be specific and should explain what you are testing and why you are testing it.

E.g. The purpose of this experiment is to determine how the amount of sunlight affects the growth of a plant.

2. State the Hypothesis

Write a testable prediction about what you expect to happen.

Format : If [independent variable is changed], then [dependent variable will change in this direction] because [scientific reasoning]

E.g. If a plant receives more sunlight, then it will grow taller because sunlight provides energy needed for photosynthesis.

3. Identify the Variables

Clearly identify the variables involved in the experiment.

- Independent variable: The factor that you deliberately change.
- Dependent variable: The factor that you measure or observe.
- Controlled variables: Factors that are kept the same to make the experiment fair.

Record the units of measurement whenever applicable.

4. Prepare the Materials

Make a complete list of the materials, equipment, and quantities required.

Include:

- Names of materials
- Amounts or quantities
- Measuring instruments
- Equipment used
- Any relevant specifications

Make sure all equipment is available and functioning properly before starting.

5. Write the Procedure

Describe the experimental procedure in a clear, logical sequence.

The procedure should:

- **Be written in numbered steps.**
- **Include enough detail for another person to repeat the experiment.**
- **State measurements, quantities, and time intervals precisely.**
- **Explain how observations and measurements will be recorded.**
- **Include relevant safety precautions.**

Avoid vague instructions such as "use some water" or "wait a while." Instead, provide specific amounts and times.

6. Conduct the Experiment (i.e. follow the written procedures)

Make sure all equipment are rinsed before using to eliminate impurities as a possible confounding variable.

7. Record the Results

Present the observations and measurements clearly and accurately. You may use Data tables, graphs, or use qualitative observations

8. Analyze the Results

After collecting the data, examine what the results show.

Consider:

- **What patterns or trends appear?**
- **Did the dependent variable change when the independent variable changed?**
- **Were there unusual or unexpected results?**
- **Do repeated trials show similar results?**
- **What calculations are needed to interpret the data?**
- **Does the evidence support the hypothesis?**

Use the data as evidence rather than relying only on what you expected to happen.

9. Write the Conclusion

The conclusion should directly answer the experimental question.

A strong conclusion should include:

- **State the Finding : Briefly explain what the experiment showed.**
  - **E.g. The results showed that plants receiving more sunlight generally grew taller over the seven-day period.**
- **Use Evidence : Support the finding with specific observations or data.**
  - **E.g. The plant receiving 8 hours of sunlight grew an average of 6 cm, while the plant receiving 4 hours grew an average of 3 cm.**
- **Address the hypothesis : State whether the results supported or did not support the hypothesis.**
  - **E.g. These results support the hypothesis that increased sunlight would lead to greater plant growth.**

10. Explain Implications of Results

The implications explain why the results matter and what can reasonably be learned from them. When writing implications, move beyond simply repeating the results. Explain what the findings suggest, demonstrate, or could be useful for.

Your explanation should answer these 4 questions :

- What do the results suggest?
- Why are the results important?
- How could the results be applied?
- What are the limitations? (ie. what the experiment cannot establish)

11. Discuss Sources of Error and Limitations

Possible sources of error during the experimental process, most commonly human errors.

Examples include

- Measurement uncertainty
- Human error
- Equipment limitations
- Environmental changes
- Small sample size
- Too few trials
- Variables that were not fully controlled

Explain how each limitation could have affected the results rather than simply listing "human error."

E.g. The amount of water may not have been measured precisely during each trial. This could have affected plant growth and introduced variation between the groups.

Poster & Video Guidelines

How to make a Poster

Size

- Standard trifold size (36x48 inches)
- Can be bought at your local dollarama
- Can also be digital as a series of pages! (PDF Filetype)

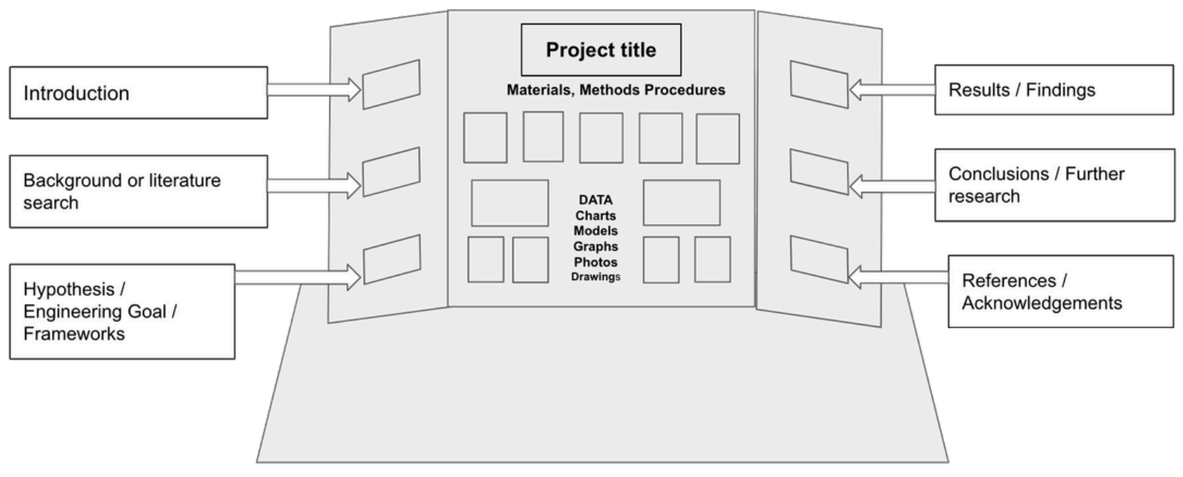
What to include (Subheadings)

- Purpose
- Hypothesis
- Variables (All 3 kinds!)
- Materials list and procedure
- Data and analysis
- Implications and limitations
- Conclusion

Style

- Try to make the poster visually interesting with distinct sections and images, not just a wall of text!
- Use graphs if applicable

Example Layout



How to Film the Video

Length

- 2 minutes maximum

Structure

- No strict structure, but make sure to go through all your main points!

Example Structure

- Intro and hypothesis (20 - 30 sec)
- Method and experiment (20 - 30 sec)
- Data, implications, limitations (30 - 40 seconds)
- Conclusion (20-30 seconds)

Other tips

- Pick a place with good lighting
- Use a higher-quality camera
- Don't read directly off your research!

- Make sure your video has distinct sections
- Make sure the audio and visuals are understandable and readable
- Speak clearly and project your voice



Evaluation Criteria

1. Clarity of Idea

- ☐ My research question is one clear, complete sentence
- ☐ My question focuses on one main factor and says what I am measuring or observing
- ☐ A classmate could read my abstract and explain what my project is about
- ☐ My hypothesis clearly states what I think will happen and why
- ☐ I use simple, specific words and explain any science terms I include

2. Creativity & Originality

- ☐ My question comes from something I noticed, wondered about, or care about
- ☐ My project is not a copy of a common online experiment, or it adds my own twist
- ☐ I found a fresh way to test my idea, use materials, or show my results
- ☐ I connected my topic to everyday life, technology, or another area of science
- ☐ My ideas and wording are my own, and I credited sources where I used them

3. Logical Reasoning

- ☐ My hypothesis is based on my background research, not a random guess
- ☐ My experiment actually tests my research question
- ☐ I changed only one variable and kept the others the same (a fair test)
- ☐ My conclusion is supported by my data, not just what I hoped would happen
- ☐ I explained what my results mean (my implications) and why they matter
- ☐ I named at least one limitation and what I would do differently next time

4. Quality of the Experiment

- ☐ My steps are written in order, so someone else could repeat them
- ☐ I recorded my data as I went, using tables, charts, or clear observations
- ☐ My tables and graphs have titles, labels, and units
- ☐ I repeated my trials when possible so my results are more reliable
- ☐ I included photos, sketches, or notes that show I really did the experiment
- ☐ I was honest about unexpected or "failed" results and explained them

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5. Overall Presentation (Poster & Video)

Poster

- ☐ It follows the required size and includes all required headings
- ☐ It is neat, easy to read from a distance, and not overcrowded
- ☐ Graphs, images, and text are balanced and support each other

Video

- ☐ It is 2 minutes or less
- ☐ I speak clearly and explain my project in my own words (I'm not reading off my proposal)
- ☐ It has a clear beginning, middle, and end
- ☐ The sound and picture are clear enough to follow

Final Check Before Submitting

- ☐ Research proposal (2-3 pages), poster, and video are all complete
- ☐ My question, hypothesis, results, and conclusion match across all three
- ☐ References are listed in MLA format
- ☐ Everything is proofread for spelling and grammar