Science Fair Resource Package
Teacher and Student Edition: Study Package

Compiled by Kelsey Knoblauch, Dr. John G Egnatoff School
Contributions by Saskatoon Public School Division Teacher Heather Reid
and Education Development Specialist Aditi Garg

Table of Contents

Science Fair Project Descriptions

There are three types of projects that may be presented at the Saskatoon Regional Science Fair:

- Experiment/Discovery Project
- Study/Discovery Project
- Innovation Project

Experiment/Discovery Project: A practical, hands-on investigation undertaken to test a scientific hypothesis. Experiments follow the scientific method and are designed to investigate one measurable variable; other variables are controlled. Data is thoroughly analyzed using statistical methods. The best projects include original questions, to which the answer is not presently known, or new experimental methods.

Study/Discovery Project: Analysis of, and possibly collections of, data using accepted methodologies from the natural, social, biological, or health sciences. This includes studies involving human subjects, biology field studies, data mining, observation and pattern recognition in physical and/or socio-behavioural data. The study correlates information from a variety of peer-reviewed publications and from systematic observations, and reveals significant new information, or original solutions to problems. Quantitative studies should include appropriate analysis of some significant variable(s) using arithmetic, statistical, or graphical methods. Qualitative and/or mixed methods studies should include a detailed description of the procedures and/or techniques applied to gather and/or analyze the data (e.g. interviewing, observational fieldwork, constant comparative method, content analysis).

Innovation: Development and evaluation of new devices, models, theorems, physical theories, techniques, or methods in technology, engineering, computing, natural science, or social science. Students may integrate several technologies, inventions, or social/behavioural interventions or design and construct an innovative application that will have human and/or commercial benefit. The best projects include a clear understanding of technological and scientific principles that guide the design and construction of the device.

If you are unsure of what category your project falls into, ask your teacher or a mentor!

Science Fair Overview

Purpose:

This document is intended to serve as a guide in creating a high-quality science fair project. There are numerous components to be considered and included in a thorough project. Before beginning, set yourself up for success by reviewing this document carefully. This resource package provides guidance specifically for study projects. For guidance on innovation and experiment projects, please see the respective resource packages.

The purpose of science fair projects is to develop *real* science skills with a topic that interests you. Science fairs give you the opportunity to complete an independent, hands-on, inquiry-based project that addresses an important scientific question or problem. Consider reaching out to universities and local scientific organizations for possible mentorship opportunities to support your project requirements.

Getting Started

1. Decide if you will be working alone or with a partner. Either way, your teachers, parents, or others may provide appropriate assistance, however the work must be student produced. Pick a partner that you will work well with. This is a major project that requires lots of time and energy. Don't just pick someone because they are your friend – make sure you can trust them to handle half of the workload. You will need to schedule time to work on the project together, so pick someone that you communicate well with and are able to meet with after school or on weekends.

2. Decide if you are doing an experiment, innovation or a study. If you choose to do a study, you are in the right place! If you want to do an innovation or experiment, look at the other resource packages on our website.

3. Choose a topic that interests you. Since this is a major project that takes up time and energy, you might as well do it on something that you like! To SPARK some ideas, you can visit: https://mystemspace.ca/spark/ and chat with spark, the AI idea generator.

4. Choose a topic that is safe and legal – making bombs, fireworks, firecrackers, drugs etc. would not be considered safe or legal. If you are working with human participants or animals, please contact the Saskatoon Regional Science Fair Committee at: saskatoonsciencefair@gmail.com. Your project must also follow Canada-Wide Science Fair ethical standards. More information on safety requirements can be found on the Canada-Wide Science Fair website: https://mystemspace.ca/start-a-project/safety-and-ethics/

5. Design an experiment that requires materials and equipment you can easily access (or plan on connecting with a mentor early in your planning).

6. Determine the type of study you will be completing for your science fair project. Research methods can be categorized as quantitative (analysis of "numbers"), qualitative (analysis of "words" or "concepts"-non-numerical data) or mixed-methods (with elements of both qualitative and quantitative methodologies). If you are unsure of what category your study falls into, ask your teacher or a mentor!

7. A study requires reliable and current research. Studies require you to gather research from reliable scientific sources. Whether that be peer-reviewed publications and/or systematic observations, you will be required to access numerous sources pertaining to your topic. There are various avenues to finding good scientific literature. You can utilize:

Google Scholar: https://scholar.google.ca/

Microsoft Academic: https://www.microsoft.com/en-us/research/project/academic/

Yahoo Research: https://research.yahoo.com/?guccounter=1

CiteSeer^X: http://citeseerx.ist.psu.edu

ArXiv: https://arxiv.org/

University of Saskatchewan online library USearch:
https://primopmtna02.hosted.exlibrisgroup.com/primoexplore/search?vid=USASK&sortby=rank
(you may need to get in touch with your school librarian to obtain access to the above library)

University of Saskatchewan Undergraduate Research Journal:
https://www.usask.ca/urj/issues.php#CurrentIssue

Contact appropriate colleges at the University of Saskatchewan: https://www.usask.ca/colleges.php

Contact your local community library branch for access to subscription-based academic journals:
https://saskatoonlibrary.ca/

8. Get yourself a binder for keeping all of your Science Fair work organized. This will make the process of writing your presentation and designing your display so much easier. Good science involves meticulous notes and careful descriptions of every step taken.

9. Be aware of the various deadlines. This project is *very* difficult (if not impossible) if you leave it to the last minute. By setting up a regular schedule and working on it in chunks, you will produce a high-quality science fair project and make your life easier!

Project Components

1. **Proposing Your Idea to an Adult or Mentor and Researching Your Topic** – Once you decide upon your science fair topic, summarize your idea and propose it to an adult or mentor. Proposing your idea to an adult or mentor can help iron out kinks before beginning your experiment. After the proposal, you need to begin researching. Background research should include information such as any current research being done on your topic, scientific information about materials, etc.

2. **Science Fair Project: Draft Your Plan for ProjectBoard** –Work on your project, following the scientific method, by completing pages 8 to 11 in this resource package.

3. **Lab Book** – A bound book or digital file including all procedures, results and observations in their raw form. This includes all qualitative and quantitative data taken during the experiment (including the dates gathered), any calculations, and statistics such as averages as averages or percentages (this may include ranges, standard deviations, or error). Essentially, judges will look through this for more detailed data. The presentation will include summarized charts and statistics to acquire only essential data.

4. **Science Fair Final Project: ProjectBoard** –You need to fully publish your findings and conclusions through a professionally written virtual presentation on ProjectBoard. For information on how to get started check out**:**
   https://youthscience.public.doctract.com/doctract/documentportal/08DB14EF8F7E96B0F6B1B2D1
   9FAB5E2B

5. **Display** – This is the final display that you will show to the world. You will need to present your project on a trifold backboard or poster display. Remember, this is what the audience gets to see, so make sure to pay attention to details! Display backboards require you to exercise skills in design aesthetics. For more guidelines, check out page 12-13 in this resource package.

6. **Abstract** – A 150-word maximum summary of your topic that includes:
   - purpose
   - methods: steps you are taking to complete your study (discuss your approach: quantitative , qualitative or mixed-methods)
   - results
   - conclusion

The abstract should allow readers to understand the project without reading the entire science fair project report. The abstract is used to classify the type of science fair project and assign appropriate judges for the regional fair. For more guidance you can visit: https://www.sciencebuddies.org/science-fair-projects/science-fair/how-to-write-a-science-fair-project-abstract

7. **Oral Presentation** – The scientific world emphasizes the value of sharing scientific findings with experts and members of the community. Make sure you are well rehearsed to share your project in various degrees of depth: 7 minutes, 5 minutes, 2 minute discussions. If there are two people presenting the project, **both** must talk. For more guidelines, check out page 14-15 in this resource package.

Science Fair Project Plan: Draft Your Plan for ProjectBoard

1. Project Title:

2. Investigative Question/Purpose: What is the purpose of your study? What is the problem to be solved or analyzed for improvements?
As you begin formulating your study's questions/purpose, make sure you clearly understand the differences between an experiment and observational study:
https://helpfulprofessor.com/experiment-vs-observational-study/

3. Resources:

    A. Finding Peer-Reviewed Publications and Other Suitable Resources: It is important to determine what is currently known about a topic so that you can extend understanding of that topic and create new knowledge. Peer-reviewed publications will provide you with important background information that will help you determine what areas other researchers are currently exploring so that you can extend that knowledge. The resources you access should be mostly peer-reviewed publications. Other resources include reports from governments or research organizations or textbooks. Wikipedia may be a helpful starting point but should not be used as a final resource. Refer to page 6 to find a list of possible links and places you can access these types of journals and articles.

    In order to determine whether or not the publication is relevant to your study, read the abstract. After reading the abstract fill in the chart below for each resource. This will help you determine key words/data, important details, and whether or not the resource is significant to your study (see appendix 1 on pages 21-22 for a template).

Resource	Key Words/Key Data	Highlights (Key Phrases)	Rating the Details
			Importance to the topic/question: ⟷ not very important valuable **Contributes to the research purpose:** ⟷ slight contribution powerful contribution

B. **Referencing:** In order to plan, analyze, and understand your results, you will need to reference the resources you used in your project. Determine which of the resources you found above will be used in your study. Keep track of all of these resources below. In a study, the resources you access should be mostly peer-reviewed publications.

Resource A:

Resource B:

Resource C:

Resource D:

C. **Reading Resources:** You will now need to read deeper into each article. Read beyond the abstracts through all information in the resources you chose. Write all research notes on separate pages.

4. **Literature Review/Critical Analysis:** Now that you've read through numerous publications and determined the information most important/applicable to your study, you need to critically analyze the articles. Look at all articles to determine the following:
   a. What questions are you left with? What gaps do you notice?
   b. What common themes are emerging?

5. **Methods:** What is the best method to answer your research question? Explain the process you used to complete your study. Some research methodologies include:
   a. Interviews
   b. Surveys
   c. Observations
   d. Systematic review and meta-analysis

For more guidance you can visit:

https://helpfulprofessor.com/types-of-research-methods/

https://helpfulprofessor.com/types-of-research-design/

6. **Results:** How your results are presented will depend on the chosen methodology. Be sure you have a clear concept of what you have determined throughout your study. Return to your initial question:
    a. What is your answer to your question? What conclusion(s) have you come to?
    b. What evidence do you have to support your conclusion?

Science Fair Project: Sharing Your Final Project

Science Fair projects can be shared in various ways. If you are entering the Saskatoon Regional Science Fair, you'll be required to:

1. **Register online with Youth Science Canada as a Regional Saskatoon Fair Participant:** To register, check out**: https://portal.youthscience.ca/

2. **Complete a virtual presentation on ProjectBoard**: For information on how to get started check out**:
   https://youthscience.public.doctract.com/doctract/documentportal/08DB14EF8F7E96B0F6B1B2D19FAB5E2B

3. **Complete a Display:** At the Saskatoon Regional Science Fair you may choose to construct a display board by utilizing a tri-fold cardboard display or a 4ft. by 3 ft. poster. Regardless of your choice of materials, the display must be sturdy enough to stand alone on a table. The display is a vital component to your science fair project. Essentially, your display showcases your work to viewers and judges and can often separate a superior project from a mediocre project. The display board should be well organized, include information allowing viewers to get a good understanding of your overall project, and be visually appealing. If you used special equipment, the set-up should be placed in front of your display or in a place to enhance the exhibit—not to overwhelm it. Remember that you must follow the rules and regulations for items displayed at the Saskatoon Regional Science Fair: https://mystemspace.ca/start-a-project/safety-and-ethics/

   For more information about how to design a display:
   a. Watch the following videos by Mike Morrison, a psychology doctoral student at Michigan State University, who is working with Youth Science Canada to promote more engaging and effective scientific posters:
      i. https://www.youtube.com/watch?v=SYk29tnxASs
      ii. https://www.youtube.com/watch?v=SYk29tnxASs
   b. Check out the project display template:
      i. https://osf.io/2rx5q
      ii. https://osf.io/6ua4k

4. **Prepare a Professional Oral Presentation:** The ability to clearly communicate the purpose, methodology, and findings of your science fair project is critical to your success and enjoyment of sharing your work to viewers and judges. This portion refers to the oral communication of your project. Scientists and researchers in various vocations and industries attend conferences to share their work and to learn and listen to others. Presenting your project orally requires specific skills and preparation. Typically, you will first have an opportunity to present your project to judges and then engage in a question and answer session. The first time you present your project to viewers should not be at the regional science fair; you need to practice presenting your project to others before attending. Prepare the flow of your presentation to follow the scientific method: plan, predict, carry out design, analyze findings, and conclude. Each person who views your project at the Saskatoon Regional Science Fair will wish to understand your project at different levels: quick summary, detailed summary, in-depth. **In order to prepare for all viewers, create a 2 min, 5 min, and 7 min oral presentation.**

Speaking/Presenting Criteria – The "Do's" and "Don'ts"

- speak with a clear loud voice
- be confident: remember, you are the expert because it's your project!
- make eye contact with the viewer (do not read straight off your board or cue cards: these are references only)
- smile and introduce yourself before talking about your project
- speak at a moderate pace (too fast—viewers cannot comprehend the information, too slow and you will not be able to explain all information to viewers)
- watch and listen to your viewers—if questions are asked during your presentation, pause, breathe, and respond to the question before continuing your speech

Appendix: Study Resource Package

Appendix 1: Links to Help Develop a Science Fair Project

- Registration: https://mystemspace.ca/create-account/
- How to Get Started: https://mystemspace.ca/
- Generating Project Ideas: https://mystemspace.ca/spark/
- Experiments vs. Observational Studies: https://helpfulprofessor.com/experiment-vs-observational-study/
- ProjectBoard Resources: https://mystemspace.ca/start-a-project/resources/
- Getting Started with ProjectBoard: https://youthscience.public.doctract.com/doctract/documentportal/08DB14EF8F7E96B0F6B1B2D19FAB5E2B
- Display:
    - https://www.youtube.com/watch?v=SYk29tnxASs
    - https://www.youtube.com/watch?v=SYk29tnxASs
    - https://osf.io/2rx5q
- Past projects are available for viewing: https://projectboard.world/ysc/home
- Saskatoon Regional Science Fair website: conferences.usask.ca/srsf

Appendix 2: Evaluating Resources Template

Resource	Key Words/Key Data	Highlights (Key Phrases)	Rating the Details
			Importance to the topic/question: not very important — valuable **Contributes to the research purpose:** slight contribution — powerful contribution
			Importance to the topic/question: not very important — valuable **Contributes to the research purpose:** slight contribution — powerful contribution
			Importance to the topic/question: not very important — valuable **Contributes to the research purpose:** slight contribution — powerful contribution

			Importance to the topic/question: ⟵————————————⟶ not very important valuable **Contributes to the research purpose:** ⟵————————————⟶ slight contribution powerful contribution
			Importance to the topic/question: ⟵————————————⟶ not very important valuable **Contributes to the research purpose:** ⟵————————————⟶ slight contribution powerful contribution
			Importance to the topic/question: ⟵————————————⟶ not very important valuable **Contributes to the research purpose:** ⟵————————————⟶ slight contribution powerful contribution
			Importance to the topic/question: ⟵————————————⟶ not very important valuable **Contributes to the research purpose:** ⟵————————————⟶ slight contribution powerful contribution