Science Fair Resource Package

Teacher and Student Edition: Experiment Package

SASKATOON REGIONAL SCIENCE FAIR

Adapted and Edited by Kelsey Knoblauch, Dr. John G Egnatoff School
Contributions by Saskatoon Public School Division Teacher Heather Reid
and U of S 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 experiment projects. For guidance on innovation and study 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 an experiment project, you are in the right place! If you want to do an innovation or study, 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. Develop a scientific question you want to answer. Experiments require that you first develop a quality, ***testable question*** with ***measurable variables*****.** Often students make the mistake of choosing a question that explores scientific phenomena through a demonstration or that does not have clearly measurable variables. From this scientific question you will develop your hypothesis.

7. 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.

8. 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/08DB14EF8F7E96B0F6B1B2D19FAB5E2B

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 experiment)
    - 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 12-13 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 experiment? Is there a problem to be solved?

3. Research and Resources: In order to plan, analyze, and understand your results, you will need to complete research. Keep track of all sources below (books, websites, magazines, etc.). Write all research notes on separate pages.

Resource A:

Resource B:

Resource C:

Resource D:

4. **Hypothesis:** What idea are you testing to see if it is true? What outcome are you expecting and why? You may reference your research for evidence to support your hypothesis.

5. **Variables:** Identify the variables of your experiment.

Independent Variable: A variable that is intentionally changed to observe its effect on the dependent variable.

Dependent Variable: What you are observing in your experiment. The dependent variable is measured to determine the effect. Its value depends on changes in the independent variable.

Controlled Variable: Aspects which are maintained the same across all groups or trials.

6. Procedure:

a. **Materials**: List any supplies utilized in the experiment (bullet points with quantities if possible). These are similar to the ingredients and equipment needed to cook a certain recipe.

b. **Method and Diagram:** Numbered step by step instructions. These should be detailed, yet simple instructions that ANYONE could follow. Your experiment needs to be replicable with reproducible results. You must include a diagram of your experimental set up. Think of this as the directions of a recipe with how-to images.

7. Results:

a. **Data Tables:** Create data chart(s) you will use to record your data during the experiment. **Put this in your lab notebook.** Consider how you will record both qualitative and quantitative data. All tables containing numerical data should be clearly titled and include units and degrees of uncertainty.

DO NOT RUSH THIS SECTION. THIS MAY BE ONE OF THE MOST IMPORTANT SECTIONS LATER WHEN YOU ARE WORKING ON YOUR EXPERIMENT!

Things to consider: How many trials do you need? What will the results look like?

i. Sample Calculation(s) – If you ever do an experiment that requires you to do a calculation after collecting your data, you always need to show one and only one example of how to perform the calculation. There should be one sample calculation for EACH different calculation performed.

A good experiment collects as much relevant data as possible. There are two types of data that you can collect in an experiment:
Qualitative Data is descriptive data that describes the qualities of an event. Could be things such as colour, smell, texture, etc. Does not include numbers.
Quantitative Data involves numbers and quantities and can be measured. Could be things such as mass, volume, length, temperature, time, speed, age, people, etc.

b. Graphs: Graphs allow for clearer communication. Quantitative results should be taken and made into a graph. As a rule of thumb, any graph being viewed should be understood without other information. The type of graph you utilize depends on the data being presented. Consider scatter plots or bar graphs.

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 (reference ethics manual).

   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: Experiment Resource Package

SASKATOON
REGIONAL
SCIENCE
FAIR

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/
- 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: https://conferences.usask.ca/srsf/index.php