Science Fair Resource Package

Teacher and Student Innovation Package

SASKATOON REGIONAL SCIENCE FAIR

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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 innovation projects. For guidance on experiment 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. **Develop a scientific question you want to answer.** Innovations require that you first develop a quality question or challenge you wish to address. You will need to apply scientific understanding of a variety of technological principles to solve or address your question.

6. **Ideation:** brainstorm and generate creative ideas and possibilities to meaningfully address your scientific question or challenge. This is an important component of design thinking, which is crucial to follow when putting together an innovation project: https://letstalkscience.ca/educational-resources/backgrounders/design-thinking

7. **Design an innovation** of a new device, model, theorem, physical theory, technique, or method in technology, engineering, computing, natural science or social science. The best innovation projects integrate several technologies, social/behavioral interventions, or innovative applications of existing technologies that will solve a problem or address a need.

8. **Prototype analysis:** 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. Innovation projects, in particular, require careful documentation which could include multiple photographs and diagrams to track the development and evaluation. Often students make the mistake of simply executing one iteration or prototype of their innovation without considering manipulation or improvement. There must be trackable, measurable progress in the development of your innovation.

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 innovation. 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 9 to 12 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 design of your prototypes and testing of your innovation (including the dates), 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 13-14 in this resource package.

6. **Abstract** – A 150-word maximum summary of your topic that includes:
    - purpose
    - your research
    - information about your prototypes that led you to your final design
    - 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 13-14 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 innovation? What is the problem or need to be solved?

3. Criteria and Constraints

Criteria are things the design needs to do in order to be successful--its requirements. Constraints are limitations on the design.

4. 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.). Wikipedia is a great starting point but not a reliable source. Write all research notes on separate pages.

	Title	Publish date	Authors	Type	Key points
Resource A:					
Resource B:					

**You will need many more resources, please make your own table to record the necessary information.

5. Brainstorming/Ideation of Potential Solutions

What outcome are you expecting and why? You may reference your research for evidence to support the question or purpose. Here we outline two methods, you can find your own with the help of your mentor or teacher.

Swim Lane Method

Come up with a few ideas that may solve your problem (can be more too but may be confusing). Then determine parameters you can use to evaluate each idea. Use the rubric to fill the 'rating' column for each idea. You can use a different colour or different table for each idea. The idea with the highest rating is the first idea you should pursue. You can always pursue the second-place or lower ranked ideas if the first doesn't work out.

Parameters	Undesirable quality (1)	Rating out of five	Desirable quality (5)
Ease of implementation	*challenging*		*easy*
Investment of Resources	*expensive or intensive*		*cheap or accessible*
Investment of time	*many hours*		*few hours*
Investment in science or technology learning	*significant amount of new knowledge acquisition*		*little amount of new knowledge acquisition*
Who will benefit – sphere of influence	*Individual/Personal*		*Global*

***Please use your own parameters and qualities as necessary!*

The Wrong Way Method

Instead of generating ideas for solving problems, deliberately try to generate poor ideas or ways to make the problem worse. For example, if trying to improve access to drinking water, ask "What could I do to ensure someone never had potable water?" By focusing on poor service, the focus is on the issues that matter most, which may generate ideas that are better positioned to solve the problem.

What makes the problem worse?	Twist/flip to make it better?
sediments in water	*remove sediments with a filter*
rusty/leaky pipes	*find a material that does not rust/leak*
Tastes bad	*Remove odor chemically or with heat*

***use your own examples*

It can be useful to write up a list of ideas without 'judgement' and then leave it for a day. Come back 24 hours later and then review your list of ideas again to critique and eliminate ideas.

6. Implementation

The prototype may be quick and rough, and cheap materials can be used to test and fix your design. There will likely be many prototypes and you should record all changes, modifications, adaptations as part of your lab book. This will likely be a cycle: Design, build, test, feedback, adjust, repeat.

Materials: Keep track of any supplies utilized. Include quantities if possible. These are similar to the ingredients and equipment needed to cook a certain recipe and will help future citizen scientists recreate or test your innovation.

Method and Diagrams: Number any step-by-step instructions. These should be detailed, yet simple instructions that ANYONE could follow. Your prototypes need to be replicable with reproducible results. Include diagrams and descriptions of each prototype. You will need many iterations or versions of your prototype before you get to the final version. Think of this as the directions of a recipe and with how-to images. In the film *Iron Man* (Favreau, Jon, director. Paramount Pictures, 2008), Tony Stark, an innovative billionaire, builds and tests his Iron Man suits while recording each test using video. At the start of each clip, he records the test number, prototype and any special details about that version of the suit. This might be a good way to document your work before you transfer details to your lab book. Please refer to the ethics section of this booklet before attempting to test a superhero suit on human subjects.

7. Data results

Create data tables to record results. 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.

Qualitative Data are descriptive data that describes the qualities of an event. Could be things such as colour, smell, texture, etc. Does not include numbers.
Quantitative Data involve numbers and quantities and can be measured. Could be things such as mass, volume, length, temperature, time, speed, age, people, etc.

Sample Calculation(s) – If you ever do any procedures 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.

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: Innovation 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/
- Design Thinking: https://letstalkscience.ca/educational-resources/backgrounders/design-thinking
- 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