ENCOURAGING WONDER

Enhance your science program and engage students as part of your curriculum

INTRODUCTION

Nova Scotia Youth Experiences in Science (NS YES) has designed this handbook as a practical reference guide for Junior High science teachers on how to inspire your students for a lifetime of innovation and learning.

This Teacher's Guide has three goals:

- To demonstrate the connection between inquiry-based science activities and curriculum expectations
- To help you encourage student success through the process of a inquiry-based activity from conception to conclusion
- To communicate the steps and celebrate the results of the student projects

And some other Really Good Stuff…..

Locate the pushpin for a wealth of support and resources

MEET CURRICULUM OUTCOMES AND ...

*Become a **S**cience Champion*

*Cultivate a **C**urious Classroom*

*Focus on **I**nquiry Learning*

***E**ngage your students*

***N**urture 21st Century Skills*

*Build Scientific **C**onfidence*

***E**nhance Your Science Program*

... INCORPORATE PROJECT-BASED SCIENCE

CONTENTS

PART 1 – Overview

PART 2 – Organizing Students for Success

PART 3 – Competition

WHAT IS INQUIRY?

Did you know that students can be actively involved in their own learning?

Incorporating project-based science as part of your curriculum is a teaching approach that engages students to learn essential knowledge and life-enhancing skills through an extended “hands-on, minds-on”, student-influenced inquiry process. When students use the scientific method to design and execute a project, they use the same steps professional researchers use to gather new information.

“I get these questions in my head and I always just want to answer them. I think science is about figuring out things for yourself.”

James Nunn,
Coldbrook and District School
Coldbrook, N.S

By encouraging exploration of science through inquiry

You Will:

- Address different learning styles and cognitive strengths
- Provide an opportunity for a positive learning experience
- Meet Curriculum Outcomes
- Promote positive attitudes, skills, and knowledge
- Nurture 21st Century Skills

You’re Students Will:

- Recognize that their own curiosity and interests can lead to compelling research questions and substantive scientific hypothesis
- Believe their research can and will have meaningful consequences
- Feel they are ‘living’ the scientific process just as professionals do
- Feel they are EXPERTS on their topics

ENGAGING YOUR STUDENTS: Inquiry-Based Projects

An important part of learning science is doing science. Inquiry-based projects offer students an opportunity to practice science investigation in a manner that incorporates their backgrounds, skills, and interest.

Benefits of Inquiry-Based Instruction

- Heightening student interest in science and allow for the exploration of personal interest areas
- Promoting the cognitive and intellectual development of students
- Providing students with authentic, hands on experiences through scientific engagement
- Engaging students in scientific investigation beyond the routine classroom
- Bringing attention to scientific experiences in school
- Fostering the development of students' sense of personal capabilities and qualities
- Providing the opportunity to recognize and commend scientific accomplishments
- Heightening public interest for scientific teaching and learning including the scientific abilities of students
- Instilling an appreciation for the relevance of science in daily life

WHERE TO GET HELP

You are not alone and we are here to help you every step of the way! NS YES offers a whole range of programs and materials to help you bring the science fair experience to your classroom.

⇒ Visit **sciencefairinfo.ns.ca** for a wealth of online resources, tips, and classroom support material

⇒ Contact us for a **Project-based learning presentation** for your classroom

⇒ Order our free **"Preparing for Science Fairs"** DVD

Other Online Resources:

Nova Scotia Department of Education and Early Childhood Development

A Closer Look: Doing Project-Based Science, A Curriculum Resource (2013)
ednet.ns.ca/files/curriculum/DoingProject-BasedScience.pdf

Youth Science Canada

The SMARTS Guide to Science Fairs
smarts.youthscience.ca/sites/default/files/frontpage/SMARTS_Guide-E.pdf

Science Buddies
sciencebuddies.org

Outcomes covered by a Science Fair Project

GRADE 7

STSE (Science, Technology, Society, and the Environment)

109-1 – describe the role of collecting evidence, finding relationships, and proposing explanations in the development of scientific knowledge

109-7 – identify different approaches taken to answer questions, solve problems and make decisions

109-10 – relate personal activities in formal and informal settings to specific science disciplines

109-12 – distinguish between terms that are scientific or technological and those that are not

ATTITUDES

425 – show a continuing curiosity and interest in a broad scope of science-related fields and topics

426 – confidently pursue further investigations and readings

427 – consider many career possibilities in science and technology related fields

428 – consider observations from a variety of sources during investigations and before drawing conclusions

430 – persist in seeking answers to difficult questions and solutions to difficult problems

431 – work collaboratively in carrying out investigations as well as generating and evaluating ideas

434 – show concern for safety in planning, carrying out, and reviewing activities

SKILLS

208-2 – identify questions to investigate arising from practical problems issues

208-3 – define and delimit questions and problems to facilitate investigation

208-5 – state a prediction and a hypothesis based on background information a\or an observed pattern of events

208-6 – design an experiment and identify major variables

208-8 – select appropriate methods and tools for collecting data and solving problems

209-1 – carry our procedures controlling the major variables

209-3 – use instruments effectively and accurately for collecting data

209-4 – organize data, using a format that is appropriate to the task or experiment

209-5 – select and integrate information from various print and electronic sources or from several parts of the same source

209-6 – use tools and apparatus safely

210-2 – compile and display data , by hand or computer, in a variety of formats, including diagrams, flow charts, tables, bar graphs, line graphs and scatter plots

210-3 – identify strengths and weaknesses of different methods of collecting and displaying data

210-6 – interpret patterns and trends in data, and infer and explain relationships among the variables

210-7 – identify, and suggest explanations for, discrepancies in data

210-10 – identify potential sources and determine the amount of error in measurement

210-11 – state a conclusion, based on experimental data, and explain how evidence gathered supports or refutes an initial idea

210-12 – identify and evaluate potential applications of findings

210-13 – test the design of a constructed device or system

210-16 – identify new questions and problems that arise from what was learned

211-1 – receive, understand, and act on the ideas of others

211-2 – communicate questions, ideas, intentions, plans and results, using lists, notes in point form, sentences, data tables, graphs, drawings, oral language and other means

211-3 – work co-operatively with team members to develop and carry out a plan and troubleshoot problems as they arise

211-4 – evaluate individual and group processes used in planning, problem solving, decision making and completing a task.

Outcomes covered by a Science Fair Project

GRADE 8

STSE (Science, Technology, Society, and the Environment)

110-5 – illustrate examples of conflicting evidence for similar scientific questions

109-8 – describe scientific inquiry, problem solving, and decision making, and provide examples where they may be applied

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ROLE OF THE TEACHER:

Facilitating and Incorporating

A project-based science activity can be designed to fit any classroom. It is a rewarding method of learning and teaching that allows students and teachers to interact in ways that are not common in traditional science classrooms. During a project-based science activity, the role of the teacher changes from that of a person who provides the knowledge to a person who facilitates research.

Assessment and Evaluation

The assessment of a project-based science activity provides teachers a unique opportunity to evaluate student learning in science. There are a variety of science, technology, society, and the environment (STSE); scientific skill; and knowledge outcomes that may be covered through a project.

It's all in the Rubric!

A complete scoring rubric that addresses all aspects of a project-based science activity is one of the most effective and efficient ways to evaluate students Assessment *of* Learning and Assessment *for* Learning. There are a number of online resources available that may be helpful when developing rubrics.

Online Scoring Rubric Resources:

ednet.ns.ca/files/curriculum/DoingProject-BasedScience.pdf

sciencebuddies.org/science-fair-projects/teacher_resources.shtml

PROJECT TYPES & DIVISIONS

An inquiry-based learning project investigates a question of interest to the student. There are three primary types of projects in science and technology that are recognized:

1) An experiment
2) An innovation
3) A study

In each of the three projects, the student will follow a process of investigation using the scientific method. This provides the opportunity to meet a number of curriculum expectations.

EXPERIMENT:
A controlled procedure carried out to discover or test or demonstrate something. Judges will look for manipulating and responding variables and check to see how well the other variables are controlled.

STUDY:
A careful examination of a subject by collecting and analyzing data. The data may be collected from an original experiment or from research into the topic. This research project focuses on the compiling of and analysis of information.

INNOVATION:
This is a project that creates something new – a new idea, method or device. In this type of project, you would be designing or building something new, or using existing technology in a new way.

All students compete in grade-related divisions.

JUNIOR: 7/8
INTERMEDIATE: 9/10
SENIOR: 11/12

CLASSROOM TIMELINE

The initial organization of a classroom project-based science activity may be assumed to be time consuming and labour intensive. In truth, once the initial guidelines are established, the process uses time effectively. Once properly organized, a project-based activity will run smoothly and achieve its goals for all students, as well as provide a number of opportunities for student assessment.

Use this helpful timeline for implementing project-based science in your classroom.

SEPTEMBER
Introduce the Idea of PBL

OCTOBER
PHASE 01—Generating an Idea

NOVEMBER
PHASE 02—Research and Planning

DECEMBER
PHASE 03—Data Collection and Analysis

JANURAY
PHASE 04—Writing a Report

FEBRUARY
PHASE 05—Creating and Exhibiting a Display

MARCH
PHASE 06—Science Celebration

CLASSROOM MANAGEMENT TIPS

PHASE 01—Curiosity

DURING THIS PHASE, STUDENTS WILL

1. brainstorm four possible subjects of interest
2. come up with two investigative questions per topic
3. choose a fitting topic and problem to be investigated
4. form a hypothesis
5. submit project proposal and gain approval from supervising teacher
6. ensure safety and ethical guidelines are met
7. record ideas in their research logbook

PHASE 02 & 03 —Gather & Predict

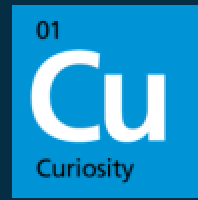
DURING THIS PHASE, STUDENTS WILL

1. begin preliminary research on the hypothesis
2. change or reconfirm the hypothesis with the supervising teacher
3. identify the “Control” and “Variables” of the experiment
4. contact all appropriate people, gather resources/materials
5. submit written project plan
6. continuing recording in logbooks, detailing the progression of their project from start to finish

PHASE 04—Conduct Experiment, Innovation, Study

DURING THIS PHASE, STUDENTS WILL

1. conduct their experiments safely (at home)
2. choose an appropriate sample size
3. perform several trials of the experiment
4. collect and record all data and observations in logbook
5. graph or chart the data and look for trends and patterns
6. prepare a written conclusion supported by the data obtained

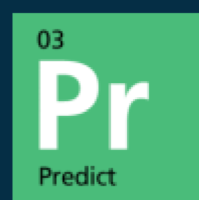


What makes a good science fair project? It depends on what you want to know!

Your project should be on a topic that's exciting to you - perhaps something from a branch of science that you're interested in such as biology, physics, chemistry or any combination. Choose something that your interested in!

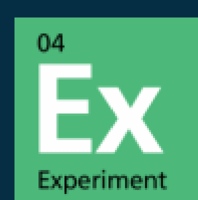
After picking your topic learn more about it.

Gather information from books, magazines, and the internet to find out the science and scientific principals behind your project. Ask an expert who might know. Keep track of where you got your information.



Based on your research, come up with a question you want to answer.

What you think the outcome of your project will be is called your hypothesis. You will try to prove or disprove your hypothesis with an experiment. Make a step-by-step list of how you will go about it.



Follow the plan you just made by creating an experiment.

Carefully record all of your measurements. Write down everything you notice, or any problems you had. Take pictures, make sketches of what’s happening. These notes are your science log, or your “private science”.

05
An
Analyze

Organize your notes, charts, and graphs.

Decide whether the results either agree or disagree with the hypothesis.

06
Co
Conclude

Look at your data and decide if your hypothesis is true or false.

If you can think of how to apply your work to a real life situation, include it. Talk about problems that you had during the experiment and list other things you may have learned.

07
Bu
Build

Construct an exhibit to display your project.

Include pictures, graphs, charts, write-ups, or anything else that makes it clear what your project is about.
The exhibit is an overview of your question, the research methods you used, the results and conclusion.

08
Pa
Pass it on

The Presentation!

This is your "public science." Now you can display all of your work and your audience will learn something new.

PHASE 05 & 06 —Analyze & Conclude

DURING THIS PHASE, STUDENTS WILL

1. prepare an outline for the scientific report
2. submit a first draft and discuss it with the supervising teacher
3. revise the draft according to feedback
4. submit finalized scientific report

PHASE 07—Build a Display

DURING THIS PHASE, STUDENTS WILL

1. design a rough layout of the display
2. build the display board within the appropriate parameters
3. display the results in a clear and interesting manner
4. give a classroom oral presentation to teacher and peers

PHASE 08—Science Celebration

DURING THIS PHASE, STUDENTS WILL

1. put finishing touches on project based on teacher/peer feedback and evaluations
2. set up projects to be presented at the science fair celebration
3. present projects to judges, schoolmates, teachers, parents and/or the public

Have Questions … Need Help ...

REQUEST A PROJECT-BASED LEARNING PRESENTATION FOR YOUR CLASSROOM TODAY!

Visit **sciencefairinfo.ns.ca** for a wealth of online learning resources and support for students and teachers

REGISTERING FOR YOUR REGIONAL FAIR

Each year, more than 10,000 secondary students in Nova Scotia participate in school-based science fairs, with more than 1,000 students registering to compete at the Regional level.

There are currently ten regional science fairs in Nova Scotia:

Annapolis Valley Region
Contact: Sarah Tessier
sarah.tessier@avrsb.ca
scifair.ednet.ns.ca/AVRSF/
Registration: scifair.ednet.ns.ca/AVRSF/

Cape Breton-Victoria Region
Contact: True Burke
tburke@staff.ednet.ns.ca
cbv.ns.ca/sciencefair/
Registration: secure.youthscience.ca/sfiab/capebreton/

Chignecto Central-East Region
Contact: Kim Wilkinson
wilkinson@eastlink.ca
cersf.ca
Registration: secure.youthscience.ca/sfiab/chignectoeast/

Chignecto Central-West Region
Contact: Tim MacDonald
macdonaldte@ccrsb.ca
secure.youthscience.ca/sfiab/ccw/
Registration: secure.youthscience.ca/sfiab/ccw/

Conseil scolaire acadien provincial
Contact: Ron LeBlanc
lronald@csap.ednet.ns.ca
csap.ednet.ns.ca
Registration: secure.youthscience.ca/sfiab/csap/

Halifax Sci-Tech Expo
Adam Sarty
adam.sarty@smu.ca
hste.ednet.ns.ca
Registration: hste.ednet.ns.ca/sfiab/index.php

Mi'kma'q First Nations Schools
Contact: Andrew Smith
a.smith@ns.sympatico.ca
wfns.ca
Registration: by email

South Shore Region
Contact: Jane Berrigan
jjoudrey@staff.ednet.ns.ca
ssrsb.ca
Registration: sstech1.ednet.ns.ca/sciencefair/index.php

Strait Region
Contact: Andrew Clarey
andrew.clarey@strait.ednet.ns.ca
srsb.ca/srsf
Registration: secure.youthscience.ca/sfiab/strait/schoolaccess.php

Tri-County Region
Contact: Gerry Randell
grandell@tcrsb.ca
tcrsb.ca/
Registration: secure.youthscience.ca/sfiab/tricounty/

The variety and excellence of the projects presented at the Regional Science Fair is a testament to the work done by teachers in encouraging student participation.

Fairs are held annually in March and April.

CELEBRATION TIME!

“I really enjoy the experience of meeting new people and talking about my project, and what I’ve done and what I’ve learned”

Julia Frenette,
Horton High School
Wolfville, N.S.

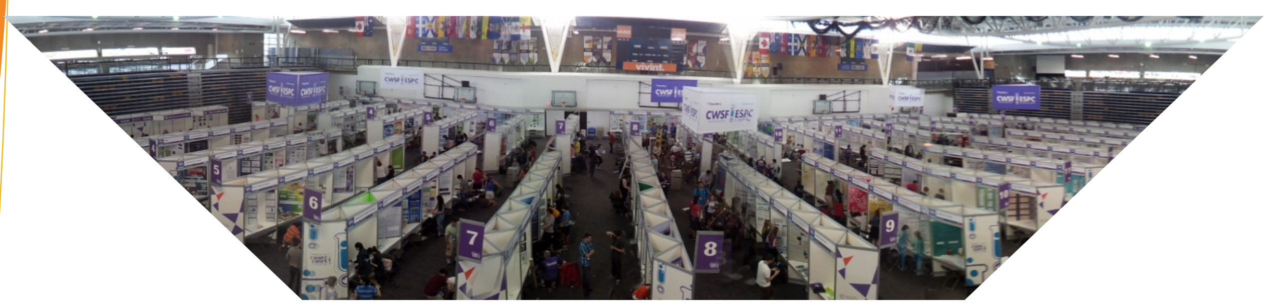
TEAM NOVA SCOTIA SHOWACSE

The annual Team Nova Scotia Event (now in it’s 14th year) hosts the top 40 Regional Science Fair winners that have won the right to represent Nova Scotia at the National Competition. This three-day celebration provides students the chance to showcase their amazing discoveries and build a unified team.

This year’s Showcase will take place April 30 – May 2, 2015 at Saint Mary’s University in Halifax, Nova Scotia.

Find out more about Team Nova Scotia Showcase at
sciencefairinfo.ns.ca

CANADA-WIDE SCIENCE FAIR



Within the National Science Fair Program, the Canada-Wide Science Fair is an annual science fair competition that has been held since 1962. Each year, only 450 participants are selected from over 500,000 school science fair projects. The regional science fair finalists from across the country gather to benchmark their scientific and technological achievements against some of the brightest young Canadian minds.

This year, the 2015 CWSF will take place in Fredericton, NB from May 9 to 16.

Find out more about the Canada-Wide Science Fair at
cwsf.youthscience.ca/

THE REALLY GOOD STUFF:

SCHOLARSHIPS, PRIZES & AWARDS

A science fair project is one of the best learning experiences a student can undertake, and when taken seriously, it can be an excellent way to earn significant prizes, qualify for scholarships, and distinguish a University application.

Each year, Nova Scotia students compete for medals, cash awards, scholarships and other prizes worth approximately $1 million.

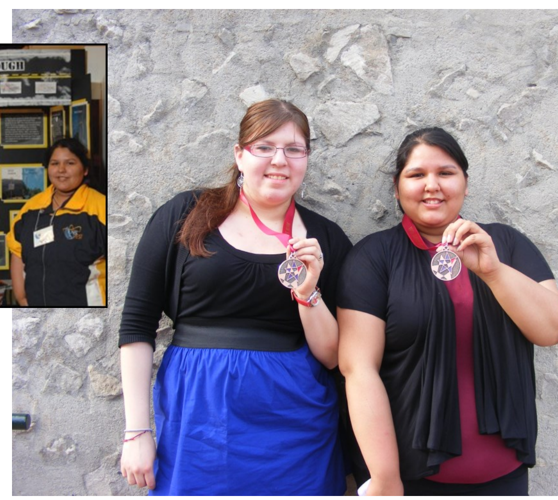
THE BEST PRIZE!

Meeting other students who achieve—

Learning it's okay to be SMART & EXCEL!

"I get excited about meeting other students who are my age, and who are just as enthusiastic about science and communicating as I am."

Jim Proudfoot,
North Nova Education Centre
New Glasgow, N.S.



Science Student Award Winnings & Prizes by Year

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Gold				2	1	3		3	2	1
Silver	1	2	5	5	2	8	6	1	3	6
Bronze	4	5	8	9	4	8	18	15	13	11
Special Award	6	9	17	7	12	9	8		6	2
Grand & Platinum									1	
Total	**11**	**16**	**30**	**23**	**19**	**28**	**32**	**19**	**25**	**20**
Scholarships & Prizes	**$8,750**	**$19,000**	**$34,150**	**$74,525**	**$30,300**	**$135,800**	**$93,550**	**$65,700**	**$48,600**	**$67,600**

For more information about NS YES and its programs, please contact us

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