



STEM on The Canadian Path:

FOUNDATIONS, GUIDELINES AND RESOURCES



Contents

- What is STEM and Why is it Important?..... 4
- Your Role as a Scouter 5
- Sample Questions for Facilitating STEM Activities 7
- STEM and the Four Elements 10
- STEM and Program Areas 12
- STEM Resources 14
 - STEM Trail Cards 15
 - STEM Kits 16
 - STEM at Provincial and National Jamborees..... 18
 - Partnership with Let's Talk Science..... 19
- STEM Resources Outside of Scouts Canada..... 20
- Sponsors and Funders 21
- Partners 21

What is STEM and Why is it Important?

STEM refers to any field of study that relates to Science, Technology, Engineering and Mathematics. Certainly you have already done a lot of STEM activities in your Section: making a catapult, building different structures, learning about space, exploring different ecosystems, etc. As part of The Canadian Path, Scouts Canada has made STEM a more prominent part of its programming.

The goal of our STEM program is to:

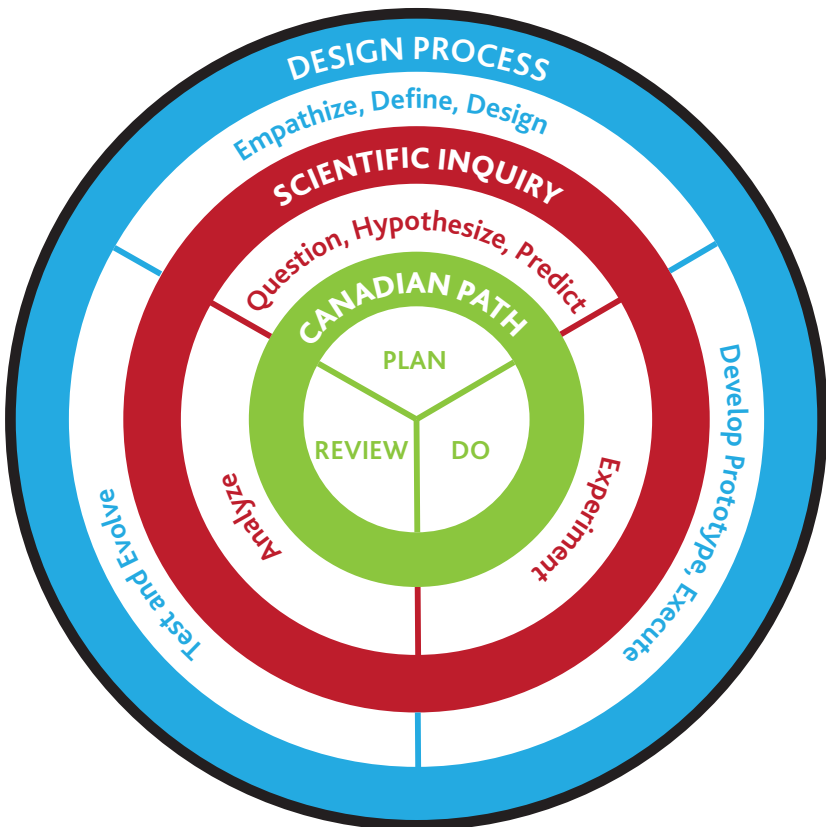
- Nurture interest in STEM fields
- Foster curiosity and imagination
- Increase youth's self-confidence in STEM fields
- Dispel discouraging stereotypes about STEM

The Scout Method is a perfect vehicle to reach these goals. When applied to STEM fields, the fundamental Scouting principle of "learning by doing" allows youth to experiment with Science, Technology, Engineering and Math through hands-on projects. They gain rich experiences, understand how STEM is present in all aspects of life, and feel empowered and have fun as they learn.

Your Role as a Scouter

As a Scouter, you have the opportunity to create a safe and fun environment for youth. The more fun they have while doing the activities, the more they learn. It is also important to make sure our STEM projects are youth-led and allow youth to feel empowered. We are looking for rich experiences in which Scouters and youth learn together. Here is what you can do to facilitate youth learning:

- Follow youth's lead and introduce STEM projects that interest them.
- Create an environment in which youth can make choices and try different materials and strategies to solve problems.
- Encourage youth to reflect on their learning to understand what they are doing is in fact STEM.
- Guide youth through the process of discovery, design or engineering with guiding questions – not the answer. The graph below shows how the scientific inquiry and the design process coincide with the Plan-Do-Review process of The Canadian Path.



- Help youth make real-life connections. Ask youth how they can use what they have learned. Complement the discussion with videos or field trips that show them how the concept or the technology is being used to solve real problems.
- You don't have to know all the answers. You can learn alongside the youth. Just be sure not to give uncertain answers that could foster youth's misconceptions. If you don't know the answer, you could choose one of the following as your response:
 - I don't know that, but it is an interesting question.
 - I don't know that – how do you think we could find out?
 - What an interesting question. No one has ever asked me that before. What I do know is...
 - I don't know that, but I wonder if you would like to find out a bit more and let us know what you find.
- If you're uncomfortable with STEM activities, remember there are Scouter and pre-made resources for youth (Expert STEM Scouters, Scouts Canada Trail Cards and STEM Kits, or resources outside of Scouts Canada).

Sample Questions for Facilitating STEM Activities

PLAN

Questioning:

- STEM-based questions/problems are developed with youth
 - What are some questions we could ask about this problem?
 - What happens if ____?
 - How does that work? How does ____ affect ____? How could ____ be improved?
 - Why does ____?

Research and Plan:

- Youth reflect on what they already know and find out more
 - What information do you have? What do you need to find out? Where could we get more information?
 - How could you find out more about this?
- Youth develop a plan to solve the problem
 - What could be the possible solutions to your problem?
 - How could we make a test/experiment to answer your question? What are we going to change? What will remain the same? What are we comparing?
 - Why did you decide to use this method? Have you thought of other strategies?
 - How will you know if your solution is a good one?
 - How are we going to be safe?
 - What materials do we need?
 - How will everyone participate?
 - Do we need an outside expert or a different location?
- Youth propose a possible solution (hypothesis) to their question/problem
 - What do you think is going to happen? What is your hypothesis?

DO

Scientific Inquiry (e.g. Scouts try to figure out what kinds of clothing or shelter would be appropriate for winter camping)

- Experiment: Youth test their hypothesis by conducting an experiment. One thing is changed; the rest stays the same
 - Are we all following our safety plan?
 - This looks interesting. What are you trying to do?
- Results: Youth make observations using their senses (qualitative data) and measurements (quantitative data)
 - What senses will you use to observe? How does it look, smell, feel, etc.?
 - What is happening? Have you seen something like this before?
 - How will you measure the result?
 - What is the most effective way to record your observations?
- Conclusion: Youth draw a conclusion to explain their observations
 - What patterns did you notice?
 - Why do you think that ____? How can you explain ____?
 - What have you found out? What else might have caused ____?
- Engineering/Design (e.g. Cub Scouts design and build a model canoe)
- Create a Solution: Youth create and evaluate a prototype
 - How will you know if your design is successful?
 - What do you notice? What is happening?
 - How will you measure the result?
 - What is the most effective way to record your observations?
 - Why does make sense to record your observations?
- Youth make improvements to the design
 - What worked in your design? What didn't work?
 - What can you change to improve your design?

REVIEW

- Youth communicate their learning
 - Did we encounter any difficulties? How did we overcome them?
 - Was our hypothesis accepted (correct) or rejected (incorrect)?
 - What did we learn from this experiment? Do you have any new questions?
 - How can we use this new learning in our future adventures?
 - Is there any way we could improve our work if we were to do it again?
- SPICES (Social, Physical, Intellectual, Character, Emotional, and Spiritual Development) are discussed during the review process
 - S-How did I work with others? What did I learn about working with others?
 - P-How did I challenge myself physically?
 - I-What did I learn that I didn't know before? What skills did I improve?
 - C- What example did I set for others?
 - E- How did I deal with a difficulty? What did I learn about leadership?
 - S- Did I live up to my beliefs and values?

STEM and the Four Elements

As with any other activity on The Canadian Path, the Four Elements apply to STEM. Here are some ideas that can help you start thinking about STEM and the Four Elements of The Canadian Path.

Youth-led	<ul style="list-style-type: none">• Youth choose the activities and are involved in planning for it.• They take charge of doing the activity and are allowed to make mistakes and learn from them.• Scouters' role is to encourage youth to think outside of the box and provide them with ideas.• The role of the Scouter in doing the activity is to guide youth by asking questions and making sure they are thinking about what they are doing.
Plan-Do-Review	<ul style="list-style-type: none">• Planning a STEM activity involves youth deciding what they want to do and then preparing for it.• In doing the activity, youth answer a question, solve a problem, or create something new.• The review process allows youth to reflect on their learning and to understand how they used Science, Engineering, Technology and Math.
Adventure	<ul style="list-style-type: none">• An adventure can be directly focused on STEM:<ul style="list-style-type: none">• Planning an overnight stay in an observatory• STEM can be incorporated in other adventures:<ul style="list-style-type: none">• Designing and building a model canoe or paddles in the process of planning for a canoeing trip

SPICES

- The most obvious benefit of an STEM adventure is youth's intellectual development.
 - Working in groups allows youth to gain better social and leadership skills
 - STEM activities often nurture the development of fine motor skills through working with tools. Many STEM adventures involve physically challenging wilderness exploration.
 - Facing a challenge and trying to solve it helps youth develop emotionally, strengthens their character, and empowers them to discover their own capabilities.
 - Connecting with nature and gaining a deep understanding of the world around them encourages youth to grow spiritually.
-

STEM and Program Areas

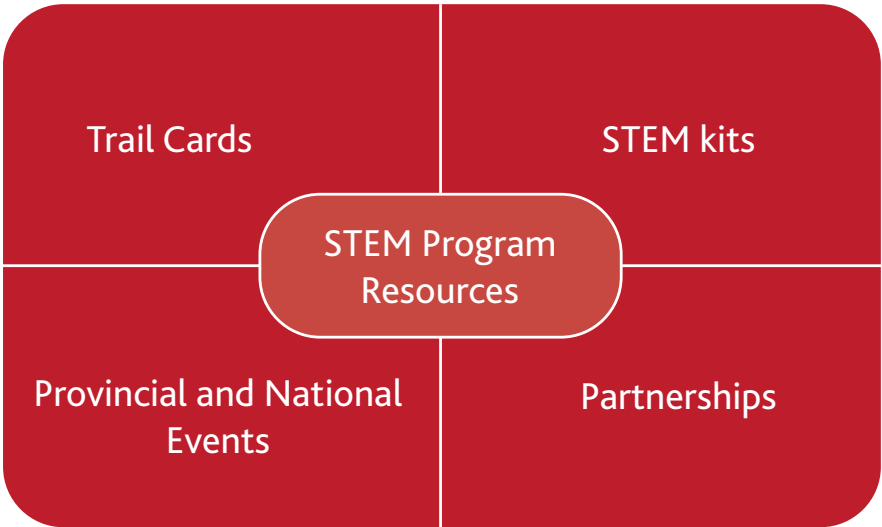
You have the opportunity to incorporate STEM projects and activities into all the Program Areas and therefore provide youth with a well-rounded Scouting experience. The table below gives you some ideas of how to incorporate STEM into the different Program Areas. This is by no means a comprehensive list. It is just a summary of suggestions to get you started. As youth get more experience in planning their adventures, they will probably come up with many more exciting ideas!

ENVIRONMENT AND OUTDOORS			
STEM concepts	Different life forms	The impact of human actions on the environment	The science and engineering of outdoor equipment
Sample Projects	Nature walks with a focus on different species	Calculating the amount of trash we produce and learning about recycling technologies	Design and build a canoe or paddle
ACTIVE AND HEALTHY LIVING			
STEM concepts	Impact of exercise our body	Science of our food	Science of hygiene
Sample Projects	Measuring heart rate after different types of exercise and creating an exercise routine	Designing menus for survival situations	Use black light powders to model the spread of germs
CREATIVITY AND PERSONAL EXPRESSION			
STEM concepts	Design and engineering projects that are based on youths' interests	Using technology for creative projects	Everyday uses of STEM in solving exciting problems
Sample Projects	Break something apart and use the parts to create something new	Use technology to create a video about your recent camping trip	Design and build a tower or a bridge that can hold the heaviest weight using everyday materials

CITIZENSHIP		LEADERSHIP	
STEM concepts	Solving a community problem with STEM	Any activity in which youth take a leadership role	Learning about the work of Canadians in STEM
Sample Projects	Design and engineer model wheelchair ramps as proposal to make your community more accessible	Youth plan for an overnight stay at an observatory	Learn about the work of Chris Hadfield.
BELIEFS AND VALUES			
STEM concepts	How advances in science and technology impact our individual and social life	Understanding and respecting people with disabilities	
Sample Projects	Youth can be involved in making decisions about rules for using technology in meetings and at camps	Design and build a device that makes life easier for people with a specific disability	

STEM Resources

The national STEM team (a dedicated group of Scouters from across the country) has been working hard for the past few years to create a lot of useful resources that help youth and Scouters integrate STEM into the program. The Volunteers have also been providing support at all levels, from Section meetings to national Jamborees, to make sure the STEM program is accessible to as many Scouting youth as possible.



In the following pages, each of these program elements are briefly explained to help you get started with STEM on The Canadian Path.

We have a pool of STEM Trail Cards and Scouters' Tips for Beaver Scouts, Cub Scouts, Scouts, and Venturer Scouts, to help youth and Scouters incorporate STEM into their programming. The Trail Cards include guidelines and facilitation questions to plan, do and review the activities, the materials the group will need and some additional online resources.

STEM | Science Technology Engineering Mathematics

SAVE THE BIRD

THE ADVENTURE:
 Explore what happens to a bird when its feathers are covered in oil and spill.

Do:
Fix the bird
 • Feed the feathers.
 • How do they feel? How do you think they help the bird as a bird?
 • Imagine you are a bird and fly around the room. Show to the women in catch fish, and on the sea. Show how you think it will be covered in feathers like the one you just did, and fly.
 • Fly the feather in water. How does a bird feel now? Can birds fly with wet feathers?
 • What does an oil feather feel like?
 • Fly your feathers on separate oil. How do they feel now? What has changed? Can individual feathers and then rub them together. Do you think the bird will fly?

STINGRAY'S HOLLOW
 Environment & Outdoors

PLAN:

- In the weeks before the activity, you can talk to your parents and teachers to learn more about oil spills.
- Your teachers will bring in feathers for everyone to use in this activity, but you can bring your own types of feathers to see if oil and water affect them the same way.

Do:

- Imagine you are a bird with oily feathers. Try to fly, dive in the water and walk on the shore.

Clean the feather:

- Try to make the oil off the feather with water. Does it work?
- Use dishwashing soap. In this case, water and alcohol clean birds best. Make sure you get rid of all the oil. How does the feather feel now? Does it fly?

STEM | Science Technology Engineering Mathematics

PILE OF TRASH

STEM | Science Technology Engineering Mathematics

Imperial

THE ADVENTURE:
 Explore how to keep your pond clean and bright! Collect your trash for a few days or a full day. Then, create something new out of the trash.

Do:

Activity #1: How much? How long?

- How much trash do you produce each day? How much trash do you think you will produce each day?
- Try to make a pile of trash smaller than it is today. How long does it take to clean it up? Can you make it smaller than it is today?
- Calculate how much trash you produce in a month. What about a year?
- Do you know how much of our waste we recycle in Canada? What happens to the remaining trash? Where does the rest of our trash go?

STEM | Science Technology Engineering Mathematics

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STEM | Science Technology Engineering Mathematics

PILE OF TRASH

STEM | Science Technology Engineering Mathematics

MILK PLASTIC

THE ADVENTURE:
 How much plastic waste does your "house" produce? How much plastic waste can you reuse? How much plastic waste can you recycle? How much plastic waste can you compost? How much plastic waste can you burn? How much plastic waste can you throw away? How much plastic waste can you reuse? How much plastic waste can you recycle? How much plastic waste can you compost? How much plastic waste can you burn? How much plastic waste can you throw away?

Do:

Activity #1: How Much Plastic?

- Collect all the plastic waste produced by your "house" during a camp or over the course of a week. Make sure all plastic waste is labeled correctly.
- Wash the plastic waste in water. At this rate, how much plastic waste would you produce in a year?
- What plastic waste can you reuse? How much plastic waste can you reuse? How much plastic waste can you recycle? How much plastic waste can you compost? How much plastic waste can you burn? How much plastic waste can you throw away?

STEM | Science Technology Engineering Mathematics

MILK PLASTIC

STEM | Science Technology Engineering Mathematics

Baghera's Hunting Grounds

THE ADVENTURE:
 Explore how to keep your pond clean and bright! Collect your trash for a few days or a full day. Then, create something new out of the trash.

Do:

Activity #1: How much? How long?

- How much trash do you produce each day? How much trash do you think you will produce each day?
- Try to make a pile of trash smaller than it is today. How long does it take to clean it up? Can you make it smaller than it is today?
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STEM | Science Technology Engineering Mathematics

PILE OF TRASH

STEM Kits

STEM kits are ready-to-use packages that contain Trail Cards, Scouters' Tips or manuals, and materials for a series of STEM activities with a unifying theme. They are designed to provide your Section with a convenient and accessible tool to experiment with new adventures and integrate STEM into your program. You can borrow the kits, free of charge, from the Scout Shop or the Service Centre in your area (depending on the city) for up to four weeks. The kits can be used over the course of four meetings or in a camp.

Use the STEM kits to create more memorable adventures on The Canadian Path and let us know about your experience. Share your adventure on social media, and see what others are up to, using the hashtag #ScoutsSTEM. Not on social media? Drop us a line at stem@scouts.ca instead. You can also contact us if you have any questions about the kits, or the STEM program in general.

The Around the Pond kit for Beaver Scouts

The kit is designed to encourage Beaver Scouts to explore the natural world around them. They use their five senses to discover how animals see the world, they find out where animals live and how they adapt to survive and they work together to build their own shelter. The kit is currently available in: **Ottawa, Toronto, Calgary, Edmonton and Vancouver.**



The Space Exploration Kit for Cub Scouts

This kit is the product of a collaboration between the Canada Science and Technology Museum and Scout Canada's STEM program. It focuses on different aspects of space technology and life on the International Space Station. The kit is currently available in **Halifax, Ottawa, Oshawa, Toronto, Oakville, London, Windsor, Regina, Calgary, Edmonton, and Vancouver.**



The Robotics Kit for Scouts

This kit is designed to provide an opportunity for Scouts to experiment with coding and robotics. It contains a laptop, an Arduino robot and supporting documents. Scouts program the robot to complete incrementally more difficult tasks in the process of exploring a distant planet for signs of life. The kit is currently available in **St. John's, Halifax, Ottawa, Toronto, London, Calgary, Edmonton and Vancouver.**



STEM at Provincial and National Jamborees

The STEM program was launched at the 2013 Canadian Jamboree with the robotics activities. Since then, we have had STEM stations at several national events and Jamborees including ADventure 14, Pacific Jam 2015, Scotia Jam 2015 and Canadian Cub Jamboree 2016. The STEM team has also helped several area and regional camps in setting up STEM experiences for youth. All events have been very successful in attracting youth and Scouters to the STEM activities and have demonstrated that there is great interest for STEM among our youth. If you are interested in having STEM activities at your event, you can contact us for help and support through STEM@Scouts.ca



Partnership with Let's Talk Science

Let's Talk Science is a volunteer organization that provides hands-on STEM programs to youth across Canada. You can contact Let's Talk Science chapters in 40 universities and colleges across the country and employ their help (their services are free of charge). Their volunteers can come to the meeting to run STEM activities, or plan a visit for youth to the university. Some chapters might also be able to help Scouters with setting up STEM-themed summer or weekend camps.



STEM Resources Outside of Scouts Canada

There are a variety of STEM outreach programs and online resources that you can use as additional support for incorporating STEM into your program. Here are just a few to help you get started.

Places to go:

- Many science museums have interactive programs for youth of different ages, including sleepovers.
- You can find a database of science centres across Canada on the Canadian Association of Science Centres website: <http://www.canadiansciencecentres.ca/Find-a-Science-Centre>

Links to find ideas for STEM activities and projects:

- National Geographic: <http://nationalgeographic.org/activity/>
- Canadian Wildlife Federation: <http://cwf-fcf.org/en/explore-our-work/education/resources/>
- Discovery education: <http://www.discoveryeducation.ca/Canada/#>
- Teach Engineering: <https://www.teachengineering.org/curriculum/browse?collection=Activities>
- Science Sparks: <http://www.science-sparks.com/>

Specific national projects:

- Canadian Water Resources Association - Project Wet (<https://www.cwra.org/en/project-wet>): Project WET's mission is to promote awareness about water issues and empower communities to solve problems.
- Canadian Wildlife Federation - Project Wild (<http://cwf-fcf.org/en/explore-our-work/education/for-educators/project-wild.html>): Project WILD's mission is to help youth and educators better understand the complexities of the natural world.

Sponsors and Funders

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Let's talk Science Canada



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CANADIAN WILDLIFE
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