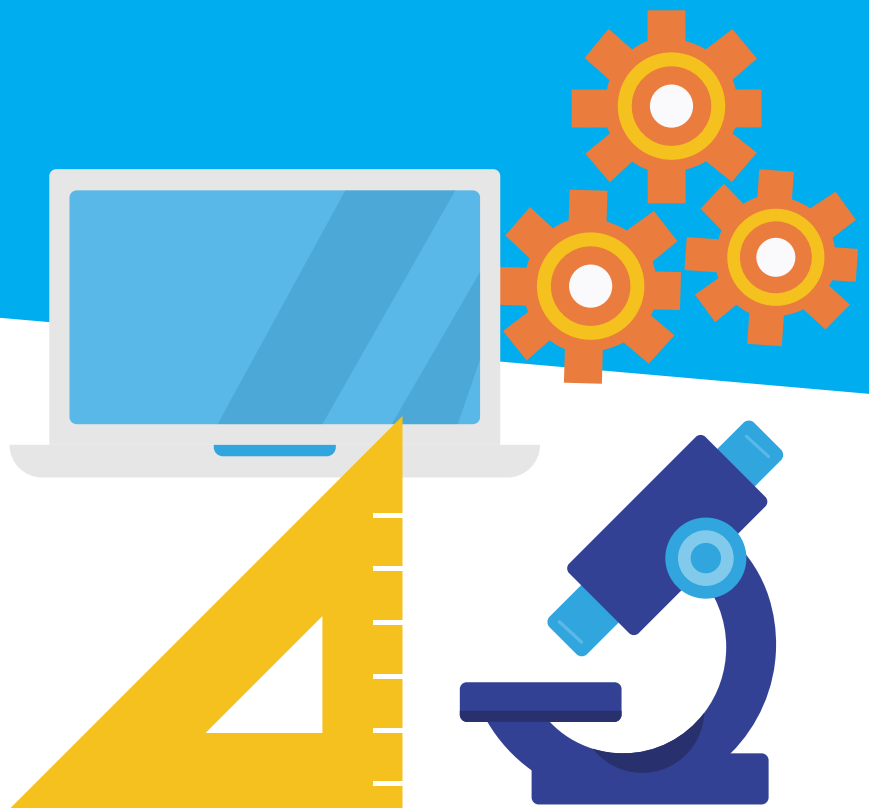# Supporting the Development of STEM Skills in Youth

A guide for integrating STEM into 4-H programming

CANADA

Introduction

Our world has changed dramatically in the last 50 years. The ways we live, and work have been impacted by globalization, technology, and a changing economy. The 21st century brings complex problems that require new approaches and innovations. STEM (Science, Technology, Engineering, and Math) has become an integral part of solving today's challenges.

STEM-related skills like design thinking, critical thinking, and the ability to learn from failures are sought by employers across various sectors. The demand for these skills is expected to grow as our world continues to evolve.

STEM is a term that is used widely. While STEM may seem complex, STEM concepts and approaches are already part of many 4-H activities and projects. As a 4-H leader you may be wondering why STEM is important and how it relates to 4-H programming. This resource is a guide to help you better understand STEM, how it relates to career readiness skills, and how you can create opportunities for 4-H members to build these skills in your club programming. This resource is only the start. Look for other resources to keep building knowledge and skills in these areas.
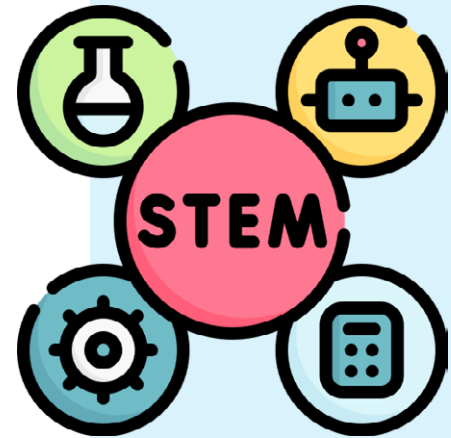
This resource is made possible thanks to the support of:

Why is STEM important?

Canada strives to be a world leader in many STEM fields, providing youth with a wide range of opportunity, options, and advantages for career pathways and work. Canada's drive for technological advances, continuous innovation, and an aging population means there will be plenty of career opportunities and a demand for STEM-related skills in the future.[1] The integration of STEM approaches and concepts are needed to solve today's complex problems like climate change, sustainable agriculture, food security, and poverty. STEM approaches and applications can provide unique solutions to these and other challenges.[2]
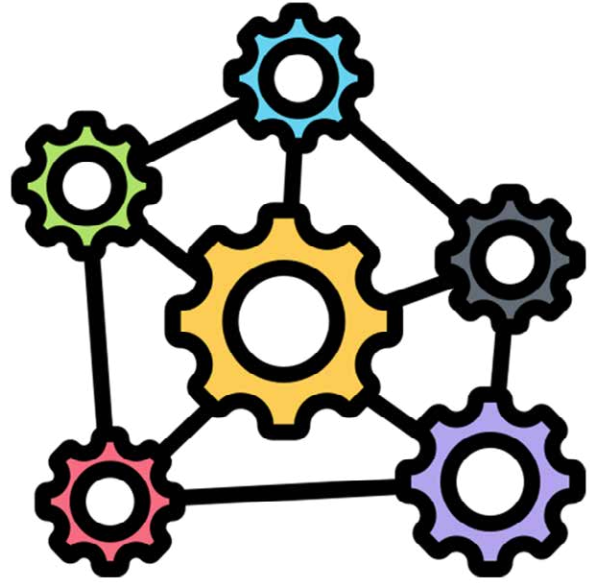
Incorporating STEM into 4 H programming allows youth to engage in learning opportunities that develop these critical, in-demand skills.[3] STEM programming encourages curiosity and teamwork, builds perseverance, and positions youth for future career opportunities by equipping them to navigate current and future challenges.[1]

How the Positive Youth Development Formula Supports Members' Future Careers

At 4-H, everything we do centres around ensuring youth are strengthening and developing their skills and abilities through the Positive Youth Development (PYD) approach. This globally recognized and research-based approach considers youth an asset and partner in the community. This general approach and philosophy are incorporated into all our programming, including career development. The 4-H PYD formula (or "honeycomb") supports youth development, as they become responsible, caring, and contributing individuals empowered to be successful!

The 4-H honeycomb identifies key assets that youth build through 4-H programming. In career development, assets are often referred to as transferable skills. Transferable skills, such as creative and critical thinking, support success in all areas of life, including work, volunteerism, and even leisure activities. Including career preparedness in regular club activities ensures youth can improve skill mastery in transferable skills. This helps members feel supported and valued. The connection between PYD and future career success is one that shouldn't be overlooked.

Positive Values

Responsibility

Safe, fun, Inclusive Environment

Caring Adults

Learn To Do By Doing

Sense of Purpose

Skill Mastery

Planning and Decision Making

Leadership Development

=

**Responsible, Caring, Contributing Leaders**

What is STEM?

STEM activities help youth develop critical skills that prepare them for the workforce of today and the future. As 4-H leaders, you have a unique opportunity to bring STEM into programming in fun and exciting ways that can help ignite a sense of wonder and spark interest in STEM for members.


SCIENCE explores the world around us. Through science we observe, ask questions, and conduct experiments to learn more about how things work. Science requires inquiry, curiosity, and problem-solving skills. It includes hypothesising or making an educated guess, then testing these hypotheses, making changes, testing again - and eventually developing a theory that explains how things behave or act. Science includes areas like biology, chemistry, physics, astronomy, and environmental science.[4]

TECHNOLOGY generally refers to the tools, machines, and systems created by people to solve problems or make tasks easier. Today we think of computers, the internet, or smartphones, which all influence our day-to-day living and working. Technological advances and rapid innovation means understanding how technology works and the importance of technological systems for today and the future.
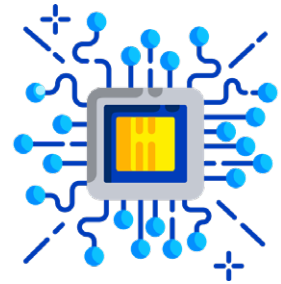
ENGINEERING applies math and science to solve problems, and design and build structures, machines, or systems. Creativity and problem-solving skills are important when developing and designing practical solutions. Fields include civil, mechanical, electrical, and aerospace engineering. From constructing buildings to designing space shuttles, there are endless career opportunities in engineering.[5]

MATH is the study of numbers, shapes, patterns, and relationships. Reasoning and critical thinking skills are important when trying to solve mathematical problems to make sense of the world. Math is often used when reading and interpreting data and is an important part of both science and technology.[6]
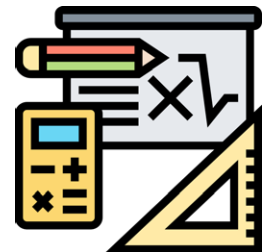
STEM-Related Skills

STEM programming can help develop a range of important skills, including critical thinking, communication, collaboration, and creativity. STEM activities help build resilience, problem-solving skills, and computer literacy. From analyzing and design thinking to teamwork and communication, STEM-related skills are vital for future work. Integrating STEM activities provides an opportunity for members to develop these important skills and help with career readiness.[3]

Critical Thinking

Critical thinking involves analyzing and evaluating information using observation and reasoning skills. In a soil or gardening activity, for example, critical thinking is used to help determine what a soil needs to enhance crop growth.

Design Thinking

Design thinking starts with researching a problem and brainstorming solutions. It can mean building prototypes and testing them. A simple LEGO or building blocks activity can provide the chance to build a structure, test it for weight capacity, and rebuild.

Collaboration and Communication

Collaboration and communication skills focus on the ability to work well with others to solve problems or accomplish a common goal. Many STEM activities and projects work well when taken on as a group. For example, working together to take apart and rebuild an engine.

STEM-Related Careers			
Science	**Technology**	**Engineering**	**Math**
Forensic Chemist	Storm Tracker	Robotics Engineer	Pharmacy Technician
Wildlife Biologist	Data Scientist	Virtual Reality Engineer	Architect
Cosmetic Chemist	Video Game Tester	Toy Designer	Statistician
Food Chemist	Drone Operator	Acoustic Engineer	Accountant
			Actuary

Things to Talk About

- Ask members which areas of STEM they like and why. Discuss different jobs they could find in the area they are interested in.

- Reflect on a recent club project. Discuss how or why different aspects of STEM are connected to the project.

- Have a discussion about a recent technological advancement, like precision farm technology, artificial intelligence, or self-driving cars. What challenges or issues is the advancement solving and how? What new challenges are they creating?

- Discuss or brainstorm invention ideas members have that might solve an everyday problem.

- Discuss with members what they believe are the biggest challenges our world faces in the future and how STEM might help address those challenges.

STEM and the Leadership Development Pillars

Community Engagement & Communications

S - Visit a local science centre

T - Build a social media page with your club to share club information and events

E - Design a simple escape room with STEM-related clues

M - Use real data to analyze levels of civic participation in your community

Science & Technology

S - Participate in 4-H Canada's Science Fair. Learn more at: 👉 4-h-canada.ca/programs/science-fair

T - Learn how to code a simple video game

E - Take apart a small engine and rebuild it

M - Explore the various ways math is used in astronomy

Environment & Healthy Living

S - Plan a star gazing evening and learn what constellations can be identified at different times of the year

T - Go on a nature walk and use an app to identify plants or bird calls

E - Design and build a stress management tool to help manage a specific symptom

M - Measure and monitor heart rates during different physical activities. Calculate how long each activity needs to be done to reach recommended activity levels

Sustainable Agriculture & Food Security

S - Invite a speaker to talk about how science is helping support global food security

T - Design a new technology to solve a challenge when raising cattle

E - Build a vertical garden using recycled materials

M - Do some calculations to determine an optimal rainfall each week for different field crops

STEM Resources

4-H Canada Science Fair 4-h-canada.ca/programs/science-fair

Notes

1   The Government of Canada and STEM (2021). https://ised-isde.canada.ca/site/choose-science/en/government-canada-and-stem

2   STEM School. "How Stem is Actively Solving Real World Problems". https://www.stemschool.com/articles/how-stem-is-actively-solving-real-world-problems#comment

3   Imagine Learning. "STEM instruction and the Four C's". (2023). www.imaginelearning.com

4   Hleboako, Jason. Environmental Science. (2023). P 1.2.1. LibreTexts.

5   Press Books. *What is Engineering? Definition, introduction and a brief history*. https://pressbooks.bccampus.ca/engineeringinsociety/chapter/chapter-1/

6   Tennessee Tech. *What is Mathematics*. https://www.tntech.edu/cas/math/what-is-mathematics.php

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To Do
By Doing