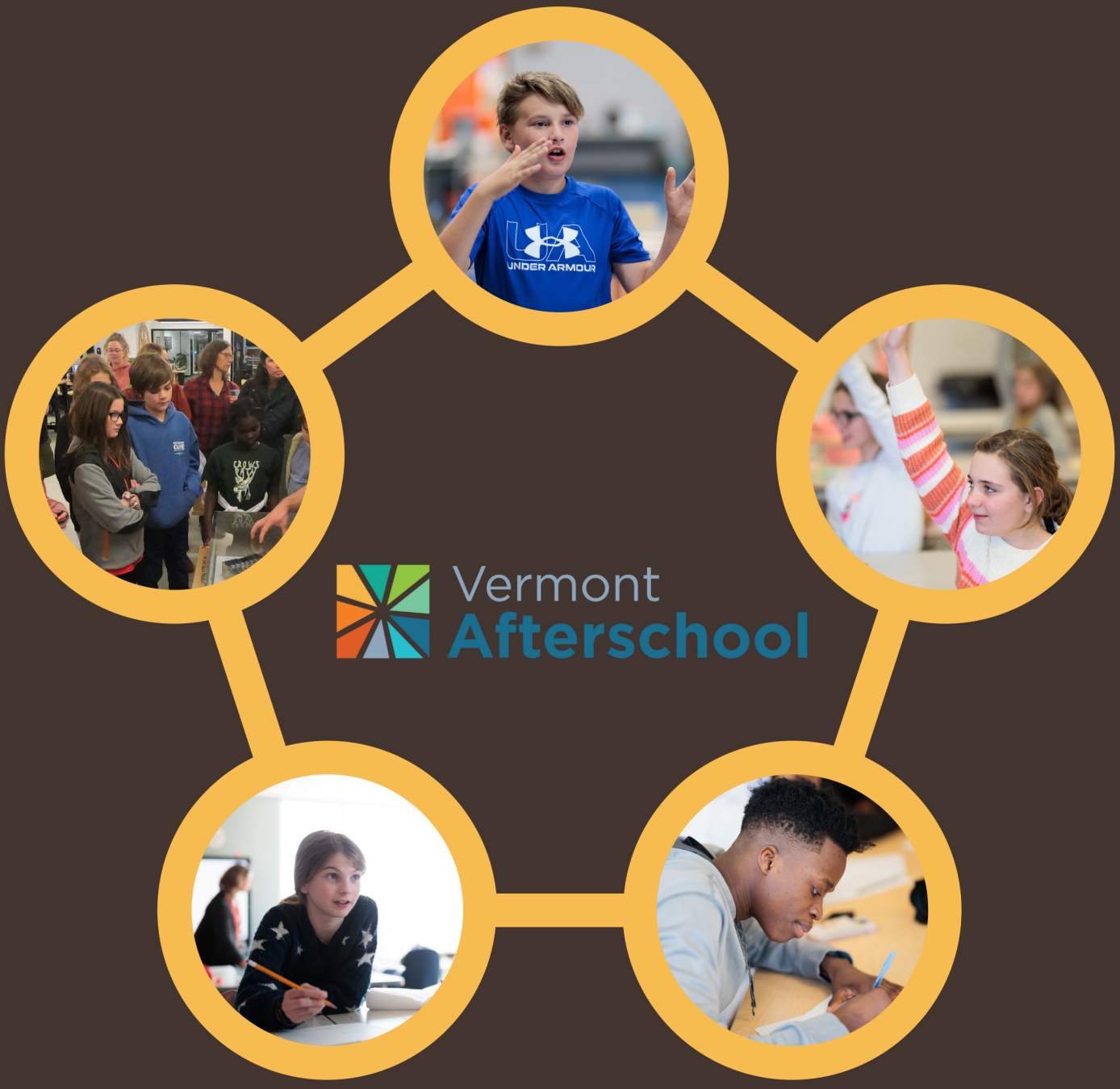
STEM
Best Practices



Vermont Afterschool

Create an inclusive space that embraces learning through mistakes, uplifts all voices, encourages collaboration and connection rather than competition, and allows for the building of ideas together to explore questions.

SPACE

Youth can feel insecure about their intelligence, so they need to feel like they are in a place where they can make mistakes and not feel like they are competing.

Get support on how to make your STEM space more inclusive:

BEST PRACTICE EXAMPLES

Elementary School: Make sure youth are in a circle or can see each other. When calling on youth to answer questions or having a group discussion—about a hypothesis, analyzing data, etc—have youth respond to each other with their thoughts about what was said, instead of you being the one responding.

Middle School: When youth are working together in groups—for example, creating a design—require them to incorporate at least one idea or opinion from every person in the group in their final design.

High School: When testing hypotheses or designs, ask youth from different groups what they thought of another group's design/hypothesis and what they could improve upon. Make sure to give them guidelines on how to do this in a positive way.

Encourage and center youth voice to ensure youth are making connections to real life and applying their knowledge to the real world, recognizing each individual's background and cultural experiences.

CONNECTIONS

Youth want STEM "connected to world issues, more meaning to them, creative, and connected to their interests." "There is not enough of this in school."

Providers struggle with "being able to help youth apply what they learn to the real world." The ***Engineering Design Process*** is a great way to get youth involved in their own learning and applying it.

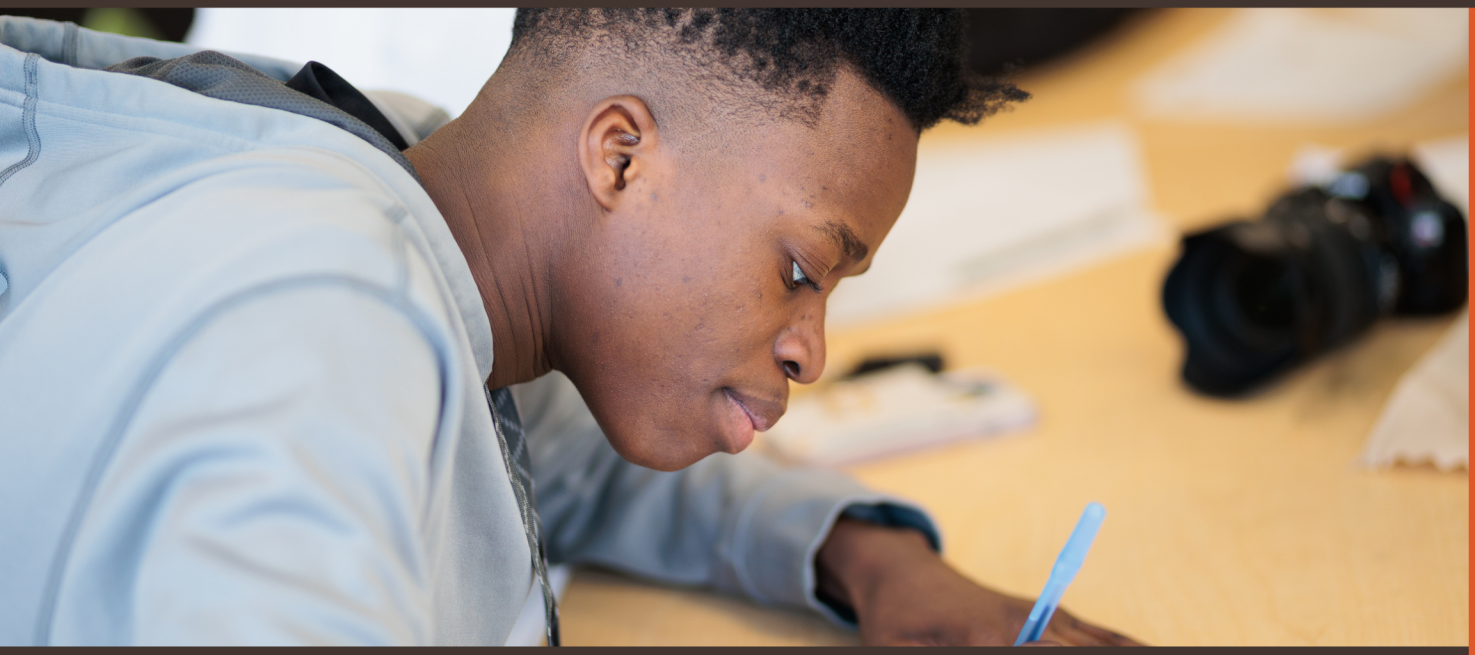
BEST PRACTICE EXAMPLES

Elementary School: Ask youth to think of an example from their own life where they can see this science concept happening. For example, if they are making slime, ask them, "What animals can you think of that use slime? Why do you think they use it?"

Middle School: Youth in the program are really interested in basketball so ask them to solve this problem: "The basketball is missing. Design your own basketball that can replace it." They can solve this by following the engineering design process.

High School: Youth in the program are passionate about the hunger issues in their community, so help them design and create a community garden at the program that the whole community can use.

Use intentional learning goals to build familiarity with STEM vocabulary and concepts, and connect content to larger systems and patterns through hands-on learning, multi-disciplinary, and project-based activities.



CONTENT

Youth want STEM that is "hands-on and lets them problem-solve together." They want a range of subjects but with more engineering and tech offered.

Providers use **Crosscutting Concepts from the NGSS** to connect to larger ideas, making it easier to use a multi-disciplinary and project-based approach.

BEST PRACTICE EXAMPLES

Elementary School: Post the learning goal on the board: "Today, we'll continue our shape project and use different colored sticky notes to identify perfect and irregular rectangles in our space." Help youth with STEM vocabulary in ways they can understand: "Do you know what irregular means? This is a regular rectangle and this is an irregular one, so what do you think irregular might mean?" This project culminates in identifying all of the shapes in the Eiffel Tower and creating a puzzle.

Middle School: Youth write the day's learning goal: "To design a bridge that holds the most weight without breaking." They also talk about the science practice of structure and function and then work together on a 4-week project to design their bridge.

High School: Tell the youth "Today's goal is to film the interview portion, which will allow the audience to see and be more engaged in the people behind the work." The project is a behind-the-scenes look at school lunch to create more awareness of the healthy foods they eat, where the food comes from, and the people who make their lunch.

Provide experiential opportunities to develop & use a hypothesis-driven mindset, including inquiry, designing, testing, data analysis & reflection, while reinforcing essential skills (e.g., critical thinking, collaboration, perseverance).

SKILLS

Providers often use the **engineering mindset** and **STEM practices** and see them as valuable in their programming.

BEST PRACTICE EXAMPLES

Elementary School: Ask youth to make a hypothesis about the baking soda and vinegar experiment they are about to do: "If you … then what will happen?" For example, "If you put together baking soda and vinegar, then it will make a big fizzy mess." Ask them questions about their hypotheses and why they think them. Then do the experiment and reflect on their hypotheses together.

Middle School: Support youth in analyzing data to draw conclusions. For example, after youth collaborate to create a survey based on most popular apps and design a way to administer it, they determine that, "In the survey data we gathered, the majority of people like app A the most."

High School: The area the program is in does not have great airflow, so youth hypothesize, create, and test a system that will allow for better airflow. Once they develop a successful system, they bring their idea to the head of maintenance.

Provide ALL youth opportunities to see themselves in STEM and understand possible future pathways through exposure to relevant fields, diverse representation, and passionate workers in STEM.

PATHWAYS

Providers "need support connecting to local businesses and accessing STEM role models to talk with youth." Providers feel like they are "not doing enough career exploration in their program." The **If/Then collection** is a great place to find women/BIPOC role models in STEM.

BEST PRACTICE EXAMPLES

Elementary School: Youth are learning about wildlife in their town forest and you read them a book about wildlife biologists, *Rewilding: Bringing Wildlife Back Where it Belongs.* Talk with them about what wildlife biologists do and then show this video of a wildlife biologist from the If/Then collection.

Middle School: Youth are designing a video game. Connect with a game designer who comes to visit your program—or does a virtual visit—and shows where they work. Also put up posters of women in tech around your room from the If/Then collection.

High School: At the end of a 4-week long project to create a more kid-friendly cast, bring youth to visit a doctor's office or hospital where they can present their cast to professionals (nurses/PAs/doctors). Have the professionals tell youth about their careers.

RESOURCES

Vermont Afterschool

- LEL, STEM Pathways, Career Foundations, VerMoney — **vermontafterschool.org/stem**
- Monthly Million Girls Moonshot resources and activities — **vermontafterschool.org/mgm**
- STEM Offerings by County and Statewide — **bit.ly/STEMOfferings**

Print and Go Resources

Scan for a digital copy of this list and document.

- Mizzen by Mott — **mizzen.org**
- Teach Engineering — **teachengineering.org**
- Discover Engineering — **discovere.org/stem-activities**
- NASA Express Newsletter — **nasa.gov/stem/express**
- STEM 2D — **stem2d.org/stem2d-at-home**
- National Geographic — **nationalgeographic.org/society/education-resources**
- Citizen Science — **nasa.gov/stem/foreducators/informal/index.html**
- Youth Development Curriculum Library 4-H — **extension.umn.edu/working-youth/youth-development-curriculum-library**
- STEM Educators Academy Activity Toolkit — **bit.ly/STEMEducatorsAcademyToolkit**

Long-term Print and Go Programming

- Math Camp-In, Super CITIES — **teachinglearningcollaborative.org**
- Venture Labs — **venturelab.org**
- UME Academy — **ume.academy**
- Go2 Science ($) — **go2science.com**
- Museum of Science Boston EiE Kits (Engineering Adventures - materials kit and guidebook) ($) — **eiestore.com/engineering-grades-prek-8/flexible-engineering-grades-3-8/engineering-adventures-grades-3-5.html**
- Flying Classroom digital STEM+ curriculum aligned to national/state standards and based on the global expeditions of Captain Irving ($$) — **flyingclassroom.com/curriculum**

Long-term Programs in Vermont

- Vermont Energy Education — **veep.org** (can also be print and go)
- Rosie's Girls (sliding scale) — **vtworksforwomen.org/programs/youth/rosies-girls_**
- Destination Imagination ($) — **creativeimagination.org**

Club Model from National Organizations

- Meta's Engineer for the Week (demystifies engineering for learners historically underrepresented in STEM and inspires them to use technology for social impact) — **engineerfortheweek.fb.com**
- Girls Who Code — **girlswhocode.com**
- Technovation — **technovation.org**
- FIRST ($) — **firstinspires.org/robotics/frc**

Extras

- NASA posters — **jpl.nasa.gov/galleries/visions-of-the-future**
- National Weather Service (meteorologists and scientists are available to meet with a classroom or a group, and we can tailor presentations toward specific topics that engage your students through age-appropriate discussions, presentations, question and answer sessions) — **weather.gov/education/school-outreach**
- If/Then collection of women in STEM role models — **ifthencollection.org**

NEED SUPPORT?

Vermont Afterschool is happy to support your program in STEM. Email Katie O'Shea at katie@vermontafterschool.org.

Vermont Afterschool

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