



NATIONAL
PEER REVIEWED

Grades
9-12

Teen Science Change Agents: Transforming Our Relationship with Plastics

A 4-H STEM Teen Engagement Curriculum



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NSF Center for
Sustainable Polymers



Acknowledgements

Curriculum Target Audience

Youth in grades 9 to 12 (ages 14-18)

Developed By

A partnership between the NSF Center for Sustainable Polymers, University of Minnesota Extension, University of California Agriculture and Natural Resources, Cornell University Cooperative Extension. This work is supported by the National Science Foundation (NSF) under the NSF Center for Sustainable Polymers CHE-1901635.

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Recommended Citation:

Stevenson, A., Mondl, A., & Maille, A. (2023). *Teen Science Change Agents: Transforming Our Relationship with Plastics. A 4-H STEM Teen Engagement Curriculum for Grades 9-12*. NSF Center for Sustainable Polymers. University of Minnesota. <https://www.4hpolymers.org/>



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Overview



Grades 9-12

Teen Science Change Agents: Transforming Our Relationship with Plastics

Overview



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Overview:

Teen Science Change Agents:

Transforming Our Relationship with

Plastics

Introduction

Young people are increasingly aware of the impacts of plastic pollution. Many feel the call to take action to help solve this urgent environmental issue. 4-H recognizes that young people are innovators and play a critical role in developing solutions to address the environmental challenge of plastic.

Youth As Change Agents

This curriculum focuses on youth building leadership skills to effectively serve as agents of change around plastic-related issues. Throughout the leadership learning sections, youth will work together to ask critical questions about our use of plastics and determine how they can become a change agent for the planet and address issues of plastics/plastic pollution.

Youth can choose from two leadership paths: Teens as Teachers or Teens Engaged in Community Action. Each path offers meaningful leadership opportunities for youth to serve as teachers and community leaders. Through discussion and reflective activities, youth will gain knowledge, skills, and confidence to transform their concern for the environment into action. Youth will learn with and about other change agents, including young people who are leading projects to reduce the environmental impacts of plastic waste.

Exploring The Science of Polymers/Plastics

As a companion to this Teen Science Change Agents curriculum, *Sustainable polymers: Confronting the Plastic Crisis. A 4-H STEM curriculum for Grades 9-12* focuses on the history, prevalence, impacts, and future of plastics. Groups looking to better understand polymer/plastic science will find this curriculum a useful companion piece. Plastics are versatile materials that come in different shapes, sizes, and exhibit different material properties. Scientists and engineers are working on new ways to create, use, and recycle plastics, so we can use plastics for their many advantages and lessen their effects on our environment. The curriculum is designed to strengthen the science and engineering practices of observation, asking questions, defining problems, planning and carrying out investigations, designing solutions, and evaluating and communicating information. Please visit <https://www.4hpolymers.org/> to download the full curriculum.

Confronting the Plastic Crisis

We have a deep dependence on plastics—from grocery bags and water bottles to high-tech medical devices and computers. **Plastics** make our lives easier because they are durable, lightweight, and easy to produce. The majority of plastics consumed each day are created from petroleum (also known as oil), a **non-renewable resource**. Of all the plastic used for packaging, only 14% is collected for recycling. Most plastic finds its way to landfills as garbage. Out in the environment, oil-based plastics create many environmental challenges because they do not biodegrade. Instead, they break down over time into smaller pieces of plastics. Microplastics are plastics less than 5 millimeters in length (the size of a pencil eraser top) and have been found in many of our rivers, lakes, and oceans, as well as some drinking water.

Many scientists, engineers, non-profits, and even young people are imagining a world where plastics are sustainable, non-harmful to the environment, and recycled to create energy. This big idea is driving the NSF Center for Sustainable Polymers (csp.umn.edu) to develop **sustainable polymers** or **bioplastics**, plastics made from **renewable resources**. These new bioplastics aim to address the environmental challenges that are inherently associated with traditional (petroleum-based) plastics, yet serve the same purpose as current plastics while remaining cost-effective to produce. Sustainable polymers can be durable and degradable, can be used in applications from adhesives to packaging to building materials, and can be produced efficiently and economically with low environmental impact. The most common bioplastic in today's market is **polylactic acid** (referred to as PLA), which is made from corn. PLA is a type of bioplastic that is very versatile and can be composted at industrial compost facilities, meaning it will break down into soil in the proper environment. Some commonly found bioplastic products are PLA cups, PLA silverware, and PLA garbage bags.



Facilitator
Resources

R

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Facilitator Resources



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I am not a
plastic cup

100% Compostable 100% Biodegradable

This tumbler is made from plant starch
and can be turned to compost
to help grow more crops.

www.biopac.co.uk

Photo Credit: Aaron Bihari (2009)

<https://www.flickr.com/photos/dakima-arts/3509297247/>



Facilitator Resources: Importance of Youth-Adult Partnership

An important step before embarking on a Teen Science Change Agent path is creating a strong youth and adult partnership. Caring adults play an important role in creating space for teens to build confidence, share their voice, and design and implement how they want to address issues that matter most to them.

Both the **Teens as Teachers** path and the **Teens Engaged in Community Action** path use a Youth-Adult Partnership approach, in which youth and adults learn together, share decision making, and value the unique skills that each brings to achieving sustained change. In each path, teens gain skills in communication, planning, decision making, and project implementation.

Below you will find:

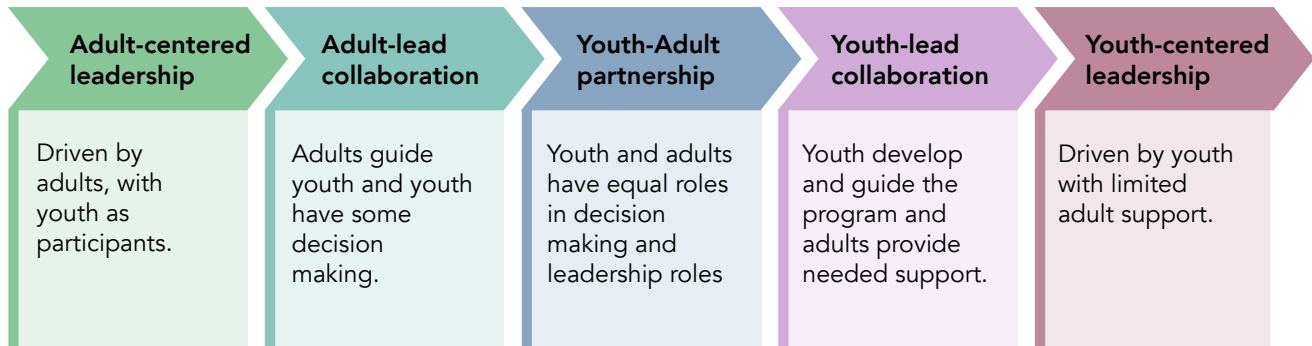
- A Continuum of Youth-Adult Partnership which outlines levels of the youth-adult partnership continuum and examples for each path (**Teens as Teachers** or **Teens Engaged in Community Action**).
- Examples of possible teen roles and adult roles that span both paths as well as offer specifics per path.

Continuum of Youth-Adult Relationships

The Continuum of Youth-Adult Partnership provides different models of how youth development programs work with young people and identifies various levels of youth-adult relationships. Young people come to youth development programs with a variety of leadership experiences, backgrounds, and a range of ages. They experience and grow leadership skills at every age and at every level of development. Facilitators should aim to cultivate youth-adult relationships that meet the needs of the group, based on where young people are in their leadership development. For example, if youth are just beginning to develop leadership skills, they may need greater program structure with adults guiding the project. After observing leadership in action, engaging in opportunities to gain skills, and learning about leadership roles available, youth may be more willing to take lead in defining the project focus, roles, and the project purpose.

Youth-Adult Continuum and Approach Examples

Youth-Adult Continuum



Approach Examples

Approach	Adult-centered leadership	Adult-lead collaboration	Youth-Adult partnership	Youth-lead collaboration	Youth-centered leadership
Teens as Teachers	Adults provide youth leaders with teen teacher training and opportunities to practice teen teaching skills.	Youth leaders provide input on planning learning experiences for younger youth.	Youth leaders co-plan and co-facilitate learning experiences for younger youth.	Youth organize and plan lessons, take the main teaching role with younger youth. Adults provide support in the program offering. Adults provide program structure.	Youth identify lesson content, organize program offerings, and solo-teach younger youth.
Teens Engaged in Community Action	Adults decide the focus of the project or community service and youth implement.	Adults initiate projects such as service-learning where youth have the opportunity to provide input, help in planning, and reflect on learning.	Youth identify the project or issue they want to address and take action, similar to a community action project or Youth Participatory Action Research (YPAR) . Adults share in the decision making.	Youth decide the project they want to lead, make the majority of decisions, craft and carry out the project plan, such as a community/citizen science. Youth engage the adults.	Youth lead all aspects of the action project with peripheral adult involvement.