NATIONAL PEER REVIEWED

Grades 9-12

Teen Science Change Agents:

Transforming Our Relationship with Plastics

A 4-H STEM Teen Engagement Curriculum

National Science Foundation

NSF Center for Sustainable Polymers

Acknowledgements

Curriculum Target Audience

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

Developed By

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Table of Contents

Overview

O

Grades 9-12

Teen Science Change Agents:

Transforming Our Relationship with Plastics

Overview

National Science Foundation

NSF Center for Sustainable Polymers

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.

Even with these new advancements in plastic materials, scientists and engineers are still working to create bioplastics that are truly sustainable. Renewable materials aren't automatically better for the environment. We need to examine factors in the creation, processing, transportation, use, and disposal of an item to determine the cost/benefits of using such a material. Despite the challenges related to plastics, scientists are committed to developing solutions.

Young people across the world are also working to address the challenge of plastics and creating a vision for the future where plastics are transformed. For example, youth in New York City worked with Cafeteria Culture to conduct a research project where they researched and analyzed plastic litter found on local streets and beaches. They engaged neighbors, local businesses, and politicians in creative problem solving to address the plastic pollution. They created an awareness campaign with giant puppets, banners, and videos.

Youth Outcomes

This curriculum was developed with key outcomes in mind for youth, including:

- **Learning** - youth learn about plastics and their impact on the environment
- **Leadership** - youth develop leadership skills and identify as a leader
- **STEM Identity** - youth think of themselves as science learners by engaging in science and engineering practices and contributing to STEM fields (scientists, technology user, engineer, or mathematician)
- **Social Emotional Learning** - youth develop social and emotional learning competencies
- **Civic Engagement** - youth become actively engaged in their communities and the world by addressing the issues of plastics

Detailed Youth Learning Outcomes are included in the Facilitator Resources.

Connections to Education Standards

This curriculum aligns with the Center for Global Education's Global Leadership Performance Outcomes (https://asiasociety.org/sites/default/files/inline-files/all-grades-global-leadership-performance-outcomes-book-edu.pdf) for grades 10 and 12, and the National Council for the Social Studies' College, Career, and Civic Life (C3) Framework for Social Studies State Standards (https://media.nationalgeographic.org/assets/file/C3-Framework-for-Social-Studies.pdf).

It is a companion curriculum to *Sustainable Polymers: Confronting the Plastic Crisis: A 4-H STEM curriculum for Grades 9-12* (https://www.4hpolymers.org/) and supports the Next Generation Science Standards (NGSS) (https://www.nextgenscience.org/)

Global Leadership Performance Outcomes

The Asia Society Partnership for Global Learning and the Council of Chief State School Officers (CCSSO) partnered to develop global competence and define the skills students need to demonstrate to be globally competent. The identified skills and abilities can be applied across disciplines and complement Common Core Standards. These Global Performance Outcomes for grades 10 and 12 are applicable to the leadership focus of the Teen Science Change Agents curriculum.

- **Investigate the World** - Youth can initiate investigations of the world by framing questions, analyzing and synthesizing relevant evidence, and drawing reasonable conclusions about global issues.
- **Recognize Perspectives** - Youth can recognize, articulate, and apply an understanding of different perspectives (including his/her own).
- **Communicate Ideas** - Youth can select and apply appropriate tools and strategies to communicate and collaborate effectively, meeting the needs and expectations of diverse individuals and groups.
- **Take Action** - Youth can translate his/her ideas, concerns, and findings into appropriate and responsible individual or collaborative actions to improve conditions.

Source: Center for Global Education's Global Leadership Performance Outcomes (https://asiasociety.org/sites/default/files/inline-files/all-grades-global-leadership-performance-outcomes-book-edu.pdf).

Connections To Next Generation Science Standards (NGSS)

The curriculum is a companion to the *Sustainable Polymers: Confronting the Plastic Crisis: A 4-H STEM curriculum for Grades 9-12*, which emphasizes the Next Generation Science Standards (NGSS) and the use of embedded evaluation and formative strategies to assess learning which may occur in multiple places during the implementation of an activity. This collection of activity modules incorporates many of the science and engineering practices identified in the Next Generation Science Standards. Youth have the opportunity to develop all eight science and engineering practices.

NGSS Science and Engineering Practices:

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematical and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

NGSS Cross-cutting Concepts

Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

Cause and Effect. Mechanism and Prediction: Events have causes, sometimes simple, sometimes multifaceted.Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

Structure and function.The way an object is shaped or structured determines many of its properties and functions.

Stability and change. For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

NGSS Disciplinary Core Ideas

ESS3.A: Natural Resources

ESS3.C: Human Impacts On Earth Systems

ETS2.B: Influence Of Engineering, Technology, And Science On Society And The Natural World

How This Guide Is Organized

The guide is organized into five sections. **Sections 1 and 2** focus on leadership development activities and are intended for all participants. In **Section 3**, youth define what will make a strong youth-adult partnership and then choose a path, **Section 4 or Section 5**, that best fits how they want to actively contribute to the sustained health of their communities and environment.

This guide is designed to be used with high school-aged youth in grades 9-12 (ages 14-18) to build leadership skills to serve as change agents tackling the harmful impacts of plastics. The curriculum is intended for delivery in out-of-school time settings/ environments led by an adult or experienced youth facilitator including trained volunteers, professional educators, community educators, parents, and community leaders.

Key Features and Resources in Each Section:

- **Driving questions** guide the learning focus for teens as they discover the issues and use of plastics prevalent in everyday life
- **Practices to support** youth provide specific strategies adults can use to encourage **youth** voice and **youth** choice
- **Questions to guide adult partners** encourage reflection to ensure the program aligns with quality youth development practices
- **Activities, tools, and resources** for facilitators to guide youth leaders

My Change Agent Path

Section 1: Discovering the Power of Why

Section 2: Building Leadership Skills in Youth Change Agents

Section 3: Choosing a Change-Making Path

Section 4: Teens as Teachers Path

- Afterschool programs
- Day Camps and Summer Camps
- School-Based Programs
- 4-H Project Learning Series

Section 5: Teens Engaged in Community Action Path

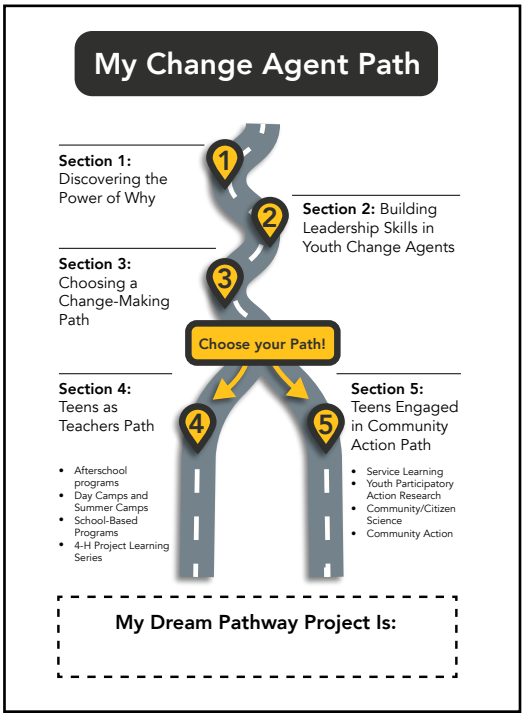
- Service Learning
- Youth Participatory Action Research
- Community/Citizen Science
- Community Action

My Dream Pathway Project Is:

All Teen Change Agents Complete Sections 1-3

Section 1: Discovering the Power of Why
Section 2: Building Leadership Skills in Youth Change Agents
Section 3: Choosing A Change-Making Path

In Sections 1 and 2, youth build leadership skills that prepare them to lead in their community. Included activities guide youth through a process of identifying what sparks their interests and activities to build their leadership skills.



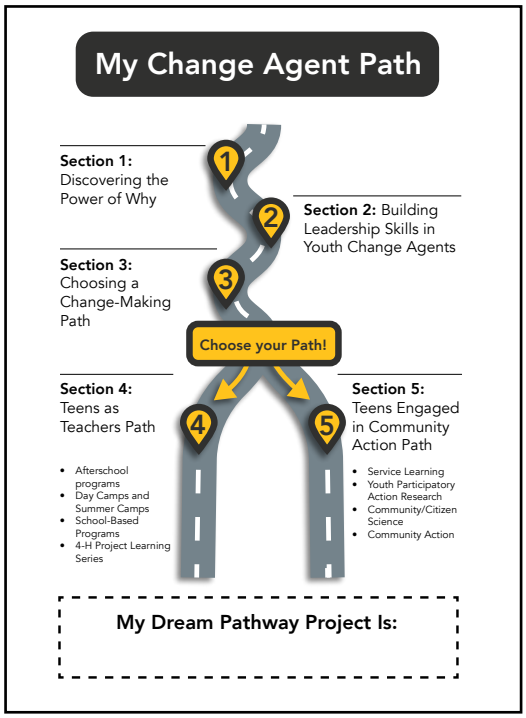
Section 3 focuses on collaboratively building a positive youth-adult partnership that will support teens in achieving their change agent goals. Youth and adults will then engage in a process of choosing a change-making path: Teens as Teachers or Teens Engaged in Community Action.

- The **Teens as Teachers Path** offers teens the opportunity to lead younger youth in polymer science learning and exploring solutions to plastic use and pollution by using the Gr. K-2 or Gr. 3-5 4-H Sustainable Polymers curriculum (Download the curriculum at 4hpolymers.org).
- In the **Teens Engaging in Community Action Path**, teens develop and implement a community action project focused on a specific plastic issue.

Each path offers important opportunities for youth to grow and implement their leadership skills, yet offer different leadership experiences, roles, and support from adult partners.

Set Out on the Change Agent Path You've Chosen

Section 4: Teens as Teachers Path



Within the Teens as Teachers path, there are learning activities for teens to build skills and strategies to effectively teach younger youth in a variety of settings. Teens increase their abilities to inspire younger youth in science and engineering, foster inquiry, help younger youth develop STEM identity, inspire youth in caring about our planet, and teach younger youth using the 4-H Sustainable Polymers curriculum. Please visit 4hpolymers.org (https://www.4hpolymers.org/) to download the full curriculum.

Section 5: Teens Engaged in Community Action Path

The Community Action path is designed to engage youth in transforming plastic impact ideas into action-oriented projects in their community. Youth ask critical questions about our use of plastics based on their polymer science learning and discussions. Youth help their community use plastics more wisely and sustainably, and inspire others to take action by addressing issues related to plastic/plastic pollution. Teens can use one of several inquiry-based learning approaches that best fits their sparks and interests. The identified inquiry-based approach will guide youth through developing and implementing an action project around a plastic issue. Please see the Change Agent Approach Matrix in the Tools for Facilitators for approaches and examples.

Positive Youth Development

In 4-H, positive youth development is the idea that all youth have the potential for bright futures. Youth are personally enriched by the world around them and are making it better at the same time. 4-H helps youth thrive by creating opportunities to discover their greatest passions in a positive community of youth with adults to support them.

Positive youth development builds on young people's strengths and assets. Youth development involves an intentional process that promotes positive outcomes for young people by providing opportunities, choices, caring relationships, and the support necessary for youth to fully participate in families and communities. High-quality programming provides valuable benefits in knowledge, skills, and interests, and also in the form of leadership development, life skills development, and civic development. Through participation in science and engineering education, youth have opportunities to strengthen their competence, confidence, connection, character, caring/empathy, and contribute to their community.

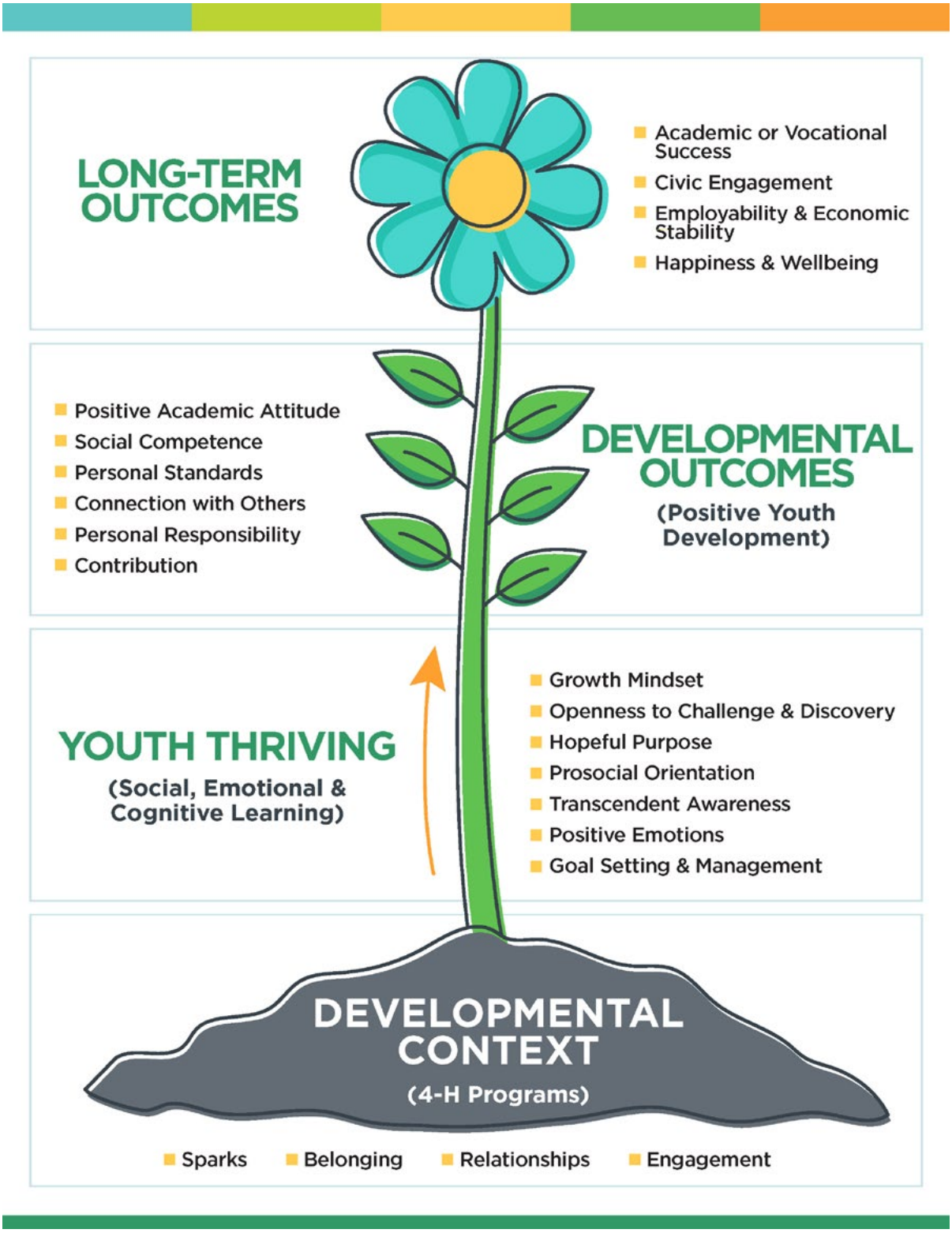
Practices to support positive youth development:

- **Establish a safe environment and build relationships**. All youth need caring supportive relationships in their lives. Educators provide this by showing interest in, actively listening to, and fostering the assets of youth.
- **Provide youth leadership opportunities**. Creating opportunities for youth to develop skills and confidence for leadership and self-discipline is important for youth development.
- **Provide community involvement experiences**. Service forges bonds between youth and the community and doing something valued by others raises feelings of self-worth and competence.

The 4-H Thriving Model is a positive youth development theory of change built on the premise that youth who participate in 4-H programs that provide a high-quality developmental context have a significantly higher likelihood of thriving, and thriving youth achieve key developmental outcomes.

Learn more about the 4-H Thriving model at https://helping-youth-thrive.extension.org/.

4-H Thriving Model



Arnold, M. E., & Gagnon, R. J. (2020). Positive youth development theory in practice: An update on the 4-H Thriving Model. *Journal of Youth Development*, *15*(6), 1-23.

A Place to Belong and Make a Difference

4-H welcomes young people of all beliefs and backgrounds, giving youth a voice to express who they are and how they make their lives and communities better. Access, equity, diversity, and inclusion are essential elements of 4-H and positive youth development. 4-H believes that diverse perspectives, values, and beliefs help generate better ideas to solve the complex problems of a changing—and increasingly diverse—world.

As you embark on this Science Change Agent adventure, this curriculum provides some support to help you practice these values together. Doing this is an on-going journey of personal and professional development. We encourage you to connect with the 4-H Program Leaders Working Group Access, Equity, and Belonging Committee's resources and to explore local resources to support that development.

Have An Exciting Teen Science Change Agent Journey!

Whichever path you choose to embark upon, we hope you will experience the joy of engaging youth people in becoming change agents for the environment as you address the complex issues of plastics in our communities, our country, and our world.

Teen Science Change Agents:

Transforming Our Relationship with Plastics

Facilitator Resources

National Science Foundation

NSF Center for Sustainable Polymers

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:

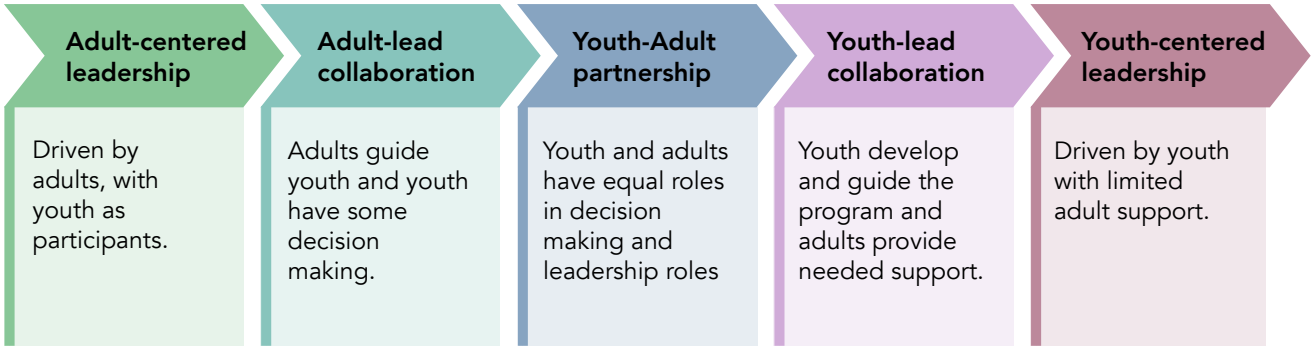
- A Continuum of Youth-Adult Partnership which outlines levels of the youth-adult partnership continuum and examples for each path (**Teens as Teachers** or **Teens Engaged in Community Action**).
- Examples of possible teen roles and adult roles that span both paths as well as offer specifics per path.

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.

Adult Self-Assessment for Youth-Adult Partnerships

Reflect on your program. Where does it fall within the Continuum of Youth-Adult Partnership?

Directions: Read each statement below and quickly choose agree or disagree.

Youth-Adult Partnership Approach Examples	Agree	Disagree
Young people have unique perspectives and knowledge that would enhance our group's capacity and efforts.	Yes, I agree	No, I disagree
Our program regularly solicits the input of young people.	Yes, I agree	No, I disagree
Young people have the right to be heard on matters impacting their lives.	Yes, I agree	No, I disagree
The idea of engaging young people in decision making excites me.	Yes, I agree	No, I disagree
The idea of engaging young people in decision making makes me nervous.	Yes, I agree	No, I disagree
Engaging young people in organizational decision making will benefit the program.	Yes, I agree	No, I disagree
Our program is prepared to include young people in decision making.	Yes, I agree	No, I disagree
Our program has clear leadership roles for both youth and adult.	Yes, I agree	No, I disagree
Our program adapts to meet the changing needs of teens.	Yes, I agree	No, I disagree
Our program is prepared to support teens in putting their plans into action.	Yes, I agree	No, I disagree
Young people are reliable and should be trusted.	Yes, I agree	No, I disagree
Teens should have the opportunity to lead younger youth.	Yes, I agree	No, I disagree
Our group should adjust certain meeting times to accommodate young people's schedules.	Yes, I agree	No, I disagree
Teens' schedules are busy and our program is flexible in leadership roles/responsibilities.	Yes, I agree	No, I disagree
I feel confident in creating a positive youth-adult partnership with teens.	Yes, I agree	No, I disagree

Sources:

Dotterweich, J. (2021). Positive Youth Development https://actforyouth.net/youth_development/professionals/manual.cfm 101: A Curriculum for Youth Work Professionals.

YPAR Hub http://yparhub.berkeley.edu/.

Youth Roles in Teen Science Change Agents

Youth share ideas, thoughts and concepts when adults give them a safe place to do so. A youth-led, adult-guided project allows young people to practice using skills such as communication and teamwork. They can begin to recognize the value of different perspectives.

Learning how to contribute their thoughts and ideas is essential as young people develop, but they need practice to build these skills. Sections 1 through 3 in this curriculum are designed to support teens in their leadership skill development.

Below are some examples of common roles youth may play across both paths as well as adult roles for the **Teens as Teachers path** and the **Teens Engaged in Community Action path**. Roles that youth play may vary depending on where they are at in their leadership development.

Teen Roles

Teen roles common across Teens as Teachers and Teens Engaged in Community Action paths

- **Learner:** youth learn about polymer science and wise use of plastics.
- **Learner:** young people engage in work related to their sparks.
- **Leader:** youth make meaningful program decisions, identify issues, and apply what they learn.
- **Leader:** youth build relationships with peers and community leaders.

Teen roles - Teens as Teachers:

- Older youth teach younger youth the science of polymers
- High school aged youth work with adult mentors
- Teens learn about ages and stages of development of younger youth
- Teens guide younger youth (build caring connections, help showcase learning, and guide reflection) as families engage in hands-on science learning activities together

Teen roles - Teens Engaged in Community Action:

- Youth conduct investigations
- Youth learn about project planning, collaboration, and community engagement
- Youth design a community action project around the impacts of plastic
- Youth make positive change to help their communities thrive

Adult Roles in Teen Science Change Agents

Adult facilitators play a critical role in teen engagement, especially as youth identify a Teen Science Change Agent path. Supporting youth voice may include asking youth for input and providing opportunities for youth to choose or make decisions. This leads to true adult-youth partnerships.

Roles that adults play may vary depending on where youth are in their leadership development. For example, adults may be more hands-on in training, organizing the classroom lessons, and working with community partners, classroom teachers, and club leaders in the Teens As Teachers path. Adult roles in the Community Action path will be rooted somewhere along the youth-adult relationship continuum with the focus on adults supporting youth in achieving their action project. Please see the Facilitator Resources section for activities, tools, and resources to help prepare adult facilitators to put the change-making power in the hands of young people.

Below are some examples of common roles adults may play across both paths as well as adult roles for the **Teens as Teachers path** and the **Teens Engaged in Community Action path**.

Adult Roles

Adult Roles Common Across Teens as Teachers and Teens Engaged in Community Action path:

- **Express Care**: adults pay attention to youth interests in this project and believe in their ability to affect change
- **Challenge Growth**: adults work with youth to create shared accountability in program planning and implementation. Expect youth to succeed and provide a safe space to learn from mistakes. Work with youth to choose projects that stretch their skills
- **Provide support**: scaffold planning and implementation process to help youth succeed. Advocate for their leadership with other adults
- **Share Power**: Collaborate with youth to make program decisions. Step back as youth leadership grows with the complexity of project
- **Expand possibilities**: connect youth to new career possibilities, introduce them to people that help them grow

Adult Roles - Teens as Teachers:

- **Adults provide basic training**. Adults will set up training opportunities in which teens will have the opportunity to teach
- **Adults support teen teachers** in preparing for their teaching experience through (1 or more of the following): co-planning, co-facilitating, coaching, gathering materials, practicing activities, or other

Adult Roles - Teens Engaged in Community Action:

- **Adults help youth navigate** community relationships and institutions
- **Adults prepare youth** and provide training for community action approaches

Experiencing Adultism

1. Sit in a quiet place. Take a moment and think back to yourself as a young person. Recall an example when you felt disrespected or disregarded, stereotyped because of your age, and/or adults acted like they were more important or "better than you." Take yourself back to that experience. What did it feel like to be unable to interrupt the behavior of the adult? What did you say or do? Knowing what you know now, what would you like to have said or done?
2. Then, think about a time as a young person that you were given an opportunity to share in decision making, to work in partnership with caring adults, and you felt respected, included, and valued by adults. How did you feel? How did you respond?
3. Finally, write down some of your reflections. What part of your power was taken away when you were a child that you would now like to reclaim as an adult? What is something you can do to empower young people?

Learn More at the YPAR Hub

The Youth Participatory Action Research (YPAR) Hub at UC Berkeley has a wide variety of excellent youth participatory action research resources, both for in-person and virtual programs. Please visit the YPAR Hub http://yparhub.berkeley.edu/. Resources include Youth & Adults resources to get started, youth-adult power sharing, and more.

Use this table as a tool to reflect on your program.

Moving From Adultism to Partnership

Manifestations of Adultism	Adult Partner Behavior	Some Guidelines to Achieve Adult Partner Behavior
Dysfunctional Rescuing - helping young people based on the assumption they can't help themselves or else helping them in a way that limits their ability to help themselves. Result is youth are set up to fail.	Functional Helping	• Resist doing things for people that they can do for themselves • Provide clear and constructive feedback that notes positive behaviors as well as areas for improvement • Engage people as partners in formulating plans to improve their lives or behaviors
Blaming the Victim - assigning behavioral problems of young people solely to youth themselves, without regard to the contexts they grow up in (maybe poverty, dangerous neighborhoods, inferior schools, without caring adults). Result is youth don't get adult support that they need.	Taking responsibility	• Take responsibility for determining your own group's standards • Define how your own thoughts and behaviors contribute to a situation • Do not degrade the concerns or issues of any group of people • Do not judge other groups of people by using the standards of your own group
Avoidance of Contact - lack of regular social or professional contact with young people and lack of effort to learn about youth and their environments. Result is adults creating programs based on their needs instead of the needs and interests of youth.	Making contact	• Make an effort to learn about the lives and concerns of people who are different from you • Make an effort to get to know and interact personally with people who are different from you • Be willing to change your perceptions to fit your new experiences
Denial of Cultural Differences - Age and cultural differences are assumed to be superficial. May be motivated by egalitarian ideals ("age-blind" or "color-blind" approaches) but the result is youth are denied the opportunity to bring their own beliefs, skills, or lifestyles into settings.	Recognition and Appreciation of Differences	• Grant equal respect to all people, but learn to distinguish among cultural differences in world views, communication patterns, issues of concern, etc. • Develop an awareness of your own assumptions and verbal and nonverbal communication patterns that may be inappropriate for use with another group of people • Do not judge other groups by using the standards of your own group • Do not assume you understand members of another group; do not assume people are like you

Manifestations of Adultism	Adult Partner Behavior	Some Guidelines to Achieve Adult Partner Behavior
Denial of the Political Significance of Adultism - lack of understanding or denial of social, political, and economic realities of young people. Also discounting the fact that young people are not treated "as equals" or "as real people" in many of the settings in their daily lives.	Recognition and Understanding of Political Significance of Oppression	• Seek knowledge about the political, social, and economic realities of different groups • Avoid depending on a sole (or merely a few) source(s) of information • Develop critical thinking skills • Recognize that the personal experiences of people constitute a valid source of knowledge

Sources:
Academy for Educational Development, Ctr. for Youth Development and Policy Research (1996). Advancing Youth Development: A Curriculum for Training Youth Workers. https://www.ojp.gov/ncjrs/virtual-library/abstracts/advancing-youth-development-curriculum-training-youth-workers

YPAR Hub http://yparhub.berkeley.edu/

Partnering with Teens

A spark is that excitement and passion that is ignited when young people discover something that really interests them. It motivates them to want to learn more, to explore their interests, and to build skills. Here are some potential youth sparks related to plastics and the environment as well as the Teens as Teachers path and the Teens Engaged in Community Action path:

Teen Sparks

Sparks Common Across Teens as Teachers and Teens Engaged in Community Action paths:

- Interest in polymer science, plastics, the environment. Share these passions with other youth and the community
- Teens understand that the wise use of resources is an increasingly important issue in our world
- Taking action to make a difference in their community: caring about the planet and protecting the environment
- Explore potential career paths

Sparks - Teens as Teachers:

- Opportunity to work with younger youth
- Be a teacher for younger youth
- Inspire younger youth to do science and engineering

Sparks - Teens Engaged in Community Action:

- Lead investigations and do science
- Have a voice and work with adults to make positive change
- Be a leader
- Opportunity to meet community leaders/ decision makers, and learn the dynamics of community leadership

Listening for Sparks

This activity presents one way to invite youth to talk about their sparks. It's also important to be aware of how youth demonstrate or hint at their sparks at any time.

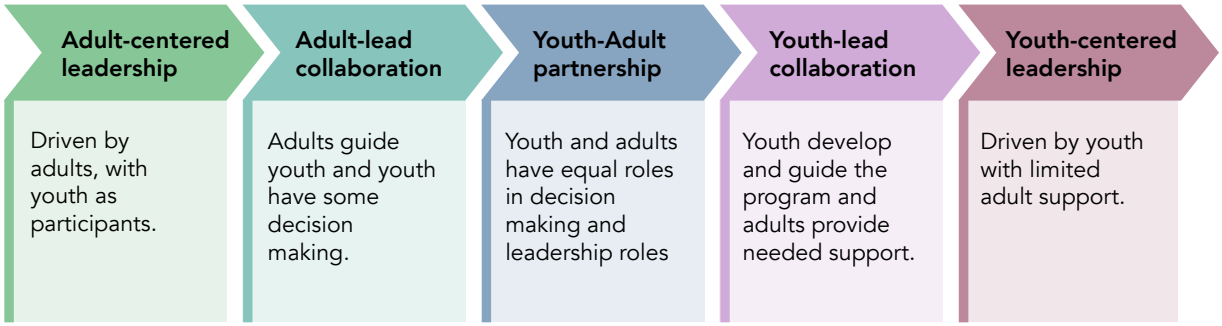
1. Sparks Matter: Listening for Sparks (https://youtu.be/R0Abi8oEgAw): You can practice noticing what drives a particular young person by watching the scenarios in this video and reflecting:
   a. What did you see that may have been evidence of a spark in this young person?
   b. How could the adult have initiated a sparks conversation?
2. Think about a young person you work closely with. What evidence of their spark have you noticed?
3. As you work with youth throughout this project, notice verbal feedback and their behaviors that might suggest their sparks.

Tips for Partnering With Teens

1. Treat young people with respect and as equals. Develop a partnership relationship. Take the time to get to know youth on a personal level.
2. Listen carefully to youth and try to understand their perspective. Have patience as they learn and practice leadership skills.
3. Articulate power structures. Adults need to be willing to share their power and responsibility. Youth people beed to be willing to share their perspective, gain power, and take on responsibilities.
4. Share leadership responsibilities. Provide specific, meaningful roles for youth. Give everyone opportunities to take on leadership roles. Provide guidelines and support, but avoid total control. Share all work activities, even tedious ones.
5. Keep youth informed about activities, even when problems occur.
6. Recognize that logistics, location, environment, and time will always play a key role for meaningful partnerships with youth. Develop meeting times in partnership with youth to accommodate their schedules. Create environments where youth feel comfortable expressing themselves.
7. Both youth and adults need the skills to work successfully together.
8. Have a positive, open attitude and share your enthusiasm.
9. Make activities fun and challenging.

Serve as role models for the young people, and be consistent and fair in your actions.

Youth-Adult Continuum



Tips For Crafting the Learning Environment

1. Welcome youth.
2. Begin with an opening activity/energizer/icebreaker that helps create connection, a sense of belonging, and teamwork with youth in preparation for group discussion.
3. Create shared agreements with youth to collaboratively build an environment that supports open discussions and shared decision making. Here are some potential agreements that support a positive discussion.
    - Respect.
    - Everyone has the opportunity to contribute ideas and take a leadership role with responsibilities.
    - Adults and youth share decision making.
    - Shared Investment: Each member plays an important role in planning and working toward the desired outcomes. This leads to a sense of shared ownership and belonging.
4. Cultivate youth voice.
    - Encourage youth to come up with ideas and share their perspectives.
    - Encourage other points of view. No idea is a bad idea. Ask for clarification.
    - Intentionally include quieter voices to offer opinions and participate.
5. Lead discussion using a variety of active discussion methods to engage youth (examples are included in the Examples of Active Discussion Methods section).
6. Support Collaboration (group mission; individual accountability).
    - Each participant is an important contributor to the project.
    - Help youth understand partnership and shared responsibility.
    - As a result, each participant should be sure to fulfill their commitment to the project and the group.
7. Manage Conflict.
    - Lively debate may turn into disagreements. Help youth understand different points of view. Suggest phrases that youth can use to acknowledge the other point of view, even if they disagree with the statement. Phrases can include: "It's okay that we have different opinions on this," "Let's give each person a chance to share their opinion," or "Let's listen to understand what they are saying, not just to respond."

- With younger youth, an objective method of decision making can be the best choice, such as the toss of a coin or "rock, paper, scissors."

8. Provide positive and concrete feedback.
    - Acknowledge the assets, contributions, and commitment that youth dedicate to the project as well as their unique leadership skills
    - Offer specific feedback unique to the young person that encourages a growth mindset. For example, "I have seen how hard you have worked and how your persistence has made an impact on the project."

Discussion Warm-Ups

The following warm-ups can be used to help get youth moving and connected around issues related to plastic:

- **Matter of Opinion** - Create a series of statements regarding plastics and ask youth to line up based on their opinion regarding the statement using strongly agree at one end and strongly disagree at the other end. For example, use the statement "I believe plastics can be both useful and good for the environment." After youth have moved to the spot on the line that best presents their opinion, ask a few youth to volunteer to share their opinion with the larger group. This can also be expanded to four corners of the room with each corner discussing the statement. Pictures of plastics can also be used to begin the conversation.
- **Photo of Mine** - This activity is geared to start exploring the issue, especially if youth are shy and hesitant to talk. Offer a range of photos related to plastics. Ask youth to choose a photo that strikes them. Once they have a photo, ask them to find a partner with a different photo. The pair then discuss the image and image meaning. Provide time for group sharing.
- **Knee to Knee** - Create two lines, each with equal numbers of youth facing each other. Provide a question or statement related to plastics. For example, "Can all plastics be recycled?" Give one minute for the pair to discuss the topic. After one minute, call for the group to switch with one line moving one person over to the right. Then pose a second plastic-related question. Continue for as many rounds as best works for the group. Ask youth to share important elements or thoughts from the conversations.
- **Ball Toss** - Ask youth to make a large circle. Use a ball (larger than a tennis ball) and ask students to toss the ball and share one question or belief related to plastics. Make sure all participants get a chance to toss the ball and share.
- **I Wonder** - Provide youth with a half sheet of paper or an index card. Ask students to write one thing they wonder about plastics (our use, the impact on the environment, or sustainability). Ask the students to place their paper or index card in a central pile once they are finished recording the thing they wonder about. Next, ask students to take a different paper or index card and read out loud to the group and discuss wonderings.
- **Rose and a Thorn** - Ask youth to find a partner and ask them to share one "rose" or positive thing about plastics and one "thorn" or negative thing about plastics. After one minute of sharing, ask a few students to volunteer to share some examples of a rose and thorn. Facilitators can also play music as youth move, then when the music stops, youth can find a different partner to share.

Tools for Group Discussion

Facilitator Tip
Identify creative ways to pair youth together to help alleviate any anxiety in finding a partner. Some ideas include: find someone who is directly behind you, find someone of the same height, find someone with the same number of letters in their first name, or find someone with shoes different than yours.

The following examples of discussion methods can be used to ensure all voices are heard, and youth are working as a team to generate and discuss ideas.

Rapid Post-It Brainstorm - Provide small sticky note pads approximately 2x2 or 3x3 in size. Give students 2 minutes to write any plastic issue they can think of or may want to solve. Ask that they don't write solutions yet, but to focus on quickly listing the issues. After 2 minutes, ask students to post their notes on a board in front of the group. After the notes are posted, ask one youth to read notes and help identify themes. Choose the top two or three themes and lead a second round of 2-minute rapid brainstorming focusing on potential solutions. Ask youth to post potential solutions. Ask one youth to read all the solution Post-Its and help identify themes. Discuss as a large group the most common plastic-related issue and most common plastic-related solution.

Rotation Brainstorm - Around a room, post a designated number of poster papers each with a different topic heading, a statement, or a question related to a plastic issue (our use, the impact on the environment, or sustainability). Ask youth to visit one poster paper to add at least one thought or suggestion. After a designated amount of time (2 to 3 minutes), the facilitator calls, "switch" for the youth to rotate to a different poster. Be sure everyone has an opportunity to contribute to each poster. Youth can switch as a group or move to the next poster in a different group. After youth have finished, a youth or facilitator reads from the posters. Discuss themes and suggestions as a large group.

Think-Pair-Share - Provide youth with an article, a video, or interesting plastic items to review or consider. Group youth in pairs and discuss the article, video, or interesting plastic items. After three minutes, ask for volunteers to share important points from the discussion.

Small-Group Rotation - Create a set of three to four different questions or statements related to plastics (our use, the impact on the environment, or sustainability) and list each question on a different poster paper. Station one poster paper at each table. Divide youth into three to four groups. Each group will have 5 minutes at a table to discuss a specific question. Ask one youth to record discussions. After 5 minutes, ask the youth to visit a different table to discuss. Have enough rotations so participants can visit each question or statement. After all the rotations are complete, ask someone from each table to share insights from the poster recordings.

Know and Want to Know - Create two posters (a) What do we know about plastics? and (b) What do we want to know about plastics? Post the paper and ask youth to visit each poster and record their thoughts. After brainstorming, ask for a volunteer to read from the posters. As a group, identify themes.

Twenty Questions - Ask youth to work with a partner to brainstorm 20 questions they have related to plastics (our use, the impact on the environment, or sustainability). Ask youth to share their list of questions. Identify the top five common questions to explore. As a large group, select the question the group is most interested in finding the answers to.

Understanding The Plastic Life Cycle

The activity from: *Confronting the Plastic Crisis: A 4-H STEM Curriculum for Grades 9-12* can be used to help teens better understand the plastic life cycle. Find the lesson at the end of this section.

SYMBOL	POLYMER NAME	PRODUCT EXAMPLES		
1 PETE	Polyethylene Terephthalate (PETE or PET)	• Soft drink bottles • Water bottles • Sports drink bottles • Salad dressing bottles • Vegetable oil bottles	• Peanut butter jars • Pickle jars • Jelly jars • Prepared food trays • Mouthwash bottles	
2 HDPE	High-density Polyethylene (HDPE)	• Milk jugs • Juice bottles • Yogurt tubs • Butter tubs • Cereal box liners	• Shampoo bottles • Motor oil bottles • Bleach/detergent bottles • Household cleaner bottles • Grocery bags	
3 V	Polyvinyl Chloride (PVC or V)	• Clear Food packaging • Wire/cable insulation • Pipes/fittings • Siding • Flooring	• Fencing • Window frames • Shower curtains • Lawn chairs • Children's toys	
4 LDPE	Low-density Polyethylene (LDPE)	• Dry cleaning bags • Bread bags • Frozen food bags • Squeezable bottles • Wash bottles	• Dispensing bottles • 6 pack rings • Various molded laboratory equipment	
5 PP	Polypropylene (PP)	• Ketchup bottles • Most yogurt tubs • Syrup bottles • Bottle caps • Straws	• Dishware • Medicine bottles • Some auto parts • Pails • Packing tape	
6 PS	Polystyrene (PS)	• Disposable plates • Disposable cutlery • Cafeteria trays • Meat trays • Egg cartons	• Carry out containers • Aspirin bottles • CD/video cases • Packaging peanuts • Other Styrofoam products	
7 OTHER	Other Plastics (OTHER or O)	• 3/5 gallon water jugs • Citrus juice bottles • Plastic lumber • Headlight lenses • Safety glasses • Gas containers	• Bullet proof materials • Acrylic, nylon, polycarbonate • Polylactic acid (a bioplastic) • Combinations of different plastics	

Youth Learning Outcomes

This curriculum was developed with key outcomes in mind for youth, including

- **Learning** – Youth learn about plastics and their impact on the environment.
- **Leadership** – Youth develop leadership skills and identify as leaders.
- **STEM Identity** – Youth think of themselves as science learners by engaging in science and engineering practices and contributing to STEM fields (scientists, users of technology, engineers, or mathematicians).
- **Social Emotional Learning** – Youth develop social and emotional learning competencies.
- **Civic Engagement** – Youth become actively engaged in their communities and the world addressing the issues of plastics.

Section 1: Discovering the Power of Why

Activity	Learning Objectives	Related Youth Outcome(s)
Activity 1: Teen Sparks	• Youth discover and highlight their sparks. • Youth reflect on how their sparks might be connected to interest in caring for the environment, using plastics more wisely and sustainably, and taking action to address issues related to plastics and plastic pollution.	**Social Emotional Learning** – Self-awareness: Leadership and STEM identity, creativity, confidence, decision-making, autonomy.
Activity 2: Cultivating Hopeful Purpose	• Youth understand some of the challenges of plastic pollution and what has been done about it. • Youth reflect on what actions they can take to use plastics wisely and more sustainably themselves and to encourage others to do so, too. • Youth develop a personal mission statement about plastics.	**Learning** – Teens will expand their science content knowledge on topics of environmental sustainability, polymers, and their skill in using scientific evidence to make informed decisions. **STEM Identity** – Increased awareness of STEM in everyday life, applications of STEM to solve community problems, and engagement in STEM issues youth are passionate about.

Activities in this section address the following education standards:

Global Leadership Performance Outcomes

- **Recognize Perspectives** - What is the evidence that a student can recognize, articulate, and apply an understanding of different perspectives (including his/her own)?
- **Investigate the World** - What is the evidence that a student can initiate investigation of the world by framing questions, analyzing and synthesizing relevant evidence, and drawing reasonable conclusions about global issues?

The College, Career, and Civic Life (C3) Framework for Social Studies State Standards

- D4.6.9-12. Use disciplinary and interdisciplinary lenses to understand the characteristics and causes of local, regional, and global problems; instances of such problems in multiple contexts; and challenges and opportunities faced by those trying to address these problems over time and place.
- D4.7.9-12. Assess options for individual and collective action to address local, regional, and global problems by engaging in self-reflection, strategy identification, and complex causal reasoning.

Section 2: Building Leadership Skills in Youth Change Agents

Activity	Learning Objectives	Related Youth Outcome(s)
Activity 1: Teen Leadership and Learning Self-Reflection	• Youth identify current leadership strengths. • Youth identify leadership skills they want to develop. • Youth gain insight into their preferred leadership pathway.	**Leadership** – Increased leadership experiences that lead to leadership identity. **Social Emotional Learning** – Self-awareness: Leadership and STEM identity, creativity, confidence, decision-making, autonomy.
Activity 2: Identity Wheel	• Youth think critically about who they are now and who they want to become in the future.	**Social Emotional Learning** – Self-management: plan strategies, evaluate what worked, and plan for next application.

Activities in this section address the following education standards:

Global Leadership Performance Outcomes
- **Investigate the World** - What is the evidence that a student can initiate investigation of the world by framing questions, analyzing and synthesizing relevant evidence, and drawing reasonable conclusions about global issues?
- **Recognize Perspectives** - What is the evidence that a student can recognize, articulate, and apply an understanding of different perspectives (including his/her own)?

The College, Career, and Civic Life (C3) Framework for Social Studies State Standards
- D4.6.9-12. Use disciplinary and interdisciplinary lenses to understand the characteristics and causes of local, regional, and global problems; instances of such problems in multiple contexts; and challenges and opportunities faced by those trying to address these problems over time and place.

Section 3: Choosing A Change Making Pathway

Activity	Learning Objectives	Related Youth Outcome(s)
Activity 1: Exploring Youth and Adult Partnerships	• Youth explore the dynamics of youth and adult relationships and strategies for positive interactions. • Youth develop skills and strategies to effectively partner with adults.	**Social Emotional Learning** – Relationships skills: building relationships with teens in the project, youth served, community partners, etc.
Activity 2: Our Youth & Adult Partnership	• Youth personally reflect on what they need to learn and work together well. • Youth create and record shared expectations about how to work together throughout this project.	**Social Emotional Learning** – Relationships skills: building relationships with teens in the project, youth served, community partners, etc.
Activity 3: Choosing a Change Making Path	• Youth understand what the choices are for possible polymer science leadership projects. • Youth collaboratively decide which project pathway your group will pursue.	**Social Emotional Learning** – Responsible decision-making: Teens as teachers listen to their own advice. **Social Emotional Learning** – Responsible decision-making. Social awareness: opportunity to help and be helped. **Learning** – Project planning skills of organizing tasks, determining resources needed, and creating a project timeline.

Activities in this section address the following education standards:

Global Leadership Performance Outcomes

- **Communicate Ideas** - What is the evidence that a student can select and apply appropriate tools and strategies to communicate and collaborate effectively, meeting the needs and expectations of diverse individuals and groups?
- **Take Action** - What is the evidence that a student can translate his/her ideas, concerns, and findings into appropriate and responsible individual or collaborative actions to improve conditions?

The College, Career, and Civic Life (C3) Framework for Social Studies State Standards

- D4.7.9-12. Assess options for individual and collective action to address local, regional, and global problems by engaging in self-reflection, strategy identification, and complex causal reasoning.
- D4.8.9-12. Apply a range of deliberative and democratic strategies and procedures to make decisions and take action in their classrooms, schools, and out-of-school civic contexts.

Section 4: Teens as Teachers Path

Activity	Learning Objectives	Related Youth Outcome(s)
Building Your Skills for Effective Teaching Activity 1: Remembering a GREAT teacher or group leader	• Youth reflect on what skills, abilities, approaches, and traits made their teacher/group leader effective. • Youth consider how they might apply these attributes to their own teen teaching experience (throughout Section 4).	**Learning** – Teens will learn approaches to reach elementary and/or middle school youth for engaging in science learning.
Activity 2: Thriving Together	• Youth increase awareness of the 4-H Thriving Model. • Youth share and develop strategies for creating welcoming spaces and opportunities for youth to belong. • Youth develop understanding of what developmental relationships are. • Youth plan strategies for nurturing developmental relationships with youth participants.	**Learning** – Teens will learn approaches to reach elementary and/or middle school youth for engaging in science learning. **Social Emotional Learning** – Relationships skills: building relationships with teens in the project, youth served, community partners, etc.
Getting To Know Your Audience Activity 3: Understanding Ages and Developmental Stages	• Youth define what a developmental stage is. • Youth identify key characteristics of ages and stages of children ages 5-11 years (grades K-5). • Youth adapt an activity to best meet the needs of children at a developmental stage. • Youth apply this knowledge to the group you will be working with.	**Learning** – Teens will learn approaches to reach elementary and/or middle school youth for engaging in science learning. **Social Emotional Learning** – Social awareness: opportunity to help and be helped.
Activity 4. Leading Learning for Everyone - Draw a Scientist	• Youth start understanding our lens on how we view the world and how that might be the same and different from others. • Youth recognize that people come from different situations and experiences and accept that with respect and care. • Youth analyze how our personal lens impacts how we teach.	**Social Emotional Learning** – • Self-awareness: Leadership and STEM identity, creativity, confidence, decision-making, autonomy. • Self-management: Plan strategies, evaluate what worked, and plan for next application. • Relationships skills: building relationships with teens in the project, youth served, community partners, etc.

Continued Section 4: Teens as Teachers Path

Activity	Learning Objectives	Related Youth Outcome(s)
Building Your Skills for Effective Teaching Activity 1: Remembering a GREAT teacher or group leader	• Youth reflect on what skills, abilities, approaches, and traits made their teacher/group leader effective. • Youth consider how they might apply these attributes to their own teen teaching experience (throughout Section 4).	**Learning** – Teens will learn approaches to reach elementary and/or middle school youth for engaging in science learning.
Activity 2: Thriving Together	• Youth increase awareness of the 4-H Thriving Model. • Youth share and develop strategies for creating welcoming spaces and opportunities for youth to belong. • Youth develop understanding of what developmental relationships are. • Youth plan strategies for nurturing developmental relationships with youth participants.	**Learning** – Teens will learn approaches to reach elementary and/or middle school youth for engaging in science learning. **Social Emotional Learning** – Relationships skills: building relationships with teens in the project, youth served, community partners, etc.

Activities in this section address the following education standards:

Global Leadership Performance Outcomes

- **Recognize Perspectives** - What is the evidence that a student can recognize, articulate, and apply an understanding of different perspectives (including his/her own)?

The College, Career, and Civic Life (C3) Framework for Social Studies State Standards

- D4.8.9-12. Apply a range of deliberative and democratic strategies and procedures to make decisions and take action in their classrooms, schools, and out-of-school civic contexts.

Section 5: Teens Engaged in the Community Action Path

Activity	Learning Objectives	Related Youth Outcome(s)
Building Your Skills for Effective Teaching Activity 1: Remembering a GREAT teacher or group leader	• Youth reflect on what skills, abilities, approaches, and traits made their teacher/group leader effective. • Youth consider how they might apply these attributes to their own teen teaching experience (throughout Section 4).	**Learning** – Teens will learn approaches to reach elementary and/or middle school youth for engaging in science learning.
Activity 2: Thriving Together	• Youth increase awareness of the 4-H Thriving Model. • Youth share and develop strategies for creating welcoming spaces and opportunities for youth to belong. • Youth develop understanding of what developmental relationships are. • Youth plan strategies for nurturing developmental relationships with youth participants.	**Learning** – Teens will learn approaches to reach elementary and/or middle school youth for engaging in science learning. **Social Emotional Learning** – Relationships skills: building relationships with teens in the project, youth served, community partners, etc.
Getting To Know Your Audience Activity 3: Understanding Ages and Developmental Stages	• Youth define what a developmental stage is. • Youth identify key characteristics of ages and stages of children ages 5-11 years (grades K-5). • Youth adapt an activity to best meet the needs of children at a developmental stage. • Youth apply this knowledge to the group you will be working with.	**Learning** – Teens will learn approaches to reach elementary and/or middle school youth for engaging in science learning. **Social Emotional Learning** – Social awareness: opportunity to help and be helped.

Continued Section 5: Teens Engaged in the Community Action Path

Activity	Learning Objectives	Related Youth Outcome(s)
Activity 4. Leading Learning for Everyone - Draw a Scientist	• Youth start understanding our lens on how we view the world and how that might be the same and different from others. • Youth recognize that people come from different situations and experiences and accept that with respect and care. • Youth analyze how our personal lens impacts how we teach.	**Social Emotional Learning** – • Self-awareness: Leadership and STEM identity, creativity, confidence, decision-making, autonomy. • Self-management: Plan strategies, evaluate what worked, and plan for next application. • Relationships skills: building relationships with teens in the project, youth served, community partners, etc.
Teaching Strategies and Practice Teaching Activity 5: Experiential Learning and Inquiry-Model It!:	• Youth learn to use an "I wonder" board as a means to help children practice the skills of observing and asking questions. • Youth identify the difference between open- and closed-ended questions and practice using open-ended questions as a skill of inquiry-based learning. • Youth Identify the steps of the Experiential Learning process. • Youth adapt an activity for various ages of learners.	**Learning** – Teens will learn approaches to reach elementary and/or middle school youth for engaging in science learning. **STEM Identity** – Youth build the 8 Practices of Science and Engineering, further expanding their STEM identity through engaging in the practices.
Activity 6: 5 Essential Teaching Skills	• Youth explore and practice effective teaching strategies.	**Learning** – Teens will learn approaches to reach elementary and/or middle school youth for engaging in science learning.
Optional Activity 7 Giving Directions	• Youth learn effective ways to give directions. • Youth gain strategies for being more clear when giving directions to younger children.	**Learning** – Teens will learn approaches to reach elementary and/or middle school youth for engaging in science learning.
Activity 1: Understanding My Community	• Youth understand what community means for the group and define the community where your group aims to make a difference. • Youth will begin learning about the identified community's strengths and needs.	**Social Emotional Learning** – Social awareness: opportunity to help and be helped. **Civic Engagement** – Youth become actively engaged in their communities and the world addressing the issues of plastics.

Activity	Learning Objectives	Related Youth Outcome(s)
Activity 2: Discovering the community action project	• Youth contribute to something larger than themselves and achieve broader impact.	**Learning** – Teens will expand their science content knowledge on topics of environmental sustainability, polymers, and their skill in using scientific evidence to make informed decisions. **STEM Identity** – Increased awareness of STEM in everyday life, applications of STEM to solve community problems, and engagement in STEM issues youth are passionate about. **Social Emotional Learning** – Social awareness: opportunity to help and be helped. **Civic Engagement** – Youth become actively engaged in their communities and the world addressing the issues of plastics.
Activity 3: Planning the community action project	• Youth gain project planning skills of organizing tasks, determining resources needed, and creating a project timeline.	**Learning** – • Project planning skills of organizing tasks, determining resources needed, and creating a project timeline. • Teens will expand their science content knowledge on topics of environmental sustainability, polymers, and their skill in using scientific evidence to make informed decisions. **Civic Engagement** – Youth become actively engaged in their communities and the world addressing the issues of plastics.

Activity	Learning Objectives	Related Youth Outcome(s)
Activity 4: Leading the Community Action Project	• Youth gain confidence through project implementation to effectively serve as change agents and engaged citizens around issues of plastics.	**Learning** – Teens will expand their science content knowledge on topics of environmental sustainability and polymers, and their skill in using scientific evidence to make informed decisions. **Leadership** – Increased leadership experiences that lead to leadership identity. Community partnership development and public-speaking skills. **STEM Identity** – • Active participation in a research projectand development of research skills (citizen science, YPAR). • Increased awareness of STEM in everyday life, applications of STEM to solve community problems, and engagement in STEM issues youth are passionate about. • Youth build the 8 Practices of Science and Engineering, further expanding their STEM identity through engaging in the practices. **Social Emotional Learning** – • Develop self-awareness, social awareness, self-management, and relationship skills and practice responsible decision-making. • Awareness of various career opportunities related to teaching, community development, and the science of polymers and developing leadership and STEM identities. **Civic Engagement** – Youth become actively engaged in their communities and the world addressing the issues of plastics.
Activity 5: Sharing and reflecting on the action project	• Youth evaluate the project impacts, both on the community and on their own experience.	**Learning** – Project planning skills of organizing tasks, determining resources needed, and creating a project timeline. **Social Emotional Learning** – Self-management: Plan strategies, evaluate what worked, and plan for the next application. **Civic Engagement** – Youth become actively engaged in their communities and the world addressing the issues of plastics.

Activities in this section address the following education standards:

Global Leadership Performance Outcomes

- **Communicate Ideas** - What is the evidence that a student can select and apply appropriate tools and strategies to communicate and collaborate effectively, meeting the needs and expectations of diverse individuals and groups?
- **Investigate the World** - What is the evidence that a student can initiate investigation of the world by framing questions, analyzing and synthesizing relevant evidence, and drawing reasonable conclusions about global issues?
- **Recognize Perspectives** - What is the evidence that a student can recognize, articulate, and apply an understanding of different perspectives (including his/her own)?
- **Take Action** - What is the evidence that a student can translate his/her ideas, concerns, and findings into appropriate and responsible individual or collaborative actions to improve conditions?

The College, Career, and Civic Life (C3) Framework for Social Studies State Standards

- D4.6.9-12. Use disciplinary and interdisciplinary lenses to understand the characteristics and causes of local, regional, and global problems; instances of such problems in multiple contexts; and challenges and opportunities faced by those trying to address these problems over time and place.
- D4.8.9-12. Apply a range of deliberative and democratic strategies and procedures to make decisions and take action in their classrooms, schools, and out-of-school civic contexts.

Change Agent Approach Matrix

There are several inquiry-based approaches that can be used when guiding youth through developing and implementing an action project around a plastic issue. The Change Agent Approach Matrix can help determine the approach that best fits the action question youth want to address. Examples are provided for each approach.

Approach definitions	Approach procedures (Full learning cycle)	Approach examples	Sample questions
Citizen science Youth work with scientists to collect data used to study real-world phenomena, or youth report data to a database or program which supports the work of professional scientists. Program model example: For programs that are delivered at or near natural resources locations, such as park facilities or nature centers, and have direct connection with scientists and field experts	**Citizen science procedures** • Discover your research question. • Identify expert mentors/ stakeholders or current research on your plastic issues. • Determine how your project might fit with other plastic focused Citizen Science projects. • Create your data collection plan (where, what, how, and who). • Collect & analyze your data. • Share findings with scientist/community. **Resources:** Explore SciStarter for possible citizen science projects: https://scistarter.org/ and https://www.citizenscience.gov/#	**Citizen science example** Citizen Science volunteers study ocean debris washed ashore and team up with a local university to study how the currents move debris through the water. https://www.frostscience.org/marine-debris/ The Big Microplastic Survey https://microplasticsurvey.org/	**Citizen science sample questions** How much litter in or near our waterways are plastics? What is the most common type of plastic litter in our community? How much plastic is recycled in our community each month? What current plastic-related research is happening in our community (at nature centers, education institutions, city/county government)? Who are the scientists working on plastic issues in our community or world?

Approach definitions	Approach procedures (Full learning cycle)	Approach examples	Sample questions
Geo-inquiry Youth analyze space, place, and human conditions through maps, usually with the aid of geographic information systems (GIS). Program model example: For programs delivered at sites with access to GIS technologies, such as college campuses, scientific facilities, libraries, etc.	**Geo-inquiry procedures** • Discover your question around plastics: Where is it? Why is it? and Why care? • Research your plastic topic. • Identify resources (community experts, organizations, multi-media channels). • Determine what and how you will collect information/ data around your plastic issue (survey, interview, observations, videos). • Analyze and map your data: How are the data points connected and what visuals can show the connection to people and places? • Develop a geo-inquiry story: Outline geo-inquiry. • Create storyboard. • Determine multimedia approach. • Share geo-inquiry story with an identified audience **Resources**: https://www.nationalgeographic.org/education/programs/geo-inquiry/	**Geo-inquiry example** Idaho youth are studying microplastics in a local creek. They are working in partnership with a local watershed organization and a university graduate student to collect data. Data they collect will be shared with researchers at the university.	**Geo-inquiry sample questions** Where does the plastic pollution in our river come from and how can we educate our community about these problems? Where is plastic pollution coming from in our community? What might be an explanation for this plastic pollution? What places of business generate the most single-use plastics in our community? Where is plastic pollution impacting our watershed the most? **Resources:** https://www.nationalgeographic.org/video/classroom-mission/ ArcGIS Story Maps https://storymaps.arcgis.com/

Approach definitions	Approach procedures (Full learning cycle)	Approach examples	Sample questions
Community engagement Youth get involved in an organized effort on behalf of a government or nonprofit organization to benefit the community. Program model example: For programs delivered in partnership with a local neighborhood, community, or shared issue	**Community engagement procedures** • Discover the plastic issue within your community that you want to address or change. • Research what is already happening in your community related to your plastic issue. • Interview community members/stakeholders, government officials/ non-profits re: identified plastic issue. • Explore collaborating with governmental departments and business to address the issue and potentially create policy. • Identify and secure project partners, organizations, and community resources (ex. school principal). • Create an action plan (key action steps with the end goal in mind, who will do what when). • Implement community action plan/advocacy plan. • Analyze community impact, publicly share impact. **Resources**: https://digitalcommons.unomaha.edu/cgi/viewcontent.cgi?article=1038&context=slcepartnerships	**Community engagement example** Youth in New York City conducted a research project where they researched and analyzed plastic litter found on local streets and beaches. They engaged neighbors, local businesses, and politicians in creative problem solving to address the plastic pollution. They created an awareness campaign with giant puppets, banners and videos. Cafeteria Culture Reduce School Lunch Waste: Resources from the U.S. Environmental Protection Agency.	**Community engagement sample questions** What concerns do youth and adults have about plastics in our community? How might we advocate for our community to stop using plastic straws and other one-use plastic items? What approach might be successful to change the way our school, community, and businesses discard plastic waste? What does our community need to know about plastic recycling?

Approach definitions	Approach procedures (Full learning cycle)	Approach examples	Sample questions
Service-learning Youth develop a project to benefit others and their community. Service-learning is a direct-service, indirect-service, or advocacy-based-service project that does not include data collection. Program model example: For programs delivered in partnership with a local neighborhood, community, or shared issue	**Service learning procedures** • Discover the plastic issue within your community or world you want to address. • Research the plastic issue within your community or world. • Determine the best project to address the plastic issue. • Plan the service action plan (who will do what, when, and where). • Secure needed resources or partners (people, materials). • Implement service plan. • Reflect on learning through focused activities (personal learning and how it is related to broader learning/ experiences) • Identify and share project impacts and if applicable sustainability	**Service learning example** Youth from Indiana Public School # 91 created Zero Waste Cafeteria from a service learning grant they received to address school waste. They worked with Earth Charter Indiana to create a project that resulted in 75% reduction in school waste. https://www.earth-charterindiana.org/zero-waste-cafeteri8 Upcycle Plastics into Art - Combine your desire to make positive change with your artistic spirit by upcycling plastics into art!	**Service learning questions** What should we do to teach others to reuse a plastic bottle instead of throwing it away? How can we create a school recycling program? Where do we see plastic litter in our neighborhood? What can we do to help clean it up and prevent future waste from collecting here? What challenges do local recyclers face with recycling plastics?

Approach definitions	Approach procedures (Full learning cycle)	Approach examples	Sample questions
Youth participatory action research (YPAR) Youth define an issue and research question, conduct an investigation (data collection, analysis), and then take action based on the results. In YPAR, youth develop a project where they collect and analyze data, followed by a service-learning project informed by their data outcomes. Program model example: for programs delivered with stakeholder observation and involvement	**YPAR Procedures** • Discover the plastic issue that is most relevant to you and your community. • Explore how the plastic issue impacts you and your community (what are the influencing factors or connections). • Develop your research question and data collection methods. • Identify strengths, resources and community stakeholders • Collect data. • Analyze the data you have collected about the identified plastic issue. • Determine how you will use data collected and what change you want to see based on data. • Identify who needs to know (local governments, businesses, schools, policymakers, etc.). • Create a plan on how you will share the information, share information, evaluate impact, determine sustainability. **Resources**: https://yparhub.berkeley.edu/	**YPAR Examples** Youth designed a research project to learn how plastics get into a watershed. They used findings to involve their community in reducing plastic pollution in the watershed. Youth designed a survey to find out what their classmates thought about recycling. They asked these research questions: *How important do middle school students think it is to recycle plastic, aluminum, and glass? What helps or hinders them in recycling? They collected and analyzed 125 responses to determine what their classmates thought and identified barriers to recycling.* They created an education and awareness campaign, including talking to their school's principal and custodian to reduce barriers.	**YPAR sample questions** Authentic YPAR questions need to be created and driven by youth participants. Examples: How much plastic do we throw away each week in our classroom? What do people in our community remember about materials we used before plastics? How do our middle school classmates feel about recycling? What messages would work to convince our middle school classmates to switch to reusable beverage containers instead of one-use containers?

Sources

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4-H Thriving Model (2022, April 23). *About the 4-H Thriving Model*. (https://helping-youth-thrive.extension.org/)

4-H PLWG Program Leaders Working Group (2022, April 23). *About us*. (https://access-equity-belonging.extension.org/)

Understanding The Plastic Life Cycle

This activity from *Confronting the Plastic Crisis: A 4-H STEM Curriculum for Grades 9-12* can be used to help teens better understand the plastic life cycle. It is included here for ease of access; appendices follow. For additional facilitator background information, please download the Gr. 9-12 curriculum at 4hpolymers.org and view Module 5.

Facilitator Preparation

SUGGESTED GROUPINGS

- ☐ Pairs or small groups of 3

MATERIALS NEEDED

- ☐ 2, 20-sided die (these are available online or in toy/game stores).
- ☐ 3, 6-sided die
- ☐ *Learning Station Set-Up Map (Appendix A)
- ☐ *Learning Station Instructions (Appendices B-J)
- ☐ *Petroleum Barrel Cards for Station 1 to Station 2 (Appendix K)
- ☐ *Plastic Resin Cards for Station 2 (Appendix L); or real plastic items corresponding to various resin symbols.

Note: The materials will be divided among learning stations. Set up the learning stations using the guide provided in Appendix A.

GETTING READY

- ☐ Make copies of Appendices to place at respective learning stations.
- ☐ Make copies of the product cards (Appendix L) and cut them out. While the index cards may be used, the learning experience may be strengthened by providing real plastic items, corresponding to various resin symbols.
- ☐ Organize learning stations, and set up materials, as shown in Appendix A.
- ☐ Position plastic card/items at the Extraction Station 1 at least 3 per group (for example, 3 items x 5 groups = 15 plastic card/items).

Opening Questions/Prompts

This is where the activity begins. Asking opening questions helps frame the thinking of the youth, as well as provides educators with some understanding of youths' prior knowledge and experience.

- Describe what you think happens to plastic items once they reach the end of their intended use.
- Discuss what you know about recycling.

Procedure

Experience Step; this is the hands-on activity; first step in the learning cycle.

1. Position all groups in the Extinction Station 1 as indicated in Appendix A.
2. Explain to the group that they will follow the path of plastic in its entire life cycle. They will start as petroleum in the ground and have an adventure through the life cycle.
3. Provide each pair/small group with a "petroleum" card (or block of plastic) representing a generic unit of plastic.
4. Let each group proceed to the next learning station – Material Manufacturing 2 – with some time (approximately 30-60 seconds) between each group.
5. Each pair/small group of youth journeys through different paths taken by plastic.
6. Once the youth reach an endpoint (Stations 4, 7, 8, or 9), leave their plastic card/item, and proceed back to the Extinction Station 1.
7. The game ends after each team have gone through the cycle 3 or 4 times; or when there are no more plastic cards/items at the Extinction Station 1.

Reflection: Share, Process, Generalize

Step two in the learning cycle. Youth share their reactions and observations publicly and processes the experience by discussing and analyzing. Help guide youth as they question, share, and compare their observations. You may choose one of the questions below as a prompt. If necessary, use more targeted questions as prompts to get to particular points. Remember these questions are not about getting one right answer.

- Invite youth to make observations and discuss the resulting placements of plastic cards/items. Ask youth to add the number of plastic pieces remaining at each station and divide by the total number of plastic pieces used in the activity to calculate the percentages of plastic at each station. Ask youth to describe and explain their thoughts about the resulting proportion of plastic at each station.
- Ask groups to sort the R's into "most preferred" and "least preferred" methods, include a justification, and then share out with the full group.
    - Reduce
    - Reuse/Repair/Repurpose
    - Recycle
    - Recovery (energy)
    - Trash/Landfill
- Discuss what might help mitigate negative environmental impacts for plastic end-of-life options.

Concept/Term Discovery

A critical, intermediate step where the goal is always to have the youth develop their understanding using their own words and as a result of the experience; however, if misunderstandings/misconceptions develop, the facilitator needs to address them. Conceptual understanding develops during discussions among youth during the Reflection phase of the activity; technical terms are also frequently used. During these discussions, facilitators need to assess concepts and/or terms the youth have understood through the activity. Any concepts or terms the youth do not discover or understand will need to be introduced by the facilitators before moving to the Application phase.

Concept Application

Last step in the learning cycle; this links learning to participants' lives through authentic applications to their own practices. The true test of young peoples' understanding is when they can apply new knowledge and skills to authentic situations. When engaging youth in inquiry-based learning, hands-on activities serve as vehicles for learning new concept knowledge and skills; however, it is the application of new knowledge or skills to independent, real-world situations that is the critical factor in the learning process. Thus, to complete the cycle of experiential learning it is important to intentionally provide youth specific opportunities for authentic applications. Suggestions for real-world applications include:

- Research an organization that help the community reduce, reuse, or recycle in some way. What services do they provide? How do they help reduce our environmental impact? What do they do with the plastic they receive?
- Look into important moments in history related to reducing, reusing, and recycling. For example, laws, practices, or inventions. How do other countries around the world reduce, reuse, or recycle?
- Create a stop animation challenge that demonstrates and narrates various plastic bottle life cycles (reuse, recycle, landfill).
- Develop a personal plan-of-action to do more of the "preferred" R and less of the "least preferred" R.

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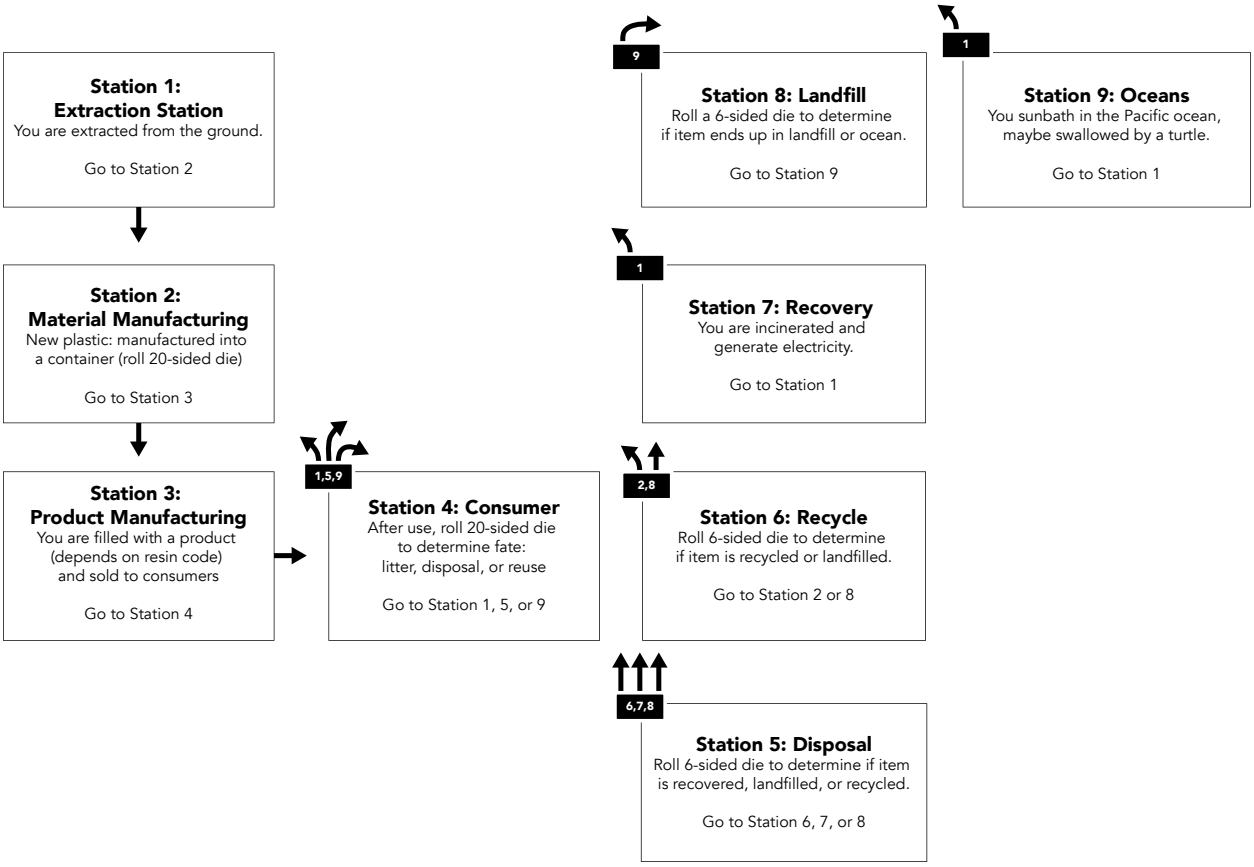
Plastic Products by Resin Identification Code

SYMBOL	POLYMER NAME	PRODUCT EXAMPLES		
1 PETE	Polyethylene Terephthalate (PETE or PET)	• Soft drink bottles • Water bottles • Sports drink bottles • Salad dressing bottles • Vegetable oil bottles	• Peanut butter jars • Pickle jars • Jelly jars • Prepared food trays • Mouthwash bottles	
2 HDPE	High-density Polyethylene (HDPE)	• Milk jugs • Juice bottles • Yogurt tubs • Butter tubs • Cereal box liners	• Shampoo bottles • Motor oil bottles • Bleach/detergent bottles • Household cleaner bottles • Grocery bags	
3 V	Polyvinyl Chloride (PVC or V)	• Clear Food packaging • Wire/cable insulation • Pipes/fittings • Siding • Flooring	• Fencing • Window frames • Shower curtains • Lawn chairs • Children's toys	
4 LDPE	Low-density Polyethylene (LDPE)	• Dry cleaning bags • Bread bags • Frozen food bags • Squeezable bottles • Wash bottles	• Dispensing bottles • 6 pack rings • Various molded laboratory equipment	
5 PP	Polypropylene (PP)	• Ketchup bottles • Most yogurt tubs • Syrup bottles • Bottle caps • Straws	• Dishware • Medicine bottles • Some auto parts • Pails • Packing tape	
6 PS	Polystyrene (PS)	• Disposable plates • Disposable cutlery • Cafeteria trays • Meat trays • Egg cartons	• Carry out containers • Aspirin bottles • CD/video cases • Packaging peanuts • Other Styrofoam products	
7 OTHER	Other Plastics (OTHER or O)	• 3/5 gallon water jugs • Citrus juice bottles • Plastic lumber • Headlight lenses • Safety glasses • Gas containers	• Bullet proof materials • Acrylic, nylon, polycarbonate • Polylactic acid (a bioplastic) • Combinations of different plastics	

Appendix A

Diagram of Room Set-Up for Learning Stations



* Probabilities for dice rolls developed to mirror estimated U.S. plastic production and end-of-life options (American Chemistry Council, 2020; Environmental Protection Agency, 2021; Hopewell et al., 2009)

Appendix B

Learning Station 1 Instruction Card

STATION: EXTRACTION

Summary

- Millions of years ago, you were algae and plants that died and sank to the seafloor. You were buried and over millions of years under high pressure and temperature, your remains transferred into petroleum.
- You have been pumped from an underground reservoir into a barrel. You (crude oil) are usually black or dark brown, but can also be yellowish, reddish, tan, or even greenish, depending on the composition of chemicals.

Environmental Impacts

- The extraction of petroleum can disrupt wildlife habitats, release pollutants into the air and water, and the drilling equipment requires energy (typically generated by burning fossil fuels and contributing to greenhouse gas emissions).
- Oil is considered a non-renewable resource because it is available in limited quantities and takes millions of years to be replenished.

Directions:

1. Pick-up an oil barrel card. Read it as you begin your journey to material manufacturing (proceed to Station 2).

Appendix C

Learning Station 2 Instruction Card

MATERIAL MANUFACTURING

Summary

- You (oil) are transported to a refinery by pipeline, land, or sea. At the refinery, oil is distilled into various useful groupings and impurities are removed. Various processes are used to produce dozens of types of plastic, linking together polymer chains (at the molecular level), each with its own properties, structure, and size. There are six primary types of plastic noted by the resin code.

Environmental Impacts

- The transportation of oil to a refinery requires energy, typically by burning fossil fuels and causing greenhouse gas emissions. Refining releases chemicals into the air leading to air pollution and causing a notable odor (although the U.S. has mandated restricts on contaminants and required technologies to reduce emissions).

Directions for Recycled Plastic

1. If you came from the Recycle station, you are manufactured back into the same item.

Directions for Crude Oil – Become New Plastic

1. If you came from the Extraction station, you are manufactured into one of the following (roll a 1d20). On a roll of:

• 1, 2, or 3, you are made into a beverage bottle	
• 4, 5, 6, or 7, you are made into a milk jug	
• 8, 9, or 10, you are made into PVC pipe	
• 11, 12, 13, 14, 15, or 16, you are made into a plastic bag	
• 17, 18, or 19, you are made into a food container	
• 20, you are made into packaging peanuts	

2. Pickup the corresponding card or item and proceed to Station 3.

Appendix D

Learning Station 3 Instruction Card

PRODUCT MANUFACTURING AND SELLING TO CONSUMERS

Summary

- You are transported to a company that will sell you for use. Depending on the type of plastic product, you might be filled with liquid (for beverage containers) or sold to restaurants (for food containers), or prepared for other uses.

Environmental Impact

- Transportation of plastic containers or products requires energy – trucks, boats, planes – which produce greenhouse gasses. However, because plastic is much lighter than glass, or even aluminum, the energy required for transportation is less when compared to glass and aluminum, thus emitting fewer greenhouse gas emissions.

Directions

1. Create a brief story of who "you" are as a plastic product. Who are you sold to and why? What will the consumer who purchased you use you for?! What type of marketing did the company use to sell you?
2. Proceed to the Consumer Use Station 4

Appendix E

Learning Station 4 Instruction Card

CONSUMER USE

Summary

- You are purchased by a consumer for use. Perhaps the consumer will keep you for a long time, or reuse you for another purpose? Most likely the consumer will dispose of you after your intended use is completed.

Environmental Impacts

- Consumer use in itself likely does not have significant environmental impacts.

Directions: Roll a 1d20. On a roll of:

- 1 = Consumer litters you in the environment and you are washed out to the ocean. Go to the Ocean Station 9.
- 2 to 18 = Consumer disposes of you, proceed to Disposal Station 5.
- 19 or 20 = Consumer keeps you and reuses you for another purpose. Keep product/item here and proceed to the Extraction Station 1 to start anew.
    - Reusing a plastic product helps increase its lifespan. Consumers might repurpose or upcycle an item for a new purpose other than what it was originally intended. Products may be maintained and repaired, rented, or shared to increase lifespan. Consumers need to reuse the item many times in order to make it environmentally beneficial.

Appendix F

Learning Station 5 Instruction Card

DISPOSAL

Summary

- The consumer is done with you (plastic product) and disposes of you. Perhaps the consumer places you in a trash or recycle bin for the municipal waste agency to pick-up?
- Perhaps the consumer returns you to a local recycling center, if your community even has one available, and you are a type of plastic accepted for recycling? Every city has a different standard for what types of plastic they will accept. PET #1 and HDPE #2 plastic bottles and jugs are the most commonly items recycled. Unfortunately, plastics #3 through #7, while collected by many recycling programs, are often sent to landfills, or incinerated instead.

Environmental Impacts

- Local waste disposal company service requires energy for collection and sorting, which contributes to greenhouse gas emissions.

Directions

- If you are PETE (1) or HDPE (2), roll a 1d6. On a roll of:
    - 1 or 2 = Go to Recycling Station 6
    - 3 = Go to Recovery Station 7
    - 4, 5, or 6 = Go to Landfill Station 8
- All other plastic types, roll a 1d6. On a roll of:
    - 1 or 2 = Go to Recovery Station 7
    - 3 to 6 = Go to Landfill Station 8

Appendix G

Learning Station 6 Instruction Card

RECYCLE FACILITY

Summary

- You are sent to a recycling facility to be sorted and hopefully converted into another product! Processing the collected items can be difficult and challenging. Only a few types of plastics (noted by the resin code symbol) can be recycled, and thus plastics must be carefully sorted by type. Unfortunately, without adequate recycling infrastructure, most plastic sorted into recycle bins is diverted to landfills. US recycles on average 8% of all plastic; however, around 30% of plastic bottles are recycled.

Environmental Impacts

- Successful recycling reduces the amount of waste sent to landfills, prevents pollution, and may boost the economy through new jobs.

Directions: Roll a 1d6. On a roll of:

- 1 to 4 = You are successfully recycled. Go to the Station 2: Material Manufacturing!
- 5 or 6 = You are not successfully recycled, perhaps due to a sorting error, contamination, or lack of a market (buyer) for recycled plastic. Go to Landfill Station 8

Appendix H

Learning Station 7 Instruction Card

RECOVERY

Summary

- You find your way to an electrical plant where you are incinerated to generate electricity. Or perhaps you are used in iron and steel production as a replacement for coal.

Environmental Impacts

- Incinerated plastic saves space in landfills and prevents plastics from entering the natural environment or ocean.
- Incineration releases pollutants (e.g., CO2) but often only 2/3rds the amount compared to coal (although not when compared to gas)
- May release other chemicals leading to air pollution if the incineration process is inefficient or lacks safeguards.
- Some argue that burying plastic in landfills may help keep carbon out of the air, thus helping to reduce overall greenhouse gas emissions.

Directions

- You are incinerated and generate electricity. Keep product/item here and proceed to the Extraction Station 1 to start anew.

Appendix I

Learning Station 8 Instruction Card

LANDFILL

Summary

- Youth find yourself in a landfill, also known as a dump, a site for the disposal of waste. Plastic – due to its strong chemical bonds – means it may take hundreds or thousands of years to decompose. Most plastic never fully decomposes, larger pieces just become smaller pieces.

Environmental Impacts

- Plastics may leach chemicals causing surface water pollution (e.g., streams, lakes, and ponds) or groundwater pollution.
- Some argue that burying plastic in landfills may help keep carbon out of the air, thus helping to reduce overall greenhouse gas emissions. Plastic in landfills may have the lowest impact on climate change, however, is the most detrimental to circularity and fossil resource use and has the most potential to pollute the environment through plastic leakage.

Directions: Roll a 1d6. On a roll of:

- 1 = Something happened on the way to, or in the landfill, and you are set free in the natural environment. Go to the Station 9 Ocean.
- 2 to 6 = You sit in the Earth for thousands of years. Keep product/item here and proceed to the Extraction Station 1 to start anew.

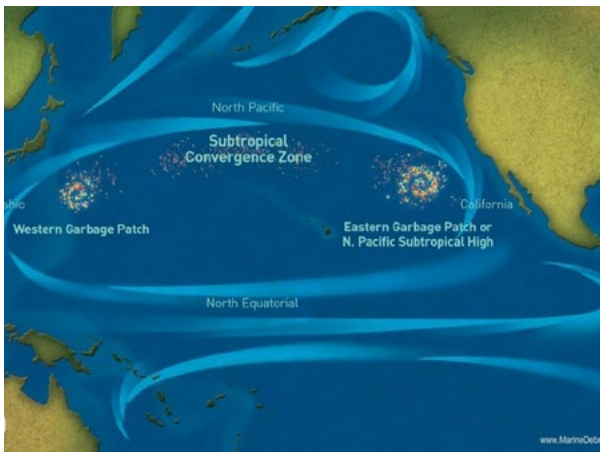
Appendix J

Learning Station 9 Instruction Card

NATURAL ENVIRONMENT AND OCEANS

Summary

- While most plastic waste goes to a landfill, some finds its way to the natural environment and ocean. Over 8 million tons of plastic are estimated to end up in our oceans every year. Plastic waste makes up 80% of all marine debris from surface waters to the deep sea. There is so much plastic waste floating in the Pacific ocean that a spot has been named the Great Pacific Garbage Patch.



Environmental Impacts

- Plastic pieces can be harmful to wildlife and marine animals; e.g., animals may mistake plastic for food and starve, animals may be entangled, or chemical residue may cause liver and cell damage or reproductive harm.

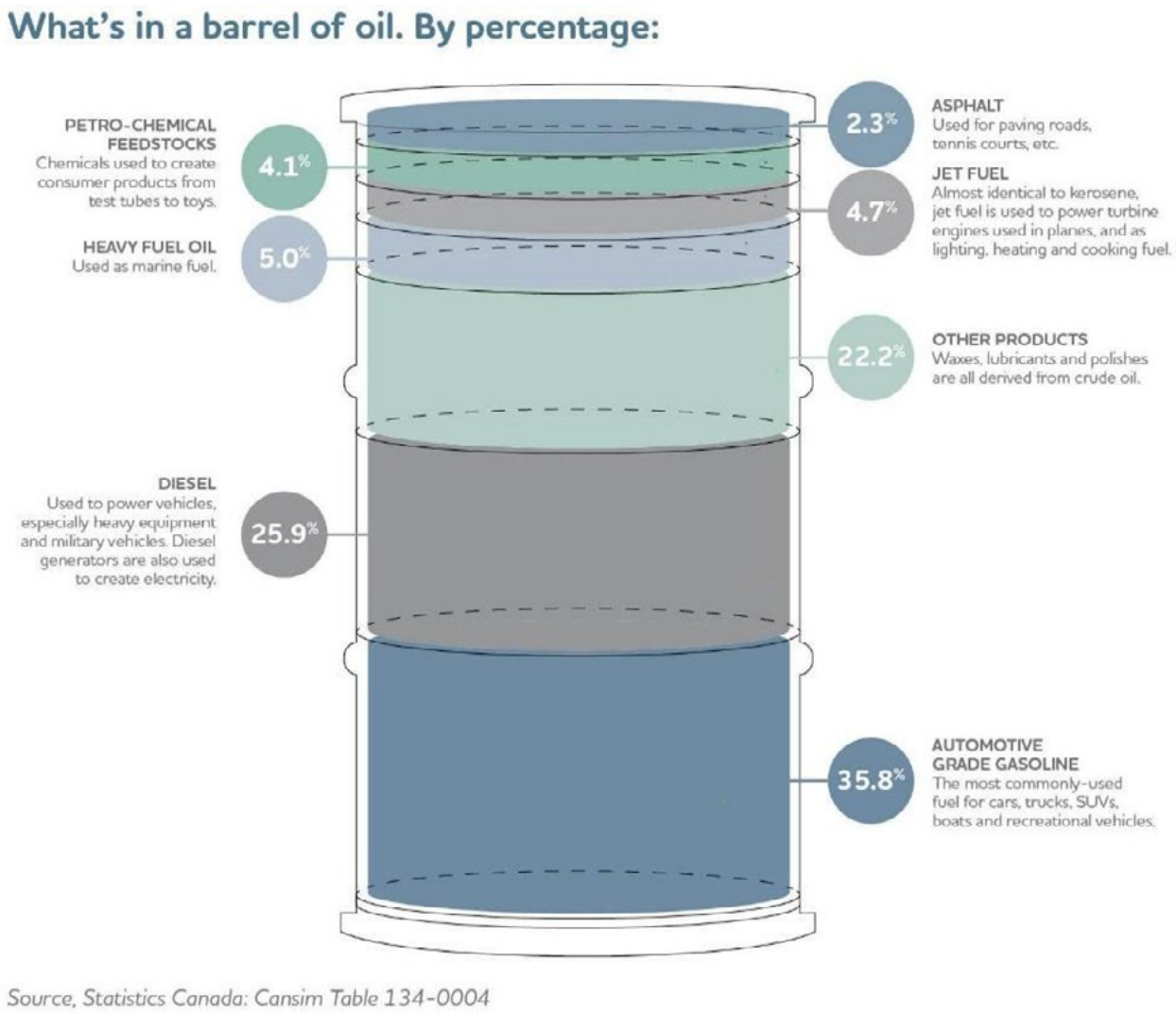
Directions

- You sunbath in the Pacific ocean, stuck forever sitting, swirling in the ocean. Keep product/item here and proceed to the Extraction Station 1 to start anew.

Appendix K

Petroleum Barrel Cards for Station 1 to Station 2

- There are 42 gallons in a standard U.S. barrel of crude oil.
- About 4% is refined into petro-chemical feedstocks (hydrocarbon gas liquids) used to make paints, plastics, and synthetic rubber.



Source, Statistics Canada: Cansim Table 134-0004

Appendix L

Plastic Resin Cards for Station 2

1. *Cards are on the following pages*
2. *Some pages are intentionally blank for proper printing*

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

1 PETE

PETE

Polyethylene terephthalate

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

1 PETE

PETE

Polyethylene terephthalate

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

1 PETE

PETE

Polyethylene terephthalate

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

1 PETE

PETE

Polyethylene terephthalate

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

HDPE

High-density polyethylene

HDPE

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

HDPE

High-density polyethylene

HDPE

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

HDPE

High-density polyethylene

HDPE

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

HDPE

High-density polyethylene

HDPE

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

03
PVC

PVC
Polyvinyl chloride

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

03
PVC

PVC
Polyvinyl chloride

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

03
PVC

PVC
Polyvinyl chloride

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

03
PVC

PVC
Polyvinyl chloride

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

4
LDPE

LDPE
Low-density polyethylene

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

4
LDPE

LDPE
Low-density polyethylene

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

4
LDPE

LDPE
Low-density polyethylene

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

4
LDPE

LDPE
Low-density polyethylene

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

5
PP

PP
Polypropylene

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

5
PP

PP
Polypropylene

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

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SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

5
PP

PP
Polypropylene

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

06
PS

PS
Polystyrene

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

06
PS

PS
Polystyrene

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

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Polystyrene

HTTPS://WWW.4HPOLYMERS.ORG/

SUSTAINABLE POLYMERS:
CONFRONTING THE PLASTIC CRISIS

06
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PS
Polystyrene

HTTPS://WWW.4HPOLYMERS.ORG/

Section

1

Grades 9-12

Teen Science Change Agents:

Transforming Our Relationship with Plastics

Discovering the Power of Why

National Science Foundation

NSF Center for Sustainable Polymers

Section 1: Discovering the Power of Why

Audience

All Teen Science Change Agents in grades 9-12

Summary

Teens begin discovering what they most care about related to the issues of plastic pollution. Your group will move through an intentional process of defining what drives teens' interest in caring for the environment and making changes in relation to plastics.

Driving Questions

- How do I discover and use my unique Sparks to create change around an issue I care about?
- Plastics are useful for everyday life yet are mostly made from non-renewable resources and cause environmental problems. What could a future look like where plastics are sustainable, non-harmful to the environment, and recycled to create energy?
- How do we develop a sense of hopeful purpose for the environment and how can we each play a role in achieving this vision?

Questions to Guide Adult Partners:

- In what ways does your program encourage youth to explore interests, passions, and purpose?
- In what ways does your program support young people to utilize interests, passions, and purpose to explore issues they care about?

Practices to Support Youth:

- Provide time for youth to share what gives them energy and purpose.
- Engage in discussions about current issues that youth care about.

Activity 1: Teen Sparks

Background Information for Facilitators

Defining Youth Sparks

Search Institute research defines sparks as "the interests and passions young people have within them that light a fire in their lives and express the essence of who they are and what they offer to the world." Sparks provide energy, joy, purpose, and direction in life and help young people thrive.

4-H Youth Development experiences like this polymer science project are one of many ways young people can find and nurture their sparks. You can be a spark champion for the youth in this program by working with them to collaboratively create this experience based on their current and potential sparks. At the end of the summary, please add a note: All URL addresses are included on Sources and Links page at the end of Section 1.

Examples of Sparks Related to Polymer Science

- Youth may have or develop an interest in polymer science, plastics, and the environment by:
- Building a deeper understanding of the complexity of using polymers wisely.
- Taking action to make a difference in their community around caring about the planet and protecting the environment.
- Leading investigations and doing science.
- Working with younger youth, teach them, and inspire them to do science and engineering.
- Being a leader and having the opportunity to use their voice.
- Working with adults to make positive change!
- Finding a spark that turns into a potential career.
- Making wise personal choices related to use of plastics.

The Impacts of Plastics

The Teen Science Change Agents paths focus on the prevalence, life cycle, and impact of plastics in everyday life. Plastics are versatile materials that come in different shapes, sizes, and exhibit different material properties (most commonly referred to by their resin code).

To build youth understanding of what happens to plastics after use, consider leading them through the Plastic Life Cycle activity included in the Resources Section. See the Resources Section an infographic for types of plastic products with thier Resin Identification Code.

Plastics may be strong and rigid (such as safety helmets and the exterior of automobiles) or soft and flexible (such as those used in shoe cushioning or plastics bags). It is easy to find examples of plastics in everyday life and we all encounter plastic items at multiple points each day. Few other materials, such as paper, aluminum, or glass, are as versatile as plastics. This versatility is perhaps why plastics have surged in production and usage in the last century, making their way into almost every facet of modern life.

Unfortunately, the chemical properties (long polymer chains) that make plastics so strong, durable, and flexible, also make them resist degradation. Plastics that end up littered in the environment can take hundreds or thousands of years to degrade. It is estimated that 4.8 million metric tons of plastics end up in our oceans each year. Plastics may break into smaller and smaller pieces (called microplastics). Microplastics are particularly harmful in aquatic environments because they are easily ingested by animals and can end up in drinking water.

The most effective method to reduce plastic waste is not to create it. Once created, reusing, repurposing, or upcycling a plastic product helps increase its lifespan. Another option in some places is to recycle plastics. Plastics that are recycled can be reprocessed into the same item or converted into a different item. However, not all plastic makes its way to the recycling bin. Only about 8% of all plastic is recycled - the rest is either incinerated, put into a landfill, or ends up as pollution in the environment.

Scientists and engineers are working on new ways to create, use, and recycle plastics made from renewable resources (like corn or potatoes) so we can use plastics for their many advantages and lessen their effects on our environment. Some plastics are now designed to biodegrade without polluting the environment and others are created using renewable resources to lessen the dependence on traditional, oil-based plastics. Sustainable polymers must address the needs of consumers without damaging our environment, health, or economy.

Learning Objectives

Youth will

- discover and highlight youth sparks.
- reflect on how each person's sparks might be connected to interest in caring for the environment, using plastics more wisely and sustainably, and taking action to address issues related to plastics and plastic pollution.

Time Required

- 20-30 minutes for Part 1 and Part 2 depending on group size

Materials

- Handout: Sparks Interview - 1 per pair
- Markers/colored pencils

Activity Steps

Sparks Interviews

Part 1: Individual Reflection

Invite youth to take 5 - 10 minutes on their own to consider the questions and record their thoughts. The questions invite youth to think about what interests and motivates them and how they might use those sparks to contribute to their communities. Please see Section 1 Handout.

Part 2: Pairing Conversations

1. Invite youth to pair up with another person. One person chooses to speak first while the other listens. The first speaker will share their reflections on these questions for 5 minutes. Listeners don't respond with their own experience or advice; they provide space and listen deeply so the speaker can continue uninterrupted.
2. Switch roles. The next partner will have 5 minutes to speak while the first listens.

Reflection

1. Invite the group back together to share about their Sparks Interview using these questions:
   - How did it feel to have these conversations?
   - What excited you about these conversations?
2. As youth reflect on their conversations, introduce the term "sparks," what it means, and point out what you hear youth saying that might point to their sparks.
3. Invite youth to think about how they might discover and nurture their sparks in this project.

Activity 2:
Cultivating Hopeful Purpose

Background Information for Facilitators

Defining Hopeful Purpose

Thriving youth have a sense of hope and purpose, and see themselves on the way to a happy and successful future. Facilitators support youth developing a sense of purpose by helping them identify and grow their sparks. The goal is to empower them to use their unique talents to make the world a better place. This activity is an opportunity for youth to learn about why they are part of this project, why they care about this issue, and how that could relate to their larger purpose.

You may find it helpful to refer back to the Overview to remind yourself of the goals and intended outcomes of this project to help youth connect their individual interests, sparks, and purpose to this polymer science project.

Polymer Science Examples

- Community Action examples are included in the Faciliatator Resources.

Time Required

- 40-60 minutes for Part 1 and Part 2 depending on group size

Materials

- Examples of Youth Leaders in action—videos or web-based resources (see Resources list)
- Paper - 1 piece of paper per youth
- Pencil and markers

Learning Objectives

Youth will

- understand some of the challenges of plastics and what has been done to address plastic pollution.
- reflect on what actions you can take to use plastics wisely and more sustainably yourself and to encourage others to do so, too.
- develop a personal mission statement about plastics.

Activity Steps

Part 1: Why We are Here

1. Share at least two stories of youth and adult leaders working to mitigate the negative impacts of plastics. Example sources:
    - The Plastic Initiative: Inspiration for Youth - UNESCO (video)
    - Young People Turning the Tide on Plastic Pollution (website)
    - The 2030 United Nations Agenda for Sustainable Development's 17 Sustainable Development Goals (SDGs) (website)
    - Youth leaders from your community

2. Invite youth to reflect on what they've seen
    - What drives each person's work?
    - What support did they rely on?
    - How did they respond to challenges?
    - Who supported these young people in their drive to create change (mentors, coaches, teachers, etc.)?

Part 2: Personal Mission Statement about Plastics

1. We've heard from other leaders about why they are working to make change - what is your why? We're each going to develop a personal mission statement.
2. Define what a mission statement is:

    A mission statement describes who we are, what we stand for, what we do, and why

we do it. In other words, the mission statement is the organization's purpose. Mission statements can be a guide for future actions and choices.

3. Invite youth to share any mission statements they've heard, seen or feel deeply impacted by. You may want to lead this discussion with the whole group, or invite youth to talk in pairs and then share with the whole group.
4. Share and reflect on the National 4-H Mission statement. Ask youth, in what ways does the 4-H Mission statement answer the question, "Who are we?" National 4-H Mission statement:

   Our mission is to give ALL kids equal access to opportunity by providing mentors, learning opportunities and a sense of belonging. 4-H is committed to eliminating barriers and providing opportunities for all kids to reach their potential.

5. Invite youth to answer the following questions. Let them know they are writing for themselves. Everyone is welcome to share but that is not required.
   - Describe your ideal resolution to plastics issues. This is not about being practical. Include as many creative solutions you can, given you have all the resources you need.
   - Imagine yourself surrounded by the future generation 150 years from now and/or the future generation of your friends in comfortable surroundings. How would you describe the importance of this issue to them?
   - Imagine it is 30, 50, or 75 years from now. You have been asked by a national media source to write a press release about your work with plastics. What would this say? What kind of difference would you like to make?
6. Building on your Sparks Interview and the reflections in this activity, write your personal mission statement about plastics.

Facilitator Tip
You may want to create your personal mission statement to share as an example for the group.

Facilitator Tip

You can also adapt this activity for youth to explore different communication styles. For example:

- Youth may prefer to work in small groups instead of individually.
- Invite youth to interview each other using the writing prompts. The interviewer can make suggestions and take notes for their partner to use to write a mission statement.
- Ask youth to draw a comic or make a graphic representation of their mission statement.
- Suggest they make a video mission statement.

Reflection

- Invite youth to share one or two themes that emerged from their personal mission statement. What patterns do you notice across the group? What common ground is there? Where are there unique opportunities?
- Considering your sparks, leadership strengths, and personal mission statement, what kind of difference do you want to make in the wise use of plastics? Who can help you grow on your way?

Applying Our Learning and Leadership

Youth are exploring their personal and collective connection to the complex issues of plastics in our communities, our country, and our world. Through the Teen Science Change Agents experience, youth gain valuable leadership skills to apply to their chosen Change Agent Pathway. Now is the opportunity for youth to individually and collectively reflect on what they learned and how they will utilize their leadership strengths, interests, and commitment to care for the environment. You may want to ask youth to reflect individually and/or collectively in a "circle share" process. Some general questions you can ask youth include:

- Describe how you will apply what you learned today about the impact of plastics on our environment in your Teen Science Change Agent experience.
- Describe one leadership skill you gained that you will use in becoming a change agent for the planet to address issues of plastics/plastic pollution and care for the environment.
- Describe how you will apply what you learned today in your Teen Science Change Agent experience.

Sources and Links

Activity 1: Teen Sparks

Search Institute research (https://www.search-institute.org/wp-content/uploads/2018/01/IE-Spark-Nov-2010-Brief.pdf)

Search Institute Sparks and Thriving (https://www.search-institute.org/our-research/youth-development-research/sparks-and-thriving/)

What are Youth Sparks? from the 4-H Thriving Model of PYD website (https://helping-youth-thrive.extension.org/what-are-sparks/)

Facilitating Youth Sparks (https://helping-youth-thrive.extension.org/wp-content/uploads/2021/04/Faciliatating-Youth-Sparks.pdf)

Act for Youth (http://actforyouth.net/)

- Act for Youth - Positive Youth Development 101 Curriculum (http://actforyouth.net/youth_development/professionals/manual.cfm)
- Sparks Peer-to-Peer Interview (http://actforyouth.net/resources/pyd/pyd_2-3_sparks-peer.pdf)
- Strength-Based Information Gathering (http://actforyouth.net/resources/pyd/pyd_2-3_strength.pdf)
- Sparks Interview Questions (http://actforyouth.net/resources/pyd/pyd_2-3_strength.pdf)

Activity 2: Cultivating Hopeful Purpose

The Plastic Initiative: Inspiration for Youth - UNESCO (https://www.youtube.com/watch?v=SiuIi0lZMUc)

Young People Turning the Tide on Plastic Pollution (https://www.weforum.org/agenda/2021/01/young-people-turning-the-tide-on-plastic-pollution/)

The 2030 United Nations Agenda for Sustainable Development's 17 Sustainable Development Goals (SDGs) (https://sdgs.un.org/goals)

Handout:
Sparks Interview

Part 1: Individual Reflection

Take a few minutes on your own to consider these questions. Use this space to record your reflections.

Directions:

Take a few minutes on your own to consider these 8 questions. Use the space to record your reflections. Now consider your responses. How do they connect? Integrating your responses can point to something that brings you joy and gives you an opportunity to contribute.

What's something and/or someone who brings you joy?

What's a social cause that you are passionate about?

What is something or who is someone who matters most?

What's a valued emotion that you appreciate about yourself (for example, curiosity)?

What about environmental stewardship or plastics peaks your interest? How does that relate to your spark(s)?

Think of somebody who is really into their spark/passion. Describe what you see.

Do you have a spark champion (someone who helps you explore and develop your skills)? If yes, describe how this person helps you. If not yet, who could become this champion?

How do you set goals and make plans to get better at your spark/talent?

Part 2: Paired Conversations

Please pair up with another person. One person chooses to speak first and the other to listen first. The first speaker will share their reflections on these questions for 5 minutes. Listeners don't respond with their own experience or advice - they provide space and listen deeply so the speaker can continue uninterrupted.

Then switch roles. The next partner will have 5 minutes to speak while the first listens.

At the end of your conversation, pairs will have an opportunity to share insights with the larger group.

Section

2

Grades 9-12

Teen Science Change Agents:

Transforming Our Relationship with Plastics

Building Leadership Skills in Youth Change Agents

National Science Foundation

NSF Center for Sustainable Polymers

Section 2:
Building Leadership Skills in Youth Change Agents

Audience

All Teen Science Change Agents in grades 9-12

Summary

Young people are growing their leadership skills at all ages through different learning experiences. In this section, youth engage in reflective learning where they identify their leadership skills, gain insight into a preferred change agent path, and learn about who they are and how they relate to others.

In activity 1, youth complete a personal leadership inventory to help them identify interests, talents, and leadership skills they want to grow (part 1). In part 2, youth identify how their leadership sparks, activities, and potential future careers may impact which change agent path to choose. In activity 2, youth explore what makes up their unique identity drawing from their visible, invisible, and personal identities.

Driving Questions

- How do I use my unique Sparks to create change around an issue I care about?
- What leadership skills do I currently have and what leadership skills do I want to grow?
- What is my identity and how does this shape how I work with others?

Questions to Guide Adult Partners:

- In what ways does your program encourage youth to grow their leadership skills?
- In what ways does your program recognize leadership skills in young people?
- In what ways does your program encourage youth to explore their unique identity?
- In what ways does your program encourage youth to share their identity?

Practices to Support Youth:

- Create opportunities that challenge youth to build their leadership skills.
- Offer youth space to reflect on their leadership experiences and what they have learned.
- Encourage different perspectives and respectful discussions around a range of topics.

Activity 1: My Leadership and Learning Self-Reflection

Background Information for Facilitators

Young people often have a wide range of talents and skills that are important in a leadership role. However, they might not identify the many ways they are a leader. Part 1 helps young people explore their leadership strengths and the skills they want to develop. Part 2 helps highlight what the young person is passionate about (My Spark), leadership activities they enjoy (My Leadership), and their interest in related career paths (My Future), including STEM fields.

Learning Objectives

Youth will

- identify current leadership strengths.
- identify leadership skills they want to develop.
- gain insight into their preferred Change Agent leadership path.

Activity Steps

Part 1: Exploring My Leadership Learning

1. Ask youth to complete the My Leadership and Learning Self Reflection, Part 1. Please see Handout.

Time Required

- 10 - 15 minutes for Part 1: Exploring My Leadership Learning (completing sheet and reflection)
- 10 - 15 minutes for Part 2: Exploring My Leadership Pathway (completing sheet and reflection)

Materials

- Copies of the My Learning and Leadership Self Reflection sheet (Part 1 and Part 2) - 1 per youth
- Paper or pen

2. Choose 1 or 2 self-reflection questions below and post them for the group. Next ask youth to pair and spend time sharing their reflections.
    - What strengths did you notice as you completed this self-reflection? What new strengths did you uncover?
    - What leadership skills would you like to develop or continue growing?
    - How would the results change if someone you love completed the reflection for you? Invite a family member, close friend, or someone else who knows you well to answer these questions about you.
3. Depending on the group dynamic, facilitate a large group sharing or small group sharing using selected group-reflection questions:
    - What new questions do you have about yourself and others?
    - What did you learn about the strengths of others in your group?
    - How can individual strengths come together to work as a team to achieve group goals?

Activity Steps

Part 2: Exploring My Leadership Pathway

Facilitator Tip
You might want to explain to the teens that the total number at the bottom of Part 2: Exploring My Leadership Pathway helps to indicate strength of interest in a particular pathway. It is not intended to be a formal assessment tool.

1. Ask youth to complete the My Learning and Leadership Self Reflection, Part 2. Please see Section 2 Handout.
2. Ask youth to personally review and reflect on the results using the reflection questions below.
3. Depending on the group dynamic, facilitate a large group sharing or small group sharing using the selected questions below.
4. Facilitate a large group discussion on how individual leadership interests may impact the larger Change Agent project using the question:
    - How might the individual leadership interests come together to guide the larger Change Agent project?

Reflection

- For the My Sparks section, what did you learn about the leadership activities you enjoy?
- For the My Leadership section, did one of the areas (teacher, community leader, and STEM) spark your interest more? What is most exciting about that area?
- How do your leadership strengths identified in part 1 relate to your leadership sparks?
- For the My Future section, what career pathways most interest you? What is most interesting about that career pathway?
- How might what you learned about yourself impact your Change Agent project?

Activity 2: Identity Wheel

Background Information for Facilitators

A young person's identity is ever changing and is made up of distinguishing characteristics. Identity characteristics can include visible aspects of a person, aspects not easily seen by others, and personal aspects that one might give to oneself. In this activity, youth will examine their own identities, examine the many characteristics that make up who they are, and gain an understanding of how they connect with themselves and others.

Learning Objectives

Youth will think critically about who they are now and who they want to become in the future.

Vocabulary

- **Identity** - a distinguishing characteristic, quality, or personality of an individual that makes the person who they are.
- **Visible Identity** - characteristics that are seen by others. Visible identities can be age, gender expression, skin color, height, style of dress, and others.
- **Invisible Identity** - characteristics that might be invisible to others. Invisible identities could be sexual orientation, gender identity, religion, immigration status, and others.
- **Personal Identity** - characteristics that youth would give to themself. Personal identities could include personality, beliefs, experiences, and other aspects that shape who the young person is (values, hopes, dreams, connection to family, community and/or school, cultural beliefs, personal background, and histories).

Time Required

- 45-50 minutes depending on group size

Materials

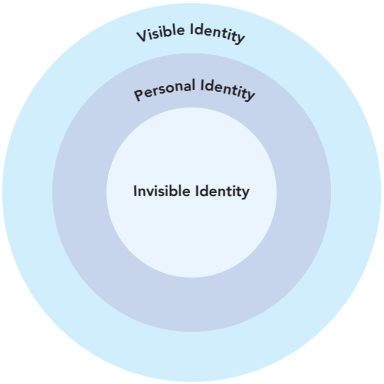
- Copies of My Identity Wheel or blank sheets of paper with large circle in the middle (i.e. Identity Wheel template) - 1 per youth
- Extra paper
- Large whiteboard or large sheet of paper
- Pencils, markers, and colored pencils

Facilitator Tip
Ensure a safe environment by letting youth know they do not have to write/draw identities they don't want to.

You can bring an example of your own identity wheel to share or a list of identity characteristics.

Activity Steps

1. Begin by telling youth that we will be talking about our identities. Ask youth to describe what an identity is.
2. As a large group, brainstorm a list of all the things that might be part of one's identity. This can include visible identity, personal identity, and inivisble identity. Record the list on a whiteboard or large post it for the group to see. Explain that each youth will create a list of characteristics of that makes up their own unique identity.
3. Next, ask youth to individually take a few minutes to write down the parts of their unique identity on a separate sheet of paper (e.g. race, ethnicity, religion, social class, abilities, etc.).
4. Share with youth the definitions of visible identity, personal identity, and invisible identity.
5. Ask youth to draw a large circle. Ask youth to label the outer circle **visible identity**. Ask youth to draw a circle inside the outer circle that represents their **personal identity**. Ask students to draw a third innermost circle that represents their **invisible identity**. Please see Section 2 Handout: My Identity Wheel as an example or if you wish to make copies for youth.
6. Next, ask them to think about what parts of their identity they think are visible or easily known to others. Ask them to write or draw all the parts of their **visible identity** in the outer circle. Ask them to think about each identity in relation to how aware they that identity on a daily basis. Is one greater than the other? Ask them to write or draw each identity in relation to how aware they are of each identity on a daily basis. (For example, gender identity might have a greater portion of the circle if youth are more personally aware of that identity.)



7. Next, ask youth to write or draw all the parts of their **personal identity**. Again, ask youth to write or draw each identity in relation to how aware they are of each identity on a daily basis.
8. Finally, ask students to write or draw all the parts of their **invisible identity**, aspects that may be invisible to others. Ask youth to write or draw each identity in relation to how aware they are of each identity on a daily basis.
9. Ask students to reflect on their identity wheel and invite them to share with the group if they are comfortable. Once ready, ask for volunteers to share their wheel.

Facilitator Tip
Determine the best way to reflect with the youth. This can be in pairs, small groups, or larger groups. Provide the option of youth not sharing their wheel. Ask for youth who feel comfortable sharing what they created and why they represented their identities in this way.

Reflection

- Tell us why you see yourself this way.
- Why are some identity parts larger than others?
- How did you relate to other identity wheels?
- After learning about other identity wheels, what are some assumptions that we make that can be harmful?
- How do we learn about others' identities (visible, personal, and invisible) and aspects of identities that we assumed, but are not correct?
- Do any of these identities make it easy or hard for you to achieve your goals or aspirations?
- Can identity change? Why or why not?

Adapted from 'Identity Wheel' activity Tzenis (2020) and 'What Makes Us Who We Are' lesson Learning For Justice. (n.d.).

Take It Further

- Do this activity again after a span of time (e.g. 6 months, 12 months, or even two years later). Have youth compare the two identity wheels and discuss why their identity wheel might have changed.

- Examine the group identity as a whole and how this might impact working together on a Change Agent pathway project. Youth have many opportunities for interaction with people from different cultural backgrounds, perspectives, ways of knowing and being.
- Offer activities from the WeConnect, A Global Youth Citizenship Curriculum to prepare youth to thrive in culturally diverse settings. WeConnect, A Global Youth Citizenship Curriculum can be found at www.shop4h.org.

Applying Our Learning and Leadership

Youth are exploring their personal and collective connection to the complex issues of plastics in our communities, our country, and our world. Through the Teen Science Change Agents experience, youth gain valuable leadership skills to apply to their chosen Change Agent Pathway. Now is the opportunity for youth to individually and collectively reflect on what they learned and how they will utilize their leadership strengths, interests, and commitment to care for the environment. You may want to ask youth to reflect individually and/or collectively in a circle share process. Some general questions you can ask youth include:

- Describe how you will apply what you learned today about the impact of plastics on our environment in your Teen Science Change Agent experience.
- Describe one leadership skill you gained that you will use in becoming a change agent for the planet to address issues of plastics/plastic pollution and care for the environment.
- Describe how you will apply what you learned today in your Teen Science Change Agent experience.

Sources and Links

Tzenis, J. (2020). Youth Aspirations: Imagining and Navigating Futures in Higher Education. University of Minnesota, Extension Center for Youth Development. (https://conservancy.umn.edu/handle/11299/214339)

Learning For Justice. (n.d.). 'Bibi' Lesson 1: What Makes Us Who We Are? (https://www.learningforjustice.org/classroom-resources/tolerance-lessons/bibi-lesson-1-what-makes-us-who-we-are-6-8)

Handout: My Learning and Leadership Self Reflection

Part 1: Exploring My Leadership Learning

What are the qualities you think are important in a leader?

Take a moment to reflect the leadership statements in the left colum. Check the skills you are good at, skills you want to improve, and skills you want help in gaining in the column to the right.

Challenges and Discovery

Skill Statement	I am pretty good at this skill	I have this skill, but want to improve	I don't have this skill yet and want help in gaining this skill
I take on different leadership experiences.	Expert	Some Knowledge	Still Learning
I like to try new leadership roles.	Expert	Some Knowledge	Still Learning
I can tackle and solve problems.	Expert	Some Knowledge	Still Learning
I can change my plan when I need to.	Expert	Some Knowledge	Still Learning
I can identify and respond to challenges in my community.	Expert	Some Knowledge	Still Learning

Communications

Skill Statement	I am pretty good at this skill	I have this skill, but want to improve	I don't have this skill yet and want help in gaining this skill
I feel comfortable sharing my ideas with others.	Expert	Some Knowledge	Still Learning
I feel confident speaking in front of a group.	Expert	Some Knowledge	Still Learning
I feel it is important for others to share their ideas.	Expert	Some Knowledge	Still Learning
I have the skills to resolve differences in a positive way.	Expert	Some Knowledge	Still Learning
I listen well to others, even if I disagree with them.	Expert	Some Knowledge	Still Learning
I can discuss controversial issues with civility and respect.	Expert	Some Knowledge	Still Learning
I have the ability to think from diverse perspectives.	Expert	Some Knowledge	Still Learning

Caring

Skill Statement	I am pretty good at this skill	I have this skill, but want to improve	I don't have this skill yet and want help in gaining this skill
I show understanding for others.	Expert	Some Knowledge	Still Learning
I understand that other ideas are just as important as my own.	Expert	Some Knowledge	Still Learning
I am compassionate to others.	Expert	Some Knowledge	Still Learning
I value connecting with others and learning from them.	Expert	Some Knowledge	Still Learning

Goal Setting

Skill Statement	I am pretty good at this skill	I have this skill, but want to improve	I don't have this skill yet and want help in gaining this skill
I can apply what I have learned to help solve problems.	Expert	Some Knowledge	Still Learning
I am self-motivated.	Expert	Some Knowledge	Still Learning
I can make goals and stick to them.	Expert	Some Knowledge	Still Learning
I know how to plan a project from start to finish (organize tasks, determine resources, and create a project timeline).	Expert	Some Knowledge	Still Learning
I feel comfortable planning and working on projects with others.	Expert	Some Knowledge	Still Learning
I am dependable, others can trust me.	Expert	Some Knowledge	Still Learning

Cooperation

Skill Statement	I am pretty good at this skill	I have this skill, but want to improve	I don't have this skill yet and want help in gaining this skill
I like to have an older teen who mentors me in leadership.	Expert	Some Knowledge	Still Learning
I am reliable, others can trust me, I make good on my promises.	Expert	Some Knowledge	Still Learning
I think it is important to listen to all group members before making a decision.	Expert	Some Knowledge	Still Learning
I value other people's ideas.	Expert	Some Knowledge	Still Learning
I like to work with others to achieve a goal.	Expert	Some Knowledge	Still Learning

Developed by Amie Mondl, Alexa Maille, and Anne Stevenson.

Sources and Links

Lange, C. (n.d.). 4-H youth leadership roles and assessing leadership experiences. https://www.canr.msu.edu/news/4_h_youth_leadership_roles_and_assessing_leadership_experiences

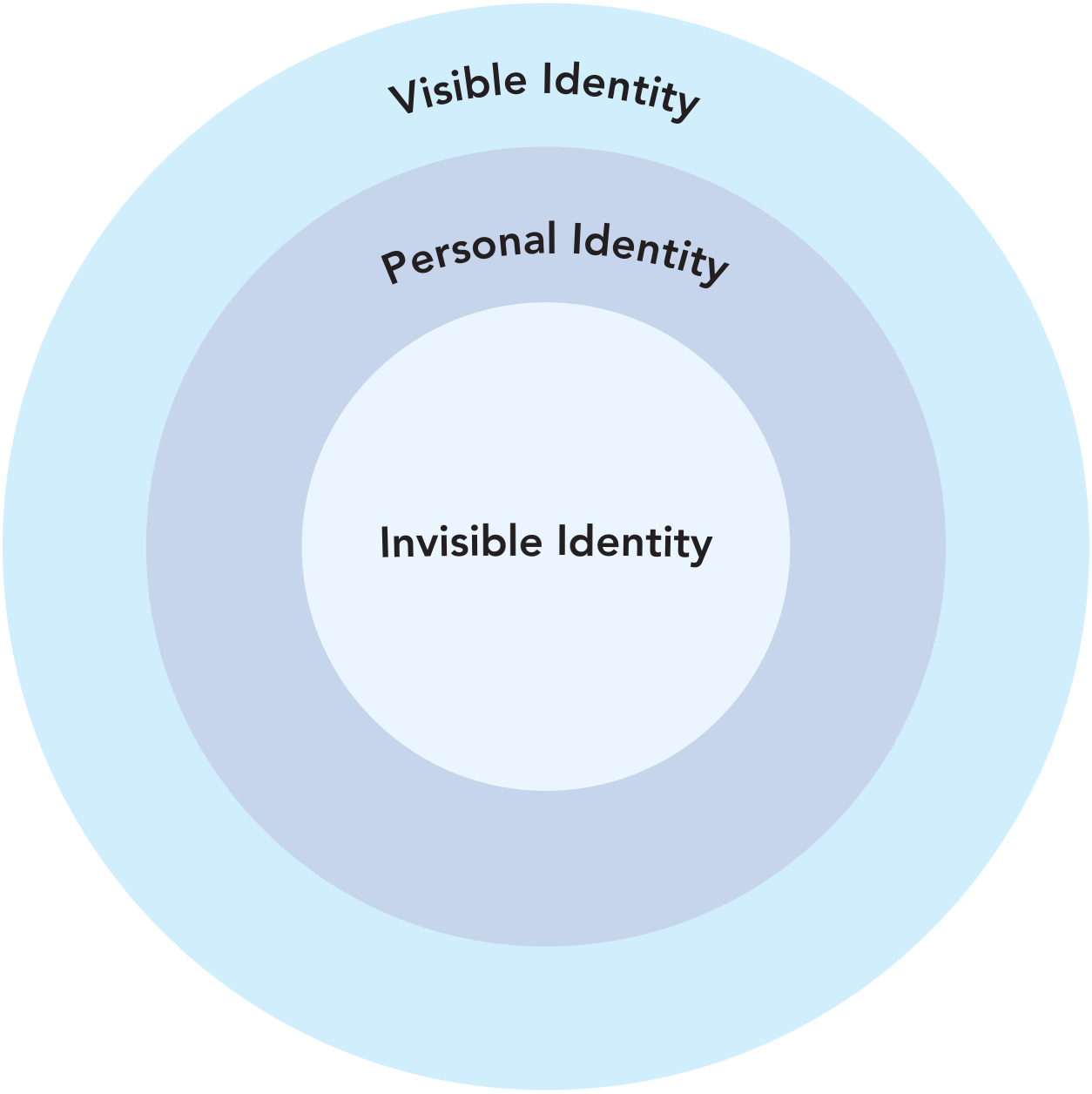
Stevenson, A., Gilbertson, A., and Moriem, P. (2006). 10 Minute Leadership Lessons: How I Rank Myself in qualities of being a leader. z.umn.edu/20MinReflectionBooks

Part 2: Exploring My Leadership Pathway

	Teacher	Community Leader	STEM
My Sparks (interest, talent, or skill) **I am passionate about...**	☐ teaching others ☐ connecting with younger youth ☐ using my skills to teach younger youth ☐ using my talents to be a role model for younger youth ☐ working with adult mentors to teach younger youth ☐ sharing my excitement for science with others	☐ helping people ☐ sharing my passions with my community ☐ volunteering with adults to make my community better ☐ using my science skills to serve my community ☐ using my science learning in collaborative, social, and community-oriented projects	☐ caring for and protecting the environment ☐ using my curiosity to seek answers to questions ☐ using my science skills to solve problems ☐ addressing the critical issues of plastics in today's world
My Leadership (accomplishing) **I enjoy or would like to try...**	☐ being a leader to younger youth ☐ leading younger youth in making important decisions ☐ engaging others in science learning ☐ inspiring younger youth to do science and engineering ☐ inspiring younger youth to care for the planet and the environment	☐ being a leader in my community ☐ making positive change to help my community thrive ☐ conducting investigations and designing a solution ☐ planning projects to better my community ☐ working with adults to take action around protecting the environment	☐ being a leader in science ☐ leading investigations and doing science ☐ working to change the way we use plastics and their impact on the environment ☐ using my science learning in my everyday life ☐ taking action to make a difference in my community
My Future **I am interested in exploring career pathways in...**	☐ teaching ☐ youth development ☐ coaching ☐ child care	☐ community services ☐ governmental agencies ☐ social services ☐ communications	☐ science and engineering ☐ environmental science ☐ natural resources ☐ technology
	Total number checked:	Total number checked:	Total number checked:

Developed by Amie Mondl, Alexa Maille, and Anne Stevenson. Adapted from National 4-H Council. (2013). Build Your Future Choices, Connections, and Careers. National 4-H Council.

Handout:
My Identity Wheel



Section

3

Grades 9-12

Teen Science Change Agents:

Transforming Our Relationship with Plastics

Choosing A Change Making Path

National Science Foundation

NSF Center for Sustainable Polymers

Section 3:
Choosing a Change-Making Pathway

Audience

All Teen Science Change Agents in grades 9-12

Summary

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 the issues. Activities in this section will assist groups in collaboratively building a positive youth-adult partnership by creating group norms and expectations. Considering their sparks and interests, groups then choose their change-making path: Teens as Teachers or Teens Engaged in Community Action.

Driving Questions

- What does a successful youth–adult partnership look like for my team and project?
- Considering our sparks and leadership strengths, what kind of impact do we want to make in the wise use of plastics and caring for the environment?
- From our desired impact on plastic-related issues, what change agent path best fits our collective goal to achieve that impact?
- How can we use what we have learned to encourage, teach, or lead others?

Questions to Guide Adult Partners:

- In what ways does your program offer youth opportunities to explore what they are passionate about?
- In what ways does your program build trust with youth?
- In what ways does your program support youth growing their Spark and transforming their Spark into action?

Practices to Support Youth:

- Offer youth space to speak honestly about what they need from the adults.
- Facilitate group discussion when agreements or group norms aren't being met.
- Outline roles and responsibilities for both youth and adults to encourage understanding of what is expected of each other.

Activity 1: Exploring Youth and Adult Partnerships

Background Information for Facilitators

Building positive youth and adult partnerships takes time and intentionality. The activities below are designed for youth and adults to explore what makes a partnership positive and impactful as well as consider the benefits and challenges of youth and adults working together. Please see Youth-Adult Partnerships in the Faciltator Resources section.

Learning Objectives

Youth will

- explore the dynamics of youth and adult relationships.
- create strategies for positive interactions.
- develop skills and strategies to effectively partner with adults.

Time Required

- 45-50 minutes depending on group size

Materials

- Copies of the Role Play Scenarios
- Extra paper - 1 per group of youth
- Large whiteboard or large sheet of paper
- Markers/colored pencils

Activity Steps

Part 1: Youth-Adult Partnership Scenarios

1. Invite youth to form small groups of 3 - 4 people.
2. Give each group a scenario. Please see Section 3 Handout: Youth and Adult Partnership Scenarios.

3. Ask youth to consider how they might handle the scenario in both a positive and a negative way.
4. Lead a whole group discussion using questions like these:
    - How would you describe the overall feelings between the adults and youth in your scenario?
    - What differences did you notice when considering how to handle the scenario in positive ways compared to negative ways?
    - What were major characteristics of the adult? Of the youth?
    - What does this say about how youth might work with adults?
5. Invite youth to share some of their previous experiences working in partnership with adults.

Part 2: Benefits and Challenges of Working with Adults

1. Based on the role play activity, facilitate a conversation about benefits and challenges of working with adults.
2. Ask youth to list all the benefits that they think an adult can bring to a partnership. Invite them to write one idea per sticky note (if collecting ideas on flip chart paper) or consider using a virtual bulletin board for online settings.
3. Lead a discussion using these questions:
    - What feelings do you have looking at these benefits?
    - Are there items/benefits listed that you have to be an adult to have?
    - How can we use this information as we go forward?

4. Ask youth to follow a similar process with the challenges or barriers of working with adults.
5. Lead a discussion using these questions:
    - How can the benefits help overcome the challenges?
    - What is there about the benefits that can help overcome the challenges?
    - Where else might you look for ideas on how to overcome the challenges?

Reflection

1. Give youth 2-3 minutes on their own to reflect on these questions:
    - What do you need from adults to support your leadership?
    - How are you going to be a good partner in this project?
    - What skills and strategies do you already have to work well with adults? Which would you like to grow?
    - What advice would you give to adults working with youth?
2. Bring everyone back together. Invite the group to use their personal experiences and reflections in this activity to create tools to help your team work together in the future.
    - top 10 Tips for Youth Working with Adults
    - top 10 Tips for Adults working with Youth
3. Please list all the benefits you think young people can bring to a partnership.
4. What are some of the challenges or barriers of working with youth?

Activity 2: Our Youth & Adult Partnership

Background Information for Facilitators

This is an opportunity for you and everyone in your community action team to reflect on and be intentional about what they need to work together well and bring their full selves to the project. You can use this group norms discussion to clarify assumptions, set up work processes and strategies for accountability, and learn about what each person needs to feel a sense of belonging.

There are many examples of working agreements and group norms for safer and brave spaces that you can find to build on. Here are some examples, based on Dr. Brené Brown's (2018) BRAVING framework:

- Be clear about what is ok and not ok for the group.
- Follow through on commitments.
- Oops, ouches, and whoa. If something you say comes out wrong, say "oops." If you hear something from someone else that is hurtful, say "ouch." If things are moving too fast and you want clarification, say "whoa."
- Share only our own stories and hold confidentiality.
- Practice integrity by living our values. Value people showing up as their whole selves (head, heart, hands, health).
- Ask for what we need and give what is needed without judging.
- Assume good intentions and practice generosity.

Time Required

- 30-45 minutes depending on group size

Materials

- Large whiteboard or large sheet of paper
- Color sticky notes
- Markers and colored pencils

Learning Objectives

Youth will

- reflect on what each individual needs in order to learn and work well as a group.
- create and record shared expectations about how to work together throughout this project.

Activity Steps

Part 1: Paired Conversations

1. Invite each person to take 2-3 minutes on their own to consider this question: "What do you need to feel safe and challenged as we complete community action projects together?"
2. Bring the group back together. Ask youth to pair with another youth for paired conversations.
3. Describe how these paired conversations will happen. This is not a typical conversation but rather is an opportunity to be heard. One person from the pairing will speak first and the second person will listen first. The speaker will have 2 uninterrupted minutes to share what they need to feel safe and challenged. The listener doesn't ask questions or offer their ideas or experience. The listener instead listens deeply. Then you will invite them to switch roles for another 2 minutes so everyone gets a chance to speak and listen.
4. Next, ask your group to form two concentric circles where people on the outer circle face people in the inner circle for pairing conversations. Keep track of time for the group, inviting them to switch roles at 2 minutes.
5. After each person has had time to speak and listen, ask the inner circle to move three people to the left while the outer circle stays still. Repeat the conversation process with new pairings.
6. Repeat this circle rotation another time or as long as you like for your group.

Part 2: Creating Our Norms To Guide Our Group Work Together

1. Bring the group back together for a whole group conversation. Invite the group to create a shared list of norms or working agreements for your work together.
2. Record these in a way that makes sense for your context (flipchart, online, sticky notes, etc.).

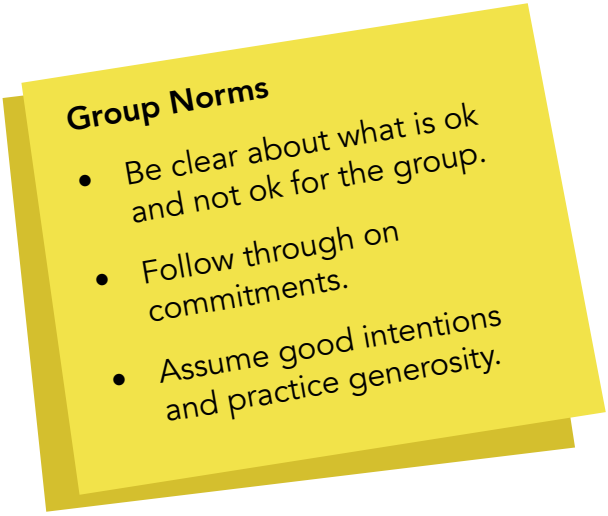
3. Here are some guiding questions to consider when creating your group norms:
    - Consider both being and doing aspects of your work. How will you nurture relationships? What is your process for completing tasks?
    - What roles do you imagine your team members will need to adopt? What roles would be open to adults? Youth? Either? When will we check in about roles and make changes as needed?
    - Who makes decisions and how?
    - What does shared power look like?
    - What does success look like?
    - How will we communicate and share work?
    - Where will these agreements be shared so we can see, use, and update them often?

Reflection

1. Invite your group to take 1 to 2 minutes for individual reflection.
2. Ask them to consider these questions and invite them to make notes for themselves if they like.
    - How did it feel to start this project by talking about and agreeing on group norms?
    - What do you hope will happen as a result of these agreements?
    - What will you want to pay attention to as you work in the group and everyone aims to live up to these agreements?

Facilitator Tip

You might want to have your preferred working agreements ready to provide examples for your group.



Activity 3:
Choosing a Change-Making Path

Background Information for Facilitators

Now that you're on your way to working well together as a team, this activity guides you through choosing how you want to make change together. You may decide to lead learning experiences for younger youth in a "Teens as Teachers" path or you may decide together to embark on an action research or service learning project on a "Teens Engaged in Community Action" path. These activities help your group explore the choices and then decide together. For more information and tools, please refer to Faciliatator Tools and Resources of the Overview.

Learning Objectives

Youth will

- understand what the choices are for possible polymer science leadership projects.
- collaboratively decide which project pathway your group will pursue.

Time Required

- 20-30 minutes for Part 1 and Part 2 depending on group size

Materials

- Large whiteboard or large sheet of paper
- Paper
- Pens and pencils

My Change Agent Path

Section 1: Discovering the Power of Why

Section 2: Building Leadership Skills in Youth Change Agents

Section 3: Choosing a Change-Making Path

Section 4: Teens as Teachers Path

- Afterschool programs
- Day Camps and Summer Camps
- School-Based Programs
- 4-H Project Learning Series

Section 5: Teens Engaged in Community Action Path

- Service Learning
- Youth Participatory Action Research
- Community/Citizen Science
- Community Action

My Dream Pathway Project Is:

Activity Steps

Part 1: Understand the Choice

1. Describe and discuss the two leadership pathways for your group.

    - **Teen as Teachers approaches**: Teens teach younger youth using the 4-H Sustainable Polymer curriculum. Teens increase their abilities to inspire younger youth in science and engineering, foster inquiry, help younger youth develop STEM identity, and inspire youth in caring about our planet. Teens and younger youth consider the impact of choices we make in our use of plastics.

    - **Community Action approaches**: Teens plan and lead a community action project in their community. Projects might help their community use plastics more wisely and sustainably or inspire others to take action to address issues related to plastic or plastic pollution. Action could be an applied research project to understand the plastics situation better.

2. Ask the group if they have any questions about the two leadership pathways to ensure a shared understanding of the possibilities.

3. Invite teens to share their past experiences with similar teaching or action projects.

Part 2: Decide Together

1. There are several different strategies your group may use to make this decision, including group discussion and consensus, voting, etc. To determine which one, consider your group dynamics and ways to involve everyone.

    Here are two examples.

    - Invite everyone to recall their sparks interviews. What excites you about plastics and protecting the environment? What questions do you have? Where do you think you'd have the most impact?

    - Take the temperature of the room with a snowball toss. Make sure each person has a piece of paper and a writing utensil. Ask them to write down their pathway choice (teaching or action project) on that piece of paper, then crumple it up into a ball. Tell them everyone will toss their paper snowball when you count to three. After the flurry, ask everyone to pick up a different snowball. Then take turns reading the papers and sorting them based on the answers.

2. Reflect together.

    - Encourage people to be candid and consider a variety of alternative perspectives. What is your group decision so far?

- What are the challenges and opportunities of each pathway?
- What do we need to come to a collaborative decision?

3. Choose your pathway and celebrate this milestone.

Reflection

- What strategies helped your team come to a shared decision?
- What was challenging about making a group decision?
- How can you use what you learned in this experience to improve group decision making processes for your future work together?

Applying Our Learning and Leadership

Youth are exploring their personal and collective connection to the complex issues of plastics in our communities, our country, and our world. Through the Teen Science Change Agents experience, youth gain valuable leadership skills to apply to their chosen change agent pathway. Now is the opportunity for youth to individually and collectively reflect on what they learned and how they will utilize their leadership strengths, interests, and commitment to care for the environment. You may want to ask youth to reflect individually and/or collectively in a circle share process. Some general questions you can ask youth include

- Describe how you will apply what you learned today in your Teen Science Change Agent experience.
- What will you contribute to the group's efforts going forward?
- What new skill or experience do you hope to gain as you move this project forward?
- How might some of the skills you are developing help you in your college or career pathway?

Sources and Links

Brown, B. (2018). The Braving Inventory. In B. Brown, *Dare to Lead*. (https://brenebrown.com/resources/the-braving-inventory/)

Handout:
Youth and Adult Partnership Scenarios

Scenario 1.

You missed a meeting with a community partner because of a family emergency. Because of this, an adult in your community action team doesn't want you to participate in the presentation to the Board celebrating your project.

Scenario 2.

You have an idea to start an activity in your community. The adult leaders continually say that it would be a waste of time.

Scenario 3.

You've been asked by an adult to make a media appearance for a youth organization that does programming at your school. The adult asks you to share positive things about the program with the media source, but you've never had a voice in developing the program or providing feedback on the program's areas of focus.

Scenario 4.

You've been asked to sit on a Youth Advisory Council for a community organization. You attend several meetings, but quickly realize there is no clear role to play. The meetings continue to be primarily led by adults with little interaction between the adults and the youth in the room.

Scenario 5.

Add your own scenarios

Section

4

Grades 9-12

Teen Science Change Agents:

Transforming Our Relationship with Plastics

Teens as Teachers Path

National Science Foundation

NSF Center for Sustainable Polymers

UNIVERSITY OF MINNESOTA EXTENSION

4-H Plastic Sculpture Challenge

extension.umn.edu/4-h/learn-more-or-join

4-H youth showcasing their plastic sculptures at the Minnesota State Fair at the 4-H Building.

Youth created these sculptures from used plastics with a focus on building awareness of how we use plastics in everyday life, the environmental impacts of single-use plastics, and how to recycle or repurpose plastic.

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Section 4:
Teens as Teachers Path

Audience

Teens who will teach younger youth in grades K through 5

Summary

For groups that have decided to pursue a Teens as Teachers path, this section will support you to be prepared to work with younger youth (grades K-5) and teach lessons from the chosen curriculum. It includes **three key components** for training teens to teach:

1. Building your skills for effective teaching
2. Getting to know your audience
3. Teaching strategies and practice teaching.

Upon completion of Section 4, facilitators will work with teens to decide what lessons they would like to teach to younger youth, based on their unique situation or settings. Both 4-H STEM curriculum: *Be a Scientist! Materials in a Green, Clean World* curriculum (for grades K-2) and the *Sustainable Polymers: Plastics of the Future for a Green, Clean World* curriculum (for grades 3-5) can be accessed at https://www.4hpolymers.org/. On our website, you will find sample teen teaching lessons from the K-2 and 3-5 curricula that your teens can practice with and use with younger youth.

Driving Questions

1. Why would it be important for younger youth to learn about the impact of their choices on our earth (land and water)?
2. How could you inspire younger youth to reduce their use of plastics, refuse, re-use, repurpose, or recycle?
3. What would you like to see changed in your community around the use and disposal of plastics?

Questions to Guide Adult Partners:

- In what ways does your program encourage teens to serve as teachers?
- How might you create new opportunities for teens to serve as teachers?
- In ways does your program support teens as they mentor other youth?

Practices to Support Youth:

- Provide experiences where youth can build teaching skills.
- Provide opportunities for youth to practice teaching. (teach back)
- Provide meaningful peer feedback.
- Provide meaningful feedback from adult partners.

Learning about Polymers and 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. Plastics are versatile materials that come in different shapes and 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.

As your group prepares to lead polymer science learning experiences, you might find it useful to develop a deeper understanding of plastics and the complexity of how they impact the world.

If you are working with middle school students as teen teachers, you may find the information and activities in our Grade 6-8 curriculum helpful: *Sustainable polymers: Taking action to solve the challenge of plastics. A 4-H STEM curriculum for Grades 6-8*

You can use activities from Confronting the Plastic Crisis: A 4-H STEM Curriculum for Grades 9-12 to support that exploration.

The Grades 9-12 curriculum includes

- Module 1: Trends in Production and Disposal of Aluminum, Glass, Paper, and Plastic Across Time
- Module 2: Comparing the Properties of Aluminum, Glass, Paper, and Plastic
- Module 3: Life Cycles of Products We Use and Their Environmental Impacts
- Module 4: All About Polymers!
- Module 5: The Plastic Life Cycle
- Module 6: The Plastics Future: Bioplastics
- Module 7: Emerging Solutions to the Plastic Crisis

Please visit https://www.4hpolymers.org/ to download the full curriculum for any of the grade bands: K-2, 3-5, 6-8 and 9-12.

Activity 1: Remembering a GREAT Teacher or Group Leader

Background Information for Facilitators

This activity invites teens to recall what made a teacher or group leader (such as a camp counselor, an after school program leader, etc.) a great teacher. You may prompt them to consider how the person acted, how the person made them feel when in their group, talents or skills the person had, personality traits, methods of teaching, ways they met social-emotional needs, creative strategies, atmosphere in the class/group, etc.

Learning Objectives

Youth will

- reflect on what skills, abilities, approaches, and traits made their teacher/group leader effective.
- consider how they might apply these attributes to their own teen teaching experience (throughout Section 4 activities).

Time Required

- 20 minutes depending on group size

Materials

- Markers
- Large sticky notes or half sheets of colored paper
- Tape

Activity Steps

1. Hand out multiple sticky notes or pieces of paper to teens. Lead them on a short trip into their past and ask them to remember a great teacher they've had. This could be a classroom teacher, a youth group leader, camp counselor, or anyone who has been a teacher or group leader. Tell them they may think of more than one person; they can imagine each one. Ask them to begin writing on their papers what made that person a great teacher, considering:
   - What skills did they have?

- Was there something creative they did?
- What stands out about their personality?
- How did they make you feel when you were with them? How did they do this?
- Other prompting questions can be asked as needed.

2. Encourage them to think about other great teachers and write down things that made them great.
3. After about 10 minutes, have youth post or tape their papers to the wall or larger flip chart paper.
4. Invite everyone to do a "walk about" and read what has been written.
5. Reconvene the group in a circle and talk about what you read.
6. Ask each person to share something that stands out to them.
7. Summarize the conversation with these or similar thoughts:
   - Great teachers work at being great: they build skills, they practice, they ask young people what they need, they get feedback from other teachers. We want to support each of you in becoming great at working with younger youth.
   - All young people have different needs at different stages of their lives; what you need from an adult in first grade is likely different that what you need in 7th grade. However, things such as feeling welcomed and included are needed by all of us at any age.
   - Every person has a unique learning style--ways they learn best or like to learn. We all have different ways of "being smart."
   - We often remember learning experiences or teachers that made the learning hands-on, fun and engaging.
   - We often remember that we learn best when we have the right balance of support and challenge.
   - Note that we will be digging into many of these elements that make a strong teacher or leader as we participate in the next activities for teen teaching.
   - We will leave the papers posted and will refer to them during other activities.

Reflection

To wrap up this activity, use a soft tossable ball or object to go around the circle and have youth respond to this question:

- What is one insight you gained from this activity that you think you'd like to apply or use when you are a teen teacher?

Activity 2: Thriving Together

Background Information for Facilitators

High quality 4-H Youth Development opportunities create spaces where youth can belong, matter, and explore their personal sparks. Caring leaders can create these environments by fostering developmental relationships that express care, challenge growth, and share power with youth. Relationships and environments like these provide a nourishing developmental context where youth can belong, grow, and thrive.

In this activity, youth explore the 4-H Thriving Model, focusing on how to nurture developmental relationships and provide opportunities to belong. Teens learn strategies for building these relationships and opportunities into their teaching experiences. These elements, along with exploring sparks, are also embedded in other activities in this curriculum.

Learning Objectives

Youth will

- share and develop strategies for creating welcoming spaces and opportunities for youth to belong.
- develop understanding of what developmental relationships are.
- plan strategies for nurturing developmental relationships with youth participants.
- increase awareness of the 4-H Thriving Model.

Time Required

- Labeling Others: 15 minutes
- Thriving Flowers: 10 minutes
- Growing Relationships: 20 minutes

Materials

- Deck of cards
- Flower (picture, potted plant, etc.)
- Sticky notes and writing utensils

Activity Steps

Part 1: Labeling Others

1. Engage your group in the Activity: Labeling Others

Facilitator Tip
Prepare the deck of playing cards based on the size of your group and the rules noted below. This activity works best with a group of 15 to 40 people. If you have a smaller group, use fewer cards but still have cards from each of the three categories below. Play for 8 to 15 minutes, depending on your group.

2. Give everyone in the group a card and tell them not to look at it. Ask everyone to hold up their card to their forehead, facing outward, so that others in the group can see it.
3. Explain the rules for the activity. When directed to, participants will mingle around the room and interact with others according to the following standards:
    - Participants with Aces, Kings, Queens or Jacks should be treated with the most respect. These are the people to know. Seek them out.
    - Participants with twos, threes or fours should be avoided at all costs.
    - Participants whose cards are numbered from five through ten should be treated at a level according to their number, that is, they should be spoken to but not in depth or for very long. (10 is more important than 5 or 6, etc.)
4. Ask the group to work together to discuss the science topics that they think a group of second graders would like to or need to learn about in a "teens as teachers" program.
5. Let the group mingle for about 2 minutes, then have everyone guess what card they have. After that, they can look at their cards.
6. Reflect on the activity together.
    - How did the others in the group react to you? How did you feel about that?
    - How much did you feel like you belonged? How do you know when you belong in a group?
    - How could you tell who mattered in this group?
    - What difference does it make to our group process and success if some people

feel like they matter and others feel ignored?

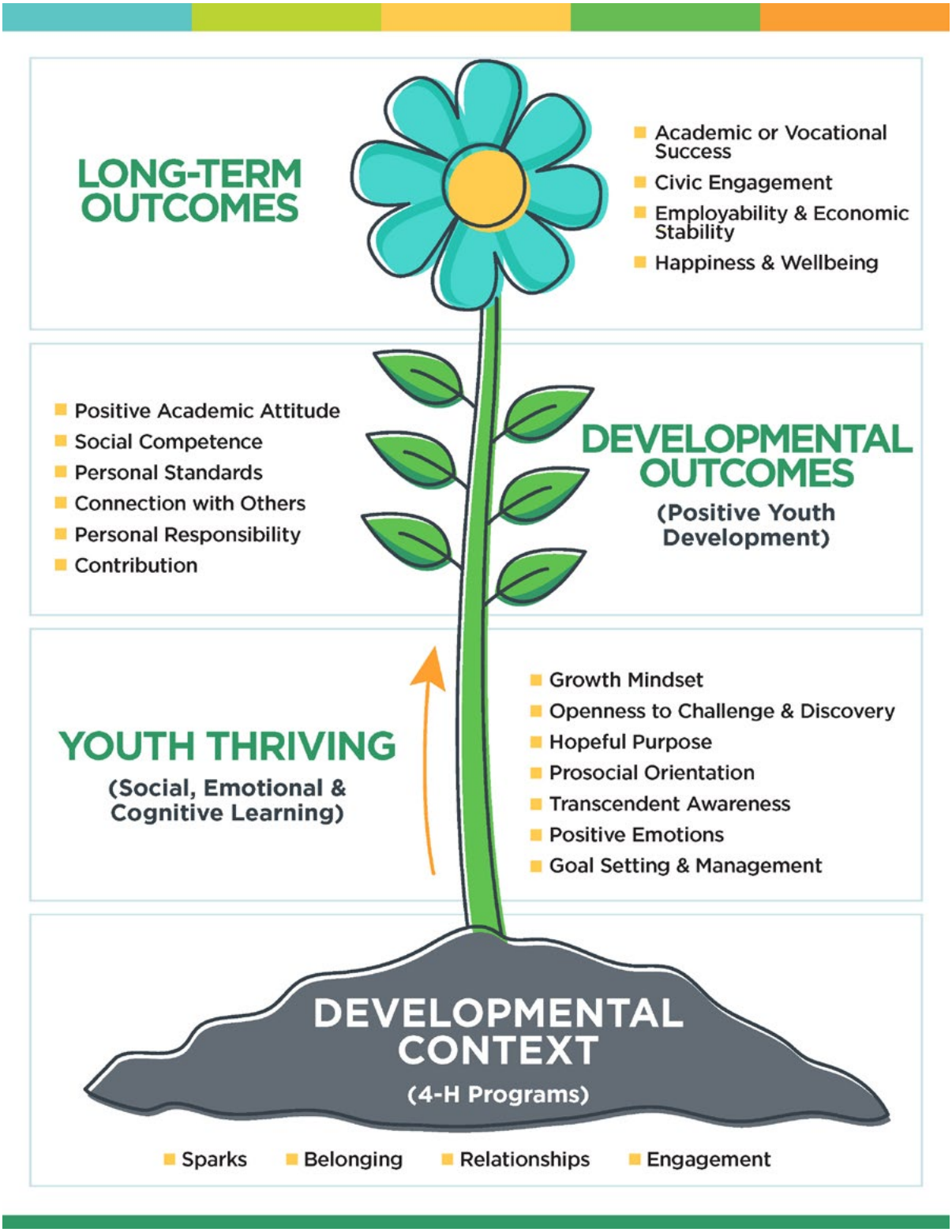
- How would you change the rules of the game so it felt more welcoming?
- How can we make it easier for everyone to belong and matter? What actions can you take to help others feel a sense of belonging?

7. After discussion, stress that we need to treat one another as the "high cards" if we truly want to include others and be a positive leader.
    - Belonging is one of the important things humans need to thrive. Let's explore what it takes to support thriving.

Part 2: Thriving Flowers

1. Show the group a flower. This could be a picture, a potted plant, etc. Ask them to describe what it takes for the flower to grow and bloom. You'll get answers like soil, water, sun, space, etc.
2. Ask the group, What do people need to grow and thrive?
3. Introduce the 4-H Thriving Model flower. Tell the group about how we use this model in 4-H to intentionally create spaces that help young people thrive. Weave in the group's responses for what people need as connected to the model.
4. Describe the developmental context in particular:
    - Sparks: A place for youth to explore their interests and passions—their sparks
    - Belonging: Feel included in a meaningful way as their authentic self.
    - Relationships: Fostering developmental relationships with adults and youth leaders who are caring, challenge growth, and share power.
    - Engagement: Actively involved in the experience—driving the thriving.
5. Tell the group that as teachers and leaders, they help younger youth thrive by creating this kind of environment.

4-H Thriving Model



Arnold, M. E., & Gagnon, R. J. (2020). Positive youth development theory in practice: An update on the 4-H Thriving Model. *Journal of Youth Development*, *15*(6), 1-23.

Part 3: Growing Relationships

The last part of this growing environment we're going to explore together today is relationships. The connections we create with younger youth in our programs are the active ingredient for positive youth development. Let's look at what developmental relationships involve when you are a teen teacher.

1. Give youth developmental relationships handout.
2. Invite to work in pairs. Brainstorm one or two ways you can imagine each of the five dimensions of developmental relationships showing up as you teach in this program. Here are some examples:
    - **Express care.** Example: Noticing when youth share excitement with what they've learned
    - **Challenge growth.** Example: Asking purposeful question.
    - **Expand possibilities.** Example: Pointing out how current interests connect to future activities, community opportunities, careers etc.
    - **Provide support.** Example: Helping youth troubleshoot challenges or navigate emotions from unexpected results.
    - **Share power.** Example: opportunities for youth to make decisions about program activities or parts of activities.
3. Come back together as a whole group. Ask teens to share their examples and ask questions of each other.
4. Wrap up: Give each person a sticky note. Ask them to write down one thing they commit to doing to nurture developmental relationships with younger youth. Invite them to put the sticky no

Reflection

- What's something you will take from today to help create spaces where everyone can belong?
- What do you hope to do to grow positive, supportive relationships with the younger youth you will teach?

Activity 3: Understanding Ages and Developmental Stages

Background Information for Facilitators

A developmental stage is defined as a phase or "stage" in a child's growth or development that all youth go through, roughly around the same age. There are developmental stages for physical, mental, emotional, and social growth. When teens work with younger children of varying ages, it will be helpful for them to understand some of the key developmental characteristics and think about how they might modify an activity, directions, or a lesson for that age group. We know each child is unique, of course, and an understanding of developmental characteristics will help teen teachers support and encourage each child's learning.

Learning Objectives

Youth will

- define what a developmental stage is.
- identify key characteristics of ages and stages of children ages 5-11 years old (grades K-5).
- adapt an activity to best meet the needs of children at a particular developmental stage.
- apply this knowledge to the group they will be working with.

Time Required

- 20-25 minutes

Materials

- Access to internet/projection capabilities to show video
- Video: https://mediaspace.umn.edu/media/t/0_hhuq7b08
- Ages & Stages Quick Sort Cards
- Handout: Ages & Stages handout
- Markers
- Drawing paper 11x17 (or flip chart paper)

Activity Steps

1. Engage teens by asking them to think of something they like to do, which they have liked to do since they were younger, maybe starting around age 6 or 7 (e.g. read, dance, play soccer, go hiking out in nature, etc.).
2. Using the following questions as prompts, ask them to remember what they were like when they were younger and did this activity:
    a. What did that look like?
    b. Who did you do it with?
    c. Did someone help you learn it and if so, how did they help you learn?
    d. What was easy for you?
    e. What was hard for you?
    f. How is doing the activity different now?
3. Ask them to talk about their reflections with the group. Listen for changes that are described in their physical, social, mental, or emotional growth.
4. View Ages and Stages video (1.4 minutes): What is a developmental stage? (https://mediaspace.umn.edu/media/t/0_hhuq7b08)
5. Ask: Using the stories group members shared before the video, what examples of developmental change did you hear about?
6. Explain briefly about ages and stages. Hand out copies of the Ages and Stages handout. In our teaching of younger youth, why would it be important for us to understand more about these stages?
7. Introduce the "Quick Sort - Quick Draw" activity as a challenge to think and talk about some of the common developmental characteristics. The facilitator will challenge participants to see how quickly they can determine what characteristics belong to which age group by working in small groups to sort descriptor cards into piles. The leader can choose how many cards to use depending on the time available.
8. The Quick Sort is followed by Quick Draw (supporting varied learning styles). Facilitators can use either or both these activities.
9. Quick Sort Directions:
    - Divide the group into smaller groups of 2-3.
    - Divide Ages & Stages cards among groups or use a full set of cards for each small group.

- Ask participants to sort the cards into piles by determining which characteristics belong to which age group.
- Discuss what the groups decided and what the correct developmental stages are. Discuss any questions.

10. If time allows, remix the participants into groups of 3-5. Half the groups are asked to draw a poster of a youth ages 5-8. Half are asked to draw a poster of a youth ages 9-11. On this drawing, indicate characteristics of a child of this age, using drawings and words. Have each group share their poster.

Reflection

- What is one thing you learned about the developmental stages of children in Grades K-2 or in Grades 3-5?
- Can you give an example of when you have seen one of the characteristics of a stage as you worked with younger children (younger siblings or relatives, in school, or other interactions)?
- What is one thing you can do as a teen teacher/leader to make children in different age groups feel welcome and included in this program?
- Describe how you would change a game (such as Red Rover or Elbow Tag or other), a science experiment (such as slime or another experiment relevant to your group), or a "Healthy Snack" lesson (such as how to make trail mix or a green smoothie) to best meet the needs of children in grades K-5.

Activity 4. Leading Learning for Everyone - Draw a Scientist

Background Information for Facilitators

Universal Design for Learning (UDL) is built on the idea that learners are very diverse. UDL is a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn. Everybody has different sparks, interests, talents, and strengths, and each of us learns in a unique way. UDL promotes using a wide range of modalities to reduce learning barriers and engage all learners. Neuroscience has taught us that our brain develops in interaction with our environment, and our experiences greatly vary. Learn more: UDL at a Glance (https://www.cast.org/impact/universal-design-for-learning-udl)

Culturally relevant teaching approaches use the cultural knowledge, viewpoints, and social conditions of participants to make programs and learning experiences more relevant. Fields (2020) compiled ten strategies for a culturally relevant approach. Strategies that are particularly useful when training teens to teach include:

- Reflect on your own cultural norms, values, beliefs, and behaviors.
- Develop a deeper, non-judgmental appreciation and authentic respect for diverse cultural beliefs and values
- Help youth understand there is more than one way of knowing by using materials that reflect people, language, art, music, stories, and games from various cultural traditions.
- Keep youth at the center of learning; show you care and facilitate experiences that give youth an opportunity to talk about their own cultures and strengths.
- Use a variety of evaluation and reflection tools

Learning Objectives

Youth will

- gain a greater understanding of the personal "lens" we each have based on our life experiences, and how this diversity impacts how we learn and how we teach.
- recognize that people come from different situations and experiences and have diverse learning styles; accept differences with respect and care.

Time Required

- 30-40 minutes

Materials

- Drawing paper
- Drawing utensils (pencils, pens, or markers)

Activity Steps

1. Start with a connection opportunity. Invite youth to think about a time they enjoyed learning something new. It might have been from a friend or family member, in school, or somewhere else. They might want to close their eyes and relive the experience or take some notes about it. Invite people to share if they want to.
2. Reflect on this experience using the following questions:
    - What did you do to learn something new?
    - How did you feel while you were learning? Why?
    - What about that experience made it powerful?
    - How might your cultural experiences (norms, values, beliefs, and behaviors) have shaped the learning experience?
3. Highlight youth responses that are examples of Universal Design for Learning (UDL) or culturally relevant approaches. (You might invite them to stand up or give a thumbs up if their own experience utilized one of these strategies described above).

Facilitator Tip

For a simplified overview, there are three aspects of reaching diverse learners:

HOW WE TEACH -One aspect of reaching diverse learners is through how we teach the content we want them to learn, presenting material in different forms (e.g., written word, spoken word and story telling, visuals, games, music, art, etc.).

WAYS TO SHOW WHAT THEY ARE DOING OR LEARNING - A second aspect of reaching a diversity of learning styles is how we have them "show what they are doing or learning" (e.g. draw a picture, graph your data, write and present a skit, tell a story, create a poem or video, demonstrate a new skill, etc.).

WHY - A third aspect is why, which involves being attentive to the learners' engagement, interest, and motivation (e.g. we build on strengths, offer choices, help show relevance to their experience, build on youth's cultural knowledge, offer challenge and provide feedback, etc.).

4. Tell a story of how you learned something as a young person in an engaging or culturally relevant way. Invite youth to share additional examples from their own experiences (both formal and informal learning settings).
5. Lead youth in the activity: Draw a Scientist (This activity is found in *Sustainable Polymers: Plastics of the Future for a Green, Clean World. A 4-H STEM Curriculum for Gr. 3-5*. Module 1, Activity A. It can be accessed at: https://www.4hpolymers.org/)
6. Guide youth through the activity:
    - Hand out blank paper and pencils or markers to each teen. Ask youth to close their eyes and imagine a scientist or an engineer at work. Allow 1-2 minutes for youth to think in silence.
    - Ask youth to sketch on their paper what they imagined and any ideas they have about what a scientist does or looks like when they are working. Let them know they will have 5 to 8 minutes to draw.
    - After drawing time is ended, have youth sit or stand in a circle and share their pictures.
7. Invite youth to describe what they drew, if desired. Ask youth to describe similarities and differences they see.

8. Reflect on the Draw A Scientist activity with the teens, using the following questions:

    - What does this drawing tell you about your experience and history with science and scientists?
    - What could you learn about others' science experiences and attitudes from observing their drawings?
    - Are there any stereotypes that you'd like to challenge or question?
    - Think about as you've grown up…What did you learn about or experience science and nature from family and loved ones growing up? How were these talked about or shown in your family/school/community/in the media?
    - How do friends and peers experience or talk about science and nature?
    - How do you/they talk or think about different genders engaged in science?
    - What hints does this give you about how different cultures may view these topics from different perspectives?
    - Invite the teens to guess the most common stereotypes of scientists that show up in children's drawings, based on this Draw A Scientist tool (see Facilitator Tip on the next page).
    - Think about the science content we will be teaching. What might we need to know about our learners' cultural experiences or awareness of these topics? How might we help expand a young person's view of what a scientist (or engineer) is?

Exciting, hands-on, and educational programs, such as what the teens will be doing with younger youth, should help youth deconstruct these images and help them start to see themselves as someone who can do, uses, and may contribute to science. Consider sharing children's literature that highlights scientists and engineers of all cultures and genders.

The most common stereotypes that show up in children's drawings? Male, white, middle-aged or elderly, presence of lightbulbs, indications of danger, mythic stereotypes such as mad or crazed, indications of secrecy, working indoors. How many of these appeared in your groups' drawings?

Facilitator Tip

Note to the teens that research has shown that children develop a stereotypic image of a scientist at an early age. The Draw a Scientist Test is an actual research tool, developed in 1983 by D.W. Chambers, which has been used for decades to make inferences about the beliefs and stereotypes that children hold about scientists (Chambers 1983).

Reflection

- How do you imagine you could tell which strategies are making the biggest difference for the younger youth you will be teaching?
- Is there something you've heard today that might inform what kind of teacher you want to be?
- What are some teaching strategies you might use to reach diverse learners?

Activity 5: Experiential Learning and Inquiry-Model It!

Background Information for Facilitators

Using two learning activities from the *Be a Scientist! Materials in a Green, Clean World* curriculum for grades K-2, (Module 1, Activity B: Exploring Hydrogel Crystals and Science Mystery Boxes), the facilitator will model the experiential learning process and inquiry-based learning methods as you engage the teen teachers in these lessons.

Facilitators will need to call out the teaching strategies ("I Wonder" board, open-ended questioning, and steps of the Experiential Learning process) as you model them, and provide adequate time to reflect on them using the Reflection questions provided.

Learning Objectives

Youth will

- learn to use an "I Wonder" board as a means to help younger youth practice the skills of observing and asking questions.
- identify the difference between open- and closed-ended questions and practice using open-ended questions as a skill of inquiry-based learning.
- identify the steps of the experiential learning process.
- adapt an activity for various ages of learners.

Time Required

- 30-45 minutes
- Additional time is needed to prepare the teaching materials; see "Getting Ready" under the Activity Steps section.

Materials

- Handout: Lesson Plan
- Handout: What's in a Question?
- Handout or visual: Experiential Learning diagram
- Hydrated hydrogel crystals (clear or colored red, yellow, blue. Order from science supply stores such as Steve Spangler Science).
- Small plates, clear cups or bowls, 1 for each pair
- Paper towels
- Flip chart paper (for the "I Wonder" board)
- Optional: 3x3 inch (or larger) sticky notes for I wonders
- Markers
- Mystery Boxes (prepared ahead of time, see below)
- Hand-held magnifying lenses, if available
- Book: What is a Scientist? By Barbara Lehn

Getting Ready

- Divide the younger youth into pairs.
- Put a small amount of hydrated crystals on each small plate/in each cup (1 plate/cup per pair).
- Create an "I Wonder" board, using poster board, chart paper, or white board. Write "I Wonder…" at the top, and post it on the wall.
- Create the 3 Mystery Boxes (MB) using non-transparent shoe boxes, photo boxes, plastic tubs, or similar boxes. Each must have a removable lid. In each box, place the items listed and close the lid. Secure with a rubber band if needed.
- MB #1: 2 small balls and 3-4 small plastic animal figures, or plastic toy cars
- MB #2: various interesting-looking shells or rocks
- MB #3: 2-3 types of dried beans or seeds, (e.g. lima beans, sunflower seeds split peas)
- Print/share handout: What's in a question?

Activity Steps

Explain that you will lead the participants through the activities, using the lesson plan from the *Be a Scientist! Materials in a Green, Clean World* Grades K-2 curriculum: Module 1, Activity B: I Wonder, Hydrogel Crystals, and Science Mystery Boxes, available at www.4hpolymers.org. Explain that you will be highlighting how to use three specific teaching strategies as the teens do this lesson designed for children in grades K-2.

Note: This lesson plan outline for teens is included in the Handouts sections. Print copies for Teen Teachers to use as they practice teaching.

Part 1: Hydrogel Crystals

Opening questions and prompts

- What is a "sense"?
- Can we name some senses?
- How do we use our senses to learn about something?

Procedure (Experiencing)

1. Read the book: What is a Scientist? By Barbara Lehn to the group.
2. Lead the children through identifying the senses: see, smell, touch, taste, and hear. Explain that in this activity we will not use the sense of taste.
3. Ask youth to think about the book we just read. Ask them to give examples of how the scientist used their senses to observe. Challenge children to act like scientists in the activity we will be doing and explore by using their senses.
4. Share a small container of hydrogels with each group. Remind children to not use the sense of taste for this activity.
5. Have youth take a few minutes to explore and observe using their other senses. In this free exploration try not to respond to any questions yet, instead wonder out loud with the children.
6. After free exploration, bring youth together and explain how to capture their wonderings onto a tool called an "I Wonder" board. On the board, collect the children's thoughts using words or drawings. Children can print their own thoughts on sticky notes to put on a larger board, write directly on the board, or have an adult write for them.

   Examples of "I Wonder" board prompts teen teachers can use are:

   - What did you see? This includes colors, shapes, sizes.
   - Did anyone touch the crystals? Observations can include that the crystals were squishy, soft, cold, or bouncy.
   - Did you notice a smell? Children may have noticed a smell or noticed there was no smell.
   - Did you hear anything? Youth may describe the sound the crystals made when bounced or report that the crystals did not make a sound in the container.

Alternate activity (if hydrogels cannot be obtained)

Go outside and take an "I Wonder" walk. In pairs, explore the yard and use your skills of observation to notice things, and share what you wonder about with your partner. Lead the group outside and model your own wonder about something you see. Then follow the "Share, Generalize, Process" procedure.

Part 2: Science Mystery Boxes

Depending on the size of the group, the facilitator may choose to engage with the boxes as a full group (e.g. 6 or fewer children in your group) or divide into 3 groups

of no more than 3 children and have each small group investigate one box then share what they discover. You might also have the groups "rotate" around to experience each box. With a larger group, you may want to prepare more than 3 Mystery Boxes.

Opening questions and prompts

- Lead a discussion with the children to introduce the Mystery Boxes. Remind students that scientists use their senses to observe, and the students will be acting like scientists.
- Have youth think of how they can use their senses to explore the Mystery Boxes.
- You might need to revisit the 5 senses with the children (sight, smell, touch, taste, and hear). Remind students that we will not be using the sense of taste in this activity.

Procedure (Experiencing)

- Have youth start with an unopened box and guide them through their observations. Ask what they hear, see, smell, or feel.
- Use the "I Wonder" board to record their observations or other "wonders" about the boxes.
- If time allows, you might have children close their eyes and use their sense of touch to feel the objects inside the Mystery Box.
- Ask again what observations they made with the sense of touch.

Facilitator Tip

You may need to probe further if any of their observations are not truly things they observed with their senses. Children might make assumptions or guesses based on evidence and their own reasoning.

Share/process/generalize (Explain these parts of the Experiential learning process using the diagram)

1. Talk about the difference between things we can know for sure compared to things we might believe or guess.
2. Unwrap and unveil the objects and note any new observations the children make.

3. Have children reflect on what scientist skills they used. Examples of prompts include:

    - What senses did you use? (This might include touch, sight, or hear).
    - What questions did you have when you were exploring?
    - What did you wonder about? (Children may have heard something rolling around and wonder if that was a ball or other similar object. They may have wondered how many items were in the boxes).
    - What guesses did you make? Were they correct? (Children may have thought objects were a specific item and could have been correct/not so correct).

Facilitator Tip

Give an example, if needed. Use these or your own examples:

- Were you ever afraid to touch something, like a snake, because you thought it would feel slimy? But then when you touched it, you found out it felt differently than you thought it would? Perhaps you found out that snakes don't feel slimy but rather they are smooth, dry or cool to the touch.
- Have you ever smelled something you thought would taste bad, but when you tasted it, you found it was really good? Or maybe the opposite, smelled good but tasted bad?

Reflection

1. Give examples of where you saw the 5 steps of the Experiential Learning cycle happen?
2. Why do you think 4-H uses the Experiential Learning process to engage young people in learning?
3. How is experiential learning MORE than simply "hands-on activities?"
4. What teaching techniques or strategies do you think worked well? Not so well? What would you do differently?
5. How would you adapt these activities to use with an older group of youth?

Activity 6:
5 Essential Teaching Skills

Background Information for Facilitators

Teaching younger children is a complex process! Helping teens feel comfortable in front of a group as well as confident as the teacher requires both strategies and practice. These five essential teaching skills provide useful tools to equip teen teachers.

Learning Objective

Youth will explore and practice effective teaching strategies.

Activity Steps

1. Introduce the activity by using a bell, squeaky toy, chime, or other sound to get everyone's attention. When you have their attention, ask what it was about the sound that caused them to stop and listen.
2. Explain that when teachers or others who work with young people get prepared for their job, they take classes, go to workshops, get a degree in elementary education, or in other ways learn the methods and strategies for being an effective teacher. In this next activity, we will learn and have a chance to practice some of these methods, or essential teaching skills. (Refer back to earlier discussions the group has had about what makes an

Time Required

- 30 minutes
- Additional time is needed to prepare the teaching materials; see "Getting Ready" under the Activity Steps section.

Materials

- 1 handout of 5 Essential Teaching Skills, cut into 5 sections
- Handouts: Copies of 5 Essential Teaching Skills and Attention Please for all
- Unique sound maker (chime, squeaky toy, bell, or other)

effective teacher, or share a personal story of a good or not so good teacher you've experienced).

3. If the group size is ten or larger, break into five groups. (If there are fewer than 10 teens, divide into two smaller groups; each group will be assigned more than one of the skills).
4. Give each group one section of the handout "5 Essential Teaching Skills" which has been cut apart. Explain that their task is to create a short (under two minutes) "role play" or scene of that skill; First giving a **bad** example of this skill (doing the opposite of the tips listed on the handout) and then giving a **good** example of this skill (modeling some or all of the tips on the handout).
5. The role of the other groups will be to guess what Facilitation Skill the group is showcasing.
6. Ask for any questions then give the groups 5-10 minutes to prepare to present their Teaching Skill.
7. Have each group present for 1-2 minutes and have other groups guess what the Facilitation Skill is. Getting the "right" term for the skill is less important than the discussion about what is effective or not effective.
8. After all groups have presented, pass out the Handout: "5 Essential Teaching Skills."
9. Invite youth to circle or put an asterisk* by the one tip that they will try to use. As a group, invite them to then share and write down any additional ideas for that skill. You might prompt them by asking them to again think about any teachers or presenters they have observed and recall any helpful strategies they saw that person use. If some of the teens are experienced teen teachers, they will be able to share strategies they have learned and used.

Reflection

1. Ask each teen teacher to share one of the tips they circled or starred.
2. Invite teens to share a tip or a scenario that makes them nervous as they think about leading a group of younger youth, and ask them how your whole group might support them.

Optional Activity 7: Giving Directions

Background Information for Facilitators

Giving clear directions and communicating clearly with younger youth will be important skills as a teen teacher. This activity helps participants see what works well and what can be challenging when giving directions.

Learning Objectives

Youth will

- understand effective ways to give directions.
- gain strategies for being more clear when giving directions to younger children.

Time Required

- 15-20 minutes
- Additional time is needed to prepare the teaching materials; see "Getting Ready" under the Activity Steps section.

Materials

- Pretzel sticks or toothpicks, 12 per person
- Napkins or paper towels if using pretzels, 1 per person

Activity Steps

1. Ask teens to pair up and sit on the floor back to back. Decide who will be Person A and who will be Person B.
2. Give each participant 12 pretzel sticks or toothpicks.
3. Ask Person A to create a design on the floor (or napkin) with their pretzels or toothpicks (give one minute to do this).
4. Now Person A will describe to Person B what their design looks like and Person B will try to replicate the design based on the description. Person B cannot ask any questions and neither partner can look at either design. Allow 3 minutes for this.
5. Discuss & Ask Person B: What was easy or difficult about this? Why? Ask Person A:

What was easy or difficult about this for you? Why? Briefly discuss the challenges of giving clear directions and of one-way communication.

6. Reverse roles and have Person B create a design and have Person A listen and replicate. However this time, Person A can ask questions of Person B and they can answer. Allow 3 minutes.
7. Discuss: Ask the same questions as above and discuss what made communication easier or more difficult. Facilitator can also note observations, such as the noise level in the room, the laughter, or if the second round went more quickly than the first.

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Search INSTITUTE

DEVELOPMENTAL RELATIONSHIPS

The Framework

Developmental relationships are the roots of thriving and resilience for young people, regardless of their background or circumstances. Through these relationships, young people discover who they are, cultivate abilities to shape their own lives, and learn how to engage with and contribute to the world around them. Just as trees rely on a system of roots to support and nourish them, young people need to experience developmental relationships in their families, schools, programs, and communities. However, too many young people miss these opportunities due to bias, prejudice, and systemic exclusion based on their race, ethnicity, income, gender, sexual orientation, abilities, or other differences. Ensuring that every young person experiences the developmental relationships they need is a vital challenge for the 21st century.

The Developmental Relationships Framework was developed by Search Institute, Minneapolis, MN; 800-888-7828; www.searchinstitute.org.

EXPRESS CARE

Show me that I matter to you.

Be dependable
Be someone I can trust

Be warm
Show me you enjoy being with me

Listen
Really pay attention when we are together

Encourage
Praise me for my efforts and achievements

Believe in me
Make me feel known and valued

CHALLENGE GROWTH

Push me to keep getting better.

Expect my best
Expect me to live up to my potential

Hold me accountable
Insist I take responsibility for my actions

Stretch
Push me to go further

Reflect on failures
Help me learn from mistakes and setbacks

PROVIDE SUPPORT

Help me complete tasks and achieve goals.

Navigate
Guide me through hard situations and systems

Advocate
Stand up for me when I need it

Set boundaries
Put limits in place that keep me on track

Empower
Build my confidence to take charge of my life

SHARE POWER

Treat me with respect and give me a say.

Respect me
Take me seriously and treat me fairly

Collaborate
Work with me to solve problems and reach goals

Include me
Involve me in decisions that affect me

Let me lead
Create opportunities for me to take action and lead

EXPAND POSSIBILITIES

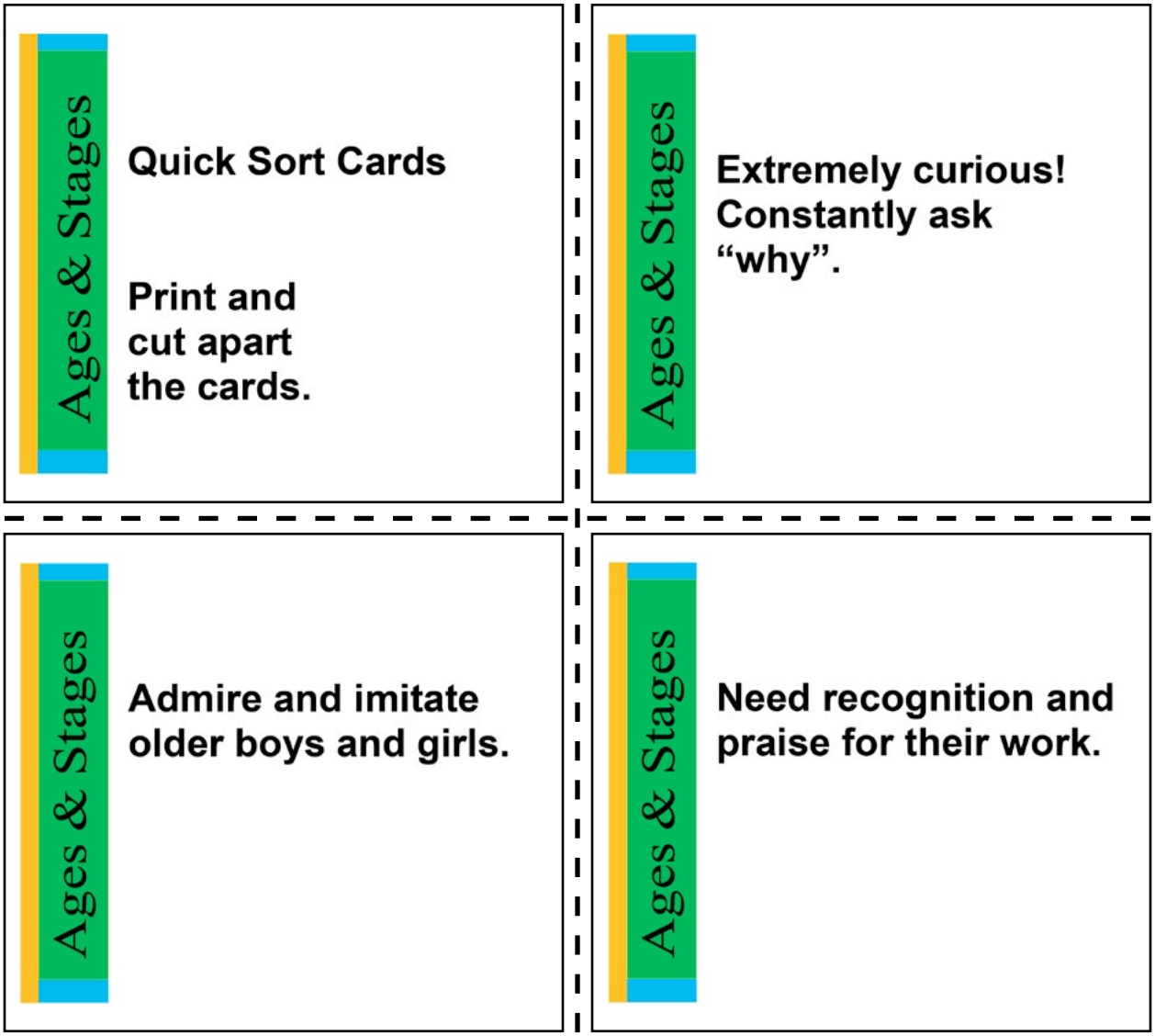
Connect me with people and places that broaden my world.

Inspire
Inspire me to see possibilities for my future

Connect
Introduce me to people who can help me grow

Broaden horizons
Expose me to new ideas, experiences, and places

Handout:
Ages and Stages Quick Sort Cards



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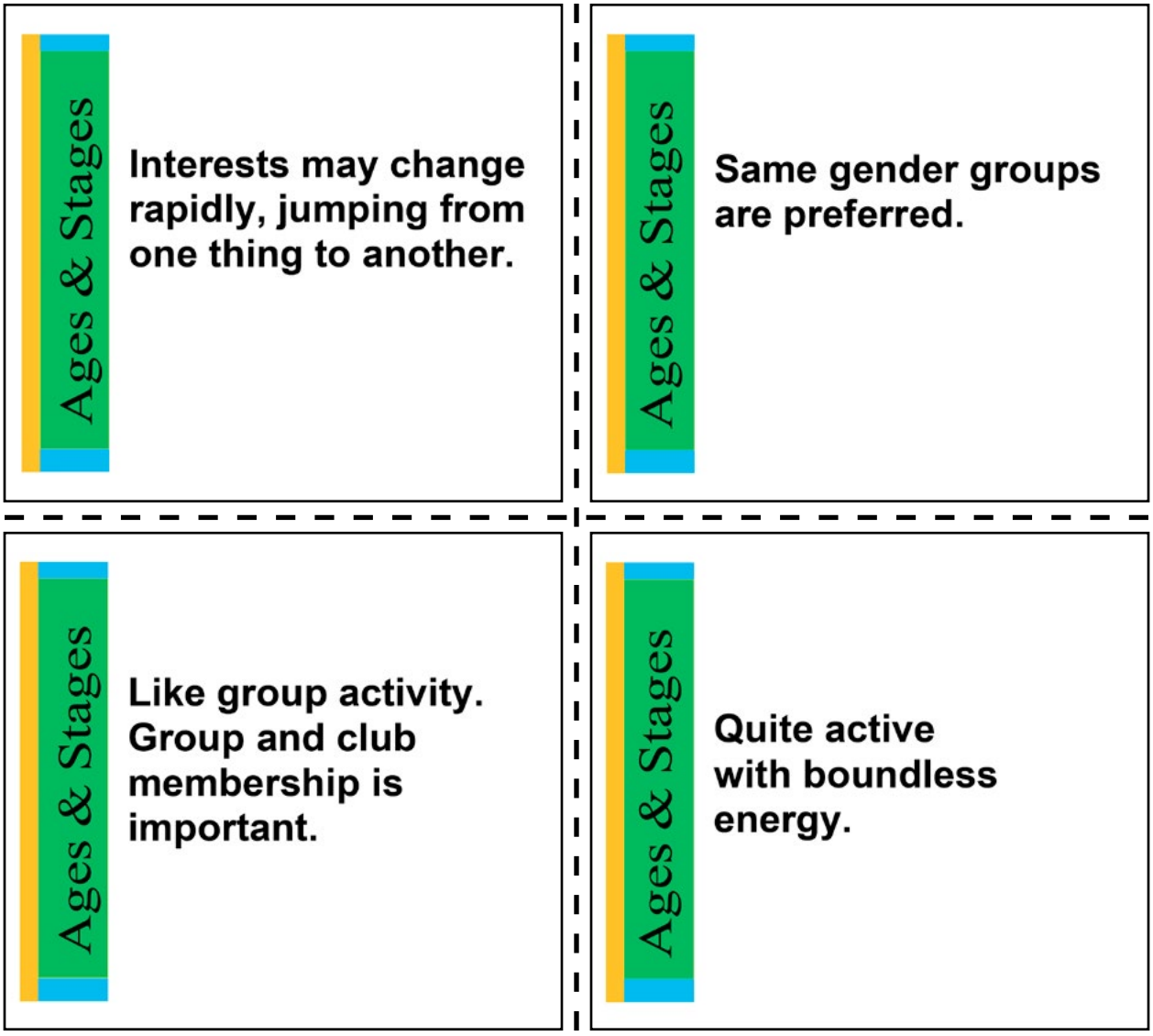
Ages & Stages
Interests may change rapidly, jumping from one thing to another.
Ages & Stages
Same gender groups are preferred.
Ages & Stages
Like group activity. Group and club membership is important.
Ages & Stages
Quite active with boundless energy.

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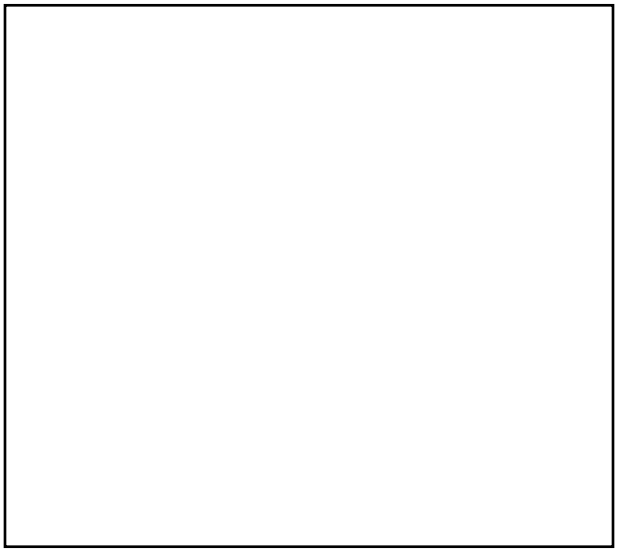

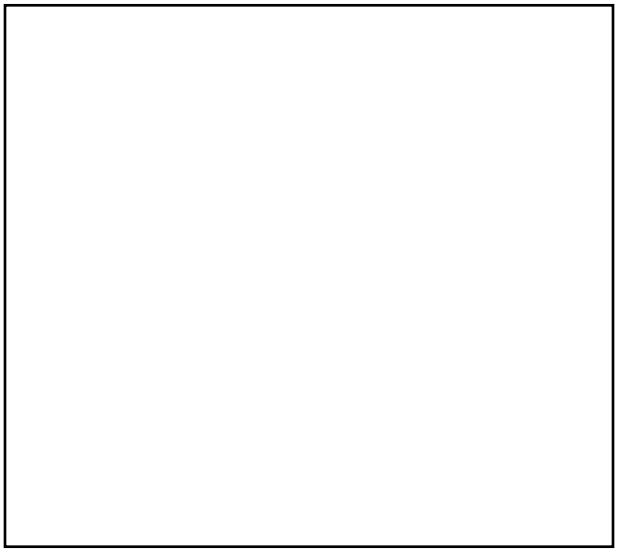

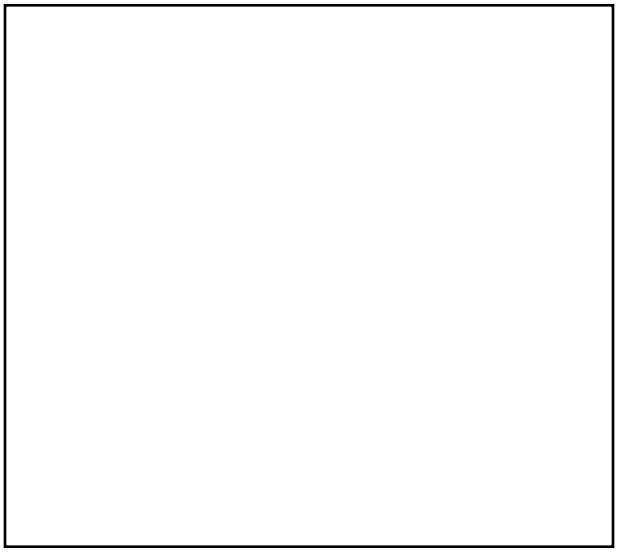

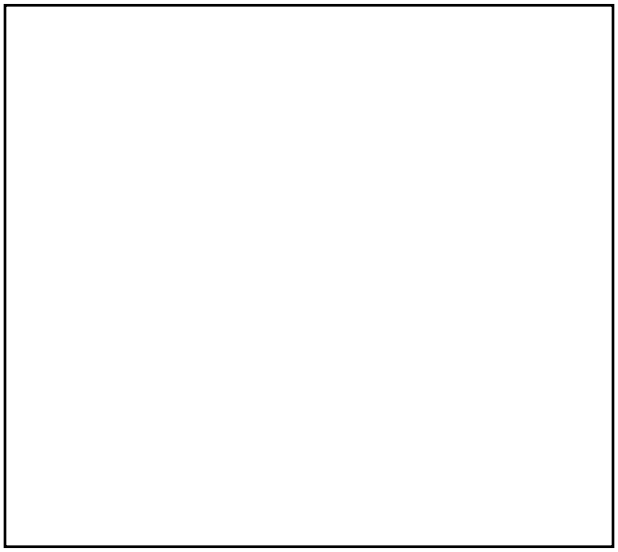

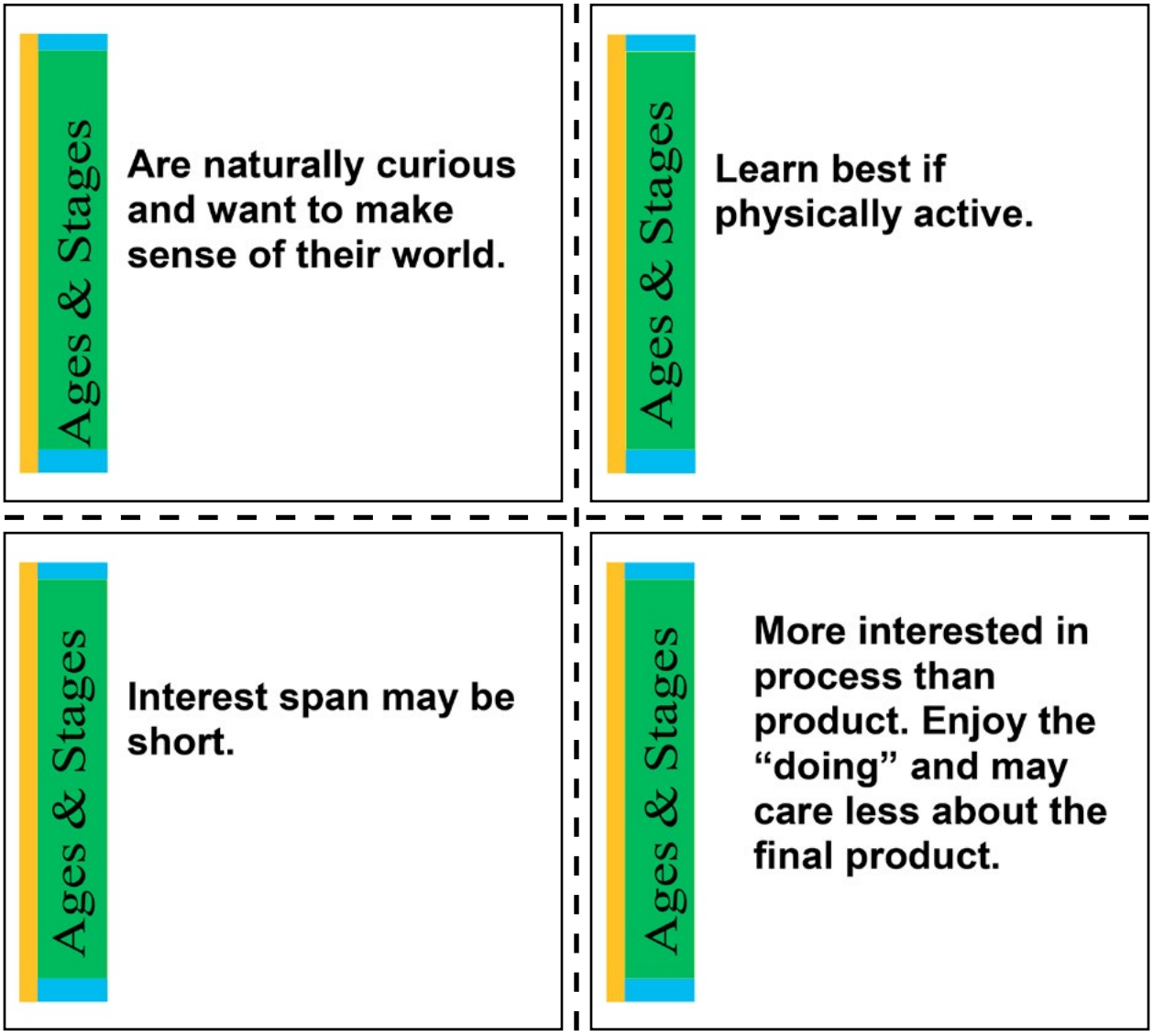
Ages & Stages
Are naturally curious and want to make sense of their world.
Ages & Stages
Learn best if physically active.
Ages & Stages
Interest span may be short.
Ages & Stages
More interested in process than product. Enjoy the "doing" and may care less about the final product.

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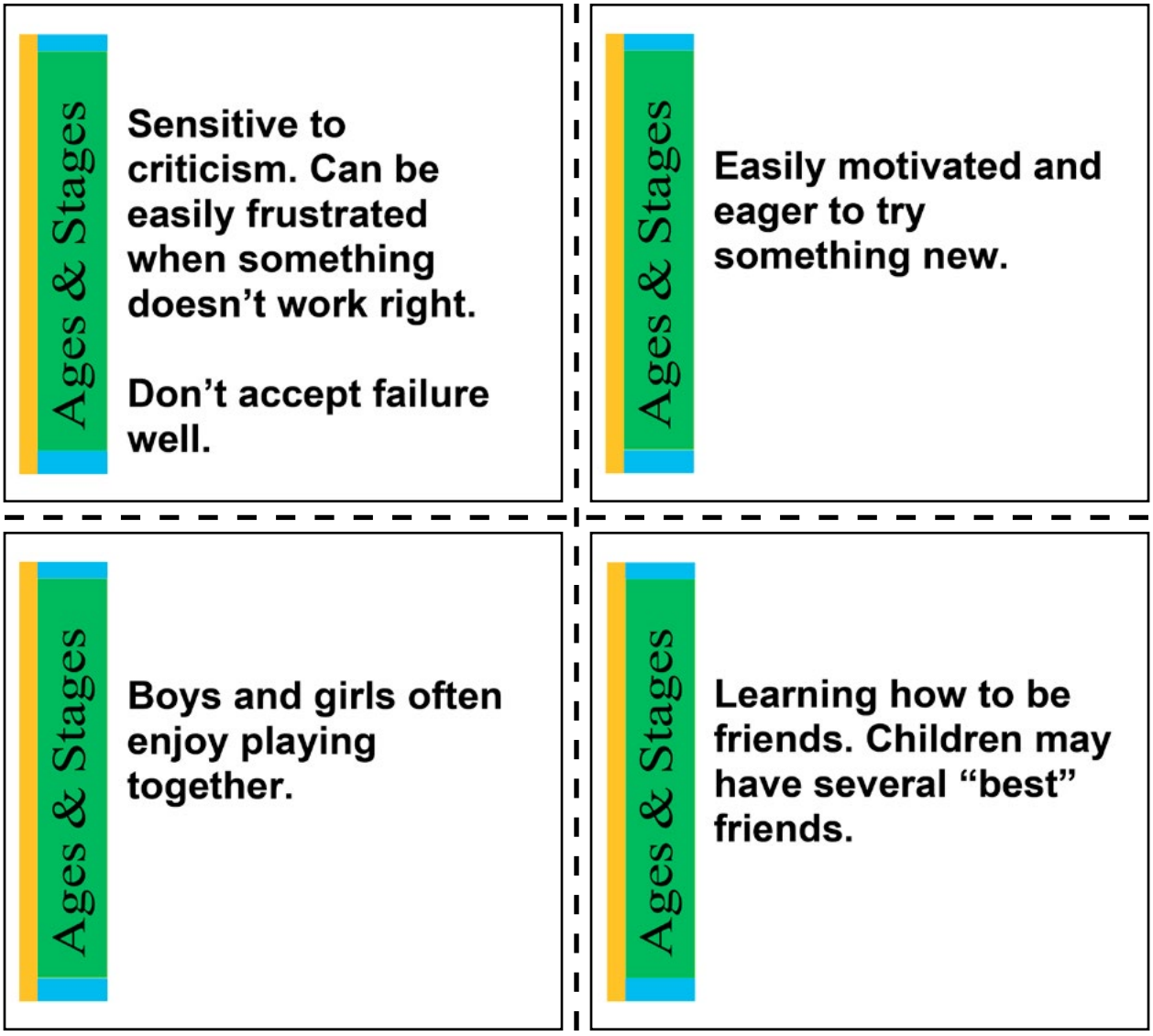
Ages & Stages
Sensitive to criticism. Can be easily frustrated when something doesn't work right.
Don't accept failure well.
Ages & Stages
Easily motivated and eager to try something new.
Ages & Stages
Boys and girls often enjoy playing together.
Ages & Stages
Learning how to be friends. Children may have several "best" friends.

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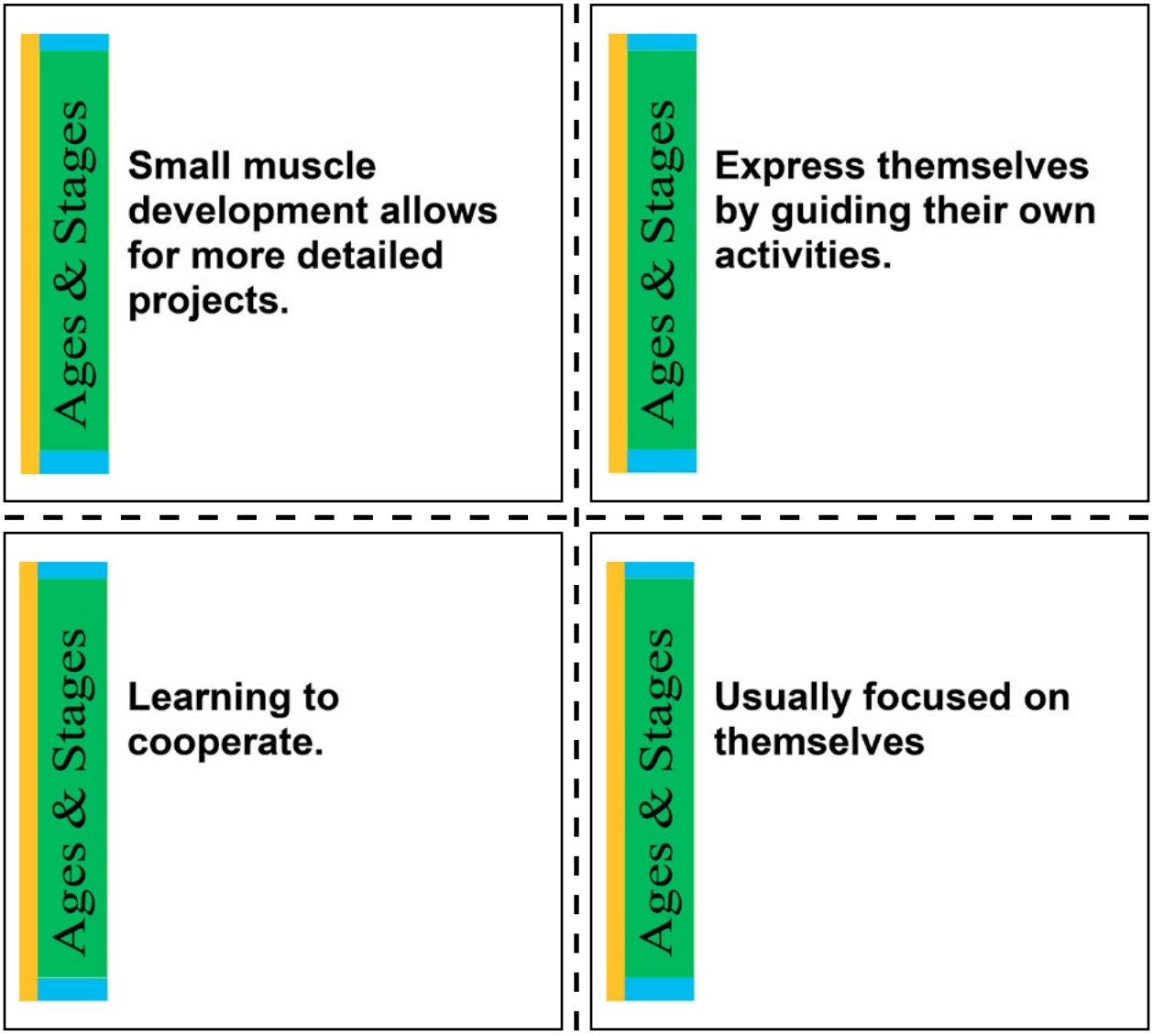
Ages & Stages
Small muscle development allows for more detailed projects.
Ages & Stages
Express themselves by guiding their own activities.
Ages & Stages
Learning to cooperate.
Ages & Stages
Usually focused on themselves

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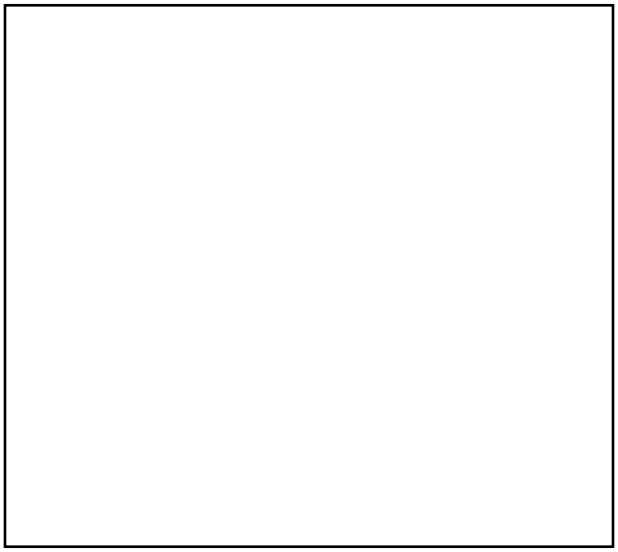

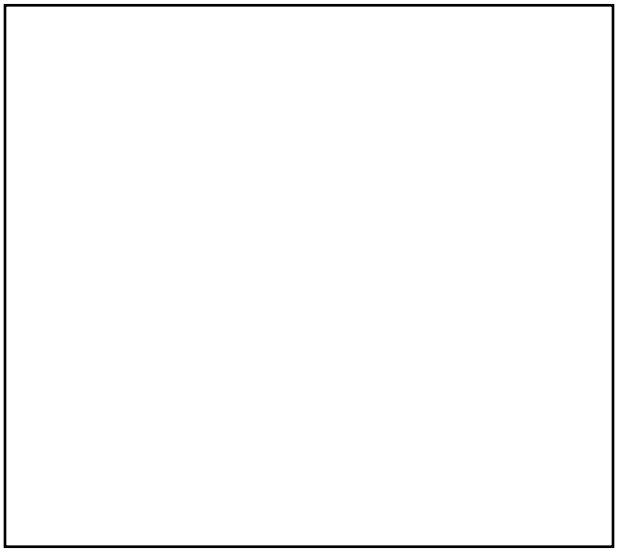

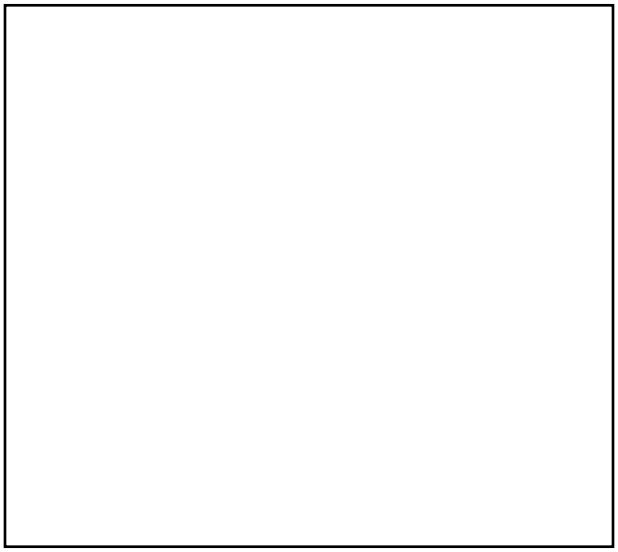

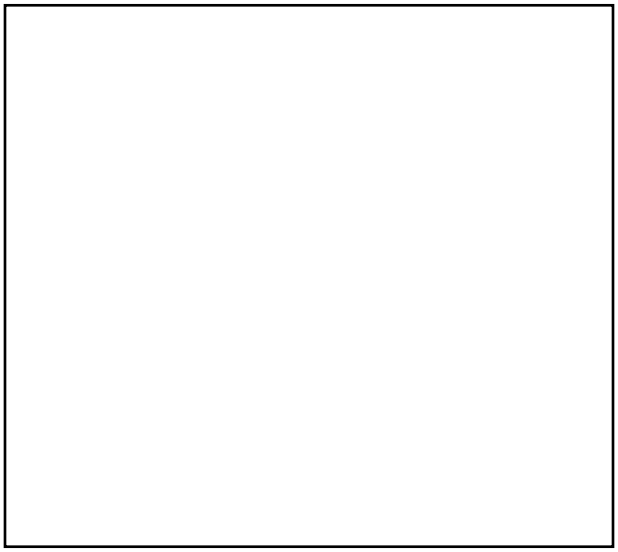

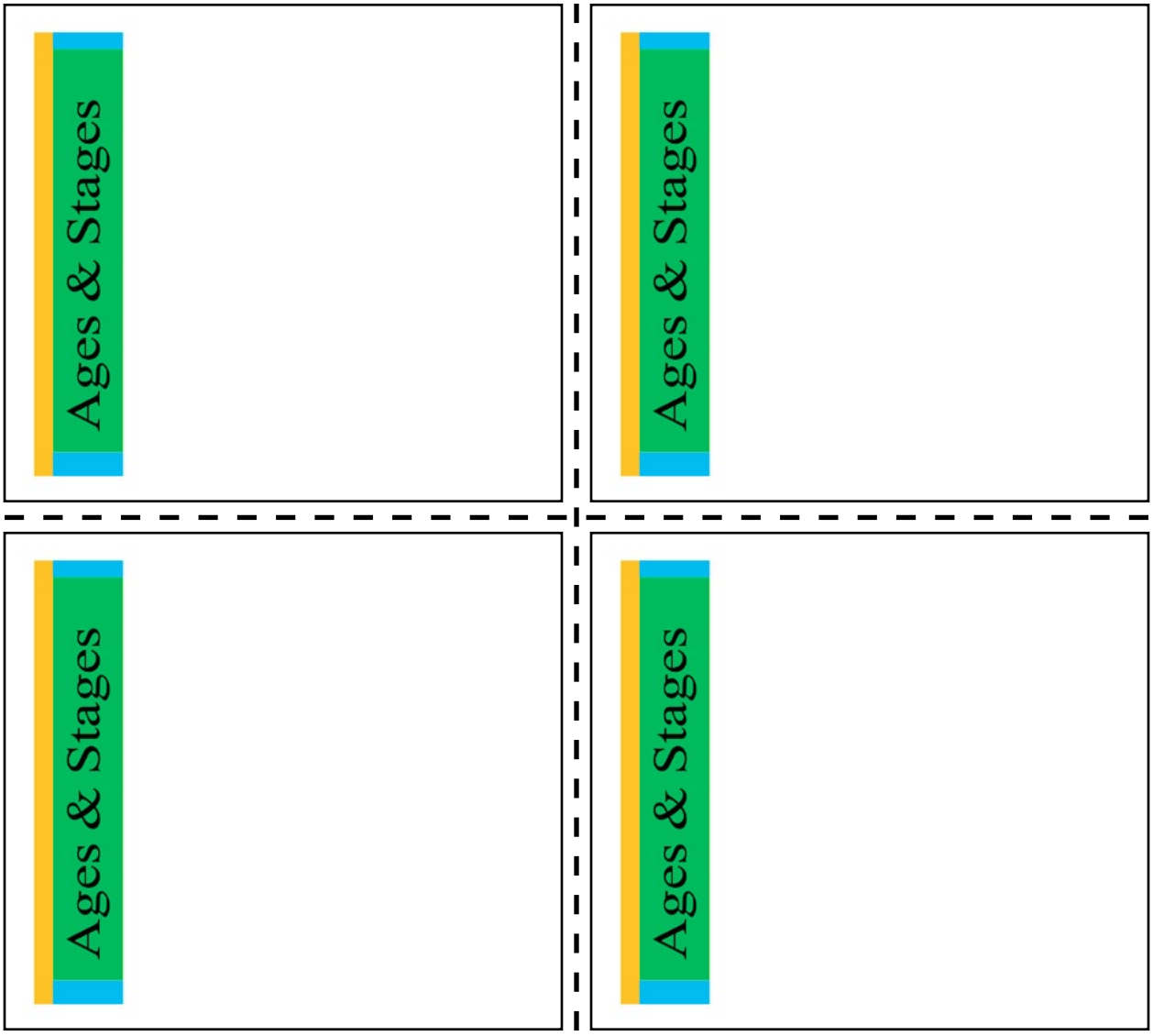
Ages & Stages
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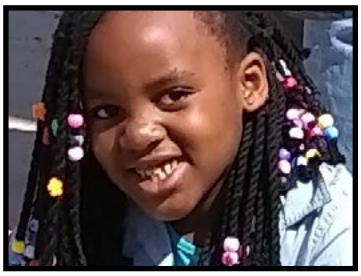
Ages and Stages of Youth Development: Ages 5 to 8

(Generally Kindergarten through 2nd grade)



Characteristics of 5 to 8 Year Olds and Teaching Strategies for Working With This Age Group

Development Stages	Teaching Strategies
Physical development of 5 to 8 year olds	**Teaching strategies**
• energetic with the need to move their bodies • able to do whole body physical activities like running and jumping • developing hand skills and eye coordination	• include lots of physical movement activities. • keep activities short (10-15 min). • offer activities like art projects that build hand skills and eye coordination, but keep brief.
Social development of 5 to 8 year olds	**Teaching strategies**
• interested in school and group activities (clubs, sports, youth groups) • learning friendship skills, often having a "best friend." • likely to have friends of the same gender • learning to cooperate	• help them recognize strengths and interests - give encouragement. • offer small group activities with individual attention. • provide mixed-gender activities to build friendship skills. • make activities/games cooperative rather than be competitive.

Development Stages	Teaching Strategies
Emotional development of 5 to 8 year olds	**Teaching strategies**
• generally focused on themselves • learning about their emotions and express a wide range of feelings • sensitive and are upset by criticism, failure, or changes in plans or routines • dependent on adults and look for approval willing to help and desire to please • learning empathy	• have youth work in pairs and groups of 3 to encourage working with others. • help them recognize emotions and give them space to discuss feelings. • offer activities where they can experience success. • offer activities with time for independent learning.
Growth in thinking	**Teaching strategies**
• focused on drawing from what they have seen, heard, tasted, and smelled • focused on what is happening here and now • concrete thinkers - right or wrong; yes or no • enjoy activities and materials that are concrete • naturally curious about the world around them • learn through senses • have a short attention span	• give clear instructions and demonstrate activities. • focus on doing the activity, not the end product. • have activities that encourage curiosity. • read books to encourage imagination. • include a variety of short activities (15-20 min) that use senses and involve physical movement. • give encouragement and praise accomplishments.

Sources:
Russo, J. (2018). Program Applications for Youth Developmental Characteristics. Regents of the Univ. of Minnesota.

Schmitt-McQuitty, L., Smith, M.H., & Young, J.C. (2011). *Preparing volunteers to meet the developmental needs of youth audiences. Journal of Youth Development*. 49.1. https://archives.joe.org/joe/2011february/iw1.php

Handout:
Ages and Stages of Youth Development: Ages 9 to 11

(Generally grades 3 through 5)

Characteristics of 9 to 11 Year Olds and Teaching Strategies for Working With This Age Group

Development Stages	Teaching Strategies
Physical development of 9 to 11 year olds	**Teaching strategies**
• physically stronger with better balance and hand coordination • very active with a lot of energy • learning small muscle coordination - making activities like playing an instrument more enjoyable	• include team games (though avoid competition between genders). • encourage physical activities to get energy out. • include activities that allow for more precision-oriented tasks (art, wood working, board games).
Social development of 9 to 11 year olds	**Teaching strategies**
• express themselves by guiding their own activities • enjoy teamwork but may begin to be competitive • enjoy group activities and have group loyalty • hold older youth in high regard and try to emulate them. • need adult direction to remain on task.	• provide choice in activities and time to explore interests. • offer cooperative group activities. • work to solve problems together, yet give clear and reasonable limits. • provide time to connect with older youth as role models/mentors. • positive adult leadership is important.
Emotional development of 9 to 11 year olds	**Teaching strategies**

Development Stages	Teaching Strategies
• self-confidence and self-esteem can be fragile. • need recognition and praise. • begin questioning parental authority, but look to those "in charge" to help guide appropriate behavior. • admire and imitate older youth. • developing decision making skills	• give one-on-one feedback and avoid comparing to others. • look for success and give specific recognition (e.g., I like the way you painted this art work). • adults are visible in group activities, but in background. • offer time to learn from older youth. • offer space to identify what they are good at.
Growth in thinking	**Teaching strategies**
• creative; curious; eager to try new things • have increased attention spans • learning to use good judgment • interested in collections and hobbies • beginning to use reasoning skills and abstract thought • vary greatly in academic abilities.	• provide activities to try new things and express curiosity. • activities can be longer (20-30 min.), but still need to be hands-on. • vary the activities offered. • give clear and to the point directions (not too complex). • promote success by planning a variety of short activities for a range of abilities and interests.

Sources:

Russo, J. (2018). Program Applications for Youth Developmental Characteristics. Regents of the Univ. of Minnesota.

Schmitt-McQuitty, L., Smith, M.H., & Young, J.C. (2011). *Preparing volunteers to meet the developmental needs of youth audiences. Journal of Youth Development*. 49.1. https://joe.org/joe/2011february/iw1.php

Handout:
What's in a Question?

Effective questioning to encourage learning

Effective questions are open-ended, asked at the appropriate moment during learning activities, and prompt further exploration and investigation. Open-ended questions foster inquiry.

Open-Ended Questions

- Have more than one correct answer
- Promote multi-word, multi-phrase responses
- Encourage participation
- Ask for reasoning
- Require communication

Closed-Ended Questions

- Are fact-based
- Often require only a "yes" or "no" response
- Tend to have right or wrong answers

Sample open-ended questions

- What is your idea?
- What would you do differently next time?
- What do you think will happen next?
- What would happen if you…?
- What might you try instead?
- Tell me what happened.
- Is there anything else you could do/use?
- What could you do instead?
- What are some different things you could try?
- Tell me what worked well.
- What else does it make you wonder about?
- In what ways are these different? Similar?

Handout:
Teen Teacher Lesson Plan Outline
Hydrogel Crystals & Mystery Boxes

Teen Teacher Prompts

Do - the actions teen teachers will take to facilitate youth learning (pass out materials, walk around the room and talk/ask questions of youth, model inquiry behaviors, and get attention).

Explain - teen teachers will explain concepts and give directions.

Ask - teen teachers ask younger youth questions and provide prompts, with the goal of youth voicing their questions or sharing ideas/responses.

Experiential Learning Model

** Cooperative State Research, Education, and Extension Service (1996). Curriculum Development for Issues Programming - A Handbook for Extension Youth Development Professionals. Based on the work of Kolb, D. (1984). Experiential learning: Experience as the source of learning and development. New Jersey: Prentice-Hall.*

Introduction

Welcome - Teen Teachers welcome youth as they arrive and get settled into their seats.

Introductions - Teen Teachers introduce yourself with your name, grade, and one thing you love about science.

Activity Introduction - With the youth in a large group, Teen Teachers will introduce the activity.:

Explain: Today we get to become scientists who are exploring a mystery material! The second challenge we will have is to study some mystery boxes and see if we can figure out what is in these mystery boxes. We will be practicing the science skills of making observations and asking questions, and we are going to do that by using our senses!

Experiencing - Step 1 in the Experiential Learning process

Part 1 Hydrogel Crystals Opening Questions

Teen Teachers will ask students the following questions and prompts.

Ask:

- What is a "sense"?
- Can we name some senses?
- How can we use our senses to learn about something?

Teens will use the steps below to guide youth through exploring hydrogel crystals using their senses.

Activity Steps

1. **Do**: One Teen Teacher reads the book: What is a Scientist? by Barbara Lehn to the group.

2. **Ask**: What are the senses you can think of? (see, smell, touch, taste, and hear). In our science activities, we will not use the sense of taste.

3. **Ask**: How did the scientists in the book use their senses to observe? You will be acting like scientists today and exploring a material using your senses

4. **Do**: Depending on the room set up, guide youth to the table/desk area. Divide youth into pairs. Hand out one paper plate of hydrogels per pair. Remind children not to use the sense of taste for this activity.

5. **Explain**: You will have 5 minutes to explore and observe using your senses, minus taste. As you first look at the crystals, what do you wonder about? (If you have science tools such as magnifying lenses or rulers, you may demonstrate how to use a magnifying lens or ask youth what they might use the ruler for).

6. **Do**: Walk around the room and talk with youth about what they are wondering about the hydrogel crystals (not responding to any questions yet). Model curiosity with your words or questions to individuals/small groups). Give youth an end time (ie - 30 seconds more to explore).

7. **Do**: Bring youth back together and collect the hydrogel crystals.

Share/Process/Generalize - Steps 2, 3, 4 of the Experiential Learning process

8. **Explain**: We are going to write your wonderings onto a tool called an "I Wonder" board. You can share your thoughts using words or drawings. I will write each of your wonders on our "I Wonder" board. Begin by asking the youth what they wondered as they explored the hydrogel crystals.

Examples of "I Wonder" board prompts teen teachers can use:

- What did you see? (This includes colors, shapes, sizes).
- Did anyone touch the crystals? (Observations can include that the crystals were squishy, soft, cold, or bouncy).
- Did you notice a smell? (Children may have noticed a smell or noticed there was no smell).
- Did you hear anything? (Youth may describe the sound the crystals made when bounced or squished, or report that the crystals did not make a sound).

Teen Teacher Tip

Remember to Encourage! Notice how they used their science superpowers of observation, asking good questions, testing properties, being curious, trying something again and again. their senses.

Alternate activity (if hydrogels cannot be obtained)

Teen Teachers, you can take youth outside and take an "I Wonder" walk. In pairs, explore the yard and use your skills of observation to notice things, and share what you wonder about with your partner. Lead the group outside and model your own wonder about something you see. Then follow the "Share, Generalize, Process" procedure.

Part 2: Science Mystery Boxes

Experiencing - Step 1 in the Experiential Learning process

Opening Questions

Teen Teachers will explain the activity and share the following questions and prompts.

Explain:

- We have a mystery box and your job is to act like a scientist to use your senses to make observations about the mystery box, think about what properties the objects have (e.g. properties may include round, flat, heavy, noisy, hard, etc.), and guess what might be in the mystery box.
- Which senses might you use in exploring the Mystery Boxes? You might need to revisit the 5 senses with the children (sight, smell, touch, taste, and hear). Remember, you will not be using the sense of taste in these science activities.

Activity Steps

Teens will use the steps below to guide youth through learning.

1. **Do**: Depending on the size of the group and the facilitator's recommendation, decide if you will engage with the boxes as a full group (e.g. 6 or fewer children in your group) or divide into 3 groups of no more than 3 children and have each small group investigate one box then share what they discover. You might also have the groups "rotate" around to experience each box. With a larger group, you may want to prepare more than 3 Mystery Boxes.

2. **Ask**: What are the senses you can think of? (see, smell, touch, taste, and hear). In our science activities, we will not use the sense of taste.

3. **Ask**: How did the scientists in the book use their senses to observe? You will be acting like scientists today and exploring a material using your senses

4. **Do**: Depending on the room set up, guide youth to the table/desk area. Divide youth into pairs. Hand out one paper plate of hydrogels per pair. Remind children not to use the sense of taste for this activity.

2. **Explain**: You have an unopened box. Don't open it. You will move the box around and shake the box. Use your senses to make observations - what do you hear, what do you see, what do you smell, and what do you feel?

3. **Do**: Use the "I Wonder" board to record observations or other "wonders" about the boxes.

Facilitator Tip

You may need to probe further if any of their observations are not truly things they observed with their senses. Children might make assumptions or guesses based on evidence and their own reasoning.

4. **Do**: If time allows, you might have youth close their eyes and use their sense of touch to feel the objects inside the Mystery Box.

Share/Process/Generalize - Steps 2, 3, 4 of the Experiential Learning process

5. **Ask**: What observations did you make with the sense of touch?

6. **Explain**: Talk about the difference between things we can know for sure compared to things we might believe or guess.

7. **Do**: Unwrap and unveil the objects and note any new observations the children make.

Apply - Step 5 in the Experiential Learning process

Teen Teachers will lead a closing reflection on what they learned.

Ask:

- What scientist skills did you use today?
- What senses did you use? (This might include touch, sight, or hear.)
- What questions did you have when you were exploring?
- What did you wonder about? (Children may have heard something rolling around and wonder if that was a ball or other similar object. They may have wondered how many items were in the boxes.)
- What guesses did you make? Were they correct? (Children may have thought objects were a specific item and could have been correct/not so correct.)
- How could you use your scientist skills in other places-at home, in school, or other?

Teen Teacher Tip

Give an example, if needed. Use your own examples.

- Were you ever afraid to touch something, like a snake, because you thought it would feel slimy? But then when you touched it, you found out it felt differently than you thought it would? Perhaps you found out that snakes don't feel slimy but rather they are smooth, dry or cool to the touch.
- Have you ever smelled something you thought would taste bad, but when you tasted it, you found it was really good? Or maybe the opposite, smelled good but tasted bad?

Handout:
5 Essential Teaching Skills for Teen Teachers

Teaching skill	What it looks like	Space to write your ideas
Create belonging	• Learn and use each child's name. • Greet each person each time you meet. • Make eye contact and smile at each child. • Strive to make everyone feel comfortable, welcome, valued, and respected. • Give each child a chance to speak and share their ideas. • Adapt activities so every child is included. • Notice and verbally recognize children who are showing kindness and respect to others.	**Your ideas:**
Energize	• Show enthusiasm for the topic and the participants. • Use your "front of the room" big voice. • Change your voice often. • Smile. • Notice when energy levels are getting low and recharge the group with a brief exercise or active activity (a few examples: do 10 jumping jacks, lead a "stomp & clap" pattern that they repeat after you, play a short music clip and have a dance party). • Adapt learning activities to allow movement around the room.	**Your ideas:**

Teaching skill	What it looks like	Space to write your ideas
Encourage	• Be a role model for children so they are inspired about what they want to become. • Be positive and supportive. • When a child shares, say "Thank you" or "I appreciate what you said because…" • Show respect for each person's previous experience, cultural background, and knowledge. • Provide opportunities for children to have input into decision making, when possible (e.g., offer two options, both of which you can live with, and let children vote). • Tell them what to do ("Please walk.") instead of what NOT to do ("Stop running!").	**Your ideas:**
Engage and keep it moving	• Ask for volunteers rather than appoint someone. • Use a method to choose children at random for special jobs or roles (e.g. picking names out of a hat). • Be sure you have everyone's attention when you are speaking. Use an "attention grabber" to help the group get quiet so they can listen to you. • Keep the talking brief and move to the "experience" so children get to do something with the information you are sharing. • Give clear directions for activities; try using "first, second, third" if there are many steps OR give directions in small chunks. • Speak loudly and clearly. Face your audience. Put the information into your own words when possible.	**Your ideas:**

Teaching skill	What it looks like	Space to write your ideas
Ask a good question	• Use open-ended questions (instead of "yes" or "no" questions) whenever possible. • Wait three before me: Allow two or three children to speak before you jump in. • After asking a question, give children time to think and raise their hands by counting slowly to five in your head, before you say anything else. • React positively to child responses even if it is incorrect or off-topic, saying "Thank you for sharing your idea" or just "Thank you." • Ask: "What questions do you have?" after explaining something or giving directions. Again, wait five seconds to give children time to think. • Weave together the group conversation. Ask youth to reflect on each other's responses.	**Your ideas:**

Stevenson, A. (2023) Five essential teaching skills for teen teachers. In Maille, A., Mondl, A., & Stevenson, 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 Minnestoa. https://www.4hpolymers.org/

Adapted from: Arnold, M., Gifford, L., Deen, M., & Edwards. J. (Eds). (2015). YA4-H! Youth Advocates for Health – Teens as Teachers. Oregon State University Public Health Extension:Corvallis OR.

Handout: Attention Please!

Ideas for Gaining and Maintaining Attention

These are some attention-getters and strategies for working with groups of youth. You will want to teach the attention-getter to your group so that when you try it, they know how to respond!

1. Create a call and response. When you say "_____" They say "_____"
   Examples:

   You say: "1,2,3, Eyes on me!" They respond: "1,2, Eyes on you!"

   You say: "Chicka Chicka" They respond: "Boom Boom"

2. Say, in a normal tone of voice, "Clap once if you can hear my voice." Those listening will quiet down and clap one time. Then say, "Clap twice if you can hear my voice." More people will respond with two claps. Finally say, "Clap three times if you can hear my voice." By this time you should have the attention of your participants.

3. Tell participants that you will often be playing a game called the "Still Waters Game." They will know the game has begun when you say, "1-2-3, 3-2-1: Still waters has begun." Ask them to freeze like an ice cube or a calm or frozen lake, and remain silent when they hear that sentence.

4. Play, "Teacher (your name) Says," similar to the game, "Simon Says." For example, "Teacher (your name) says, touch your nose," "Clap once," "Stop talking," or "Sit down in your chair."

5. Bring an object that makes a sound and ask participants to stop talking, turn to you and listen when they hear it. (bell, chime, squeaky toy)

6. Create a clapping pattern. When they hear you do your clap pattern, they repeat it. Do a second time if you need more time to get them quieted.

Handout: Have a Ball – Games and Icebreakers

This packet is designed to give you some quick and easy ideas utilizing a variety of different-sized balls to increase the fun in your group with mixers, recreation, and reflection activities.

Mixers

Toss-a-Name Game

Arrange the group in a circle. One person starts off by saying the name of someone else in the circle, and tossing the ball to them. That person catches the ball, then in turn says the name of a different person who has not yet received the ball, and tosses the ball to the identified person. This continues until everyone in the circle has received the ball once. Generally, the objective is to pass the ball around the circle without dropping it. If the ball is dropped, the group restarts until completed without dropping. You can add a "thank-you, (name)" from the receiving person if you like, add additional balls to the mix or see how fast you can complete the circle of names.

Over and Under Relay

Split the group into two teams and have each form a line behind one another, giving the first person in each line a ball. When the leader says go, the first person passes the ball over their head while shouting out the name of the next individual in line to receive the ball. The next person passes the ball under their legs while shouting out the name of the next individual to receive the ball. This pattern continues until the ball gets to the end of the line. When the last person gets the ball, he runs to the front with it and starts the pattern all over again. This continues until the person that started the game returns to the front and everyone sits down.
Hot Potato Shout

Arrange the group in a circle. One person starts off by saying the name of someone else in the circle and tosses the inflatable ball into the air in the middle of the circle. That identified person runs to the middle of the circle and hits the ball to keep it up in

the air while shouting out the name of another person. This continues until everyone in the circle has hit the ball or the ball touches the floor. The object is to keep the ball from touching the floor.

Recreation

Water Bottle Bowling

Wash 10 similar size water bottles and let dry. Remove any paper or wrapping glued to the bottle. Screw on caps. If you would like add strips of green electrical tape around the bottle to look like a bowling pin. Line up the pins in a V-shape on a smooth surface. Mark off a lane of 5 to 10 paces. Roll a small, inflatable beach ball down the lane and try to knock down all of the bottles.

A What?

Take two different balls and name them "Big Black Bug" and "Slippery Slimy Snake." Form a circle or sit around a table. One person is the mastermind and holds both balls. The Mastermind passes one ball to the person on their left and says, "This is a Big Black Bug." That person says "A What?" Mastermind replies "A Big Black Bug." And it goes to the next person and is repeated back to the person handing them the object. As that ball continues to the left, the Mastermind begins the same process to the right side with the other ball saying, "This is a Slippery Slimy Snake." The person on the right says, "A What?" Mastermind "A Slippery Slimy Snake." Repeat until objects cross and return to the mastermind.

Fluff ball

Play volleyball with an inflatable ball or try baseball with a newspaper bat and an inflatable ball.

Who Has It?

Arrange the group in a circle, facing inward and holding their hands behind their backs. Have one person be "It" and stand in the middle. Put a small ball in the hands of one person in the circle. Have the individuals in the circle secretly pass the ball around behind their backs while the person in the middle tries to identify who has the ball. Switch roles when the ball is located.

Reflection

Reflection Toss

Have participants form a circle. When one receives the ball, they are to share with the group one thing they learned today or one idea they will take home with them to make their 4-H programming better.

Big Idea

Have participants form a circle. Have 3 different-sized balls to toss around the circle. Explain that if you catch the big ball, you must share one big idea that you learned about today. If you catch the medium sized ball, you must share one idea that you are still thinking about how you can use it with your group. If you catch the small sized ball, you must share one tidbit of information that was new for you today. Toss the balls in the circle, stopping after each round of catching to allow for participants to complete their sharing.

Adapted by Carrie A. Olson, University of Minnesota Extension Center for Youth Development. 2014.
Updated 2022.

Bibliography

Indoor Mixers. Salt & Light Retreat Resource Manual. Boston College.

McNeill, B., & Johnson, K. (2006). Go For the Games. University of Minnesota Extension, Center for Youth Development.

Section

5

Grades 9-12

Teen Science Change Agents:

Transforming Our Relationship with Plastics

Teens Engaging in Community Action Path

National Science Foundation

NSF Center for Sustainable Polymers

Section 5: Teens Engaged in Community Action Path

Audience

Teens in Community Action

Summary

In this path, youth will use their polymer science knowledge and ideas for addressing the challenges of plastics and develop a Community Action Project. Youth will work together to ask critical questions about our use of plastics. Using an inquiry-based learning approach that best fits your program, youth will

- develop and implement a Community Action Project focused on a specific plastic issue;
- gain knowledge, skills, and confidence to effectively serve as change agents around plastic related issues;
- learn from other change agents, both youth and adults, who are working to solve the environmental challenges of plastics.

This section guides you through several core components that are applicable across Community Action Projects, regardless of the approach you choose:

- Learn about your community
- Define the issue
- Investigate
- Take Action
- Youth-adult relationships
- Community partnerships

For more information on youth and adult partnerships and potential youth and adult roles, please refer back to Facilitator Resources Section.

Driving Questions

- What could a future look like where plastics are sustainable, non-harmful to the environment, and recycled to create energy?
- How can we each use our leadership skills to play an important role in achieving this vision?

Questions to Guide Adult Partners:

- In what ways does your program encourage youth to explore and take action around issues they care about?
- In what ways does your program provide opportunities to set goals, lead planning, and lead activities?
- In what ways does your program work with young people to build their connection to community?

Practices to Support Youth:

- Provide opportunities for youth to try different leadership roles.
- Provide time for youth to connect with community.
- Provide activities and discussions that encourage youth voice and choice.
- Provide meaningful reflection on learning.

Background Information for Facilitators

This pathway is an opportunity to partner with youth in addressing plastics in your community. What this experience looks like and how long it takes will depend entirely on your group and which project you choose. This plan includes several steps to move from forming your team to choosing a project through celebrating your impact. While these steps are linear in this guide, in practice they are not as discrete. You may find yourself moving back and forth between steps to work towards your vision.

Learning About Polymers and Plastics

As a companion to this *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. 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 build foundational skills of science and engineering: observation, asking questions and defining problems, planning and carrying out investigations, and communicating.

The curriculum includes:

- Module 1: Trends in Production and Disposal of Aluminum, Glass, Paper, and Plastic Across Time
- Module 2: Comparing the Properties of Aluminum, Glass, Paper, and Plastic
- Module 3: Life Cycles of Products We Use and Their Environmental Impacts
- Module 4: All About Polymers!
- Module 5: The Plastic Life Cycle
- Module 6: The Plastics Future: Bioplastics
- Module 7: Emerging Solutions to the Plastic Crisis

As your group develops their Community Action Project, you might find it useful to develop a deeper understanding of plastics and the complexity of how they impact the world. You can use activities from *Confronting the Plastics Crisis* to support that exploration.

Please visit https://www.4hpolymers.org/ to download the full curriculum.

Ways to Approach Your Community Action

The approach you choose will vary depending on the plastic issue youth want to address. For example, youth may want to study microplastics in the local waterway and collect data to contribute to a scientific study to help inform the public. This action project could use a citizen science approach or geo-inquiry approach, depending on the goals of your group.

Youth may want to:

- Conduct a scientific investigation including data collection and analysis.
- Embark on an action project to improve a condition in their school or community.
- Start an advocacy campaign to change a condition or policy.

The Change Agent Approach Matrix (Section 5 Handout) is a guide to help determine the best approach to use in addressing the group's question or chosen plastic issue. The Change Agent Approach Matrix includes examples of each approach and can help your team choose an action strategy. Here is a brief description of each approach:

- **Citizen science** – Youth collect data which is shared with the professional scientific community to study real-world phenomena.
- **Geo-inquiry** - Youth analyze space, place, and human conditions through maps, usually with the aid of geographic information systems (GIS).
- **Community engagement** – Youth get involved in an organized effort on behalf of a government or nonprofit organization to benefit the community.
- **Service learning** – Youth develop a project to benefit others and their community. Service learning can be a direct-service, indirect-service, or advocacy-based-service project that does not include data collection.
- **Youth participatory action research (YPAR)** – Youth define an issue and research question, conduct an investigation (data collection, analysis), and then take action based on the results. In YPAR, youth develop a project where they collect and analyze data, followed by a service-learning project informed by their data outcomes.

Activity 1:
Understanding My Community

Background Information for Facilitators

In this activity, youth will explore, define, and map their community. Community can be defined as a group of people sharing living space or a feeling of camaraderie with others because of shared attitudes, interests, and goals.

Learning Objectives

Youth will

- understand what community means for the group and define the community where your group aims to make a difference.
- understand that there are many different communities within the same geographic space.
- begin learning about your community strengths and needs.

Time Required

- 45-60 minutes depending on group size

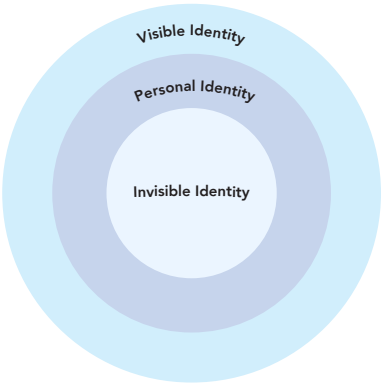
Materials

- Large whiteboard or large sheet of paper
- Markers and colored pencils
- Camera

Activity Steps

Part 1: Defining Our Community Why

1. Remind the group of their experience with the Identity Wheel activity. Each person has complex visible and invisible identities. Communities also have complex visible and invisible identities. Many communities can be layered into the same geographic space.
2. Lead youth through the key core learning experiences using the guiding questions as outlined below.



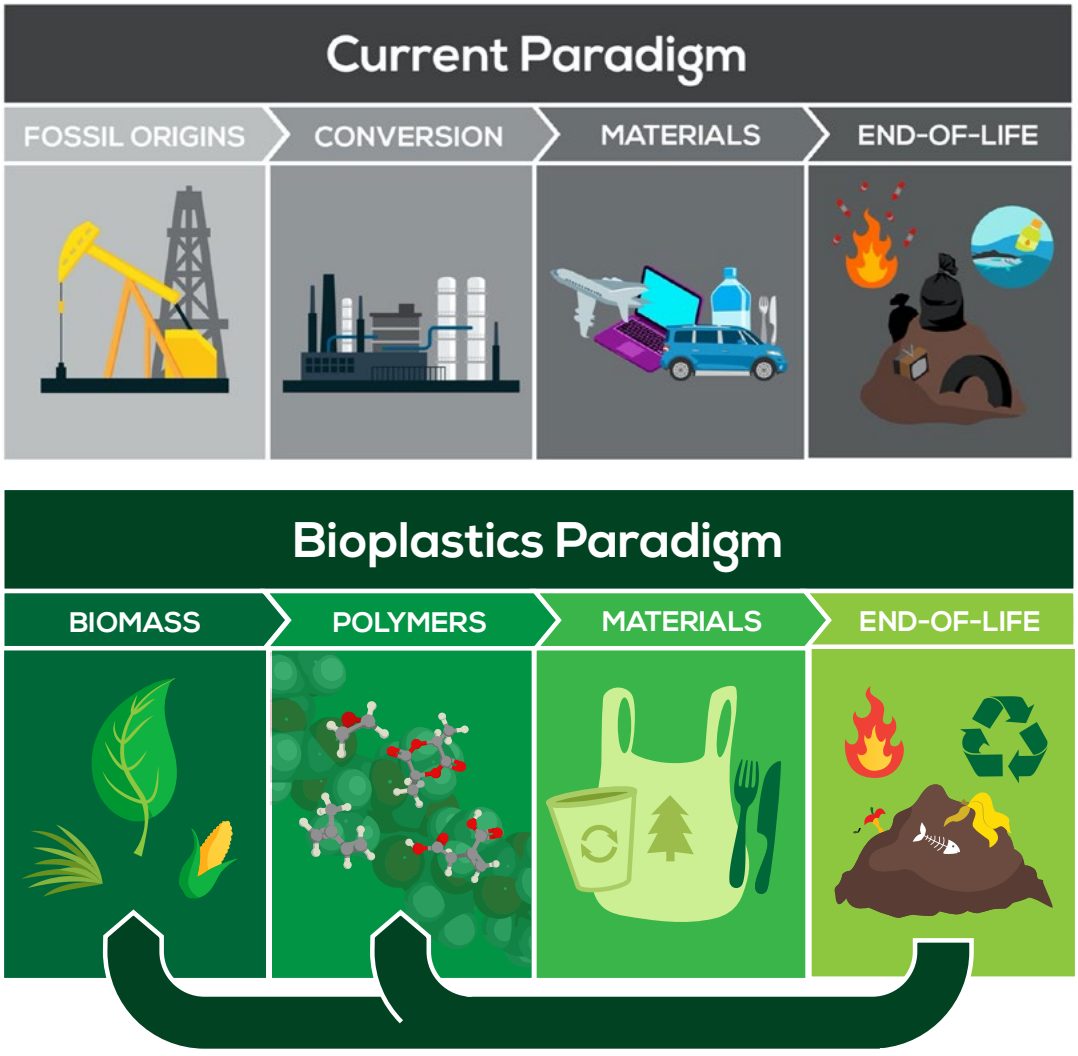
3. Give youth a few minutes to think about how they would define their community for this particular project then invite each person to draw a picture of that definition.
    - For example, if a young person were interested in their school community, what might that look like?
    - Be sure to consider boundaries: How large of a community are you considering? Whose voices are included in your definition of community? Whose voices are not included yet?
4. Invite people to share their drawings and definitions.
5. What patterns do you notice? What shared elements and what differences do you find?
6. Facilitate a group discussion to come to a shared definition for your Community Action Project. You may want to create a new drawing or write down this shared understanding.

Part 2: Mapping Our Community

1. Take a walk around your community (you might do this in person, virtually, or in your imagination). Take pictures and field notes as you tour.
    - What are your community's strengths?
    - What challenges does your community face?
    - Where do you notice plastics?
    - How do plastics contribute to the growth or challenges of your community?
2. Consider social connections and networks in your community.
    - What organizations do you know?
    - Who can help?
    - Add a layer to your map that includes these connections and resources.
    - Who is not included in this network and needs to be included?
3. This project will give you a chance to create the kind of community and world you want to live in. So, what do you hope to see in your community? Add things to your map to make it as you'd like it to be for yourself and others.

Reflection

1. Invite your group to take a few minutes for individual reflection.
2. Ask them to consider the questions below and invite them to make notes for themselves if they like.
    - What possible plastics issues can you find in your community?
    - Which issues are you interested in doing something about?



Activity 2: Discovering the Community Action Project

Background Information for Facilitators

In this activity, youth will generate, discuss, advocate, and select a handful of issues or questions to explore.

Consider leading youth through the activity referenced in the Resources Section to support youth in increasing understanding about what happens to plastic after it is used.

Learning Objectives

Youth will:

- investigate plastic related issues in their community
- selection action project to address the issues and contribute to something larger than themselves and achieve broader impact

Time Required

- 30-45 minutes depending on group size

Materials

- Large whiteboard or large sheet of paper
- Color sticky notes
- Markers and colored pencils

Activity Steps

1. Facilitate a group discussion to help youth ask critical questions about our use of plastics. Review the table below and Tips for Facilitating Group Discussions in the Facilitator Resources Section.
2. Record youths' observations, questions, and discussion on flip chart paper. This discussion will help ground youth in the larger issues as they move into discovering their action project.

3. Describe what happens to plastic after it is used.
    - How do you see your personal role in addressing plastic issues?
    - Refer to your community map. What do you see as the community's role in addressing plastic issues?
4. Lead youth through the key core learning experiences and guiding questions outlined in the table. This process will help youth generate, discuss/advocate, and select a handful of issues or questions to explore. *The goal is to have students contribute to something larger than themselves and achieve broader impact.*

Core Learning Experiences and Guiding Questions for Discovering the Action Project

Core Learning Experiences	Guiding Questions
Planning the Action Project • Youth ask questions and discuss issues related to plastics. • Youth brainstorm/generate ideas for a project/plan to address the issue. • Youth record ideas. • Youth identify what additional information is needed to select a project/plan. • Youth select a project. • Youth will identify how the project will make a positive change.	**Planning the Action Project** • What do we already know about plastics in our community? In our world? • What do we wonder about plastic use and the environment? • How do the polymer science explorations influence how we want to take action? • What information do we need to know about plastics in our community or world (research)? • What action can we take to answer or address the question or issue?

Facilitator Tip

Highlight scientist and change agents who are currently working to address real-life plastic issues using different approaches.

See change agent matrix in facilitator resources section for examples of scientists and citizens who are addressing the issue.

Activity 3: Planning the community action project

Background Information for Facilitators

Now that you identified your Community Action Project, your team will plan and prepare the various steps and ways to navigate potential barriers to completing the action.

The goal is for youth to gain project planning skills of organizing tasks, determining resources needed, and creating a project timeline.

Learning Objectives

Youth will:

- gain or improve the project planning skills of organizing tasks, determining resources needed, and creating a project timeline.

Activity Steps

Youth will plan and prepare the various steps of the action project to work towards their goals using the core learning experiences and guiding questions outlined in the table.

Time Required

- 45-60 minutes depending on group size

Materials

- Copies of handout - Change Agent Project Planning Tool
- Access to internet to conduct research, write emails, and/or connect with community members through social media
- Large whiteboard or large sheet of paper
- Markers and colored pencils

Core Learning Experiences and Guiding Questions for Planning the Action Project

Core Learning Experiences	Guiding Questions
• Youth discuss and determine project goals. • Youth identify resources. • Youth create action steps/data collection plan to guide the project. • Youth determine who will do what by when.	• What do we want to achieve in this project? • What skills do we need to accomplish this project? How could we gain them? Who can help? • Who in our community is already doing related work? How can we collaborate or support their leadership? • Who can we invite to partner with us on planning the project? (elected officials/government representatives, businesses, schools or non-profits)? • What resources do we need to help us achieve our goal? • What else do we need to know to help us be more prepared for this project? • What steps do we need to take to achieve this goal? • What is our timeline - which activities will we do when? • What are the roles for our group members (who will do what when)?

Facilitator Tip

Change Agent Project Planning Tool in the Section 5 Handouts can be used when developing a detailed project plan.

Facilitator Tip

During the process of planning the action project, youth should identify a range of people in the community that can support their action project. Before reaching out to community members, guide youth as they craft written correspondence, social media posts, and in-person interactions with community members. You may want to share effective examples. This will help youth develop and grow their communication skills and gain confidence. Please see the Facilitator Resources Section for additional resources to support youth in developing their communication skills.

Activity 4: Leading the Community Action Project

Background Information for Facilitators

Now that your team is ready to put your plan into action, youth will engage in the final project preparation steps and then experience carrying out their Community Action Project.

The goal is for youth to gain confidence through project implementation to effectively serve as change agents and engaged citizens around issues of plastics.

Learning Objectives

Youth will:

- gain confidence through project implementation to effectively serve as change agents and engaged citizens around issues of plastics.

Activity Steps

Youth engage in final project preparation steps and then experience carrying out their action plan using the core learning experiences and guiding questions outlined in the table.

Time Required

- 45-60 minutes depending on group size

Materials

- Supplies for Action Project as identified in Activity 3
- Large whiteboard or large sheet of paper
- Markers and colored pencils
- Camera

Core Learning Experiences and Guiding Questions for Leading the Action Project

Core Learning Experiences	Guiding Questions
• Youth implement an action plan. • Youth share project impact/project research. • Youth determine project sustainability.	• What final preparation steps do we need to take in order to implement the plan? • Are there additional people we can invite as we put the plan into action - peers, family members, community members, leaders, others? • How will we record what we did? • How will we share the results of our work? Is it already part of the project (for example, in a citizen science project protocol)?

Facilitator Tip

Governmental departments, elected officials, and businesses may be eager to support your action project, especially if it aligns well with their mission and goals. They may offer hands-on support of the project (e.g. setting up a tour of the local recycling center or a recycling business).

Facilitator Tip

Be sure to take pictures or video during the action project or designate a youth or adult to be the photographer.

Activity 5: Sharing and reflecting on the action project

Background Information for Facilitators

Congratulations on putting your project into action. Now your team will reflect on the action project and share results with peers, community leaders, members of their community, and other stakeholders.

The goal is for youth to evaluate the project impacts, both on the community and on their own experience.

Learning Objectives

Youth will:

- evaluate the projects' impacts, both on the community and on their own experience.
- build skills in public speaking.
- build skills in the public dissemination of scientific information.
- reflect on and celebrate achievements and personal growth.

Activity Steps

Using the core learning experiences and guiding questions outlined in the table, guide youth to reflect on the action project, share results with peers, and celebrate accomplishments.

Time Required

- 45-60 minutes depending on group size

Materials

- Supplies for Reflection/ Celebration as identified in Activity 5
- Large whiteboard or large sheet of paper
- Markers/colored pencils
- Camera

Core Learning Experiences and Guiding Questions For Reflecting on the Action Project

Core Learning Experiences	Guiding Questions
Sharing and Reflecting on the Action Project • Youth analyze and evaluate the project's impact. • Youth reflect on personal learning. • Youth publicly showcase the project. • Youth share results with community and stakeholders. • Youth celebrate project impact and personal contributions.	**Sharing and Reflecting on the Action Project** **Youth Learning:** • What ways did we impact the plastic issue in our community/ world? • What could the future of this action/project look like? • Are there new questions or ideas? • If we were to do this project again, what would we do differently? • Who else can we share our actions/finding with? • What do you think would happen if more people did this same project? **Youth Leading:** • What skills did we gain? • What was our favorite part of the project? • What was the hardest part of the project? • How do we feel about how our group worked together during the project?

Core Learning Experiences	Guiding Questions
	• What leadership skills did we gain through the project? • What communication skills did we gain as a result of our project? **Celebrating:** • Who helped us along the way? How should we thank them? • Who else can help elevate and share out our actions and findings? • How can we celebrate together?

Facilitator Tip

Use the Change Agent Project Evaluation sheet (Section 5 Handout) to evaluate the outcomes and impact of the action project as well as reflect on personal skills gained through the process. Personal reflection can also include writing, pictures, charts, or other expressions that assess the impact of the project. Create an opportunity for group reflection.

Facilitator Tip

Celebrating provides an opportunity to publicly recognize positive achievements and personal growth of youth. Depending on time available, offer a public showcase of what youth learned and accomplished during the action project. If time is limited, provide certificates of recognition.

Congratulations Change Agents!

Through the Youth as Change Agents experience, youth addressed the complex issues of plastics in our communities, our country, and our world. Youth gained valuable leadership skills by planning and implementing a plastic-focused action project reflective of their interests and passions. They successfully served as important change agents and engaged community members to imagine a new future of plastics.

Handout:
Change Agent Project Selection Tool

Here are some questions to consider:

- What is the most important plastic issue we want to help solve?
- How do we know this is a problem or issue? (What data do we have? What data do we need?)
- How can we share what we learned to help solve the problem?
- What do we want to learn during our action project?
- What do we want to accomplish in our action project?

Project ideas
Project 1:
Project 2:
Project 3:
Project 4:
Project 5:
Our project recommendation is...
We recommend:
Why do we want to do this project?
Reasons:

Handout:
Change Agent Project Planning Tool

The Change Agent Project Planning Tool can be used when developing a detailed project plan to solve a plastic issue. The planning tool outlines the tasks that need to be done, who will do them, and when they will be accomplished.

- Identify specific tasks to be accomplished in order to address the plastic issue.
- Decide when, and in what order, each task needs to be done. Make sure that you give enough time for each task.
- Decide who will be the team leader for each task. Volunteer for specific duties and stick to your commitments.

Write your project name, goal, and date(s) of service in the space below:

What are we planning to do? (Action steps)	Who is responsible?	Date to be completed	Follow-up needed
Step 1:	Person:	Date:	Follow up:
Step 2:	Person:	Date:	Follow up:
Step 3:	Person:	Date:	Follow up:
Step 4:	Person:	Date:	Follow up:
Step 5:	Person:	Date:	Follow up:
Step 6:	Person:	Date:	Follow up:

Handout:
Change Agent Project Evaluation

Action Project Title: _____ **Name:** _____

Explain how your project addressed an issue related to plastics.	**What difference do you think you made related to the challenge of plastics?**
Describe how you applied what you learned in the Polymer Science curriculum to your action project.	**If you were going to do this project again, what would you do differently? Explain how you collaborated with other groups, individuals, or organizations.**
Describe what you learned in the action project.	**How, in your opinion, could you adapt your project in the future to make it even more impactful?**