WE Are Innovators

Elementary Resource

Module 1: Sustainable Innovation

Welcome Educators

WE is committed to empowering young people to change the world through innovation. When young people are encouraged to use an innovative mindset, they can put their creativity, observation, critical thinking and problem-solving skills to work and design a new solution to issues that challenge our local and global communities.

The WE Are Innovators steps:

- Visit **WE.org/WVLC** to access resources.
- Introduce the module options and select one or more based on student interest and potential links to current classroom program or extracurricular groups.
- Use the resources to explore the issue related to the module topic.
- Learn about innovative scientific work being done and related career case studies.
- Work as innovators to create a new idea for the issue.
- Share your class or group idea online using #WEareInnovators.

Module	Students will explore
Sustainable Innovation **Guiding Questions** *How* can science combined with critical thinking and creative problem-solving skills work together to solve social issues? *How* can science be used safely while still meeting the needs of the world's population?	• What is an innovative mindset? • What types of skill sets, problem-solving styles and knowledge support an innovative mindset? • What makes a solution sustainable? • How do scientists work safely? • What does work look like in this area? How do scientists approach problems?
Circular Economy and Nature **Guiding Questions** *How* do human behavior, attitudes and mindsets about consumption contribute to a sustainable planet? *How* can science create opportunities beyond the original "reduce, reuse and recycle" approach? *How* can innovative designers contribute? *How* can nature lead us to a more sustainable world?	• What is "responsible consumerism"? • How can an innovative mindset impact product development or change a related behavior? • What does work look like in this career area?

Module	Students will explore
Food Waste **Guiding Questions** *How* does food waste impact our ability to eradicate hunger? *How* can science create ways to keep food fresher longer? *How* will food preservation ultimately save resources?	• What is meant by food waste and what are the statistics? • How does innovation in packaging and refrigeration keep food fresh? • How can technology support human behavior to prevent food waste? • What does work look like in this career area?
Energy and Housing **Guiding Questions** *How* can choices about how we build and maintain homes and buildings create efficiency? *How* does energy efficiency affect the environment?	• What makes a home energy efficient? • How exactly do building materials and products save energy? • What opportunities are there in homes and buildings that will create energy efficiency? • What does work look like in this career area?
Transportation Solutions **Guiding Questions** *How* can transportation options be accessible for all? *How* can transportation solutions be safe for both people and the planet?	• What are the physical and economic barriers to transportation in urban and rural areas? • How do conventional transportation options impact the environment? • How can science and technology support the development of sustainable transportation? • What does work look like in this area?

Meet the Experts in the Field

In this module you will meet STEM employees, chemist Dr. Danniebelle Haase and Tanesha Ellis

Our Learning Skills Legend

Argument formation	Information literacy	Leadership skills	Organization	Action planning	Research and writing	Critical thinking	Reflection

Word Bank	Materials and Resources
Innovate—Make changes in something established, especially by introducing new methods, ideas or products. Innovator—A person who introduces new methods, ideas or products. Sustainable—Meeting the needs of the present without compromising the ability of future generations to meet their own needs.	• A computer with internet access • Speakers • WE Are Innovators – Educator Planning Form • WE Are Innovators Challenge – Student Planning Form • Appendix 1: Working Toward Sustainable Innovation

Sources: **www.lexico.com**

Pre-Activity:

Sustainable Innovation

Overview:

This module is designed to aid in creating an inclusive classroom environment for students to learn, grow and collaborate. Through the module, students will understand the concept of inclusion, evaluate the inclusivity of the classroom and explore ways to build an inclusive environment inside and outside the classroom.

1. Display the word "inclusive" and invite students to create groups of 2-3 to discuss what that word means to them.

2. Ask each group to share their definitions, writing each definition or key word beside the word "inclusion", making a word web. Once students have provided their answers, share the following definition. Ask students how the definition is similar or different from their own.

Inclusion: The action or state of including or of being included within a group or structure.

3. Show students the video "Education - Collaboration", **https://www.youtube.com/watch?v=Po40I4c94R0**. Ask students to consider the definition of inclusion and how it is connected to collaboration. Do you need to be inclusive in order to collaborate? How does it impact collaboration? What are signs of an inclusive classroom/space?

4. Explain to students that now that they understand what a collaborative and inclusive space is, they are going to audit their own classroom, to see how inclusive and collaborative it is.

5. Divide students up into groups of 5-6. Invite each group to reflect, discuss and log their group answers. Display the following questions to students for reference:

a) How is your class already inclusive?

b) What do your peers and students do to make it an inclusive space?

c) What are ways you can make the classroom more inclusive?

d) How can you collaborate more as a class?

e) Why is inclusion important and how does it affect us being innovators?

6. Invite each group to present and share their answers. Make note of any common answers and display them to the rest of the class.

7. To conclude, have students reflect over the common responses and evaluate their class's environment. Remind students that today's focus was on understanding what inclusion is, and it was important to reflect so that as a class you can ensure your space is where everyone is included and can share their ideas.

Module 1:

Sustainable Innovation

Overview:

This module is designed to help students understand the importance of innovation and how developing an innovative mindset can help create ideas that can change the world. Students will explore the characteristics of an innovative mindset and will discover how these behaviors, skills and attitudes can support the development of unique and creative ideas to support people and communities around the world.

Through this module, students will be introduced to innovative people and organizations that are designing alternative products and services to address local and global problems. Students will learn how these innovators are creating sustainable innovations that help to improve working and living conditions without compromising natural resources.

Based on the case studies, students will use their creativity and imagination to work as innovators and develop an original, innovative idea of their own.

How to Use This Module:

The five parts of this module will develop student understanding of sustainable innovation and how an innovative approach from young people can be used to develop solutions for the future.

1. Exploring the Issue
Engage students in learning about social, economic and environmental issues affecting both local and global communities.

2. Thinking Outside the Box
Introduce students to people and organizations that are developing new and innovative solutions to help address local and global issues.

3. Become an Innovator
Challenge students to use their creativity and innovation skills to develop an idea that will address the environmental issues they care most about.

4. Share and Reflect
Students will be given opportunities to share ideas within the school and potentially their local community. Students will reflect on what they have learned about themselves as innovators and their power to shape the future.

5. WE Are Innovators Challenge
The best idea from the class can be show cased on a digital platform to inspire others! Don't forget to use the hashtag #WEareInnovators.

The **Educator Planning Form** and recommended module timeline are included as support resources to personalize the module to meet student needs and complement current unit plans. The module can be used as part of an existing Science unit or as part of an integrated unit that combines Science, Social Studies and English Language Arts.

The culminating activity of creating an innovative solution offers assessment and evaluation opportunities as students apply their science knowledge and skills to a real-world context.

It is important to note that internet access will be required to access videos and articles used in this module. Make sure to review your school or district's internet-use policy before you begin.

Exploring the Issue

1. Display the following quote from Albert Einstein. If students are not familiar with Albert Einstein, show a picture of him and explain that he was one of the most important scientists of the 20th century and he was also an extremely influential thinker and innovator.

"We cannot solve a problem by using the same kind of thinking we used when we created them."

2. Discuss what students think Einstein meant by this quote. What types of problems is he referring to? How might this quote have been influenced by his work as a scientist?

3. Invite students to create small groups and log any discussion answers or thoughts. In their groups, ask them to discuss the term "sustainable development." What is sustainable development? What are examples of sustainable development? Who developed this term? Explain to students that sustainable development is "development which meets the needs of the present without compromising the ability of future generations to meet their needs."

4. Display the questions below and invite students to consider the concept of sustainable development while watching the video. Show students the video "**What is sustainable development?**" **www.youtube.com/watch?v=7V8oFI4GYMY** (3:40). After students have watched the video, in their groups, encourage them to discuss the questions and log their answers using a mind map.

- What is sustainable development?
- Why is sustainable development important?
- How can each individual contribute to sustainable development?
- What is the role of organizations in sustainable development?
- What three factors must come together to ensure sustainable development occurs?

5. Show students the following four items, a paper and pencil, a typewriter and a laptop. Ask students, what is the purpose of each of these items? Invite students to consider, why was each item created if the previous item was surviving its purpose of collecting and storing information. Ask students, what is innovation? What are examples of innovation in this classroom? Why is it important to be innovative?

6. Explain to students, many individuals and organizations create items to increase efficiency, productivity and provide entertainment. Innovation is the process of developing a new idea or product. However, as we continue to use the resources of the world, it is important to consider how the resources we use to be innovative have an impact on the environment.

7. Show students the video, "**Sustainable Innovation**", **www.youtube.com/watch?v=E3QXVLleetg** (1:55). Ask students, if they were creating a new product, what are some important questions that they need to consider during the design stage of the product. Encourage them to think about where the resources are coming from to develop the product, who is the consumer, how will the product impact the environment? Ask students, why is sustainable innovation important for the future of the planet?

8. Display the following statements separately:

- Innovators Are Curious
- Innovators Are Problem Solvers
- Innovators Are Risk-takers
- Innovators Are Empathetic
- Innovators Are Resilient

9. Prepare the classroom for a carousel activity by displaying one statement from the list provided in point 8 to the classroom.

10. Divide students into five groups.

11. Explain to students that a statement will be displayed to them. They will have three minutes to brainstorm how the attitude or way of thinking regarding the statement shown to them helps innovators transform ideas into valuable products and services.

> **Educator's Note:** Make sure to clarify each statement for students. If students need more support, provide an example before students begin the activity. For example: Being curious can help innovators investigate problems or issues that others may not consider.

12. After three minutes, allow all groups to share their brainstormed thoughts. Invite students to either add on to what has already been shared or they can add any new ideas of their own. Continue these steps until all statements have been responded to.

13. Once students have responded to the last statement, ask a representative from each group to summarize their learnings.

14. Answer any questions or clarify any misunderstandings that may have come up during the activity. Leave answers from the brainstorming carousel activity for the class to refer throughout the module.

15. To conclude, ask each student to log a reflection to the comment, "An innovator is…" or create a visual representation to describe what it means to have an *innovative mindset*.

Thinking Outside the Box

1. To begin, show students "GreenChar - An Innovate Kenya '13 Winner", **www.youtube.com/watch?v=11UchSYXM_g** (2:54).

2. Discuss:
- What problem was Tom Osborn trying to solve or what process was he trying to improve?
- Why was this an innovative idea?
- What motivates Tom's actions?

3. Explain to students that innovators are often motivated to solve problems affecting people around the world. When innovators develop ideas that aim to help many people over a long period of time without harming the environment, this is called *sustainable innovation*. Sustainable innovation aims to find solutions that provide safe living and working conditions for people, while also protecting the environment.

GreenChar is an example of sustainable innovation. Instead of cutting down trees to make charcoal, the company uses agricultural waste (sugar cane husks, cassava peels, etc.) to produce its briquettes. Not only is this solution addressing the problem of household pollution, but it also makes sure that natural resources are not being wasted.

4. Use one or more of the following options and the guiding questions to explore how people and organizations are developing sustainable innovations to solve problems around the world.

Option 1: Science and Sustainable Innovation

One of the United Nations Sustainable Development Goals is to advance the well-being of humanity by helping lead the transition to sustainable planet and society. To learn more about United Nations Sustainable goal, check out **https://www.un.org/sustainabledevelopment/cities/**. To learn more about company's tackling the UN sustainable development goal, check out **https://medium.com/proofofimpact/how-7-companies-help-tackle-the-un-sustainable-development-goals-b06a83d80785**.

Scientists and employees are working in the areas of chemistry and technology to find sustainable solutions to some of the most urgent problems affecting the world today.

- Dr. Danniebelle Haase is passionate about developing paints used to coat metal and wood that are water-based and healthier for people and the environment. To learn more about Dr. Haase and her work, check out Appendix 1: Working Toward Sustainable Innovation.

- Tenesha Ellis is an Outside Production Technician in the Ethylene Unit at a site in Louisiana. She uses her skills to maintain the safety of the plant and she is passionate about being part of a team that manufactures products people use in their everyday lives. To learn more about Tenesha and her work, check out Appendix 1: Working Toward Sustainable Innovation.

Guiding Questions:

a) Why are companies developing goals to support sustainability?

b) What skills or knowledge in science and technology do employees like Dr. Haase and Tenesha Ellis use in their work?

c) What positive impact does their work have on people and the environment?

d) How does their work represent sustainable innovation?

e) How can companies aim to protect the safety of people while also protecting the environment?

Option 2: Planet Abled

Neha Arora, an Indian engineer, is committed to providing accessible travel and leisure activities for people with a variety of disabilities. Planet Abled aims to help people travel regardless of their disability.

- **www.planetabled.com**

- "Planet Abled: Meet the Woman Making Travel Accessible for Disabled People in India", **www.independent.co.uk/travel/asia/planet-abled-accessible-travel-india-disabled-disability-universal-design-a7948901.html**

- "Planet Abled Turns One - Happy Travelling 2017", **www.youtube.com/watch?v=8Hmb52-Gwjs** (2:22)

Guiding Questions:

a) What problem is Neha Arora trying to solve or what process is she trying to improve?

b) What positive impact does this idea have on people and the environment?

c) Why is this an innovative idea?

d) What motivates her actions?

e) How does her idea represent sustainable innovation?

f) How does it aim to protect the safety of people while also protecting the environment?

Option 3: Flybot

Mihir Garimella is a college student who is designing small flying robots that can be used by first responders during natural disasters and in other danger zones. His inspiration comes from nature and he hopes to develop technology that is efficient to use and inexpensive to produce.

- "Mihir Garimella", **www.tedxteen.com/speakers/mihir-garimella**

Guiding Questions:

a) What problem is Mihir Garimella trying to solve or what process is he trying to improve?

b) What positive impact does this idea have on people and the environment?

c) Why is this an innovative idea?

d) What motivates his actions?

e) How does his idea represent sustainable innovation?

Become an Innovator

1. Divide students into small groups and challenge them to use an innovative mindset to design a product or service that aims to solve a social, economic or environmental problem. Remind students that designing an innovative solution may seem difficult at first, but they should use their imagination and challenge themselves to consider ideas that have never been tried before. Post the criteria for an innovative mindset on the board for reference.

2. Provide each student or group with a copy of the Student Planning Form to support their work.

> **Educator's Note:** Explain to students that innovators and scientists must think about their own safety and the safety of those around them. They must always consider hazards or safety risks while they are working or developing their ideas. Discuss each group's idea and identify any health or safety risks they might present. For example: If students will need tools to develop their ideas, they must consider what safety equipment will be required to use those tools.

3. Inform students that once they have designed their idea, it will be presented to the class. Advise students on the presentation format options available.

Share and Reflect

1. Ask each group to present their idea. This is a time for students to receive peer and/or teacher feedback. The process of answering questions, clarifying ideas and justifying their thinking will encourage students to continue to develop their skills and mindset as innovators.

> **Educator's Note:** If this presentation will be used to assess students' knowledge and skills based on curricular expectations, it's important to first establish research and/or presentation criteria with students so they are clear about what is expected.

2. As innovative ideas are completed, create an opportunity for students to present their ideas to other classes in the school, to parents or to other community members. This will not only allow students to celebrate their achievements, but to also raise awareness of how science and sustainable innovation can have a positive impact on issues they are passionate about. Consider using one of the following options:

- Host an "Innovation Fair" where students display and present their ideas in school or a large meeting area and present them to other classes, parents or community members.

- Ask each group to create a short presentation and record it. Share the video on the school website or other social media platforms. Make sure to refer to the school or district internet-use policy before posting anything online.

3. Collect all **Student Planning Forms** and presentation materials and conclude the module by asking students to log a reflection in response to one of the following questions:

- What have you learned about the importance of an innovative mindset and approach?

- How can innovation in science create positive change in local and global communities?

- To what extent do you see yourself as an innovator?

- What skills or attitudes do you still need to develop?

- How has this experienced changed the way you feel about the power of science to solve problems and challenges in the world?

4. Encourage students to make connections to the United Nations Sustainable Development Goals. Introduce students to the United Nations Sustainable Development Goals by showing them **"The World's Largest Lesson 2016", www. vimeo.com/178464378**. Examine the purpose of the goals and what each of the 17 goals are by visiting **www.un.org/ sustainabledevelopment/sustainable-development-goals/**.

Challenge students to justify how their innovative idea supports one or more of the Sustainable Development Goals. Investigate how to contact the United Nations and ask each group to compose a letter to send that outlines their idea and how it would contribute to achieving the goal(s) by the UN's 2030 deadline.

WE Are Innovators Challenge

1. Challenge students to showcase their idea to their school, community or online.

2. Students will need to describe the idea and its potential impact on the issue, and take photos of any prototypes or models created.

3. Share the idea online using #WEareInnovators.

Appendix 1: Working Toward Sustainable Innovation

Dr. Danniebelle Haase

What is your role?

I am the lead synthetic chemist in the Coating Materials' industrial coatings segment. I've been with the company for more than four years, and my job is to use chemistry to create new ways to make paint and wood coatings for customers all over the world.

What is your educational background?

I grew up in Jamaica, where I attended college and earned a bachelor's degree in both chemistry and management. I then attended the University of Florida, where I obtained a Ph.D. in organic chemistry, with a minor in medicinal chemistry. After graduating, I pursued post-doctoral studies at the University of Pennsylvania, where I helped develop biosensors to guide the treatment of lung cancer patients.

What brought you to STEM?

After attending a chemistry conference, a job recruiter recommended that I consider an industry position. I was excited to be offered a job in STEM and accepted a research position in the coatings segment of the company.

What do you like most about your job?

The best part of my job is the challenge of designing high-performance polymers, which are used in paints and other coatings for buildings, bridges and homes. I enjoy the research involved in producing coatings that beautify our world, and it's really exciting to make a connection between the research in the lab and real life. It is also very rewarding to see a product that I developed on store shelves, knowing that it is going to help others.

What does being an innovator mean to you?

To me, an innovator is someone who does something to make the world a better place. I strive to be a radical innovator, someone who is a technology disruptor!

How can science, critical thinking and creative problem solving work to solve social issues?

In the past, it was normal for paints to contain a large amount of dangerous substances. When these substances all come together, they have a negative effect on the environment and human health. Through science, we've developed water-based paints, which are more sustainable, limit the amount of waste in the environment and pose fewer health risks to humans.

How do scientists approach problems?

We are always looking for ways to improve quality of life. Our scientists find ways to make products work better through sustainable solutions, which are discovered through research, discussions with other researchers and exploring new fields.

What types of skills and knowledge are needed for careers in STEM (Science, Technology, Engineering and Mathematics)?

You need to be hard working, have endurance to stay focused on a problem through successes and failures and you need to be able to work well with other scientists and engineers as you collaborate throughout the process. Overall, you must be open to learning new things by interacting with others and researching ideas.

How do jobs in fields like science, engineering and manufacturing contribute to innovation?

These jobs improve our quality of life through innovative discoveries. For example, we have sustainable products such as smart-coatings that help improve air quality, materials that help keep our food fresh, materials that can improve safety and noise level in cars, and coatings for buildings and bridges that can improve the length of service they provide to the public.

Appendix 1: Working Toward Sustainable Innovation

Tenesha Ellis

What is your job?

I have been an outside production technician in an ethylene unit for the past two years. I help maintain the safety of the plant and make quality ethylene, which is used to make a lot of plastic items, like Ziploc bags, water bottles and Saran wrap. I also do a lot of hands-on work, from checking levels of oil in pumps to adjusting equipment.

Where did you go to school?

I attended Thibodaux High School for three years and then transferred to Saint James High School my senior year; I then continued my education at ITI Technical Community College of Baton Rouge, LA, where I graduated with an associate's degree in process technology.

How did you start working in STEM?

I heard about an internship opportunity right around the time I was about to graduate. I did some research on the company and found out how safe and diverse it was, so I decided to give it a shot and apply. I was offered the internship and it led me to where I am today! I haven't looked back since.

What do you like most about your job?

I really like how hands-on my job is! I am able to learn new things almost every day, so no two days are exactly the same. I like the challenge of trying to troubleshoot equipment and the feeling you get when you figure it out—knowing you're keeping the plant running safely. I also love that I'm part of a team that makes products we use in our everyday lives! Besides all that, the people I work with are great; they're like a second family. Knowing my coworkers have my back helps relieve a lot of work stress.

What does being an innovator mean to you?

Being an innovator means a lot to me because I'm helping to change things around the world. We're constantly pushing ourselves to make new and better products, and for that I'm very grateful. For example, I'm able to walk down a grocery aisle and see cleaning products and garbage bags that I might have had a hand in making!

How does a scientist approach a problem?

It's all based on experience—if you're a new scientist you won't approach a problem the same way as someone with 10 years of experience would. With that being said, we all use our critical-thinking skills to fix problems with our equipment. We normally pull trends of data to see when things started to go wrong or we adjust the equipment. For example, we might close a valve to prevent releases of chemicals into the atmosphere. Our ultimate goal is to see what caused the problem in the first place, and then go from there.

What type of skills and knowledge are needed for careers in STEM?

Well, first off, you should have a curiosity for one of the STEM subjects: Science, Technology, Engineering or Math. You also should be a people person because there are so many different types of personalities working in STEM. Also, be ready to work with your hands a lot!

How do jobs in fields like science, engineering and manufacturing contribute to innovation?

We contribute to innovation by improving products and making them more easily accessible—without us we might still be doing things like making soap by hand! STEM jobs are all about innovation and creating change.

WE Are Innovators - Educator Planning Form

Lesson	Length (# of days)	Start Date	End Date
Exploring the Issue			
Thinking Outside the Box			
Becoming an Innovator			
Share and Reflect			
WE Are Innovators Challenge			

Learning Goals:

Personalize to fit within your school district context and long-range program goals.

-
-
-

Curricular Expectations and/or Outcomes to Be Assessed:

How will I connect this to my existing curricular expectations?

-
-
-

Grouping:

☐ Small groups

☐ Whole class

☐ Other: _____

_____

Integrated unit: ☐ Yes   ☐ No

Subject areas:

Opportunities for Cross-curricular Planning:

What connections or links can I make to other subject areas?

☐ English Language Arts:_____

☐ Communications/Technology:_____

☐ Social Studies (History/Geography): _____

☐ Science: _____

☐ The Arts (Visual or Performing Arts): _____

☐ Other: _____

Options for Summative Assessment:

☐ Presentation

☐ Product: _____

☐ Reflection

☐ Other: _____

Planning Considerations:

What resources will I need to help students create and present their ideas? Who will I need to consult?

Options for Extension/Enrichment:

How can the class or individual students go beyond the WE Are Innovators Challenge?

WE Are Innovators Challenge - Student Planning Form

What area of innovation will I focus on?

- [ ] Sustainable Innovation
- [ ] Environmental Protection
- [ ] Food Waste
- [ ] Energy and Housing
- [ ] Water Access and Reuse

What are my key dates?

Draft due:

Final version due:

Presentation:

What problem am I trying to solve?

Why is it important to me?

Guiding Questions

- How does this problem affect people, animals or the environment?
- In which region, country or city does this problem occur most?
- What information do I still need to find out?

What do I already know about the problem?

Guiding Questions

- How will these ideas help to solve the problem?
- Which idea do I think will work best?
- How will it have a positive impact on people and the environment?

What ideas could help to solve this problem?
List all your ideas, even those that seem impossible!

WE Are Innovators Challenge - Student Planning Form

Guiding Questions	**How will my idea work?**
• What do I need to do first?	Use words and images to make a plan for your idea.
• What steps will I take?	
• What will my idea look like?	
• Where can I access the materials and resources I will need?	
	What materials or resources will I need?
	Consider what building materials, tools or technology you will need and what type of space you will require to work. For example: glue gun, cardboard/wood, laptop, etc.
	What could the hazards or safety risks be?
Guiding Questions	**What challenges or problems could I face? How will I resolve them?**
• Who can I ask for help?	