

WE Are Innovators

Elementary Resource

Module 5: Transportation Solutions

AN INITIATIVE OF



MADE POSSIBLE BY



Welcome Educators

In partnership with Dow, 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:

- 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
- Submit one idea per class or group for a chance to win a financial grant for your school and join on a ME to WE Service Trip!

| Module | Students will explore |
|---|--|
| <p>Sustainable Innovation </p> <p>Guiding Questions</p> <p><i>How can science combined with critical thinking and creative problem-solving skills work together to solve social issues?</i></p> <p><i>How can science be used safely while still meeting the needs of the world's population?</i></p> | <ul style="list-style-type: none"> • 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 Dow scientists approach problems? |
| <p>Circular Economy and Nature </p> <p>Guiding Questions</p> <p><i>How do human behavior, attitudes and mindsets about consumption contribute to a sustainable planet?</i></p> <p><i>How can science create opportunities beyond the original "reduce, reuse and recycle" approach?</i></p> <p><i>How can innovative designers contribute?</i></p> <p><i>How can nature lead us to a more sustainable world?</i></p> | <ul style="list-style-type: none"> • 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 |
|---|--|
| <p>Food Waste </p> <p>Guiding Questions</p> <p><i>How does food waste impact our ability to eradicate hunger?</i></p> <p><i>How can science create ways to keep food fresher longer?</i></p> <p><i>How will food preservation ultimately save resources?</i></p> | <ul style="list-style-type: none"> • 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? |
| <p>Energy and Housing </p> <p>Guiding Questions</p> <p><i>How can choices about how we build and maintain homes and buildings create efficiency?</i></p> <p><i>How does energy efficiency affect the environment?</i></p> | <ul style="list-style-type: none"> • 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? |
| <p>Transportation Solutions </p> <p>Guiding Questions</p> <p><i>How can transportation options be accessible for all?</i></p> <p><i>How can transportation solutions be safe for both people and the planet?</i></p> | <ul style="list-style-type: none"> • 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? |

Visit www.WE.org/we-schools/program/campaigns/we-are-innovators to download the application.

Our Learning Skills Legend



Argument formation



Information literacy



Leadership skills



Organization



Action planning



Research and writing



Critical thinking



Reflection

| Word Bank | Materials |
|---|--|
| Innovate—Make changes in something established, especially by introducing new methods, ideas or products. | <ul style="list-style-type: none"> • A computer with Internet access, speakers • Chart paper • Markers • Appendix 1: Working Toward Sustainable Innovation • WE Are Innovators – Educator Planning Form • Innovators Today Challenge – Student Planning Form |
| Innovator—A person who introduces new methods, ideas or products. | |
| Transportation—A system or means of transporting people or goods. | |
| Sustainable—Meeting the needs of the present without compromising the ability of future generations to meet their | |

Sources:

www.oxforddictionaries.com

Module 5:

Transportation Solutions



Overview:

This module is designed to help students understand that conventional transportation options in towns and cities around the world can have negative impacts on both people and the environment. Students will learn how issues of safety, accessibility, and air and water pollution make many of these transportation options unsustainable.

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.

Based on the case studies, students will use their creativity and imagination to develop an original, innovative idea of their own to contribute to sustainable transportation solutions.

One idea from each group or class can be submitted to the **WE Are Innovators Challenge!**

How to Use This Module :

The five parts of this module will develop student understanding around issues of transportation 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 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 protect the environment.

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 their ideas within the school and potentially their local community. Students will reflect on what they have learned about themselves as innovators and the power they have to shape the future.

5. WE Are Innovators Challenge

Encourage students to submit their ideas to the WE Are Innovators Challenge!

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:

Educator's Note: Based on discussions and case studies presented in this module, students will explore how innovators use creativity, observation, critical thinking and problem-solving skills to identify and understand problems or issues, and how they develop unique and effective ways of seeking solutions. They will learn how innovators often see large and complex problems as challenges and focus on possibilities first and the obstacles second. Students will see how resilience and reflection help innovators overcome obstacles and adjust until their idea is the best it can be. Albert Einstein once said, "We cannot solve a problem by using the same kind of thinking we used when we created them."

1. Pose the following question to the class: If I wanted to go from one side of our town/city to the other, what are all the different ways I could get there?
2. As a class, use the question above to investigate all the different transportation options available in your community. Choose one of the following options to collect data:
 - Distribute a survey to students in the class, students and staff in the school or members of the community
 - Interview a representative from the local government or a member of the local transit authority
 - Conduct research using local government websites and municipal records
3. Record each of the modes of transportation available to people in your community on separate pieces of chart paper.
4. Divide students into groups and assign each group to one of the pieces of paper. Ask students to brainstorm the issues or problems each of these modes of transportation could cause for people or the environment. For example: The town or city has a bus system, however, the buses use diesel fuel that pollutes the air and the cost of taking the bus is not accessible for everyone.
5. Once students have had a chance to respond, ask them to rotate to the next piece of paper, review what the previous group wrote and add additional ideas.
6. After each group has responded on all the pieces of paper, review the issues students highlighted and divide them into categories. Examples of categories could be: Cost, Pollution, Access, etc.
7. Explain to students that governments, scientists, architects and innovators around the world are looking for ways to solve these issues by designing sustainable transportation solutions. Sustainable transportation can be described as transportation options that are:
 - Low-emission
 - Active

- Safe
- Equitable
- Resilient
- Ecological
- Beautiful

Source: <https://www.asla.org/sustainabletransportation.aspx>

Educator's Note: If students are unfamiliar with any of the vocabulary listed above, take a moment to discuss each term before moving on.

8. Divide students into seven new groups and give each group one of the terms listed above. Ask students to brainstorm why that term has been included in the definition of sustainable transportation and how it connects to one of the issues identified earlier. Ask a representative from each group to share their thinking with the class.
9. Show students one or more of the following videos to demonstrate how different cities are implementing sustainable transportation solutions:
 - a) "The Buses of Bogotá," *The New York Times*, www.youtube.com/watch?v=cU6ImWY4IBc (2:20)
 - b) "Welcome to Copenhagen, the City Where Cycling Is King," www.cnbc.com/2018/02/23/welcome-to-copenhagen-the-city-where-cycling-is-king.html (2:11)
 - c) "India: Mysuru's SMART Public Bus Transport for Livable Cities," www.youtube.com/watch?v=qttS2HnOFGY (5:17)
 - d) "Autonomous Buses Go on Trial in Shenzhen," www.youtube.com/watch?v=6bIB-ihPrX8 (1:44)
10. In an oral or written reflection, ask students to share their reactions to these sustainable transportation solutions. How do these options impact people and the environment? Do these options align with the definition of sustainable transportation? Why or why not? What questions do you have about these options?

Educator's Note: If students have further questions about any of the options presented in the videos, consider providing time for them to investigate these projects in more detail individually or as a class.



Extension: To continue to explore how science and innovation are helping to address transportation issues, encourage students to investigate and connect with local social entrepreneurs or nonprofit organizations that are developing new and sustainable ideas in this area. This experience will help students to deepen their learning in preparation for creating their own innovative idea.

Thinking Outside the Box:

Educator's Note: To prepare for the next activity, prepare 10–15 slips of paper with different ways individuals, businesses and cities can improve their local transportation. Explore the article "101 Ways to Improve Transportation in Your City," www.curbed.com/2017/9/20/16317036/best-transportation-ideas-cities-transit for additional ideas.

1. Divide students into pairs and give each pair one of the slips of paper. Ask students to review the paper and discuss:
 - a. How the idea aligns with the definition of sustainable transportation
 - b. Whether or not this idea could be an option in their town or city
 2. Give students two to three minutes to discuss and then ask them to trade papers with another pair and discuss the new idea.
 3. If time permits, give students time to discuss four or five different ideas. Depending on the needs of your students, this activity can be done seated at desks or tables, or while moving around the classroom.
 4. Explain to students that these ideas are examples of new and innovative ways that individuals, governments and business can advocate for transportation options that are safe and accessible for all.
- Educator's Note:** An innovative idea is a new or creative idea that changes the way we think about a problem. At first, innovative solutions may seem impossible or unrealistic, but the innovators who create them use their imagination and perseverance to bring these ideas to life. Post this definition in the class for students to refer to throughout the module. Source: www.oxforddictionaries.com
5. Use one or more of the following options and guiding questions to explore how people around the world are working to find new and different sustainable transportation solutions.

Option 1: A New Approach to Vehicle Design

Dow is a leader in sustainable innovation. Their 2025 Sustainability Goals are designed to support the United Nations Sustainable Development Goals and to advance the well-being of humanity by helping lead the transition to sustainable planet and society. To learn more about Dow's 2025 Sustainability goals, check out www.dow.com/en-us/science-and-sustainability/2025-sustainability-goals.

- Esther Quintanilla is a marketer for automotive products at Dow in Horgen, Switzerland. She is passionate about taking on challenges and finding new and innovative solutions. In her work at Dow, she recognizes the importance of developing new technology for vehicles that keeps them lightweight, quiet, energy efficient and low-emission. To learn more about Esther and her work, check out **Appendix 1: Working Toward Sustainable Innovation**.

Educator's Note: To learn more about the future of automotive mobility check out "More Change in the Next 5 Years than in the Last 50" rfina.ca/2016/07/08/the-next-revolution/.

- Bindu Krishnan is a senior scientist working in the Research & Development department at Dow in Freeport, Texas. Through her research, she is committed to finding ways to use adhesive technology to create cars that are lighter, more fuel efficient and safer to drive. To learn more about Bindu and her work, check out **Appendix 1: Working Toward Sustainable Innovation**.

Guiding Questions:

- a) Why is Dow committed to finding new and innovative ways to design vehicles?
- b) What skills or knowledge in science and technology do Dow employees like Esther Quintanilla and Bindu Krishnan use in their work?

Educator's Note: Working Toward Sustainable Innovation is available at two different reading levels to meet the needs of all your students.

Option 2: Exploring Accessibility Mapping

Research shows that over 18 million people in the United States have mobility issues (Source: www.ncbi.nlm.nih.gov/pmc/articles/PMC1495195/). This means they experience barriers that limit their ability to move around their environment. Explore the links below to see how innovators are developing new ways to make transportation accessible for all.

- Maayan Ziv is a young innovator who is using crowdsourcing technology to create an app that maps the accessibility of locations around the world. Use the following links to check out Maayan's work:
 - "AccessNow," accessnow.me/
 - "The Future Is Accessible," www.WE.org/stories/young-innovators-break-accessibility-barriers/
- Jason DaSilva is committed to finding ways to help people with disabilities be spontaneous about where they eat, shop, work and play. He created the online and mobile app Axs Map that allows people to review the wheelchair accessibility of locations in their local area.
 - "What Is Axs Map?" wheniwalk.com/axs-map/
 - "Introducing AXS Map!" <https://www.youtube.com/watch?v=DFswxhQj6UI> (1:49)
 - "Axs Map," www.axsmap.com/

Guiding Questions:

- What problems were Maayan and Jason trying to solve, or what processes were they trying to improve?
- What positive impact does this technology have on people and the environment?
- Why is this an innovative idea?
- How does this technology represent sustainable innovation?

Become an Innovator:

1. Divide students into small groups and challenge them to choose a transportation issue and create a new and innovative way to approach it. 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. Refer to the innovative mindset and behaviours discussed earlier.
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 as they return to their idea and make adjustments or revisions.

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 also to take action and raise awareness for issues around access to transportation in their local and global communities. Consider using one of the following options:

- Host an "Innovation Fair" where students can display and present their ideas at different stations in the school library 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 using video recording software. 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 write a reflection in response to one of the following questions:
 - What have you learned about the importance of an innovative mindset and approach?
 - To what extent do you see yourself as an innovator? What skills or attitudes do you still need to develop?
 - How has this experience 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 innovation 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 what their idea is and how it would contribute to achieving the goal(s) by the UN's 2030 deadline.

WE Are Innovators Challenge:

1. Challenge students to submit their idea to the WE Are Innovators challenge.
2. Students will need to describe the idea and its potential impact on the issue. Take photos of any prototypes or models students created.
3. To submit an idea, download the application form from www.WE.org/we-schools/program/campaigns/we-are-innovators.

Appendix 1: Working Toward Sustainable Innovation

Bindu Krishnan

What is your role at Dow?

I am a senior scientist working in research and development for Dow in Freeport, Texas.

What is your educational background?

I have a master's degree in Organic Chemistry and a Ph.D. in Organic Polymer Chemistry from the University of Bordeaux in France. After my Ph.D. I took a two-year break to start a family and spend time with my daughter. Then, I pursued my post doctorate at Goodyear Polymer Center at the University of Akron.



What brought you to Dow?

Dow is a well-recognized, science-focused company and I always wanted to work here. However, I wasn't sure I would ever get the opportunity. Growing up my mother always said, "Dream big. They do come true." So now here I am working for DOW and I know it's because I believed in it.

What do you like most about your job?

It's challenging, I'm always learning. I get to use my creativity every day to find solutions to real life problems. This job is always interesting and intriguing.

What does being an innovator mean to you?

As an innovator, I am proud to be part of the solution and help to make life better for us all. Innovation means making things better and improving our quality of life while preserving our environment for future generations to enjoy.

Appendix 1: Working Toward Sustainable Innovation

Esther Quintanilla

What is your role at Dow?

I am a marketer for interior, exterior and under-the-hood automotive products at Dow in Horgen, Switzerland.

What is your educational background?

I have my undergraduate degree in physical organic chemistry and a Ph.D. in chemistry. I did my post-doctorate work in Switzerland in chemistry and chemical engineering.

What brought you to Dow?

The common path after post-doctorate work would have been to go into academia, but with the good advice of a professor I applied to Dow. I wanted corporate experience and was interested in being at an organization that was open and innovative.

What do you like most about your job?

I love solving customer issues. I can help the customer, listen to their problems and provide them with a solution using my technical background.

What does being an innovator mean to you?

An innovator is someone who can provide an out-of-the-box solution to a challenge. With the pace of how the world is changing and new technology is developing, an innovator needs the confidence, resilience and motivation to dive in and tackle those challenges.



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.

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-
-

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

| | |
|---|---|
| <p>What area of innovation will I focus on?</p> <p><input type="checkbox"/> Sustainable Innovation</p> <p><input type="checkbox"/> Environmental Protection</p> <p><input type="checkbox"/> Food Waste</p> <p><input type="checkbox"/> Energy and Housing</p> <p><input type="checkbox"/> Transportation Solutions</p> | <p>What are my key dates?</p> <p>Draft due:</p> <p>Final version due:</p> <p>Presentation:</p> |
| <p>What problem am I trying to solve?</p> <p>Why is it important to me?</p> | |
| <p>Guiding Questions</p> <ul style="list-style-type: none">• How does this problem effect 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? | <p>What do I already know about the problem?</p> |
| <p>Guiding Questions</p> <ul style="list-style-type: none">• 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? | <p>What ideas could help to solve this problem?</p> <p>List all your ideas, even those that seem impossible!</p> |

WE Are Innovators Challenge - Student Planning Form

| | |
|--|--|
| <p>Guiding Questions</p> <ul style="list-style-type: none">• What do I need to do first?• What steps will I take?• What will my idea look like?• Where can I access the materials and resources I will need? | <p>How will my idea work? Use words and images to make a plan for your idea.</p> <p>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.</p> <p>What could the hazards or safety risks be?</p> |
| <p>Guiding Questions</p> <ul style="list-style-type: none">• Who can I ask for help? | <p>What challenges or problems could I face? How will I resolve them?</p> |