Innovation

Inquiry Question: How can we innovate to improve the world around us?

Inquiry Product: 2D Product (Whole Class)

Unit Description:

Students investigate how innovation touches every facet of life – past, present, and future. Through historical photos, oral histories, patent drawings, and even a legend, they investigate how innovation has led to significant changes in the way that people live, work, travel, communicate, and play. Students consider how innovation changes society as a whole as they make their own blueprints for inventing a better world.

LAUNCH

Module 1: Launch the Unit

Materials and Prep Guide

This module is designed to hook students into the inquiry process through an engaging, thought-provoking activity. The Inquiry Question is introduced and students' initial Investigation Questions begin to surface. There is no pre-teaching required to start students on their inquiry journey.

Objectives

- Make predictions, observations, and inferences about innovative people, ideas, and objects
- Use sources to draw conclusions about the meaning of a vocabulary term ("innovative")

Checkpoint Assessment

- As an informal pre-assessment, observe the class discussion and review "Predict Investigate Conclude" handouts to gauge prior understanding of concepts and critical thinking; look for:
  - Accuracy of predictions about key term ("innovative")
  - Conclusions about the definition of the key term ("innovative") reflects content of the sources

Lesson & Description	Outcome
Core Lesson 1. Hook Activity: Recognizing Innovation Students examine examples of innovative objects, ideas, and people in order to uncover what it means to be innovative. Then, they are introduced to the challenge that will guide this unit: an investigation into the ways in which innovations have changed lives and communities. This lesson is designed to spark curiosity and excitement in response to the Inquiry Question as well as provide an opportunity to pre-assess concepts central to this unit.	• Make predictions, observations, and inferences about innovative people, ideas, and objects • Use sources to draw conclusions about the meaning of a vocabulary term ("innovative") • Engage in collaborative discussion
Core Lesson 2. Generating Investigation Questions Students are introduced to a modified version of the Question Formulation Technique (QFT) to generate Investigation Questions that will guide their exploration of the past, present, and future of innovation.	• Generate meaningful questions about invention and innovation with support of question words (Who, What, Where, When, Why, How) • Evaluate and select Investigation Questions

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Module 2: How has innovation changed daily life?

Materials and Prep Guide

Students investigate the stories behind inventions that have brought about significant changes in transportation, communication, health and safety, and manufacturing. Through informational texts, historical images, and oral history interviews, students gain a better understanding of how innovation has led to significant changes in the way people live, work, and play. Throughout the module, students practice sequencing key innovations on a timeline that will be populated throughout the unit.

Objectives
• Analyze historical sources to gather information about the past
• Describe common sparks and impacts of innovation
• Use evidence to evaluate the impact of a specific invention or innovation
• Sequence – and investigate relationships between – events on a timeline
	Checkpoint Assessment
	• Review "Reflecting on Everyday Inventions" handouts to assess content understanding; look for:
	  ◦ Cites evidence from sources to explain the spark and impact of an innovation
	  ◦ Gives an example of everyday invention or innovation that impacts their daily life
	  ◦ Gives an example of an innovation that might improve an everyday object
	• Use the "Module 2 Observations" teacher worksheet during the discussion activity to assess content understanding; look for:
	  ◦ Gives examples to describe sparks and impacts of innovation
	  ◦ Generates questions about historical innovations and their impacts
	  ◦ Cites evidence to draw conclusions about how innovation has changed daily life
	  ◦ Arranges events in chronological order with accuracy

Lesson & Description	**Outcome**
Core Lesson 1. Innovation Changes Lives Students explore changes to daily life that have occurred as a result of innovation. They investigate the spark and impact of everyday inventions and innovations, and begin to work on compiling a class timeline of key events in the history of innovation.	• Investigate how inventions and innovations have been created to solve problems or meet needs and wants • Make inferences about ways in which inventions and innovations have shaped daily life • Sequence examples of inventions and innovations on a timeline • Demonstrate chronological thinking by distinguishing among years and decades • Engage in collaborative discussion
Core Lesson 2. Innovations Over Time Students investigate innovations to things they use in their daily life, including the telephone, bicycle, and toothbrush. They explore how these technologies have changed the ways in which people live, work, and play, and in turn led to more innovation.	• Analyze images and text to describe how and why everyday technologies have changed over time • Make inferences about the goals and impact of innovation • Sequence discoveries on a timeline • Engage in collaborative work
Extension Lesson 3. Generating Oral History Questions Students engage with a framework for working with a Guest Interviewee to explore the impact of innovation within the local community. They identify the unique information that can be gathered about the impact of innovation through the memories and stories of elders. They weigh the strengths and limitations to personal memory as an historical source and apply this understanding as they brainstorm and prioritize in preparation for the interview. If time allows, select this Extension lesson if you plan to implement the "Innovations of the Past Interview" Extension lesson in order to allow students to generate their own questions. This lesson is not required to complete the upcoming "Innovations of the Past Interview" Extension lesson.	• Conduct a source analysis related to oral history and interview subjects • Generate questions for an interview with an elder • Evaluate and prioritize questions based on source and objective of interview • Engage in collaborative discussion
Extension Lesson 4. Innovations of the Past Interview Students conduct an interview with a community elder to learn more about how innovation has changed daily life in the local community. Select this Extension lesson to help students gather evidence to support or revise their theories about how innovation has impacted people and the community, and to show how oral history can offer a unique and detailed glimpse into the past.	• Listen to the interviewee and take notes on key ideas and experiences • Ask relevant questions and follow-up questions about the interviewee's experience of innovation • Demonstrate active listening during the interview

Core Lesson **5. Reflecting on Innovation** Students return to key concepts from their investigation into this Essential Question (How has innovation changed daily life?) by reflecting on the role and impact of invention and innovation in daily life past, present, and future. Then, they complete a content check to assess understanding. Together as a class, they reflect upon their Investigation Questions and take stock of their progress through the larger inquiry.	• Reflect on how innovation has changed way of life • Describe sparks and impacts of innovation • Evaluate the impact of an invention or innovation • Engage in collaborative discussion

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Module 3: What does it take to be an innovator?

Materials and Prep Guide

Students investigate key characteristics and actions demonstrated by historical innovators. They gather information to create an Innovator Profile for a selected innovator, drawing evidence-based conclusions about what made them effective.

Objectives

- Use primary and secondary sources to investigate an individual who has shaped historical change
- Use text evidence to draw conclusions about characteristics and actions of effective innovators
- Use different types of sources (historical photos, patent drawings, biographies) to understand the past
- Draw connections between innovators and themselves
- Give and respond to meaningful critique feedback

Checkpoint Assessment

- Review finalized "Innovator Profile" handouts using the "Innovator Profile Rubric" to assess progress toward Success Criteria and application of feedback; look for:
  - Drawing shows an important invention or innovation created by the innovator
  - Selected characteristic or action is supported with evidence
  - Innovator's impact is supported with evidence
  - Shared or admired characteristic or action includes a rationale

- Use the "Module 3 Observations" teacher worksheet during the discussion activity to assess content understanding; look for:
  - Cites evidence to support conclusions about characteristics and actions that contribute to innovation
  - Gives an example of a connection between an innovator's profile and their own
  - Follows protocol: listens, takes turns, and contributes

Lesson & Description	Outcome
Core Lesson **1. Innovator Investigation** Students investigate important characteristics and actions that help make innovators effective. They begin with a shared look at George Washington Carver before researching a historical innovator with a small group. Together, they begin to build a profile of what it takes to be an innovator.	• Investigate key characteristics of innovators • Use text evidence (narrative nonfiction) to make inferences about the qualities, skills, and behaviors that lead to an innovator's effectiveness • Engage in collaborative work
Extension Lesson **2. Further Research into Innovators** Students use a Paired Text to continue their research into a selected innovator's life story, qualities and skills, and contributions to innovation. Use this Extension lesson to allow students to deepen their investigation and extend their research before they create their Innovator Profile.	• Analyze and compare evidence gathered in Paired Texts to corroborate findings • Identify evidence about actions and characteristics of an innovator • Compare and contrast evidence with previous findings • Engage in collaborative work

Core Lesson **3. Innovator Profile** Students create an Innovator Profile to share key findings from their independent investigation of a selected innovator. They synthesize information to determine the spark and impact of this person's key invention or innovation and gather evidence to explain why this person is considered an innovator.	• Synthesize findings to create a profile of an innovator who has shaped historical change • Describe an historical innovator's contributions and impact • Use text evidence to draw conclusions about characteristics and actions of effective innovators • Self-assess progress toward Success Criteria
Core Lesson **4. Critiquing the Innovator Profile** Students use a small-group Critique protocol to give and receive kind, helpful, and specific feedback on their "Innovator Profile" handouts. At the end of the lesson, students apply the feedback they received and finalize their work.	• Give meaningful critique feedback • Accept and use feedback to make improvements • Analyze progress and identify if a particular Criterion is being met in a piece of work • Engage effectively in group discussion
Core Lesson **5. Reflecting on Innovators** Students synthesize findings from their research through a Concentric Circles discussion. They discuss qualities, tools and skills, and behaviors that spark innovation before reflecting on the fact that they share some of these traits and can build others.	• Use text evidence to draw conclusions about characteristics and actions of effective innovators • Identify the contributions and impacts of historical innovators • Engage in collaborative discussion

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Module 4: How does innovation impact society?

Materials and Prep Guide

Students learn about the major developments of the Industrial Revolution and, in particular, innovations that allowed for faster production and transportation. They investigate how rapid innovation led to dramatic changes in the nature of work, the workforce, and, over time, American society. They use historical sources to dig into human stories in order to understand what progress meant for textile workers and railroad laborers. Finally, they consider ways in which progress can bring about both positive and negative impacts.

Objectives	Checkpoint Assessment

• Identify major innovations of the Industrial Revolution and their impacts
• Describe how innovations change society, using historical and contemporary examples
• Sequence and investigate relationships between events on a timeline
• Identify and use different types of historical sources (historical photos, oral history, legend) to understand the past
• Analyze and compare content and points of view reflected in historical sources
• Reflect on the strengths and limitations of historical sources
	• Review "Reflecting on the Industrial Revolution" handouts to assess content understanding; look for:
	  ◦ Gives 3 accurate examples of innovations from the Industrial Revolution
	  ◦ Gives 2 accurate examples of changes to society during the Industrial Revolution
	  ◦ Gives 1 example of a useful historical source
	  ◦ Provides rationale to describe the benefits and limitations of an historical source
	
	• Use the "Module 4 Observations" teacher worksheet during the discussion activity to assess content understanding; look for:
	  ◦ Identifies key innovations (steam engine, railroad, textile mill, assembly line) that changed daily life
	  ◦ Arranges events on a timeline with accuracy
	  ◦ Identifies positive and negative impacts of innovation with accuracy
	  ◦ Provides rationale or evidence to support conclusions about how innovation changes society
	  ◦ Gives examples to describe how or why historical sources differ in content or perspective, using evidence

Lesson & Description	Outcome

Core Lesson **1. Exploring the Industrial Revolution** Students learn about the period of rapid innovation that marked the Industrial Revolution. They investigate changes in transportation and manufacturing that brought about significant changes in daily life and society as a whole. They begin to consider ways in which technological progress can lead to both positive and negative outcomes.	• Read a nonfiction text to learn about the rise of technology, industry, and transportation during the Industrial Revolution • Use evidence to make inferences about changes in daily life and society during this time period • Sequence events on a timeline • Engage in collaborative work
Extension Lesson **2. Investigating the Textile Mills** Students construct an understanding of the life of workers in the textile mills through a variety of primary and secondary sources. They explore how sources can be revisited with new understanding as their knowledge grows. Select this Extension lesson for students to develop context across multiple sources.	• Analyze primary and secondary sources to learn about changes to work and society brought on by the rise of the textile mill • Synthesize information from multiple sources to contextualize findings • Identify the strengths and limitations of various sources
Core Lesson **3. The Transcontinental Railroad** Students analyze a famous historical photo that depicts the moment when the east and west lines of the Transcontinental Railroad connected to unify the country. They read about the construction of the railroad and the changes it brought to the country, applying this historical context to the photo to see how it confirms or changes their thinking. They discuss the importance of considering perspective and context when making interpretations.	• Analyze an historical image celebrating the completion of the Transcontinental Railroad • Read closely to determine positive and negative impacts of the Transcontinental Railroad • Summarize conflicting perspectives on an historical moment of change
Extension Lesson **4. Analyzing a Legend as an Historical Source** Students analyze the legend of John Henry as an historical source. They consider the values of oral tradition as they draw connections between the story and prior learning about the building of the railroads and the rise of machine-driven work. Then, they reflect on why John Henry would be a symbol for workers of the Industrial Revolution era.	• Use different types of historical sources to understand the past (legend, statue, historical marker) • Describe what oral tradition (legend) can tell us about the past • Draw connections between folklore and the events of the time period • Identify point of view (perspective) in historical sources
Core Lesson **5. Reflecting on the Industrial Revolution** Students reflect on what they have learned about the impact of the rapid changes that transpired during the Industrial Revolution. They consider how the primary and secondary sources they have encountered provide evidence of how innovation can bring about both positive and negative impacts – and even change society as a whole. They reflect on how innovation can lead to positive and negative impacts by considering contemporary challenges brought on by the rise of technology.	• Identify major innovations of the Industrial Revolution, as well as their impacts • Describe how innovation changes society, using historical and contemporary examples • Reflect on the strengths and limitations of historical sources

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Module 5: What is timeless about innovation?

Materials and Prep Guide

Students explore contemporary examples of innovation to identify timeless aspects, including recurring challenges and opportunities, as well as enduring characteristics and actions that advance innovation. Students then conclude the module by reviewing the key learning from the unit to help them prepare to take action. They work together to develop an Inquiry Challenge Statement that describes the action they will take, the product they will create, the people they will affect, and the goals they will work toward in the Action Module.

Objectives

- Use case studies to investigate how people are improving their communities through innovation
- Identify timeless problems and possibilities that have been addressed through innovation
- Describe practices and habits of mind that help and hinder innovation
- Use evidence to predict the potential impacts of modern-day inventions
- Generate ideas about local challenges and opportunities that might be addressed through innovation

Checkpoint Assessment

- Review "Reflecting on the Future of Innovation" handouts to assess content understanding; look for:
  - Identifies a community challenge or opportunity that might be addressed through innovation
  - Describes a proposed solution and its potential impact
  - Gives an example of a lesson from the past that can inform their work

- Use the "Module 5 Observations" teacher worksheet to assess developing understanding of concepts that repeat throughout these lessons; look for:
  - Gives examples of sparks and impacts of modern-day inventions and innovations
  - Cites evidence to identify a key step, practice, or habit of mind that contributes to innovation
  - Identifies timeless challenges and opportunities addressed through innovation, using historical and contemporary examples
  - Follows protocol: listens, takes turns, and contributes

Lesson & Description	Outcome
Core Lesson **1. Innovating to Address Community Problems** Students explore how communities can work together to solve challenges by reading *The Soda Bottle School* by Seño Laura Kutner and Suzanne Slade. They engage in a discussion about the ways people can work together to take action to innovate solutions to issues and problems impacting their community.	• Use a case study to explore how communities respond to and address problems through innovation • Use text evidence to describe the spark and impact of an invention or innovation • Identify practices and habits of mind required for the innovation process • Engage in collaborative work
Core Lesson **2. Inventing the Future** Students investigate a variety of modern-day inventions or innovations to identify timeless aspects of the process. They look at what sparks innovation and how it continues to impact our lives and society.	• Analyze examples of contemporary inventions or innovations • Make inferences about the purpose and spark of an invention or innovation • Identify timeless aspects of the innovation process • Make predictions about the potential impact of an invention or innovation, with evidence • Engage in collaborative work
Extension Lesson **3. Kid Innovators** Students learn about William Kamkwamba, who as a teenager famously built a windmill to power his village using only found materials and a sketch from a library book. Then, they use a Jigsaw protocol to investigate and share other stories of kid inventors who are designing new and imaginative sources of energy. Select this Extension lesson to give students an opportunity to learn more about steps in the process of invention.	• Explore a variety of imaginative solutions to a real-world challenge (energy) • Evaluate the merits of designs based on prior learning about innovations that have changed the way people live, work, and play • Engage in collaborative work
Extension Lesson **4. Innovation Takes Persistence** Students learn that perseverance, imagination, prototyping, failure, and collaboration are inevitable and healthy parts of the process of innovation. They give advice to a fictional character experiencing a failed innovation attempt, drawing upon examples of historical and contemporary innovators to identify habits of mind that help or hinder the innovation process. Select this Extension lesson to highlight the importance of a growth mindset in overcoming challenges and achieving goals.	• Use text and illustration to investigate habits of mind that help or hinder the process of innovation • Draw connections between the experiences of historical innovators and a fictional character • Write statements of advice that reflect prior and current learning about important practices and habits of mind for innovation • Engage in collaborative discussion

Core Lesson **5. Reflecting on the Future of Innovation** Students reflect on the timeless aspects of innovation, and how the inventions of today connect them to the innovations, innovators, and key innovation periods of the past. Students conclude this lesson by reviewing the key learning from the unit to help them prepare to take action.	• Synthesize learning of the unit to draw conclusions about how innovation changes way of life and communities • Identify timeless sparks, impacts, and lessons related to innovation • Generate ideas about local challenges and opportunities that might be addressed through innovation • Engage in collaborative discussion
Core Lesson **6. Issuing the Inquiry Challenge** In this pivotal lesson, students transition from investigation to action. They consider the content they have explored, the relevant knowledge they have gained, and the questions they have asked (acknowledging that some may have remained unanswered and new questions may have emerged) to decide how to create an Inquiry Product that has an authentic impact.	• Reflect on learning about innovation to identify opportunities for improving the world around them • Construct an Inquiry Challenge Statement that will guide them in taking informed action • Collaborate with peers

ACTION

Module 6: Take Informed Action

Materials and Prep Guide

Students shift focus in this module, using the conclusions and key findings from their investigation to impact the world beyond their classroom. Preview the module in order to determine how to customize the lessons and accompanying materials to best fit your selected product. Add Flex lessons from the Flex Lesson Library to introduce or reinforce important skills. For additional support, refer to the *"Preparing for Your 2D Product" unit resource*.

Objectives

- Draw on disciplinary concepts to explain opportunities for addressing local, regional, or global problems
- Generate, evaluate, and implement ideas to act on civic challenges in the school or wider community, and predict possible results of those actions
- Use a range of deliberative and democratic procedures to make decisions about effective courses of action
- Take ownership of work in terms of quality, degree of challenge, revision, and completion

Checkpoint Assessment

- Assess students' final Inquiry Products using the "Inquiry Product Rubric" created using the "Inquiry Product Rubric Guide"
- Use the "Action Module Observations" teacher worksheet to assess developing understanding of concepts that repeat throughout these lessons; look for:
  - Gives examples to identify what makes the work strong or areas for improvement
  - Explains connection between work and "Inquiry Product Rubric" Success Criteria
  - Work shows progress toward "Inquiry Product Rubric" Success Criteria
  - Gives kind, helpful, and specific feedback
  - Demonstrates a growth mindset by accepting and considering feedback
  - Follows protocol: contributes ideas, takes turns to speak

Lesson & Description	Outcome
Core Lesson **1. Brainstorm: Comparing Models to Develop Success Criteria** Students compare models of the products they will create, identifying specific elements that make these examples successful and generating ideas for Success Criteria that they can use to guide and evaluate their own work.	• Critically analyze models to identify what makes a product successful or unsuccessful • Generate ideas for Success Criteria • Engage in collaborative discussion

Extension Lesson **2. Brainstorm: Team Norms** Students work together to define what they need from each other to be successful as a team. Select this Extension lesson for students to develop awareness of how they collaborate with others and to form a common language to use when challenges arise.	• Generate ideas about effective team dynamics • Select ideas to generate team norms • Engage in collaborative discussion
Core Lesson **3. Brainstorm: Generating Ideas for the Work** Students use a Rapid-Fire Brainstorm protocol to generate, evaluate, and select ideas for their Inquiry Product. In the next lesson, they will use these selected ideas to create a prototype of their product.	• Generate ideas for the content of the Inquiry Product • Evaluate and select ideas for an effective product using Success Criteria in the "Inquiry Product Rubric," and any constraints, as a guide • Give meaningful feedback to peers • Use feedback to develop work
Core Lesson **4. Prototype: Sketching a Mock-Up** Prototyping, or creating a rough draft, is the next step in the design process. For visual works, the prototype is a mock-up. Students use the ideas that they generated in the brainstorm session to sketch their mock-ups.	• Design and create a draft product to address the Inquiry Challenge • Explore a variety of solutions for the most effective product
Core Lesson **5. Improve: Critiquing Rough Drafts** Students use a small-group Critique protocol to give and receive kind, helpful, and specific feedback on their rough drafts. They use feedback to identify next steps in their work.	• Give meaningful critique feedback • Accept and use feedback to form a revision plan • Engage effectively in group discussion
Core Lesson **6. Improve: Developing the Work** In this teacher-guided work session, students apply critique feedback to develop the next draft of their work. If needed, this lesson could be repeated to allow for multiple work sessions.	• Make changes to work based on feedback and a set of criteria
Extension Lesson **7. Share: Crafting a Maker Statement** Students develop written Maker Statements to explain the ideas behind their work. Maker Statements allow students to describe their work in more detail to their audience. In addition, a written explanation of the work can provide the teacher with additional assessment insights.	• Explain the meaning and purpose of the work • Use criteria to evaluate and improve work
Extension Lesson **8. Share: Practicing to Present the Work** Students practice talking about their work to prepare them to present, either formally or informally. They also give and receive feedback in order to help strengthen their ability to present. The resulting verbal explanations of the work can provide the teacher with additional assessment insights.	• Practice and reflect upon ability to present work • Give meaningful feedback to peers • Engage effectively in group discussion

Core Lesson **9. Reflect: Revisiting the Inquiry Challenge** Students reflect on the unit as a whole now that they have shared their completed Inquiry Products. They reflect upon their successes, struggles, and strides by revisiting content and skills that were the focus of the unit. In doing so, students lay a groundwork for continued growth in future projects.	• Identify successes, struggles, and personal growth • Reflect upon the degree to which the project was successful in meeting the overall goal