## [**ChatGPT Link**](https://chat.openai.com/share/1872cb09-dae2-49ca-b622-95c215e9a615)

## **Lesson Plan: STEM Investigation Skills - Engineering Design Process**

### **🚀 Engage: Sparking Curiosity and Making Connections**

Let's kick off by thinking about the gadgets and systems we encounter every day. Consider something as simple as a pencil sharpener or as complex as a smartphone. How are these designed to function so well for their purposes? In today's lesson, we'll uncover the secrets behind these designs through the engineering design process, an essential set of steps that engineers and designers use to solve problems and create innovative solutions.

### **🧩 Explore: Individual Discovery through the Engineering Design Process**

**Individual Activity: Building a Mini Catapult** For a hands-on understanding of the engineering design process, you'll individually design and test a mini catapult using popsicle sticks, rubber bands, and a spoon. This task will allow you to personally experiment with how levers work and see first-hand the importance of testing and redesigning to improve a product.

### **🔍 Explain: The Steps of the Engineering Design Process**

The engineering design process is more than just a method; it's the backbone of all great inventions. Here are the critical steps you'll follow:

1. **🎯 Define the Problem** - Identify a clear problem that needs solving. For example, "How can I launch a small object using simple materials?"
2. **📚 Do Background Research** - Investigate existing solutions and gather information to help develop your design.
3. **📋 Specify Requirements** - Establish what your solution needs to achieve and any constraints you must work within.
4. **💡 Create Alternative Solutions** - Think outside the box to come up with as many different solutions as possible.
5. **🔍 Choose the Best Solution** - Assess your ideas and select the one that best meets your criteria.
6. **🛠 Do Development Work** - Start developing your chosen solution, considering the details of how it will work.
7. **🏗 Build a Prototype** - Construct a preliminary model of your chosen solution.
8. **🔬 Test and Redesign** - Put your prototype through tests to see how well it works and make any necessary adjustments.

### **🌐 Elaborate: Application in Real-World Contexts**

**Individual Task: Designing a Sustainable Water Bottle** Take on the role of a product designer tasked with creating a new, sustainable water bottle for school use. Using the engineering design process, you'll think about materials, design features, and usability. Sketch your ideas and consider how your design could be produced, used, and eventually recycled. This activity will challenge you to apply the engineering design process to a practical, real-world problem, thereby deepening your understanding and encouraging innovative thinking.

### **✅ Evaluate: Reflecting on Learning and Understanding**

Reflect individually on the mini catapult and water bottle design activities. Consider the following reflection points:

* How did the engineering design process aid your design and testing phases?
* What were the biggest challenges you faced, and how did you address them?
* In what ways can the skills you've practiced be applied to other subjects or areas in your life?

This self-assessment is crucial for understanding the depth of your learning and the practical application of the engineering design process.

This lesson immerses you in the engineering design process, a cornerstone of STEM education, through engaging, practical activities tailored for individual exploration. By the end of this lesson, you'll have a stronger grasp of systematic problem-solving that engineers use to turn ideas into reality, enhancing both your critical thinking and creative skills.

encouragement

* Answer: C) To guide further improvements

1. Which step requires brainstorming for alternative solutions?
   * A) Defining the problem
   * B) Background research
   * C) Doing development work
   * D) Creating alternative solutions
   * Answer: D) Creating alternative solutions
2. How does the engineering design process promote innovation?
   * A) By following strict rules
   * B) By encouraging creative thinking and problem-solving
   * C) By limiting experimentation
   * D) By discouraging collaboration
   * Answer: B) By encouraging creative thinking and problem-solving
3. What does the engineering design process have in common with the scientific method?
   * A) They are unrelated
   * B) Both involve experimentation and iteration
   * C) The scientific method is not used in engineering
   * D) The engineering design process is not systematic
   * Answer: B) Both involve experimentation and iteration
4. Which step of the engineering design process focuses on refining the chosen solution?
   * A) Building a prototype
   * B) Testing the prototype
   * C) Doing development work
   * D) Choosing the best solution
   * Answer: C) Doing development work

## **🚀 Hard Quiz: Testing Critical Thinking**

1. How might the absence of background research affect the engineering design process?
   * A) It speeds up the process
   * B) It leads to uninformed decisions and potentially flawed designs
   * C) It simplifies the process
   * D) It improves creativity
   * Answer: B) It leads to uninformed decisions and potentially flawed designs
2. What distinguishes a constraint from a requirement in the engineering design process?
   * A) Constraints are flexible, while requirements are not
   * B) Requirements are optional, while constraints are mandatory
   * C) Constraints limit what can be done, while requirements specify what must be done
   * D) Constraints are never considered
   * Answer: C) Constraints limit what can be done, while requirements specify what must be done
3. Why is it important for engineers to consider multiple solutions during the design process?
   * A) It adds unnecessary complexity
   * B) It ensures there is only one correct solution
   * C) It increases the likelihood of finding the most effective solution
   * D) It limits creativity
   * Answer: C) It increases the likelihood of finding the most effective solution
4. What is the purpose of testing and redesigning a prototype in the engineering design process?
   * A) To confirm that the prototype works perfectly
   * B) To address any issues or flaws and improve the design
   * C) To demonstrate the prototype to stakeholders
   * D) To save time and resources
   * Answer: B) To address any issues or flaws and improve the design
5. How does collaboration contribute to the effectiveness of the engineering design process?
   * A) It hinders progress
   * B) It brings together diverse perspectives and expertise to solve complex problems
   * C) It creates conflicts
   * D) It slows down the process
   * Answer: B) It brings together diverse perspectives and expertise to solve complex problems
6. Which step of the engineering design process requires the most creativity?
   * A) Defining the problem
   * B) Doing background research
   * C) Creating alternative solutions
   * D) Choosing the best solution
   * Answer: C) Creating alternative solutions
7. How does testing a prototype under various conditions contribute to the design process?
   * A) It is unnecessary
   * B) It ensures the prototype works perfectly in all situations
   * C) It helps identify potential weaknesses and areas for improvement
   * D) It complicates the process
   * Answer: C) It helps identify potential weaknesses and areas for improvement
8. In what ways can the engineering design process be applied outside of STEM fields?
   * A) It cannot be applied outside STEM fields
   * B) By promoting problem-solving and critical thinking skills
   * C) By restricting creativity
   * D) By following a rigid set of rules
   * Answer: B) By promoting problem-solving and critical thinking skills
9. What role does iteration play in the engineering design process?
   * A) It is unnecessary
   * B) It ensures that the final solution is perfect
   * C) It allows for continuous improvement through repeated testing and refinement
   * D) It slows down the process
   * Answer: C) It allows for continuous improvement through repeated testing and refinement
10. How does the engineering design process contribute to innovation?
    * A) By limiting experimentation
    * B) By encouraging creativity and exploration of new ideas
    * C) By following strict guidelines
    * D) By discouraging collaboration
    * Answer: B) By encouraging creativity and exploration of new ideas