

## Tinkering a Tool in Tinkercad

**Subject: Engineering  
Design Process**

**Grade: Kindergarten  
through 8th Grade**

**Time: One or Two  
45-minute sessions**

### Learning Objectives:

Students will learn to design a tool using Tinkercad, a web-based 3D modeling platform.

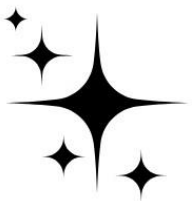
### Standards and Competencies:

#### **NGSS Elementary (K-5)**

- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

#### **NGSS Middle School (6-8)**

- MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.
- MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.



### **Background Knowledge:**

Tinkercad is a user-friendly, web-based 3D design and modeling tool that provides an accessible entry point into the world of computer-aided design (CAD). With Tinkercad, students can create 3D models by combining basic shapes and manipulating them to design objects of their imagination. Prior to teaching Tinkercad, it's beneficial for educators to familiarize themselves with the platform's interface, tools, and features. Additionally, having a basic understanding of 3D design concepts and terminology will assist in guiding students through the learning process. Tinkercad is an excellent resource for fostering creativity, problem-solving, and spatial thinking skills, making it an engaging tool for students to bring their ideas to life in a virtual space.

### **Materials:**

- Computers with internet access
- Tinkercad accounts for each student

### **Procedure:**

#### **Step 1: Introduction (10 minutes)**

- Introduce the concept of 3D design and its applications in various fields.
- Explain that students will be using Tinkercad to design a tool of their choice.
- Show examples of different tools, highlighting their features and purposes.

#### **Step 2: Tinkercad Basics (20 minutes)**

- Give a brief overview of Tinkercad's interface and tools.
- Demonstrate how to navigate the workplane, add shapes, resize, rotate, and group objects.
- Explain the importance of using accurate measurements and dimensions for functional tools.

#### **Step 3: Brainstorming and Planning (15 minutes)**

- Engage students in a brainstorming session to generate ideas for their tools.
- Encourage them to consider a tool needed for P.I.P. and how real-world problems can be solved or tasks that can be facilitated with their tool.
- Have students sketch their tool designs on paper, labeling important dimensions and features.

#### **Step 4: Designing the Tool (40 minutes)**

- Instruct students to log in to their Tinkercad accounts and create a new design.
- Guide them through the process of adding basic shapes, resizing, aligning, and grouping objects to build their tool.
- Encourage experimentation with different shapes and features to make the tool functional and visually appealing.

- Circulate around the classroom, providing support and guidance as needed.

**Step 5: Iteration and Refinement** (15 minutes)

- Ask students to evaluate their designs critically and identify areas for improvement.
- Discuss the importance of iteration in the design process and encourage students to make necessary adjustments.
- Emphasize the balance between functionality and aesthetics.

**Step 6: Presentation and Reflection** (20 minutes)

- Provide an opportunity for students to present their tools to the class.
- Each student should explain the purpose of their tool, its features, and how it solves a specific problem or enhances a task.
- Facilitate a class discussion about the different tools, highlighting creative solutions and effective design choices.
- Have students reflect on their design process and what they learned from the experience.

**Assessment:**

- Observe student engagement and participation during the lesson.
- Evaluate students' tool designs based on functionality, adherence to specifications, and overall creativity.
- Assess students' presentations and reflections on their design process and problem-solving abilities.

**Additional Resources:**

**Extension Activities**

- For students who finish early or show a keen interest in 3D design, provide an extension activity.
- They can explore advanced features of Tinkercad, such as adding custom shapes, combining multiple designs, or creating complex assemblies.
- Students can 3D print their designs.

\*\*Note: The duration and complexity of the design challenge can be adjusted based on the students' age, skill level, available materials, and time constraints.