Tinkercad Lesson 3: Alignment, Mirroring, and Robot Creation

Lesson Objectives:

- Students will review previously learned Tinkercad skills, including grouping, making holes, and duplication.
- Students will learn how to use the align tool to position objects precisely.
- Students will learn how to use the mirror tool to create symmetrical designs.
- Students will design and build a robot using the Engineering Design Process (EDP), including naming their robot and writing a description of its purpose and functions.

Materials:

- Computers with internet access
- Tinkercad accounts (set up prior to the lesson)
- Paper and pencils for robot design sketches

Lesson Plan:

1. Review of Previous Skills (5-7 minutes)

- **Teacher Action:**
    1. Ask review questions to recall skills from the previous lesson:
        - "How do you group objects, and why is it useful?"
        - "How do you create a hole in an object?"
        - "What does the duplicate feature do?"
    2. Encourage students to demonstrate these skills to a partner or the class.
    3. Have students create a quick shape (e.g., a simple house) to practice grouping and creating holes if necessary.

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2. Introduction to the Align Tool (10 minutes)

- **Activity 1: Making a Ring**
    - Drag out two flat cylinders onto the workplane.

    - Show students how to resize one cylinder to make it smaller in radius and position it inside the larger cylinder.
    - Demonstrate how to select both objects, use the **align tool** to center them horizontally and vertically, and group them to create a ring.
- **Activity 2: Layered Cake**
    - Drag out a cylinder and resize it so the face (radius) is **50**.
    - Drag out a second cylinder and resize the face (radius) to **30**.
    - Align the second cylinder to the center of the first and raise it so it sits directly on top of the larger cylinder.
    - Group the two cylinders together.
    - Repeat the process with a third cylinder, resizing the face (radius) to **20** and aligning it on top of the second layer.
- **Guiding Questions:**
    - "Why is the align tool helpful when placing objects together?"
    - "What would happen if you didn’t align the layers of the cake?"
- **Practice:**
    - Students follow along to complete their own layered cake.

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3. Introduction to the Mirror Tool (10 minutes)

- **Activity:**
    - Demonstrate duplicating the completed cake and raising the duplicate above the original.
    - Show how to use the **mirror tool** to flip the duplicate upside down and align it with the top of the original cake.
    - Explain how this resembles a set of wheels with an axle in between.
- **Practice:**
    - Students complete the mirrored cake activity and experiment with mirroring other objects.

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4. Independent Practice with Alignment and Mirroring (10 minutes)

- **Activity:**
    - Allow students to bring out various objects and practice aligning and mirroring them in creative ways.
    - Encourage experimentation with symmetrical designs, such as creating decorative patterns or symmetrical structures.
- **Guiding Questions:**

    - "What types of designs look better with perfect alignment?"
    - "How can mirroring save time when creating symmetrical objects?"

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5. Robot Project: Design and Build (20-25 minutes)

- **Step 1: Introduce the Robot Design Challenge**
    - Explain that students will design and build their own robot using the skills they have learned.
    - Students will start by drawing their robot on paper, including:
        - A name for their robot.
        - A brief written description of its purpose and what it is designed to do.
        - An explanation of how the parts of their robot will help fulfill its purpose.
- **Step 2: Begin Robot Creation**
    - Once students finish their sketches and written descriptions, they will begin creating their robot in Tinkercad.
    - Encourage them to use alignment and mirroring to ensure their robot is symmetrical and balanced.
    - Remind students to use grouping and holes to add detail and functionality to their design.
- **Teacher Tip:**
    - Circulate the room to provide guidance and encourage creative solutions. Offer feedback on how alignment and mirroring can improve their designs.
- **Guiding Questions:**
    - "What purpose does your robot serve, and how does its design reflect that purpose?"
    - "How can symmetry make your robot look more polished or professional?"

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6. Reflection and Sharing (5-7 minutes)

- **Activity:**
    - Allow students to showcase their robots to the class in a gallery walk or shared screens.
    - Encourage them to share their robot's name, purpose, and favorite feature.
- **Guiding Questions for Reflection:**
    - "What was the most challenging part of creating your robot?"

    - "How did using the align or mirror tool improve your design?"
    - "What part of your robot are you most proud of?"

Adaptations for Younger Grades (2nd-3rd):

- Simplify alignment and mirroring tasks to focus on stacking shapes and basic symmetry.
- Provide more structured guidance during the robot project.
- Allow more time for independent practice or reduce the robot design requirements.

Assessment:

- Observe students during practice activities to ensure they understand and apply alignment and mirroring.
- Evaluate robot designs for creativity, use of tools, and how well they reflect the written description of the robot's purpose.
- Participation in the reflection and sharing activity.

Extension Ideas:

- Advanced students can add accessories or functional features to their robots, such as tools or decorative elements.
- Challenge faster learners to create a companion object for their robot, such as a vehicle or a pet.