

Lesson Plan: Intermediate Tinkercad Lesson - Customizable Phone Stand

Grade: 7-8

Subject: Integrated Math, Science, and Visual Arts

Lesson Topic: Intermediate Tinkercad Lesson - Customizable Phone Stand

Length of Lesson: 90 minutes

Curriculum Expectations:

Grade 7 Curriculum Expectations

- **Mathematics:**
 - **E1.4:** Create and analyze designs involving geometric transformations and measurements.
 - **E2.1:** Solve problems involving surface area of right prisms.
- **Science (Strand A - STEM Skills and Connections):**
 - **A1.3:** Investigate how to optimize designs using CAD in engineering challenges.
- **Science (Strand D - Form, Function, and Design of Structures):**
 - **D2.3:** Identify the magnitude, direction, point of application, and plane of application of forces on a structure.
 - **D2.5:** Describe factors that can cause a structure to fail.
- **Visual Arts:**
 - **D1.2:** Use multiple principles of design to create thematic or narrative artworks.
 - **D1.4:** Create artworks using increasingly complex tools and techniques.

Grade 8 Curriculum Expectations

- **Mathematics:**
 - **E1.2:** Construct 3D objects from 2D representations and analyze their geometric properties.
 - **E2.2:** Solve problems involving surface area and volume of composite shapes.
 - **Science (Strand A - STEM Skills and Connections):**
 - **A1.2:** Refine CAD designs based on data and feedback to meet specific needs.
 - **Science (Strand D - Structures and Mechanisms):**
 - **D2.4:** Analyze the efficiency and effectiveness of systems and structures designed to perform a function.
 - **Visual Arts:**
 - **D1.3:** Use design elements to communicate messages through multimedia artwork.
 - **D2.2:** Evaluate the use of design principles in communicating meaning in artworks.
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Learning Goals:

- Students will apply intermediate Tinkercad techniques to create a functional and customizable phone stand.
 - Students will learn to use advanced features such as aligning, grouping, custom shape creation, and modular design.
 - Students will develop problem-solving skills and apply geometric and structural principles in their designs.
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Success Criteria:

- Students can successfully create a customizable phone stand using Tinkercad's intermediate tools.
 - The design demonstrates an understanding of modularity, functionality, and aesthetic appeal.
 - Students can refine their designs based on peer feedback and practical testing.
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Prior Knowledge:

- Basic understanding of Tinkercad's interface and tools.
 - Familiarity with designing simple 3D objects and applying basic geometric concepts.
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Materials/Resources:

- Computers or tablets with internet access
 - Tinkercad accounts for each student
 - Rulers and graph paper (optional, for initial sketches)
 - 3D printer (optional, if students want to print their designs)
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Lesson Sequence:

Introduction (10 minutes):

- 1. Review Previous Skills:**
 - Briefly review the basic Tinkercad skills learned in previous lessons, such as shape manipulation, grouping, and aligning.
 - Introduce the new objective: designing a customizable phone stand using intermediate Tinkercad techniques.
- 2. Explain the Learning Goals:**

- Outline the goals for the lesson: applying intermediate Tinkercad techniques, creating a functional design, and exploring the concept of modularity.

Step 1: Logging into Tinkercad (5 minutes):

1. Log in:

- Ensure all students have their Tinkercad accounts and are logged in.

Step 2: Creating a New Project (5 minutes):

1. Start a New Design:

- Guide students to click on "Create New Design" from the Tinkercad dashboard to begin their phone stand project.

Step 3: Designing the Phone Stand Base (20 minutes):

1. Create the Base Shape:

- Demonstrate how to create a rectangular or square base (e.g., 100mm x 60mm x 5mm) that will serve as the foundation for the phone stand.
- Use the Ruler tool to measure and place the shape accurately on the workplane.

2. Add Support Features:

- Show students how to add support arms or slots to the base to hold the phone securely.
- Use the Align tool to ensure the support features are symmetrically placed.

Step 4: Creating Customizable Features (25 minutes):

1. Designing the Phone Holder:

- Guide students in creating a phone holder using custom shapes or the Scribble tool.
- Demonstrate how to add custom text or engravings to personalize the stand.

2. Using Modular Design:

- Teach students how to create modular components that can be attached or detached from the main base.
- Explain the importance of designing for interlocking parts and how modularity enhances the functionality of the stand.

Step 5: Advanced Techniques for Customization (20 minutes):

1. Custom Parameters and Shape Generators:

- Introduce the concept of custom parameters to adjust dimensions and design features.
- Show students how to use shape generators to create complex shapes like gears, angles, or customizable cutouts.

2. Mirroring and Duplicating Components:

- Demonstrate how to use the Mirror tool to create symmetrical designs or duplicate components.

Step 6: Finalizing and Testing the Design (15 minutes):

1. Review and Adjust:

- Have students review their designs, make any necessary adjustments, and ensure all parts are aligned and properly grouped.
- Encourage students to test the stability and functionality of their design.

2. Peer Review Session:

- Organize a peer review session where students can share their designs with classmates and receive constructive feedback.

Step 7: Exporting and 3D Printing the Design (10 minutes):

1. Export for 3D Printing:

- Show students how to export their design as an STL file, suitable for 3D printing.
- Discuss how to prepare the design for 3D printing, including considerations for supports and orientation.

Step 8: Reflection and Discussion (10 minutes):

1. Reflect on the Learning Process:

- Ask students to reflect on what they learned during the project, focusing on how they applied intermediate Tinkercad techniques to solve design challenges.

2. Share Final Designs:

- Encourage students to share their final phone stand designs with the class, discussing how they addressed issues of stability, functionality, and aesthetics.

Differentiated Instruction:

- **Visual Learners:** Use visual examples and step-by-step demonstrations to explain Tinkercad tools and techniques.
- **Kinesthetic Learners:** Provide ample hands-on practice with Tinkercad, allowing students to explore and experiment with the tools.
- **Advanced Learners:** Challenge students to add more complex features, such as adjustable components or additional modular attachments.

Assessment:

- **Formative:** Monitor student engagement during the design process and provide feedback on their use of Tinkercad tools and techniques.

- **Summative:** Evaluate the final phone stand designs based on their functionality, modularity, and application of intermediate Tinkercad features. Use the Quizizz quiz to check your students' knowledge of Tinkercad functions and shortcuts.
 - **Reflection:** Assess students' reflections on their learning process and their ability to incorporate feedback into their final designs.
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Next Steps:

- **Extension:** Encourage students to design additional modular components for their phone stand or explore more advanced Tinkercad features, such as importing custom SVG files.
- **Follow-up:** Introduce students to more complex CAD software or design challenges that build on the skills learned in this lesson.