Introduction to 3D Printing Center

6-Lesson Elementary Curriculum (Grades 3-5)

Course Overview

Students will learn basic 3D design and printing through hands-on projects using Tinkercad. This 6-lesson rotation (45 minutes each) begins with understanding what 3D printing is, then progresses to hands-on design and creation of simple, functional objects.

Learning Objectives

Students will:

- Understand what 3D printing is and how it works
- Navigate Tinkercad to create basic 3D designs
- Explain the layer-by-layer printing process
- Design objects considering size and printing limitations
- Create at least two original 3D designs
- Identify real-world applications of 3D printing

Materials Needed

- 3D printer (any modern FDM printer)
- Computers/tablets with internet access
- PLA filament
- Sample printed objects for demonstration
- Simple infographics showing 3D printing process
- Cross-section examples of printed objects
- Variety of 3D printed objects from different industries

Lesson 1: What is 3D Printing? (45 minutes)

Introduction and Hook (10 minutes)

Hook: Show students amazing 3D printed objects - toys, tools, prosthetics, food!

Key Question: "What is 3D printing and how does it work?"

Core Concepts with Visual Demonstrations (15 minutes)

How 3D Printing Works: - 3D printing builds objects layer by layer, like stacking pancakes - We design on computers, then the printer makes it real - Plastic gets heated and squeezed out like frosting from a tube - Show infographic: "From Computer to Object in 3 Steps"

Visual Demonstrations: - Use simple infographics showing the layer-by-layer process - Pass around printed objects at different stages (if available) - Show cross-section of a printed object to reveal layers

Real-World Examples and Applications (10 minutes)

Examples for Kids: - Custom phone cases and game pieces - Replacement parts for broken toys - Art projects and sculptures - Helpful tools for people with disabilities - Medical devices like prosthetics - Aerospace and car parts - Food printing (chocolate, pizza!)

Interactive Activity: Students examine printed objects and guess what they're used for

3D Printer Live Demonstration (5 minutes)

- Show the actual 3D printer (if available)
- Explain the basic parts: hot end, build plate, filament
- Safety rules: Never touch hot parts, don't reach in while printing

Cleanup and Preview (5 minutes)

- Students help organize demonstration materials
- Preview next lesson: "Now that we know what 3D printing is, we'll learn to design our own objects!"
- Quick reflection: "What was the most surprising thing you learned about 3D printing?"

Lesson 2: Introduction to Tinkercad + Design Your First Project (45 minutes)

Introduction to Tinkercad (15 minutes)

1. **Login to Tinkercad** (5 minutes)
   - Use school Google accounts
   - Navigate to tinkercad.com
2. **"Learning the Moves" Tutorial** (10 minutes)
   - Built-in Tinkercad tutorial (abbreviated version)
   - Focus on basic navigation: rotate, zoom, pan
   - Basic shape placement and manipulation

First Design Project: Simple Keychain (20 minutes)

Project Requirements: - Must have a hole for keyring - No bigger than 50mm in any direction - At least 3mm thick - Use at least 2 shapes

Step-by-Step Guidance: 1. Start with a basic shape (cube, cylinder, etc.) 2. Add text with their name or initials 3. Create a hole for the keyring 4. Combine shapes together

Teacher Support: - Circulate constantly - students need lots of help with first design - Have printed keychain examples available - Focus on successful completion rather than complexity

Save, Share, and Cleanup (10 minutes)

- Students save their work (5 minutes)
- Quick gallery walk to see designs (3 minutes)
- Cleanup workstations and preview next lesson (2 minutes)

Lesson 3: How Printing Works + Design a Container (45 minutes)

Printing Process Deep Dive (10 minutes)

- Review keychains that have been printed from last lesson
- Explain the printing process in detail:
  - Computer slices design into thin layers (show slicing software if possible)
  - Printer draws each layer with melted plastic
  - Layers stick together as they cool
- Show printer in action if available

Safety Rules Review: - Never touch the hot parts - Don't reach into the printer while it's working - Tell a teacher if something looks wrong

New Project: Simple Container (25 minutes)

Design Challenge: Create a small container for desk supplies

Requirements: - Big enough to hold paperclips or erasers - Has walls and a bottom - Learn to use the "Hole" tool to hollow out the inside

Step-by-Step Guidance: 1. Start with a cube or cylinder (5 minutes) 2. Add a smaller shape inside (5 minutes) 3. Make the inner shape a "Hole" (10 minutes) 4. Group them together (5 minutes)

Troubleshooting and Cleanup (10 minutes)

- Help students who are struggling (7 minutes)
- Save work and clean up workstations (3 minutes)

Lesson 4: Problem-Solving Design Challenge (45 minutes)

Problem Introduction (10 minutes)

The Challenge: "Design something to solve a problem at school or home"

Examples to spark ideas: - Pencil holder that doesn't tip over - Hook for backpack - Phone stand for watching videos - Organizer for small toys or supplies

Design Process (30 minutes)

1. **Think** (5 minutes): What problem will you solve?
2. **Sketch** (5 minutes): Quick sketch on paper
3. **Build** (20 minutes): Create in Tinkercad

Teacher Role: - Help students identify realistic problems - Guide them toward printable solutions - Encourage creativity while keeping designs simple

Sharing and Cleanup (5 minutes)

- Students briefly explain their problem and solution (3 minutes)
- Clean up workstations (2 minutes)

Lesson 5: Improve Your Design + Print Prep (45 minutes)

Review Printed Projects (10 minutes)

- Look at keychains and containers that have been printed
- Discuss what worked well and what could be better
- Introduce "iteration" - making designs better through improvement

Design Improvement Time (25 minutes)

Students can: - Fix problems with their existing designs - Make their problem-solving project better - Start a completely new project if they want

Focus on: - Making walls thick enough (at least 2mm) - Checking that parts fit together - Adding personal touches and creativity

File Preparation and Cleanup (10 minutes)

- Students export their best design as STL file (5 minutes)
- Teacher demonstrates the export process
- Save files for printing and clean up (5 minutes)

Lesson 6: Reflection and Future Thinking (45 minutes)

Show and Tell (20 minutes)

- Students present their printed objects
- Simple format: "This is my *, it solves the problem of* , and I'm proud of _____ "
- Celebrate everyone's work!

Reflection Activity (15 minutes)

Discussion Questions: - What was the hardest part about 3D design? - What surprised you about 3D printing? - If you had a 3D printer at home, what would you make? - How could 3D printing help people?

Quick Write: Students write 2-3 sentences about their favorite project

Looking Forward and Cleanup (10 minutes)

- Show advanced 3D printed objects (gears, moving parts, etc.) (5 minutes)
- Explain that 3D printing is used in many jobs (3 minutes)
- Final cleanup and encourage continued exploration (2 minutes)

Assessment and Differentiation

For 3rd Graders:

- Focus on basic shape manipulation
- Provide more step-by-step guidance
- Celebrate any successful design completion

For 4th Graders:

- Encourage combining multiple shapes
- Introduce basic problem-solving concepts
- Support independent exploration

For 5th Graders:

- Challenge with more complex designs
- Discuss real-world applications
- Encourage peer mentoring of younger students

Quick Assessment Checkpoints:

- Can student navigate Tinkercad independently?
- Does student understand basic 3D printing concept?
- Has student completed at least one printable design?
- Can student explain what they created?

Teacher Preparation Notes

Before Each Lesson:

- **Lesson 1:** Prepare infographics, demonstration objects, and cross-sections
- **Lessons 2-6:** Test all computers/tablets for Tinkercad access
- Have backup activities for students who finish early
- Queue up printing jobs from previous lessons
- Prepare printed examples to show
- **Important:** Plan for 5-minute cleanup time at end of each lesson

Printing Management:

- Print student work between lessons when possible
- Keep designs simple to ensure printing success
- Have a few backup printed items in case of printer failures
- Consider printing 2-3 designs per session to manage time
- **New timing:** With 45-minute lessons, printing schedule is more critical

Common Challenges:

- **Students going too fast:** Encourage them to add details or help peers
- **Students struggling:** Pair with successful peers or provide extra guidance
- **Technical issues:** Have simple backup activities ready
- **Mixed grade levels:** Use peer mentoring and differentiated expectations
- **Time management:** Shorter lessons require tighter pacing and clear transitions

Lesson 1 Specific Preparation:

- Gather diverse 3D printed objects from different industries
- Create or find simple infographics showing layer-by-layer process
- Prepare cross-section examples (cut printed objects in half if possible)
- Have printer ready for live demonstration
- Plan interactive activities for examining objects

Extension Ideas:

- Create a classroom gallery of printed objects
- Connect to other subjects (math shapes, science tools, art projects)
- Invite parents to see student work
- Consider a school-wide 3D printing showcase
- Document the "what is 3D printing" lesson with photos for future reference