

Design for 3D Printing

Difficulty Intermediate	Time 1-2 class periods	Type Skill Builder
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Background

A part was designed in CAD without considering how it would be printed. It requires excessive supports, wastes material, and takes too long.

Engineering Problem

Redesign the part to improve printability while preserving its function.

Learning Objectives

- Recognize common additive manufacturing limitations
- Modify geometry for reduced supports
- Compare slicer estimates
- Justify design-for-manufacturing decisions

Materials

- Instructor-provided CAD part
- Fusion 360
- Slicer software
- Engineering notebook

Procedure

1. Import or open the baseline part.
2. Write the part's intended function and identify features that must not change.
3. Slice the baseline in the most reasonable orientation and record print time, material, and support amount.
4. Identify at least three printability problems.
5. Create two redesign sketches and select one.
6. Modify overhangs, holes, wall thickness, orientation surfaces, or part segmentation.
7. Slice the redesign using the same printer and comparable settings.
8. Compare estimates and check that all functional dimensions remain correct.

Engineering Requirements

- Reduce support material by at least 50% or eliminate supports
- Reduce print time or material use by at least 15%
- Preserve specified functional dimensions
- Maintain minimum printable wall thickness
- Document all slicer settings used for comparison

Constraints & Safety

- Use the same printer profile and layer height for baseline and redesign

- Do not remove functional features
- No print is required unless approved
- Use classroom-safe geometry and scale

Deliverables

- Baseline slicer screenshot and estimates
- Three identified printability problems
- Two redesign sketches
- Revised CAD file
- Final slicer screenshot
- Before/after comparison table
- Design explanation

Reflection Questions

1. Which geometry caused the most support?
2. What change produced the largest improvement?
3. Did reducing print time create a new tradeoff?
4. How would injection molding change the design rules?

Engineering Tip

Before changing the part, rotate it in the slicer. Sometimes orientation solves more than redesign.

Common Mistake

Comparisons are invalid if the baseline and redesign use different layer heights or infill settings without explanation.

Stretch Goal

Create a two-part version that prints even faster and compare assembly complexity.

Career Connection

Additive manufacturing engineers adjust geometry, orientation, supports, and process settings to improve quality and cost.