Fungi01

Life Science | Engineering Design Process

Engineering Challenge

Visible Elements in Photo

- A single mushroom (fungus) with a large, flat, umbrella-like cap
- Thin, parallel gill structures visible on the underside of the cap
- A slender stem (stalk) supporting the cap
- Short grass and soil surrounding the mushroom's base
- Blurred structures (possibly more mushrooms or garden elements) in the background

Reasonable Inferences

- From the cap's flat, wide shape: The mushroom's design allows it to release spores efficiently and maximize surface area exposure to air currents for dispersal.
- From the parallel gill structures: The gills are a load-bearing design that supports the cap's weight while remaining lightweight and providing maximum spore production area.
- From the slender stem: The mushroom uses a thin, rigid support structure to hold the cap aloft, suggesting engineering principles about strength-to-weight ratio in nature.

Engineering Task

K-2 Challenge:

Design and build a "spore spreader" shelter for tiny mushroom creatures. Using paper, straws, and tape, create an umbrella-like structure with a tall, skinny pole. Your design must be able to stand up on its own and have a flat top at least the size of your hand. Can you make it tall enough that a small toy could hide under it?

3-5 Challenge:

Design a lightweight mushroom-inspired canopy structure that can support a 500g load (books or sand) while using the least amount of material. Your structure must include:
- A horizontal cap at least 20cm wide
- A central support stem no thicker than a pencil
- Internal bracing (inspired by the mushroom's gills) to prevent collapse
- Materials available: paper straws, cardstock, tape, wooden dowels, string

Test your design by gradually adding weight until it fails. Calculate the load-to-weight ratio (weight supported ÷ weight of structure). Which design principle from the mushroom (thin stem, angled supports, flat cap) was most effective?

EDP Phase Targeted

Ask / Define Problem — This task works best here because the photo shows a natural structure solving a real biological problem (holding a spore-releasing surface aloft efficiently). Students start by observing the mushroom and identifying the engineering challenge it solves, then reverse-engineer a solution. This mirrors the real EDP process: nature identifies the need first.

Suggested Materials

- Paper straws or thin wooden dowels
- Cardstock or foam sheets (for cap)
- Masking tape or hot glue
- String or fishing line (for bracing/gills)
- Books or sand (for load testing)

Estimated Time

K-2: 30-40 minutes (single session: observe, design, build, test)
3-5: 60-90 minutes (two sessions: Session 1 = observe, sketch, build; Session 2 = test, measure, redesign)

Why This Works for Teachers

This task directly addresses NGSS ETS1.A (defining engineering problems) and ETS1.B (developing possible solutions) by having students extract design principles from a real organism and apply them to a human-made structure, bridging life science and engineering design.