Orb Weaver

Life Science | Engineering Design Process

Visible Elements in Photo

- An orb weaver spider (brown/tan coloring, long legs with dark markings)
- A human hand holding the spider
- Long, thin spider legs extending outward
- Blurred green background (natural outdoor setting)
- Spider's small body relative to leg span

Reasonable Inferences

- From spider's long, thin legs + natural setting: The spider needs to move quickly across surfaces and climb to build webs in elevated locations; lightweight leg structure allows this.
- From orb weaver body type: This spider builds intricate webs to catch flying insects, so its legs must be precise enough to weave and maintain delicate structures.
- From hand placement: Spiders are small but resilient creatures; any structure they build must work despite environmental forces (wind, rain, moving objects).

Engineering Task

K-2 Challenge:

Your classroom has a friendly spider that needs a safe web-building spot! Design and build a "web frame" using string and craft sticks that the spider could use to stretch its web. Your frame should:
- Hold up on its own (not fall over)
- Have corners or edges where a spider's web could attach
- Be bigger than your hand but small enough to fit on a shelf

3-5 Challenge:

Orb weaver spiders must build webs that can catch flying insects while surviving wind and rain. Design a lightweight frame structure (using only string, straws, popsicle sticks, or dowels) that mimics the support points of a natural orb web. Your design must:
- Support a web span of at least 20 cm across its widest point
- Withstand a gentle tug (10 N force) without collapsing
- Use only 5 pieces of building material (frame supports only—string doesn't count)
- Allow at least 4 attachment points for "web threads" (string)

EDP Phase Targeted

Ask / Define Problem

This photo shows a real organism in nature with no visible engineering solution yet. Students must observe the spider's structure and infer why a web-building support system matters (catching food, surviving weather, efficient geometry). This naturally launches the "Ask" phase: "What does a spider need to build a successful web, and how can we create a structure that helps?"

Suggested Materials

- Popsicle sticks or wooden dowels (3–4 mm diameter)
- Cotton string or yarn
- Tape (masking or painter's tape)
- Straws (plastic or paper)
- Hot glue gun (teacher-supervised) or craft glue

Estimated Time

- K-2: 40–50 minutes (15 min. discussion + building, 10 min. testing/display)
- 3-5: Two 40-minute sessions (Session 1: design sketch, material selection, building; Session 2: testing with force application, iteration, reflection)

Why This Works for Teachers

This task directly aligns with NGSS 3-5-ETS1-1 (Ask questions to clarify design problem) and K-2-ETS1-1 (Ask questions to improve designs) by asking students to observe a real organism, identify its structural needs, and prototype a human-made solution inspired by nature.