Straw Structures

Turn flat shapes into towers as tall as you are.

PRE-K THROUGH GRADE 8 | AGES 4 TO 14 | ABOUT 60 MIN

These are the standards listed in the Straw Structures educator guide. Under each one is where you will see it in the activity.

Next Generation Science Standards (NGSS)

CODE	WHAT IT COVERS
K-2-ETS1-3	Analyze data from tests of two objects to compare strengths and weaknesses
WHERE YOU'LL SEE IT (GRADES K-2): Learners **build two structures with different base shapes and compare how each performs** - testing whether a triangle base or a hexagon base stands taller before it wobbles, and which one resists tipping when gently pushed. Comparing the two builds side by side gives them evidence for which design better solved the "build as tall as you" challenge, and why a wider base wins.	
K-2-ETS1-2	Engineering Design: Develop a simple sketch, drawing, or physical model
WHERE YOU'LL SEE IT (GRADES K-2): Learners **build a physical model of a prism by first creating a flat base shape, then adding vertical straws, then connecting a matching shape on top** - iterating on their design when they realize a triangle base is too narrow and switching to a square or hexagon base to create a structure tall enough to meet the "build as tall as you" challenge.	
3-5-ETS1-1	Define a simple design problem reflecting a need or want that includes criteria for success and constraints
WHERE YOU'LL SEE IT (GRADES 3-5): Learners **define the constraints of the "reach the ceiling" challenge** - they must build tall enough to touch the ceiling using only straws and connectors, cannot stand on chairs, and must work with a partner - identifying that the success criteria (ceiling height) and constraints (no chairs, limited materials) require them to plan their base width, structural reinforcement, and partner coordination strategy before building.	
3-5-ETS1-3	Plan and carry out fair tests to identify failure points
WHERE YOU'LL SEE IT (GRADES 3-5): Learners **systematically test why their tall structure keeps leaning to one side** by checking whether the issue is uneven connector pressure at the base, missing cross pieces on the leaning side, or misaligned vertical straws - isolating one variable at a time by adding a single cross piece and observing whether the lean corrects before trying the next fix.	
MS-ETS1-1	Define the criteria and constraints of a design problem
WHERE YOU'LL SEE IT (GRADES 6-8): Learners **analyze the "fit people inside" collaborative design challenge** by defining quantitative criteria - the structure must be wide enough for a person to stand inside (minimum ~24-inch interior diameter) and tall enough to reach above their head - then calculating how many hexagonal base segments they need and how many partner structures must be combined to achieve the required interior volume.	
MS-ETS1-2	Evaluate competing design solutions using a systematic process
WHERE YOU'LL SEE IT (GRADES 6-8): Learners **compare the structural performance of triangular-prism, cubic, and hexagonal-prism towers** by building all three to the same height and testing which withstands gentle lateral force - evaluating trade-offs between the triangle's rigidity with less interior space, the cube's simplicity with moderate stability, and the hexagon's superior base coverage with higher material cost.	

Common Core State Standards (Math and ELA)

CODE	WHAT IT COVERS
RI.K-2.7	Use illustrations and words in a text to describe key ideas
WHERE YOU'LL SEE IT (GRADES K-2): Learners **refer to the visual guide included in their Straw Structures kit** to identify each base shape - triangle, square, pentagon, hexagon - and match the diagram to the number of straws needed, using both the picture and the shape name to plan their build before assembling.	
SL.K-2.1	Participate in collaborative conversations
WHERE YOU'LL SEE IT (GRADES K-2): Learners **describe to a partner how they rolled their connected line of straws into a shape**, using vocabulary like "line segment," "connector," and "shape" to explain how a flat line of five straws became a pentagon when they attached the last connector back to the first straw.	
RI.3-5.3	Explain relationships between concepts in a text
WHERE YOU'LL SEE IT (GRADES 3-5): Learners **explain the relationship between their two-dimensional base shape and the three-dimensional form it becomes** by describing how adding vertical straws to a flat hexagon and then connecting a second hexagon on top transforms the 2D shape into a hexagonal prism - tracing the concept of shape-to-form transformation from the visual guide to their physical build.	

CODE	WHAT IT COVERS
SL.3-5.4	Report on a topic using appropriate facts and details
WHERE YOU'LL SEE IT (GRADES 3-5): Learners **present their structure to the class and explain their design decisions** - why they chose a hexagonal base over a square one, how they added cross pieces through connector centers for reinforcement, and what they would change to make it taller - using specific structural vocabulary like "prism," "cross piece," and "line segment."	
RST.6-8.3	Follow a multistep procedure when carrying out experiments
WHERE YOU'LL SEE IT (GRADES 6-8): Learners **follow the sequential Straw Structures build process precisely** - first counting out the correct number of straws for their chosen shape, then creating line segments by connecting straws end-to-end, then rolling the line into a closed shape, then building upward with vertical segments - understanding that skipping the base-building step and going straight to vertical construction results in an unstable structure.	
SL.6-8.1	Engage in collaborative discussions with diverse partners
WHERE YOU'LL SEE IT (GRADES 6-8): Learners **compare the structural stability of wide versus narrow bases during the design challenge**, discussing why a hexagonal base with six points of contact supports more vertical height than a triangular base with three - and debating whether adding cross pieces to a narrow base could compensate for fewer ground contact points.	
K.G.A.1	Describe objects using names of shapes and relative positions
WHERE YOU'LL SEE IT (GRADES K-2): Learners **identify and name each base shape they build** - triangle, square, pentagon, hexagon - and describe spatial relationships during vertical construction: "the square is on the bottom," "the vertical straws go up from each corner," and "the top square sits above the bottom one."	
K.CC.B.5	Count to answer "how many?"
WHERE YOU'LL SEE IT (GRADES K-2): Learners **count out the exact number of straws needed for their chosen base shape** - four straws for a square, five for a pentagon, six for a hexagon - and then count the vertical straws needed to connect two layers, practicing one-to-one correspondence as they sort straws by color and match each straw to a connector.	
3.MD.B.4	Generate measurement data by measuring lengths
WHERE YOU'LL SEE IT (GRADES 3-5): Learners **use the known 12-inch length of each straw as a measurement unit** to estimate and measure the height of their growing structure - counting vertical segments to calculate total height (three vertical straws = 36 inches = 3 feet) and comparing their tower's height to their own body height during the "build as tall as you" challenge.	
3.G.A.1	Understand that shapes in different categories may share attributes
WHERE YOU'LL SEE IT (GRADES 3-5): Learners **observe that all their base shapes - squares, pentagons, hexagons - share the attribute of being closed polygons** made from straight line segments, and discover that when they build upward from any of these bases with vertical segments and a matching top shape, every resulting form is a prism - connecting shared geometric attributes across different shapes.	
6.G.A.1	Find the area of polygons by composing and decomposing into known shapes
WHERE YOU'LL SEE IT (GRADES 6-8): Learners **calculate the base area of their hexagonal structure by decomposing the hexagon into six equilateral triangles**, using the 12-inch straw length as the side measurement - and compare this base area to a square base's area to reason about why the hexagon provides more ground coverage and greater stability for tall builds.	
6.RP.A.1	Understand ratio concepts and use ratio reasoning
WHERE YOU'LL SEE IT (GRADES 6-8): Learners **explore the ratio of base perimeter to structure height** as they build taller - observing that a structure with a 4-straw square base (48-inch perimeter) becomes unstable at 5 straws tall (60 inches) while a 6-straw hexagonal base (72-inch perimeter) remains stable at the same height, reasoning about the ratio between base width and height that determines structural stability.	

LEARNERS EXPLORE

2D shapes to 3D prisms; structural stability and base width; measurement and scale; collaborative engineering; reinforcement techniques