6-2018

Truss Bridge Construction Project, High School Geometry

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Unit Title	*Geometry of Bridge Design*	Course(s)	Geometry
Designed by	Dayton King	Time Frame	2 weeks (Block Schedule)

Stage 1- Desired Results

Establish Goals

In this unit, students will apply their knowledge of transversal/parallel relationships to the construction of a truss bridge. This bridge will be constructed out of popsicle sticks and hot glue and will need to support as much weight as possible. Students will also need to sketch cross sections of the bridge; identifying special angles created by a transversal intersecting a pair of parallel lines and similar triangles.

TEKS:	**Common Core:**	**NCTM:**
G7.A G5.A G3.D	HSG.SRT.A2 HSG.MG.A3	Geometry Measurement

Transfer

Students will be able to independently use their learning to....

- Effectively implement the design process to use materials wisely.
- Design triangles and special angle pairs to address a real world problem.
- Construct similar objects as objects affected by a scale factor.
- Collaborate effectively with peers

Meaning

UNDERSTANDINGS

- Sides of shapes are proportional if and only if the shapes are similar
- Periodic constructions create congruent and similar figures.
- Trusses supporting a beam do so by spreading out the pressure and tension created by the weight of the object on the beam.
- There is a relationship between scale factors and proportions.

Essential Questions

- How do I make a bridge that supports weight with the fewest resources?
- Why do I need standardized units of measurement?
- How do I know when a result, design, or plan is reasonable?

Acquisition

Students will know...

- Definitions, criteria, and results of
  - Alternate Interior Angles
  - Supplemental Angles
  - Angle Sum of Triangles
- Standard units of measure
  - Standard and Metric systems with reasonable units
- Dilations create similar, but not congruent, figures

Students will be skilled at...

- Creating accurate sketches of designs
- Identifying congruent angles
- Identifying supplemental angles
- Using tools to measure distances accurately
- Setting up proportions
- Recognizing periodicy and reflective symmetry

Stage 2- Evidence

Code	Evaluation Criteria	
		PERFORMANCE TASK(S): ***Students will show that they understand by evidence of...***
T	Organized Accurate	Bridge Construction: **Problem Statement: Click Here** **Rubric: Click Here** By designing and constructing the bridge, students will need to explain how their scale model of a bridge is a legitimate representation of a full sized bridge and the geometric concepts that form the trusses of their bridges (such as the triangle angle sum theorem, the reflection symmetry of their truss, and the alternate interior angle identity). Further, students can show that the triangles in their truss are similar through equality of proportions of the triangles' sides.
		OTHER EVIDENCE: ***Students will show they have achieved Stage 1 goals by...***
A	Practical Accurate	Research – What is a Truss and why is it used? (Excellent video for visualization: "How trusses behave – analyzing compression and tension in a truss by example" – DartmouthX – the Engineering of Structures Around Us (Youtube: https://www.youtube.com/watch?v=TXJRrlb0YUc).
A	Insightful Thorough	KW Chart (Whole Class) Click Here – Students will complete a KW chart detailing everything we know about the project as it is presented (Ex: We need to build a bridge, it needs to span the Rio Grande at Eagle Pass, it needs to hold two lanes of traffic, we have 5 class periods to work on this, we will need a blueprint, sketch, model, and report, etc) and the teacher will probe to see what the groups still need to figure out, what they want/need to know (How long is the Rio Grande at Eagle Pass? How wide is a two lane road? What do good blueprints and sketches look like? Etc.)
M	Revealing Insightful	Error Analysis Click Here – Students will be given blueprints and sketches from fictional students and asked to provide feedback on each of them. This acts as a soft check on whether students' designs are on track themselves.
M	Creative Thorough	Reflection of the Project – This gives students an opportunity to explore their thought process and why they implemented certain strategies during the project. It gives them space to recognize what went well in the project and what changes (and why!) they would make should they do the project again.
M/T	Reflective	Reflection on the Group – This gives students an opportunity to tell the teacher if certain members of the group took on more or less of their fair share of the project and reflect on how the group worked together.

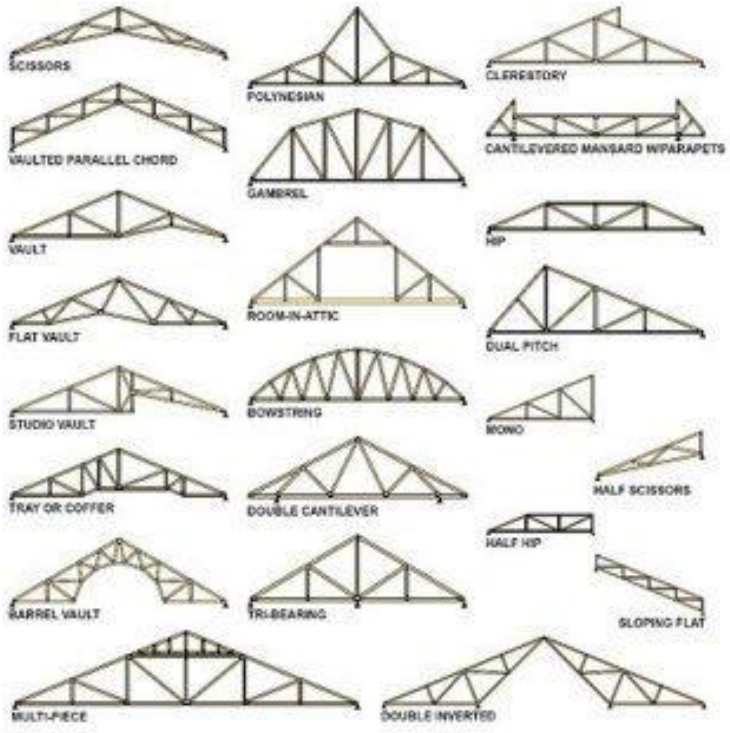
Stage 3- Learning Plan

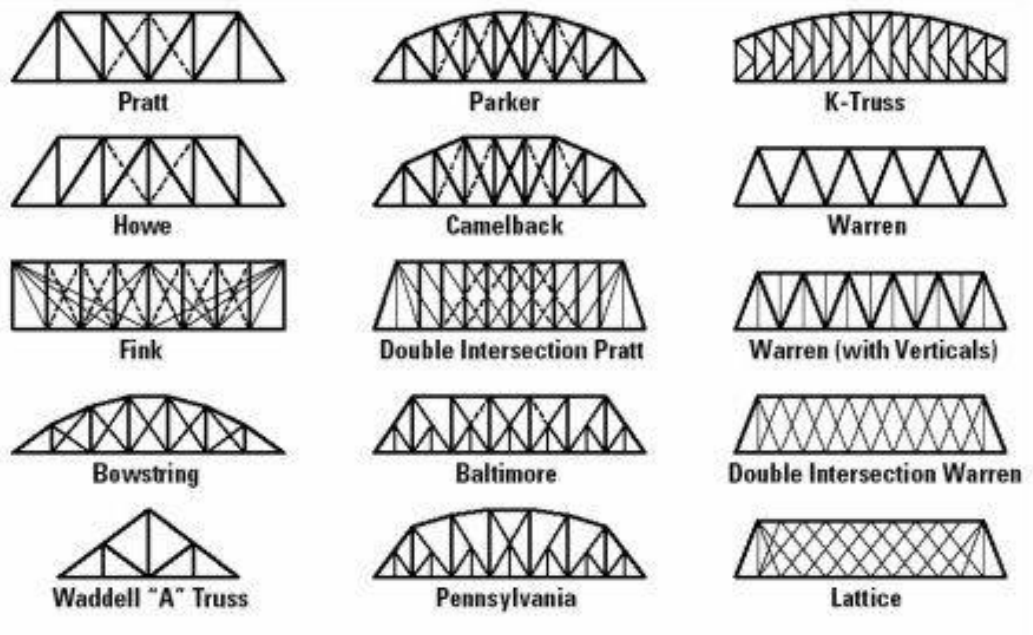
Code	Learning Events	Progress Monitoring
	Student success at transfer, meaning, and acquisition depends upon...	Day 1: Truss Bridges – Simulation and research Group and role assignments KW Activity Research Blueprint and Sketch work
T	Group Role Assignments Click Here	
A/M	Simulation/Demonstration	
A	KW Chart Click Here	Day 2: Design revisions Continue Blueprints and Sketches Begin Construction
A/M	Research Youtube Link	
M	Error Analysis Click Here	
T	Bridge Project Testing	Day 3: Continue Construction Consultations Error Analysis
M	Reflection of Project	
T	Reflection on Group	Day 4: Finish Construction Preliminary Testing Bridge Refinements (Possible Reflections)
		Day 5: Final Touches Stress Testing Reflections Group Reflections

Resources / Materials:

- Approximately 100 popsicle sticks per student group
- Glue Guns and Glue
- Access to Youtube
- Laptops or other forms of technology for students to research the site they are building the bridge and trusses
- Bamboo shish kabobs for simulation/demonstration

(Non-Exhaustive) Exemplars of Trusses





Mission Bay High School UbD Unit Planner is from Wiggins, Grant and McTighe, Jay.
Understanding by Design Guide to Creating High-Quality Units. Alexandria, VA: Association for Supervision and Curriculum Development. 2011.