**Raytown Lesson plan**

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| **Title of Lesson:** | Gumdrop Bridge |  | | | |
| **Grade Level:** | Elementary K-5 | **Lesson Length:** |  |  |  |
| **Materials:** | | **Vocabulary:** | | | |
| Per group:  50 gumdrops  100 toothpicks  120 pennies  Ruler  Bowl of water  [Student Planning Sheet](https://drive.google.com/a/raytownschools.org/file/d/0B9gJCq6nNDd9UlpaRVJUQ25MRlU/view?usp=sharing) | | Load  Gorge  Pros vs cons  Prototype  Beam bridges  Truss bridges  Cantilever bridges  Arch Bridges  Suspension bridges  [Gumdrop Bridge Vocabulary](https://docs.google.com/a/raytownschools.org/presentation/d/1Mo9Hd3-BWjfwPwobZwSFuwKJ6lvKNPYwVwDM5CG86fU/edit?usp=sharing)  [Types of Bridges](https://docs.google.com/a/raytownschools.org/presentation/d/1pW6-iO3-LzjzNOwgUahhWrMuEToBDvGylbw9dEK5cbY/edit?usp=sharing) | | | |
| **Integration of Technology:** | | Video of instruction | | | |
| **Prioritized Common Core Standards:** | | | | | |
| 3-5-ETS1-1 Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost.  3-5-ETS1-2 Generate and compare multiple possible solutions to a problem based on how well each is likely to meet criteria and constraints of the problem. | | | | | |
| **Student Objective:** | | | | | |
| I can design and build a model to prove or disprove my prediction.  I can collect and organize data and use it to draw conclusions and make predictions. | | | | | |
| **Hook/ Anticipatory Set/ Focus Questions:** | | | | | |
| How many of you crossed a bridge while driving this week?  Have you ever crossed a bridge while riding in a vehicle or walking?  Have you and your family ever crossed a bridge that made you nervous to cross?  Why did you feel nervous?  How do you think bridge designers know what types of materials they need in order to make bridges?  Bridges are structures built to get from point A to point B when the land in between is inaccessible.  The earliest bridges were simply logs laid across a stream or stones creating a path across a river, and grew to be more advanced by weaving together combinations of sticks, logs, branches, weeds, and other fibers to form ropes capable of holding together bridge materials.  These simple ideas were the foundations of the beam designs used in modern culture.  Bridges today are made of wood, concrete and/or steel and have many different structures.  Show images of bridges [24 most amazing bridges](http://travel.cnn.com/explorations/none/24-worlds-most-amazing-bridges-062644/)  [Bridge Construction- Magic school bus](https://www.youtube.com/watch?v=WVN715XKaoM) | | | | | |
| **Ask:** | | | | | |
| Engaging Scenario:  You and your engineer colleagues have been asked to design a new bridge that will span a “gorge” in the Missouri River Valley that will allow cars to travel along it.  Working as a team, how can you use 50 gumdrops and 100 toothpicks to span a 6-inch “gorge”?  (may want to show image of a gorge from vocabulary slides)  [Gumdrop Bridge Vocabulary](https://docs.google.com/a/raytownschools.org/presentation/d/1Mo9Hd3-BWjfwPwobZwSFuwKJ6lvKNPYwVwDM5CG86fU/edit?usp=sharing)  You need to build a bridge that can hold 120 penny “cars”.  This will be your load.  Introduce the term load.  [Gumdrop Bridge Vocabulary](https://docs.google.com/a/raytownschools.org/presentation/d/1Mo9Hd3-BWjfwPwobZwSFuwKJ6lvKNPYwVwDM5CG86fU/edit?usp=sharing)  Your team will need to think about how you can solve this problem.  Before we can begin we will do some research on possible solutions to our problem which is how to create a bridge that will reach the length of our gorge that will hold a load.  Here are some different types of bridge designs you may want to consider during the construction of your bridge.  [Types of Bridges](https://docs.google.com/a/raytownschools.org/presentation/d/1pW6-iO3-LzjzNOwgUahhWrMuEToBDvGylbw9dEK5cbY/edit?usp=sharing)  What are some possible constraints and available materials are you going to have to while completing this challenge?  Constraints:  only have 50 gumdrops and 100 toothpicks, time,  Materials:  50 gumdrops and 100 toothpicks | | | | | |
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| **Brainstorm:** | | | | | |
| Boys and girls now we will begin our brainstorming process.  Brainstorm some possible solutions to our problem.  How is your team going to construct a gumdrop bridge that will  span 6 inches and hold a load of 120 “cars” pennies?  Try to come up with as many ideas as possible.  Engineers’ first ideas are rarely their best ideas.  Draw labeled sketches of all you ideas so you can communicate your thinking. | | | | | |
| **Design:** | | | | | |
| Discuss pros and cons of your brainstormed designs with your group members.  (see pros and cons slide in vocabulary for images to help explain) [Gumdrop Bridge Vocabulary](https://docs.google.com/a/raytownschools.org/presentation/d/1Mo9Hd3-BWjfwPwobZwSFuwKJ6lvKNPYwVwDM5CG86fU/edit?usp=sharing)  Select the design that will solve the challenge best within the given constraints.  Draw a detailed model of how your model will be built and how it will work.  Use arrows and labels to show all the parts. | | | | | |
| **Create:** | | | | | |
| Choose the best solution to develop into a prototype (model).  (see slide in vocabulary to discuss what a prototype is. [Gumdrop Bridge Vocabulary](https://docs.google.com/a/raytownschools.org/presentation/d/1Mo9Hd3-BWjfwPwobZwSFuwKJ6lvKNPYwVwDM5CG86fU/edit?usp=sharing)  Build your model using the available materials.  Students will be creating their bridges using 50 gumdrops and 100 toothpicks.  You will want rulers available so students can be sure their bridge is at least 6 in long.  Remind students of the design constraints before and during their building of their model.  You may have a few testing stations available for testing during this creation stage.  You will place 2 desks 5 inches apart with a tub or bowl of water underneath.  Students will then begin stacking the 120 pennies on their bridge to determine if they bridge will hold the load.  You may start with adding pennies by groups of 10 to begin or by ones depending on grade level. | | | | | |
| **Evaluate & Refine:** | | | | | |
| After students have tested their design and identified problems.  Discuss in teams what could be changed to make their design better.  Brainstorm ways you can improve the design to fix the problems and make your model even better.  Repeat the design process- it’s a cycle.  After this whole process you may want to create a gallery walk for students to observe other bridges and discuss with other groups what was successful and what was unsuccessful. | | | | | |
| Rationale:  A = Acquisition: Students gather and store bits of knowledge and information.  B = Application: Students use acquired knowledge to solve problems, design solutions, and complete work.  C = Assimilation: Students extend and refine their acquired knowledge to be able to use that knowledge automatically and routinely       to analyze and solve problems and create unique solutions.  D = Adaptation: Students have the competence to think in complex ways and also apply knowledge and skills they have acquired. | | | | | |