In more depth: Exploring the Gummy Bear Launch

Instructional Objectives:

- Families will know what a catapult is and be able to demonstrate how it works.
- Students will know and be able to demonstrate the basic science and engineering concepts behind designing a catapult.

Performance Expectation: Families will plan, design, and create their own catapult. The catapult should be designed to launch gummy bears as far as possible.

Procedure: During this activity families will build a catapult of their own design and compete against others to see which catapult can launch gummy bears the furthest distance. Families receive brief instruction on the background of catapults, basic designs, catapults through-out history, and why they are important. Families then receive their materials and are allowed to work alone or in groups to draw a rendering of the catapult they intend to build. After the drawing is complete, families then begin building their designs. Facilitators are available to ask questions such as: "Why do you think building your catapult this way will launch your gummy bear the furthest?" and "Can you think of any other ways to build your catapult?" After the catapults are built, students line up and begin launching their

gummy bears. Each family is allowed to launch three gummy bears. After each launch, a piece of tape is placed on the floor and the family's name is written on the tape. After all gummy bears are launched, the facilitator announces the winner. Families then take turns explaining their catapult and the

reasoning behind its design.

Time: This activity takes 20–30 minutes. It includes basic instruction and hands-on learning.

Materials: Popsicle sticks, rubber bands, gummy bears, Dixie cups, glue, masking tape, scotch tape, paper, and markers.

Possible Assessment Measures:

Formative :

K–2: Ask questions, “If I pull on this catapult harder, will the gummy bear go further?” “If I change the direction of the catapult, will the gummy bear land in a different direction?” “What part of your design makes the gummy bear launch from the Dixie cup?” “Why do you think this person’s gummy bear landed further than yours?” “What pieces will you need to construct your catapult?” and “What do you think is the best way to construct your catapult, so it lands the furthest?”

3–5: Ask questions, “What design do you think will produce a catapult that can launch a gummy bear the furthest?” “What materials do you need to construct a successful catapult?” “How will those different pieces add or take away from the effectiveness of your catapult?” and “How will your catapult model achieve the desired effect of a gummy bear launched the furthest?”

Summative:

K–2: Students will look at a picture and identify with “yes” or “no” if the picture is a catapult. Students will try a catapult to see how far they can launch different objects. A group of students will design (through a drawing) a catapult they would like to build. The same group of students will then attempt to build their catapult and launch objects. Groups of students will compete against each other to see whose catapult can launch an object the furthest distance.

3–5: Students will write a small report on the importance of catapults, what needs they were designed to fix, and come up with an engineering design idea for the world’s current or future needs.

The materials/lessons/activities outlined in this article are just one step toward reaching the Performance Expectations listed below. Additional supporting materials/lessons/activities will be required.

K-2-ETS1 *www.nextgenscience.org/k-2ets1-engineering-design*	
Performance Expectation	Connections to Classroom Activity
K-2-ETS1-2: Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a problem.	Students design and draw a model for their intended catapult. Include brief description on parts of catapult.
Science and Engineering Practices	
Developing and Using models Analyzing and Interpreting Data	Students • Design and draw model of catapult • Construct catapult • Construct explanation on why they are building a catapult • Observe why one gummy bear was launched further than another • Observe and explain how they can improve their catapult for a further launch
Disciplinary Core Idea	
ETS1B: Developing possible solutions • Designs can be conveyed through sketches, drawings or physical models. These representations are useful in communicating ideas for a problem's solutions to other people.	Students design and build catapults to see which student can launch their gummy bear the furthest.
Crosscutting Concept	
Structure and Function	Students use models to draw and explain components of a catapult Students measure the gummy bears to see whose was launched the furthest

STEM Field/Activity	Description	Suggested Assessment
3D printer	Students see a 3D printer create toys. They are able to see the printer working up close and hold the material before it goes through the printer and then hold the objects once they are printed.	Formative: Ask questions, "What material is used in a 3D printer?" and "How does the printer create objects?" Summative: The student could create a design that would be printed in a 3D printer. This would allow students to think towards the future of manufacturing engineering and about the various objects that can be printed.
Roman Arch	Students will build a roman arch using provided kit, which demonstrates static equilibrium and the resolution of forces in clear fashion.	Formative: "How can the correctly built bridge hold the weight of a human?" and "What is important about the structural formation of the bridge?" Summative: Student could attempt to build the arch correctly, which would show the understanding of design concepts behind the arch.
Spectral Diffraction	Students will learn about the spectral properties of light, activities are best done in low light or a dark setting.	Formative: "What are some of the spectral properties of light?" and "How can you create multiple beams?" Summative: Students could play the laser khet game, which will teach them about reflective properties of light combined with geometry and game strategy. If a beam splitter is added on, multiple beams can be created.
Human Biology and You	Students will observe and handle anatomical pieces and learn about how body systems work.	Formative: "What process does the heart do for the body?" and "Where are lungs located?" Summative: Students could complete a lab report; in the lab report they would look at drawings/picture and identify the parts of the body with its function.
Nutrition and You	Students will observe and handle nutrition pieces while matching	Formative: "Where can you find the sugar content on a food

	sugar contents to various food models.	label?" and "Do you think pudding or mayonnaise has more sugar?" Summative: Students would put together a lab report that showed various groups of foods and the sugar content in those foods (found on labs of the food products).
How much is 293?	Students attempt to guess how big of a container is needed to hold 293 popped kernels based on the unpopped kernels only.	Formative: Summative: Students would create a container made from construction paper, which they believe will hold 293 kernels. Containers could be any geometrical shape.