

Kacey Legare

Engineering CUP: Paper Bridge Construction

Teaching and Learning LAP 4: How Do We Decide What To Improve Upon? Intervention

I. Content: Describe *what* it is you will teach. What is the content?

- This lesson is an intervention surrounding the “Improve” section of the Engineering Design Process. In this lesson, students will engage in a vocabulary session in which they will have visuals and the vocabulary surrounding the materials and types of folds they had used and explored in the previous lessons. Students will identify the strengths and weaknesses of each material or type of fold. They will also be connecting their reasoning to Project Lead the Way, another engineering unit they are working on. This will connect their ideas and concepts and provide them the language necessary to show their thinking in written work. They will then get to show their ideas for improvements visually in a Redesign section. By co-defining the vocabulary needed, students can take ownership over the words and apply them to their explanations. .

II. Learning Goal(s): Describe what specifically students will *know* and *be able to do* after the experience of this class.

- SWBAT list positive and negative qualities of the materials and folds we had used previously.
- SWBAT use vocabulary to explain why a material or fold would not be an effective option for a bridge.
- SWBAT defend their choices for the best material and the best folding style using vocabulary.
- SWBAT connect PLTW ideas around “Structure” and “Function” to this unit.
- SWBAT decide upon improvements to make to their designs and models.
- SWBAT create and label a diagram of their redesigned bridge model.

III. Rationale: Explain how the content and learning goal(s) relate to your Curriculum Unit Plan learning goals.

- The above learning goals relate to my CUP in response to the previous two lessons. I noticed that my students were struggling to show their understanding of the effectiveness of the choice in materials and folds. It was important to make sure students had this understanding because this was the lesson most closely relating to the standard for engineering. After this lesson around improvements, vocabulary, and defending our thinking, students will be moving onto final designs and final tests.

IV. Assessment: Describe *how* you and your students will know they have reached your learning goals.

- I will know my students have reached their learning goals by their ability to express ownership of the vocabulary and explain their decisions around improving their designs and models in writing. Students will connect ideas about “structure” and “function” into this lesson as well. This construction of defining qualities and using vocabulary to defend thinking will strengthen their understanding around the reasons engineers make decisions and try out different options before making their final choices. I know students have reached the learning goals by their completed reflection sheets and Improve and Redesign sections of their packets.

V. Personalization and equity: Describe how you will provide for individual student strengths and needs. How will you and your lesson consider the needs of each student and scaffold learning? How specifically will ELL students and students with learning disabilities gain access and be supported?

- ELL students are supported in this lesson through this lesson because it is designed to strengthen all students' use of language to describe their thinking. This lesson should have probably been an introduction lesson but nevertheless students will have visual representations of materials and folds on the board to refer to. We will co-define the elements of each word to make sure everyone has access to descriptive words for their writing. Lastly, the Redesign section is a diagram so there minimal lingual barriers to complete it.

VI. Activity description and agenda

a. Describe the activities that will help your students understand the content of your class lesson by creating an agenda with time frames for your class. Be prepared to explain why you think each activity will help students on the path toward understanding.

Schedule:

<b>Time</b>	<b>Students</b>	<b>Teacher</b>	<b>Materials</b>
2:40-2:55	• Define Elements and Characteristics of Each Material and Folding Style both Positive and Negative	• Record Definitions on Whiteboard	• Expo • Whiteboard
2:50-3:05	• Fill Out Reflection Sheet regarding Structure, Function, and Improvements	• Pass Out Reflection Sheets • Assist with Fill-Ins	• Reflection Sheets
3:05-3:20	• Fill Out Improve and Redesign sections of Packet	• Provide Sentence Stems for Improve section	• EDP packets

b. What particular challenges, in terms of student learning or implementing planned activity, do you anticipate and how will you address them?

- I anticipate engagement to be lower for this type of lesson. I know students will be disappointed they do not get any materials and there won't be any testing bridges in this lesson. However, this work is important to deepen their understanding. My concern is that if engagement is low, behaviors might be harder to manage and I won;t be able to help the students who need my assistance because I'll be creating behaviors. I will try and intercept this by being clear about why we are doing this work and where we will be heading in the unit so that they can focus on what they need to do here so that they can be successful the next time they do have access to materials for the final tests.

VII. List the Massachusetts Learning Standards this lesson addresses.

- Grade 2 Common Core standards

- **2.K-2-ETS1-3.** Analyze data from tests of two objects designed to solve the same design problem to compare the strengths and weaknesses of how each object performs.
  - Data can include observations and be either qualitative or quantitative.
- **2.W.7.** Participate in shared research and writing projects (e.g. read a number of books on a single topic to produce a report; record science observations).
- **2.W.8.** Recall information from experiences or gather information from provided sources to answer a question.
- **2.W.10.** Write routinely for a range of tasks, purposes, and audiences.
- **2.SL.1.** Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
  - a. Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
  - b. Build on others' talk in conversations by linking their comments to the remarks of others.
  - c. Ask for clarification and further explanation as needed about the topics and texts under discussion.
- **2.SL.4.** Tell a story, recount an experience, or explain how to solve a mathematical problem with appropriate facts and relevant, descriptive details, speaking audibly in coherent sentences and using appropriate vocabulary.
- **2.SL.6.** Produce complete sentences when appropriate to task and situation in order to provide requested detail or clarification.
- **2.L.1.** Demonstrate command of the conventions of standard English grammar and usage when writing or speaking; retain and further develop language skills learned in previous grades.
- **2.L.2.** Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
- **2.L.3.** Use knowledge of language and its conventions when writing, speaking, reading, or listening.
- **2.L.6.** Use words and phrases acquired through conversations, activities in the grade 2 curriculum, reading and being read to, and responding to texts, including using adjectives and adverbs to describe.
- **2.MD.9.** Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Organize and record the data on a line plot (dot plot) where the horizontal scale is marked off in whole-number units.
- **2.MD.10.** Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems,11 using information presented in a bar graph.

## VIII. Reflection

- a. In light of all areas of planning, but especially in terms of your stated purpose and learning goals, in what ways was the activity(ies) successful? How do you know? In what ways was it not successful? How might the activity be planned differently another time?
  - This was my unannounced CAP observation. This lesson went very well in regards to students getting the concepts and using appropriate vocabulary to explain their

thinking. Students were very engaged and helpful when we were codefining the vocabulary words. They were really trying to think of adjectives to describe why a particular material or fold was successful or not and why. After we completed the whiteboard, students got right to work. They completed the Reflection paper in chunks, as I designed it. I walked them through the initial question about what the function of these bridges is. When I had most of the class ready to move on, I explained how they would need to pick a material or a fold and then, by using vocabulary, describe why it did not work well. Some students struggled with the question but once they understood what I was asking from them, they successfully used the vocabulary to describe their thinking.

When students were ready to move to the final section of the Reflection, I explained how they will need to write down which material and which fold is the best in their opinion. They will have to explain why they think those are the best choices. Once they completed their worksheet, they could get their packets and fill in the Improve and Redesign sections with the remaining time. I thought that students transitioned safely and quickly between sections of the paper, between paper and packets, and from whole group to independent work and back again. Their focus and transitions were on task and that helped the lesson flow smoothly.

I saw students collaborating with others at their tables respectfully during this exercise. I also saw many students referring to the whiteboard with the vocabulary and adjectives on it. This confirms that they did need to complete this lesson in order to deepen their understanding and learning in this unit. In order to be the most successful in the final tests and designs, students knew they had to have a strong idea about what choices to make and this lesson helped build those connections between units and experiences.

- b. What did you learn from the experience of this lesson that will inform your next LAP?
- As I mentioned above, I would have taught this lesson in the introduction to the project if I could reteach this unit. Although the students all came to strong conclusions with good reasoning, see Student Work below, if they had had this vocabulary and understanding from the beginning, I wonder how their explorations of materials and folds would have been more effective. As for their work, almost all students could identify a poor material or fold and explain why it was a poor choice and used their decisions about the best materials and folds in their Improve and Redesign sections in their packets. They thought deeply and critically about their choices and wanted to make the strongest bridge in the class. This was shown through their focus and engagement even when no materials were present.

Student Work on Next Pages

## A. Vocabulary Board Work

February 3, 2020

2/3 - 2/7 pennies

function - what something does  
structure - how something is made

materials

- wax paper - light, weak, floppy
- tin foil - fold it, bendable, weak
- construction paper - bendable, strong
- cardstock - thick, strong, bendable

folds

- circle tube - roll, not stable
- square tube - unstable
- crinkle - strong, wide
- flat with edges - strong, long, edges

Reading Stamina 13 minutes

1275517

Writing Our Owns  
Picture Books

Writers can study...

Make it longer, longer, and then, something!

ROSTIE REVERE - IT ENGINEER

## B. Student Improvement Reflection Intervention

Name: Michael Kyri-Baffour

Reflect

The function of the bridges we are building is to hold pennies

One of the structures that is weak is the circle tube (fold / material).  
It did not hold a lot of pennies because every time we put pennies on it it just rolls off,

The best structure to use is the crinkle fold with the cardstock material. I think this will be the strongest and hold a lot of pennies because the cardstock is very thick strong and bendable and the crinkle is wide and strong also, so if you do it together is going to be very strong and thick to hold a lot of pennies

Name: Ny Shyia

Reflect

The function of the bridges we are building is to to hold pennies

One of the structures that is weak is the circle tube (fold / material).  
It did not hold a lot of pennies because it didn't hold a lot of pennies. That's not holding of.

The best structure to use is the flat with fold with the cardstock material. I think this will be the strongest and hold a lot of pennies because that was on top of the sides, and it was folded just. It holds a lot of pennies.

Name: Nanna Asala

**Reflect**

The function of the bridges we are building is to hold onto pennies

One of the structures that is weak is the Wax paper (fold / material).  
It did not hold a lot of pennies because it's light weak and floppy.

The best structure to use is the flat with edges fold with the tin foil material. I think this will be the strongest and hold a lot of pennies because it is bendable because it is strong

Name: Cesar R.

**Reflect**

The function of the bridges we are building is to pennies  
Wax paper

One of the structures that is weak is the Wax paper (fold / material).  
It did not hold a lot of pennies because It was so bad because it kept falling

The best structure to use is the Card stock fold with the Paper with edge material. I think this will be the strongest and hold a lot of pennies because is flat and the edge happy it

Name: Jeremy

**Reflect**

The function of the bridges we are building is to hold the pennies

One of the structures that is weak is the wax paper (fold / material).  
It did not hold a lot of pennies because its very light, weak, plastic, unstable and thick.

The best structure to use is the crinkle fold with the construction paper material. I think this will be the strongest and hold a lot of pennies because it strong it is bendable, it has more structure in it.

Name: JoJo

**Reflect**

The function of the bridges we are building is to to hold pennies

One of the structures that is weak is the circle tube (fold / material).  
It did not hold a lot of pennies because it didn't hold a lot of pennies, because it roll

The best structure to use is the construction fold with the crinkle material. I think this will be the strongest and hold a lot of pennies because I think it's strongest because it hold a lot of pennies a it fold

Name: Natalia

**Reflect**  
 The function of the bridges we are building is to hold  
pennies

One of the structures that is weak is the wat paper (fold / material).  
 It did not hold a lot of pennies because it was  
light, weak, and floppy. And  
it was not strong.

The best structure to use is the crinkled fold with the  
construction paper material. I think this will be the strongest and hold a lot  
 of pennies because it's steady and strong  
and bendable. It also holds  
a lot of pennies.

rilly really

Name: Eliah

**Reflect**  
 The function of the bridges we are building is to hold stuff  
like pennys.

One of the structures that is weak is the square fold (fold / material).  
 It did not hold a lot of pennies because it was  
not folded unike.

The best structure to use is the tin folded fold with the  
tin material. I think this will be the strongest and hold a lot  
 of pennies because when me and  
Nisha fold it from it when  
it is our turn I  
now it will hold a  
lot of pennys.

### C. Student Improvements and Redesigns

**Improve**  
 How can you make your design and model better?  
I can improve  
my material by using  
cardstock. I can improve the  
way I folded my bridge by  
making it stron

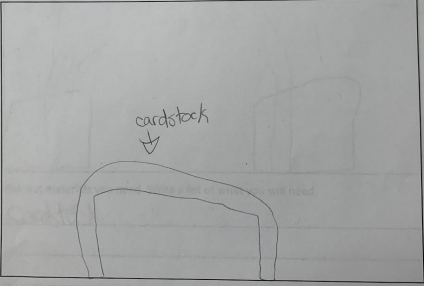
**Redesign**  
 Draw out your idea with improvements. Show all the parts of your redesign.

**Improve**  
 How can you make your design and model better?  
I can make my model better  
by making my design into a  
table then put the crinkle  
on the top of table to make  
it strong.

**Redesign**  
 Draw out your idea with improvements. Show all the parts of your redesign.

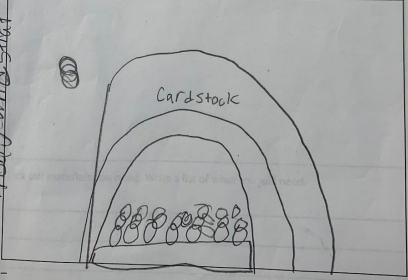
**👍 Improve**  
 How can you make your design and model better?  
 I can make my model better by making my design into a table than put the crinkle on the top of table to make it strong.

**✍️ Redesign**  
 Draw out your idea with improvements. Show all the parts of your redesign.



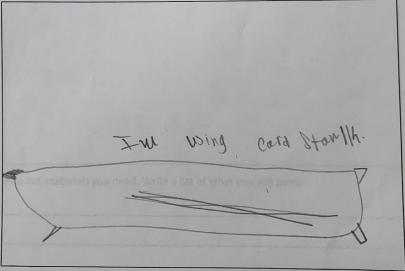
**👍 Improve**  
 How can you make your design and model better?  
 I can improve my material by using cardstock.  
 I can improve the way I folded my bridge by using cardstock.

**✍️ Redesign**  
 Draw out your idea with improvements. Show all the parts of your redesign.



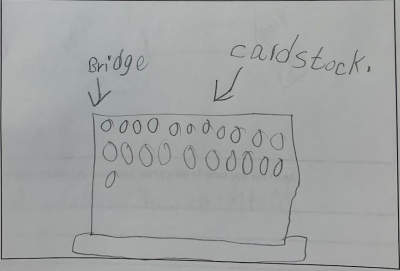
**👍 Improve**  
 How can you make your design and model better?  
 By making it tall instead to ten the ground. You be the briges in nature. You'll have to hold it. I can improve it by using cardstock on paper. I can improve the way I folded my bridge by...

**✍️ Redesign**  
 Draw out your idea with improvements. Show all the parts of your redesign.



**👍 Improve**  
 How can you make your design and model better?  
 I can improve my material by using cardstock. I can improve the way I folded my bridge by folding cardstock.

**✍️ Redesign**  
 Draw out your idea with improvements. Show all the parts of your redesign.





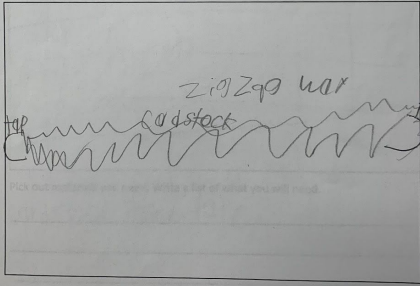
### 👍 Improve

How can you make your design and model better?

Make it up stronger, I can improve my material by using tape and make it strong, I can improve the car I folded my bridge by, Not letting it go down.

### ✏️ Redesign

Draw out your idea with improvements. Show all the parts of your redesign.



### 👍 Improve

How can you make your design and model better?

I can make it stronger and longer and I can make it sturdier, I can make it so the pens don't fall off.

### ✏️ Redesign

Draw out your idea with improvements. Show all the parts of your redesign.

