

Kacey Legare

Engineering CUP: Paper Bridge Construction

Teaching and Learning LAP 5: Final Design, Final Tests, Reflection on Collaboration

- I. Content: Describe *what* it is you will teach. What is the content?
  - This lesson is the conclusion to the paper bridge building project and rounds off the Engineering Design Process. Students will be making a final design based off of their improvements made in the previous lesson. Then we will be having one last class-wide test for the bridges. Students will record data as groups get to test. Lastly, students will reflect on their collaboration skills across the unit on a Likert scale.
  
- II. Learning Goal(s): Describe what specifically students will *know* and *be able to do* after the experience of this class.
  - SWBAT use new information to make changes to a design and model.
  - SWBAT collaborate to determine final decisions regarding design and material choices.
  - SWBAT co-construct a model bridge using one material and a maximum of 2 pieces of tape.
  - SWBAT record data into a chart.
  - SWBAT reflect on their own collaboration efforts throughout the unit.
  
- 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 as a conclusion to the unit. By allowing the final tests and reflections be my summative assessment, I can conclude our work with Engineering in an authentic way. Students will be applying all their prior knowledge from experiences, literature, conversations, and previous lessons to create a cohesive and successful final bridge model. Students will practice collaborating, sharing, waiting, and recording data. They will also practice being self-reflective and grading their own collaboration skills. This allows my students to use all their knowledge gained to show their improvement from their initial designs to their final bridges.
  
- 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 complete the Final Design sections, Final Tests charts, and Reflection sections. I will also be observing how well students are able to observe testing as a whole group and record their own data. Their collaborative efforts will be observed again by myself listening to their thinking and conversations while designing and constructing the final models.
  
- 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 hands-on experiences. Again, there is partner work and conversational verbal skills needed to be successful in this final lesson but by removing intense writing and reading from the individual, ELLs and all other students benefit from being able to focus purely on the engineering ideas. Additionally, I chose a Smiley face Likert scale for the self-assessment because I wanted

all my students, whether they are visual learners, ELLs, or Special Ed to be able to understand that question and answer accurately and honestly. I also wrote every pair's names on the board I was testing so that spelling names did not take away from the experience and learning which was occurring.

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:

Time	Students	Teacher	Materials
2:40-2:55	<ul style="list-style-type: none"> <li>● Create Final Design and Final Models to be Tested</li> </ul>	<ul style="list-style-type: none"> <li>● Pass Out Materials and Packets</li> <li>● Facilitate Discussions</li> </ul>	<ul style="list-style-type: none"> <li>● Packets</li> <li>● Tin Foil, Cardstock, Construction Paper</li> <li>● Tape</li> </ul>
2:55-3:15	<ul style="list-style-type: none"> <li>● Record Results in Packet</li> <li>● Test Bridges</li> </ul>	<ul style="list-style-type: none"> <li>● Test Bridges</li> <li>● Write Names on Board</li> </ul>	<ul style="list-style-type: none"> <li>● Expo</li> <li>● Pennies</li> <li>● Books</li> </ul>
3:15-3:20	<ul style="list-style-type: none"> <li>● Reflect on Collaboration</li> </ul>	<ul style="list-style-type: none"> <li>● Collect Packets</li> </ul>	<ul style="list-style-type: none"> <li>●</li> </ul>

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

- I anticipate timing to be the largest issue in this lesson. I think it will be hard to get everyone focused and calm to test effectively in one lesson period. I know this will take more time than one 45 minute lesson. Regardless, when we finish testing, students will reflect briefly and we can conclude the unit alongside PLTW. I will be aware of time and try and test as many pairs as I can but I know the excitement and engagement will be so high their behaviors and focus might not allow for everyone's bridges to be tested in one period. I do not think I can prevent this with better planning, I am just prepared to continue the tests the following day. By expecting this, I won't be stressed or worried when time is running out and we have students left. This also allows students who may have been absent to participate the following day.

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,<sup>11</sup> 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?
  - I thought this lesson went moderately well. We did get lots of engagement and bridges that included evidence of students improving their designs and thinking about choice in material and design. Students' bridges were very successful, many held 100 pennies. However, their focus and ability to dial into a lesson or activity was poor all week long due to breaks in routine and surprises. We had the 100th day of school, Valentine's Day, a 2 hour delay, and it was the week before February break. All of that

came together to make it very difficult for students to follow expectations. There was so much deviance from regular programmed school routines that most students struggled behaviourally this week. This was reflected in their abilities to collaborate in this lesson. Partners who had been positive and collaborative were arguing and not sharing. They were finding difficulty in the excitement surrounding the final testing.

As a teacher, sometimes we cannot control the environment we teach in. This is a prime example of that in action. Ideally, I would have finished this unit in the prior week but inclement weather prevented its completion. My students showed understanding and made successful bridges despite the challenges they faced.

- b. What did you learn from the experience of this lesson that will inform your next LAP?
- This is the last lesson in my CUP. This lesson will inform how we move forward in STEM and science in our room. I was extremely impressed with my students' improvements regarding collaboration skills. They all seemed to grade rate themselves highly on the Likert scales (See Student Work) but I think they were deserved mostly. I also saw stark improvement in their ability to record data in a chart. Everyone had almost 100% completion and accuracy in their data in their charts. One group I was very impressed with was Joseph and Cesar. They had made the most improvements throughout the entire unit. In this lesson, you can watch their test below, and see how successful their bridge was. Their initial bridge held 4 pennies and they made many improvements. Their final bridge held 100 pennies. Moving forward, I plan to refer to their hard work in this unit with problem solving strategies to help them across other subjects and disciplines.

#### Student Work on Next Pages

Follow the links to watch video of the final tests.

[Michael and Kayle](#)

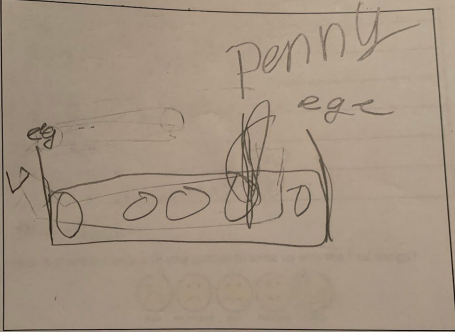
[Cesar and Joseph](#)

[Claishlee and Jasharys](#)

## A. Students' Final Designs

**Final Design**

Draw out your final idea with all improvements. Show the way you will fold the material and label which materials you need. This is the way you will build it for the final testing.



Pick out materials you need. Write a list of what you will need.

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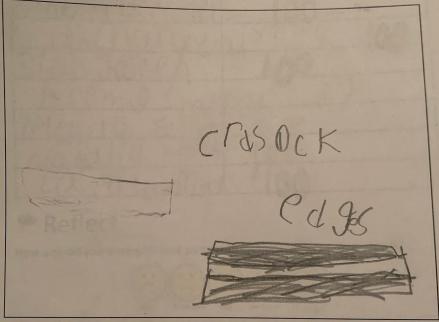
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**Final Design**

Draw out your final idea with all improvements. Show the way you will fold the material and label which materials you need. This is the way you will build it for the final testing.



Pick out materials you need. Write a list of what you will need.

maybe tinfoil or  
cardstock with  
edges

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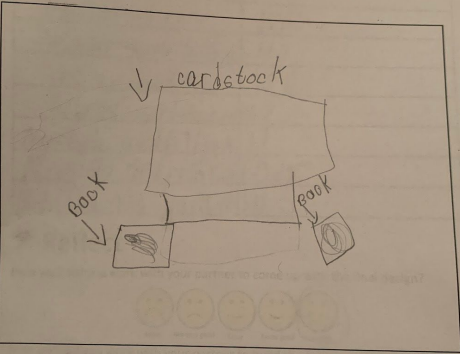
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**Final Design**

Draw out your final idea with all improvements. Show the way you will fold the material and label which materials you need. This is the way you will build it for the final testing.



Pick out materials you need. Write a list of what you will need.

I fold the cardstock

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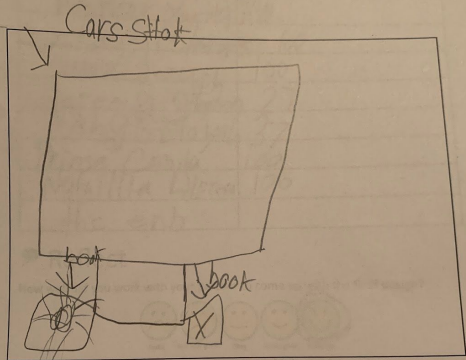
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**Final Design**

Draw out your final idea with all improvements. Show the way you will fold the material and label which materials you need. This is the way you will build it for the final testing.



Pick out materials you need. Write a list of what you will need.

I fold the Cardstock

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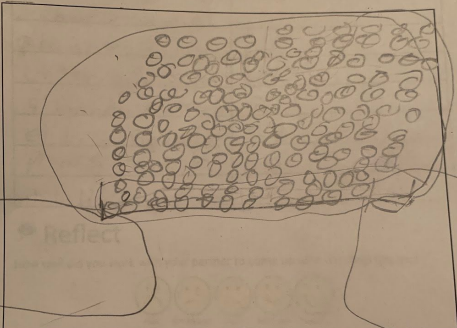
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**Final Design**

Draw out your final idea with all improvements. Show the way you will fold the material and label which materials you need. This is the way you will build it for the final testing.

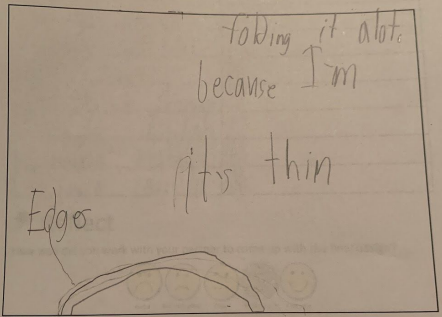


Pick out materials you need. Write a list of what you will need.

tape & paper.

**Final Design**

Draw out your final idea with all improvements. Show the way you will fold the material and label which materials you need. This is the way you will build it for the final testing.

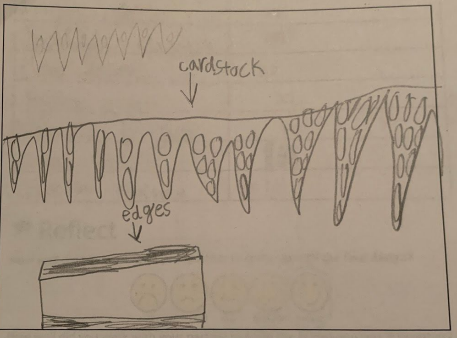


Pick out materials you need. Write a list of what you will need.

My material is cardstock. I will fold it alot and make it stronger and combine me and my partner's ideas.

**Final Design**

Draw out your final idea with all improvements. Show the way you will fold the material and label which materials you need. This is the way you will build it for the final testing.

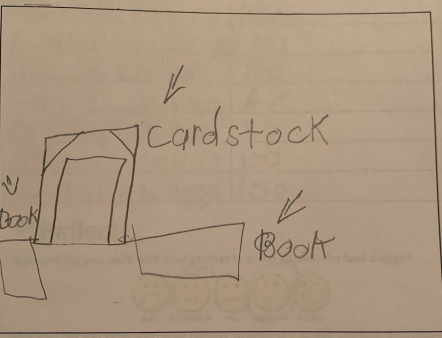


Pick out materials you need. Write a list of what you will need.

Cardstock edges all edges cardstock

**Final Design**

Draw out your final idea with all improvements. Show the way you will fold the material and label which materials you need. This is the way you will build it for the final testing.



Pick out materials you need. Write a list of what you will need.

cardstock



## B. Students' Final Results and Collaboration Reflection

**Final Tests**  
Build your final design. Test your model with pennies. Record the results.

Group	Number of Pennies
Kayle Michael	41
Nomar Yoviel	100
Clashlee Jashmy	100
Joseph Cesar	100
Jeremy Shannon	27
Nyshyla Elijah	37
Prince Camila	100
Natalia Hanna	100

**Reflect**

How well did you work with your partner to come up with the final design?

Awful  Not very good  Okay  Really good  Fantastic

How well did you work with your partner to build the bridge and test it together?

Awful  Not very good  Okay  Really good  Fantastic

How well did you use the Engineering Design Process to improve your model?

Awful  Not very good  Okay  Really good  Fantastic

**Final Tests**  
Build your final design. Test your model with pennies. Record the results.

Group	Number of Pennies
Michael / Kayle	41
Nomar Yoviel	100
Jasharys clashlee	100
Joseph Cesar	100
Jeremy Shannon	27
Prince Camila	0
Natalia Hanna	100
Prince Camila	100

**Reflect**

How well did you work with your partner to come up with the final design?

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How well did you work with your partner to build the bridge and test it together?

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Build your final design. Test your model with pennies. Record the results.

Group	Number of Pennies
Michael Kayle	41
Nomar Yoviel	100
Jasharys clashlee	100
Joseph Cesar	100
Jeremy Shannon	27
Nyshyla Elijah	37
Natalia Hanna	100
Camila Prince	100

**Reflect**

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Awful  Not very good  Okay  Really good  Fantastic

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**Final Tests**  
Build your final design. Test your model with pennies. Record the results.

Group	Number of Pennies
Michael Kayle	41
Nomar Yoviel	100
Jasharys clashlee	100
Cesar Joseph	100
Jeremy Shannon	27
Nyshyla Elijah	37
Hanna Natalia	100
Camila Prince	100

**Reflect**

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How well did you use the Engineering Design Process to improve your model?

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### Final Tests

Build your final design. Test your model with pennies. Record the results.

Group	Number of Pennies
Michael Kayle	41
Nomar Yoriel	100
Jashark Sclaid	100
Cesar Joseph	100
Jeremy Shannon	27
Nyshya Elijah	37
Prince Camila	100
Natalia Lyanna	100

**Reflect**

How well did you work with your partner to come up with the final design?

How well did you work with your partner to build the bridge and test it together?

How well did you use the Engineering Design Process to improve your model?

### Final Tests

Build your final design. Test your model with pennies. Record the results.

Group	Number of Pennies
Michael Kayle	41
Nomar Yoriel	100
Jashark Sclaid	100
Cesar Joseph	100
Jeremy Shannon	27
Nyshya Elijah	37
Natalia Lyanna	100
Prince Camila	100

**Reflect**

How well did you work with your partner to come up with the final design?

How well did you work with your partner to build the bridge and test it together?

How well did you use the Engineering Design Process to improve your model?

### Final Tests

Build your final design. Test your model with pennies. Record the results.

Group	Number of Pennies
Michael Kayle	41
Nomar Yoriel	100
Jashark Sclaid	100
Cesar Joseph	100
Jeremy Shannon	27
Nyshya Elijah	37
Prince Camila	100
Natalia Lyanna	100

**Reflect**

How well did you work with your partner to come up with the final design?

How well did you work with your partner to build the bridge and test it together?

How well did you use the Engineering Design Process to improve your model?

### Final Tests

Build your final design. Test your model with pennies. Record the results.

Group	Number of Pennies
Michael Kayle	41
Nomar Yoriel	100!
Jashark Sclaid	100!
Cesar Joseph	100!
Jeremy Shannon	27
Nyshya Elijah	37
Prince Camila	100!
Natalia Lyanna	100!

**Reflect**

How well did you work with your partner to come up with the final design?

How well did you work with your partner to build the bridge and test it together?

How well did you use the Engineering Design Process to improve your model?