

Kacey Legare

Engineering CUP: Paper Bridge Construction

Teaching and Learning LAP 1: Introduction to EDP and Project

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

- This lesson is an introduction to the Engineering Design Process and the paper bridge building project we will be taking part in. Students will be engaging their prior knowledge of engineers and what they do through Interactive Read Alouds of the books Rosie Revere Engineer, Iggy Peck Architect, and Ada Twist Scientist. These books will also follow the Engineering Design Process which we will define and use in our project. Then students will be introduced to the bridge building project by watching a video describing the EDP and how to solve a bridge-based problem. Students will also watch a real-life demonstration of a very weak paper bridge and then they will complete the “Ask” and “Imagine” sections of their Engineering packets while beginning to think about how they plan to make their own models.

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

- SWBAT identify and explain each of the parts of the EDP (Ask, Imagine, Plan, Create, Improve).
- SWBAT connect the EDP to a bridge building problem.
- SWBAT identify the problem of the project in the “Ask” section.
- SWBAT construct possible solutions to the problem in the “Imagine” section.
- SWBAT use ideas from classmates to expand upon their own ideas for solutions.

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 an introduction to the unit. This lesson introduces the EDP and the project to students in an engaging way. Through video media and through real life testing, students will get to think about the problem and devise different solutions. They will hear about the problem and the EDP repeated by me, the video, and in the packet visually. This introduction allows students to think about their prior experiences with engineering through literature we have read recently, their previous experiences in younger grades, and the current framework and project we will embark on. This lesson allows the students to have the stable introduction necessary to be successful in pairs for the next lesson when they will make their initial designs and test for the first time as well.

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 “Ask” and “Imagine” sections of their Engineering packets. I will know they are ready to plan out their models through hearing their conversations and comments during the video and demonstration. They will have to finish the sections in order to move onto the initial designs and testing in the next lesson. Because of the nature of the EDP, it is crucial students complete the steps in order. I will know students are thinking critically if they can formulate in their own words the problem in this project and begin to think of solutions.

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 the multiple representations of data. After reading multiple books, I will have an anchor chart available as well as smaller versions of the EDP in a visual cycle in their Engineering packets to be used. Students will also get to watch an engaging video explaining the project. I will also be running initial trials to explain the project and the limitations. ELLs will benefit from visual aids, sentences stems, and the multiple explanations of the content in different ways. This project is also meant to be collaborative and even though they have not been assigned to their partners yet, ELLs and other students seeking support can work with peers at their tables.

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
2:40-2:50	● Think About Anchor Chart and EDP	● Go Over EDP and Introduce Project	● Anchor Chart
2:50-2:55	● Watch Video	● Play Video https://youtu.be/RM04n0-QtNo	● Computer ● Elmo ● Video
2:55-3:00	● Watch Brief Trials	● Set Up Dictionaries, Paper Bridge ● Show Pennies on Flat Paper ● Show on Folded Paper	● Dictionaries ● Construction Paper ● Pennies ● Elmo
3:00-3:15	● Fill in the “Ask” and “Imagine” Sections of the Packet	● Pass Out Packets ● Start the Ask and Imagine Sentences	● Packets ● Elmo ● Marker
3:15-3:20	● Share Out Ideas	● Call on Children to Share ● Communicate important and not important parts to include	● Completed 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 some slight confusion about expectations to be an issue with this lesson. I am assuming my students have had some experiences with the Engineering Design Process and will recognize the parts from the Anchor chart. If they don't have a strong base in the EDP, they might be very confused about what I am asking for when I say complete the "Ask" and "Imagine" parts of the packet. After reviewing the EDP, watching the video, and seeing the initial trials and the problems and potential solutions, students should have a decent launch point for thinking about the project. I will be aware of students' understanding of the EDP while going over the chart as well as during the video. I will provide sentence starters for both sections and answer misconceptions and questions as they arise.

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 lesson was successful in engaging the students for the project. They seemed to be able to access their prior knowledge of engineering units from previous grades. They were very attentive and thoughtful during the video and demonstration parts of the lesson. As far as the hands on piece, my students seemed to be excited about getting their hands on their own paper to test out their own versions of what a bridge can be. While thinking about their “Ask” and “Imagine” sections to start, many students could come up with their own ideas for a response.

As far as things that did not go as planned, many of my students drew out their responses to the “Imagine” sections and did not write out ideas for solutions but rather began planning their own bridges. This could have been prevented if I had modelled the writing I was expecting from them. I had provided the sentence stem for the “Ask” section but left them to their own devices for the “Imagine” section and that was apparent through their work (See Appendix Below).

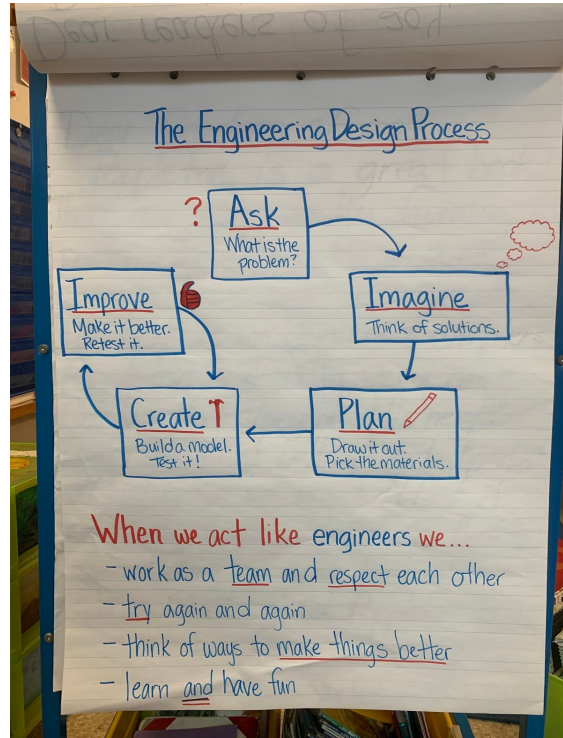
Additionally, some students drew out sharks and fish under their bridges, or cars on top of their bridges. Some students drew bridges resembling suspension bridges or arch bridges. This student work showed me that they were using their background knowledge to think about bridges they knew but not about the confines of the experiment we would be trying out. The sharks and fish and cars that were added were not necessary to include in a design and were not possible for a “bridge” within two large books in a classroom. Also, the designs resembling bridges that could not be made with paper-like materials were also out of the realm of possible solutions. As I saw these plans unfolding, I tried to prompt students towards a more appropriate answer and design, omitting unnecessary details and focusing on what their real design will look like in our room. This did not deter them from drawing what they felt best depicted the solution to our problem which was to hold many pennies between two books.

- b. What did you learn from the experience of this lesson that will inform your next LAP?

- In our next lesson, we will be drafted our initial designs, playing around with construction paper for the first time, and testing our first prototype bridges. By seeing that students had already gotten strong concepts of the EDP, I knew I could move right along in that fashion. I knew I would have to explain how the “Imagine” and “Plan” sections are different and that most students had already begun to plan out their bridges. I would not make them redo the “Imagine” because it would take a long time to erase and redo and most students probably understood that there was not room for much deviance in their solutions because I told them they would be building bridges with paper. I am confident that my students have an understanding that will allow them to be successful in the next lesson from this lesson’s introduction.

Student Work

A. Anchor Chart for EDP



B.

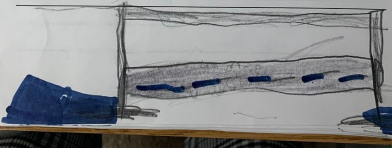
Ask
What is the problem?
that our bridge is not strong.

Imagine
Think of ideas to solve the problem. These are called solutions.
to add more stuff.

C.

Ask
What is the problem?
over people give need to build
bridge to hold a lot
of pennies


Imagine
Think of ideas to solve the problem. These are called solutions.
I want it like this



D.

Ask
What is the problem?
The problem is that we need to build
a bridge that holds a lot of
pennies,

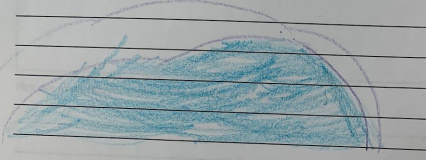
Imagine
Think of ideas to solve the problem. These are called solutions.



E.

Ask
What is the problem?
The problem is that we need
to build a that holds
a lot of people

Imagine
Think of ideas to solve the problem. These are called solutions.

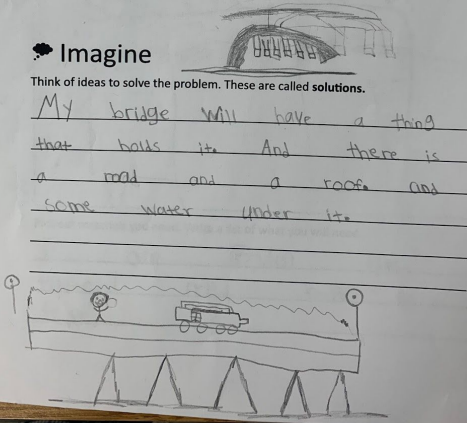


F.

Ask
What is the problem?
The problem is that we need
to build a bridge that holds
a lot of people

Imagine
Think of ideas to solve the problem. These are called solutions.


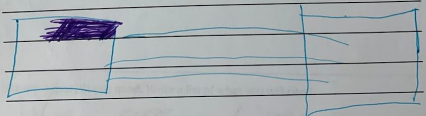
My bridge will have a thing
that holds it. And there is
a road and a roof and
some water under it.



G.

Ask
What is the problem?
The problem is that need
to ~~build~~ a bridge
that hold lots
of pennies

Imagine
Think of ideas to solve the problem. These are called solutions.



H.

Ask
What is the problem?
we need to make a bridge

Imagine
Think of ideas to solve the problem. These are called solutions.

