LAUSD Elementary Engineering

THE PLANT CONTAINER CHALLENGE

Second Grade – Life Science

PURPOSE

IN THE PLANT CONTAINERS CHALLENGE, STUDENTS WILL:

- Design and build a plant container that will hold soil using the Engineering Design Process (EDP)
- Exhibit understanding of relevant science content/concepts
- Construct relevant questions
- Use appropriate tools and materials to complete task
- Determine effectiveness of their design
- Answer the Focus Question: How will you design a plant container?

NEXT GENERATION SCIENCE STANDARDS (NGSS)

Students who demonstrate understanding can:

2-LS2-1. **Plan and conduct an investigation to determine if plants need sunlight and water to grow.** [*Assessment Boundary: Assessment is limited to testing one variable at a time.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence to answer a question.	**LS2.A: Interdependent Relationships in Ecosystems** • Plants depend on water and light to grow.	**Cause and Effect** • Events have causes that generate observable patterns.

Connections to other DCIs in second grade: N/A

Articulation of DCIs across grade-levels:
K.LS1.C ; **K.ESS3.A** ; **5.LS1.C**

Common Core State Standards Connections:

ELA/Literacy —

W.2.7 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-LS2-1)

W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (2-LS2-1)

Mathematics —

MP.2 Reason abstractly and quantitatively. *(2-LS2-1)*

MP.4 Model with mathematics. *(2-LS2-1)*

MP.5 Use appropriate tools strategically. *(2-LS2-1)*

Students who demonstrate understanding can:

K-2-ETS1-1. **Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.**

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 given problem.**

K-2-ETS1-3. **Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Asking Questions and Defining Problems
Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions.
- Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1)
- Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)

Developing and Using Models
Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.
- Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)

Analyzing and Interpreting Data
Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
- Analyze data from tests of an object or tool to determine if it works as intended. (K-2-ETS1-3)

Disciplinary Core Ideas

ETS1.A: Defining and Delimiting Engineering Problems
- A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1)
- Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1)
- Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1)

ETS1.B: 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. (K-2-ETS1-2)

ETS1.C: Optimizing the Design Solution
- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-3)

Crosscutting Concepts

Structure and Function
- The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-2)

Connections to K-2-ETS1.A: Defining and Delimiting Engineering Problems include:
Kindergarten: K-PS2-2, K-ESS3-2
Connections to K-2-ETS1.B: Developing Possible Solutions to Problems include:
Kindergarten: K-ESS3-3, **First Grade:** 1-PS4-4, **Second Grade:** 2-LS2-2
Connections to K-2-ETS1.C: Optimizing the Design Solution include:
Second Grade: 2-ESS2-1

Articulation of DCIs across grade-levels:
3-5.ETS1.A (K-2-ETS1-1),(K-2-ETS1-2),(K-2-ETS1-3); **3-5.ETS1.B** (K-2-ETS1-2),(K-2-ETS1-3); **3-5.ETS1.C** (K-2-ETS1-1),(K-2-ETS1-2),(K-2-ETS1-3)

Common Core State Standards Connections:

ELA/Literacy —

RI.2.1 Ask and answer such questions as *who, what, where, when, why,* and *how* to demonstrate understanding of key details in a text. (K-2-ETS1-1)
W.2.6 With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers. *(K-2-ETS1-1),(K-2-ETS1-3)*
W.2.8 Recall information from experiences or gather information from provided sources to answer a question. (K-2-ETS1-1),*(K-2-ETS1-3)*
SL.2.5 Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings. *(K-2-ETS1-2)*

Mathematics —

MP.2 Reason abstractly and quantitatively. *(K-2-ETS1-1),(K-2-ETS1-3)*
MP.4 Model with mathematics. *(K-2-ETS1-1),(K-2-ETS1-3)*
MP.5 Use appropriate tools strategically. *(K-2-ETS1-1),(K-2-ETS1-3)*
2.MD.D.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 using information presented in a bar graph. (K-2-ETS1-1),(K-2-ETS1-3)

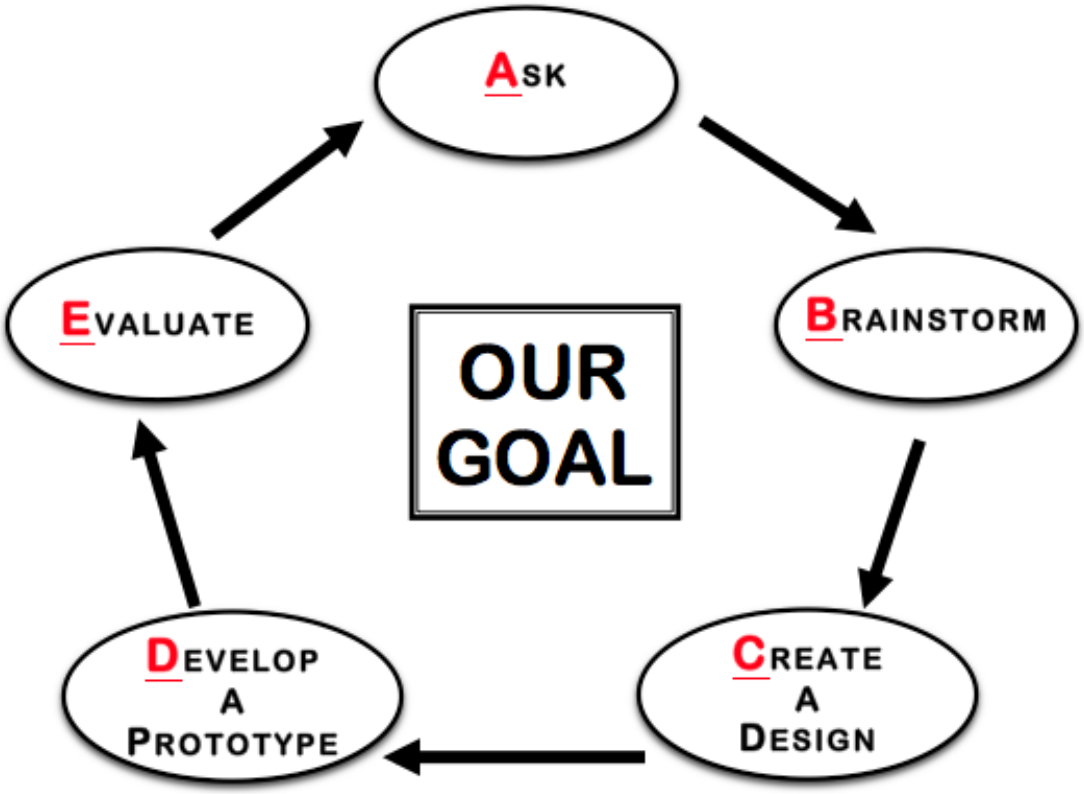
CA ENGLISH LANGUAGE DEVELOPMENT CONNECTIONS

- **P1.2.A.1:** Exchanging information and ideas with others through oral collaborative conversations on a range of social and academic topics
- **P1.2.A.3**: Offering and supporting opinions and negotiating with others in communicative exchanges
- **P1.2.C.9**: Expressing information and ideas in formal oral presentations on academic topics
- **P1.2.C.11**: Supporting own opinions and evaluating others' opinions in speaking and writing

SPECIAL EDUCATION (SPED):

To make accommodations or modifications for students with special needs, provide simple directions, instructions, provide multiple opportunities for repetition, make frequent checks for understanding, use visuals to accompany all vocabulary, simplify questions, be specific with sequence and steps, provide opportunity for paraphrasing, and adjust time and pacing.

THE ENGINEERING DESIGN PROCESS (EDP)



ENGINEERING DESIGN PROCESS (EDP)

ASK

- What is the **problem** or **need**?
- What is already out there?
- What are the **requirements (criteria)** and **restrictions (constraints)**?

BRAINSTORM

- What are possible **solutions**?
- Choose your two best solutions.

CREATE - A - DESIGN

- **Draw** a diagram with labels.
- Have a critical design review (peer review & input).
- What materials are available?

DEVELOP - A - PROTOTYPE

- Follow your best diagram and **build** a prototype.
- **Test** the prototype!

EVALUATE

- **Improve** your prototype!
- Conduct more compatibility tests.

BACKGROUND FOR THE TEACHER

You may teach lesson once students have completed:

FOSS CA – INSECT AND PLANTS

- **Investigation 2 (all parts)**

Students will have enough content knowledge to engage in the Plant Container Challenge by exploring through the investigation, Brassica Seeds, texts, videos, hands-on explorations on the basic needs of plants. Students will create a design and develop a prototype of a plant container.

MATERIALS

FOR EACH TEAM (2 students)

- Pressed paper plate (from school)

FOR THE LESSON

- Individual Student Engineering Notebooks
- Scissors
- Pencils
- Pipe Cleaners
- Sponges
- Paper Bags
- Popsicle Sticks
- Masking Tape
- Straws
- Tissue Paper
- Rubber Bands (Various Sizes)
- White Glue
- Potting Soil
- Seeds

GETTING READY

1. **Schedule the Engineering Challenge**
   The challenge will take two-to-three 45-60 minute sessions to complete.

2. **Gather / obtain materials**

3. **Prepare a materials station**

4. **Plan Teams**

5. **Print Focus Questions**
   Have Focus Questions printed on self-stick labels OR precut labels for gluing into Engineering Notebook –
   How will you design a plant container?

GUIDING THE ACTIVITY

Students will engage in the Engineering Design Process (EDP).

Setting the Context

- Go to your school garden with garden boxes or show images of garden boxes.
- Research what others have done. (What shapes are created?)
- Remind students they have been studying and observing Brassica plants and garden plants (if you have a school garden).
- ***NOTE:*** You may want to engage in this challenge out by the school garden.

1. ASK

Present problem or need

- Inform engineers of the PROBLEM:

You will design your own miniature plant container to keep in our classroom.

Present Focus Question: "How will you design a plant container?" *(Printed on self-stick labels)*

- Display the Focus Question and have students stick/glue the Focus Question into their Engineering Notebooks.
  How will you design a plant container?

Present Requirements and Restrictions

- **Requirements** (Criteria) *standards that must be met; rules/directions that must be followed*:
  - Teams consist of two members
  - The structure must be built on the plate base and contain soil and plant(s) that will grow.
- **Restrictions** (Constraints) *limitations that keep something from being the best it could be; may be problems that arise or issues that come up*:
  - Use only the materials supplied by teacher

- The team design must incorporate an aspect of each team member's design

2. BRAINSTORM

- Brainstorm solutions
- Observe materials, discuss properties of materials and imagine how they might be utilized.
- Encourage students to come up with their OWN solutions, think about the focus question, and about requirements and restrictions.

3. CREATE - A - DESIGN

- Each member must draw a design individually (2-3 minutes), without team member input, into his/her engineering notebook.
  - Title the page "My design"
  - Students should label parts of their design
- Team members share designs with one another (3-5 minutes), compromise, and collaborate in order to create into a "team design" incorporating an aspect of each member's own design. (SEP-1)
  - Title the next page in the engineering notebook, "Team design"
  - Team members should each draw and label parts of this collaborative design

4. DEVELOP - A - PROTOTYPE

- Build It! (SEP-2)
- Test design
- Once the plant container is built, put dirt in it

- Plant seeds
- Water the seeds
- Observe to see if seeds will grow
- Once the team decides the plant container is done, students return to their sketch and adjust, re-label the plant container in their engineering notebooks.

5. EVALUATE

- Teacher facilitates discussion about student successes and challenges. Students may observe other teams solving similar problems in a different way and consider modifying their own designs.
- After observation of other designs and input from colleagues, students **redesign** and **rebuild**, if necessary.
  - Have students answer the Focus Question in their engineering notebooks using both text and diagrams.
    - For scaffolding, sentence frames work well.
    - For example, "We built our plant containers by using _____ so _____.

Second Grade Student examples: