

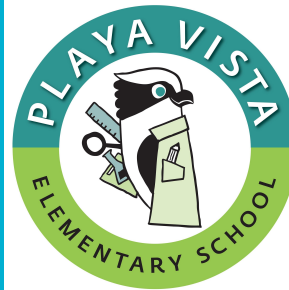
Building an Ideal Playground: An Engineering Project-Based Learning Unit

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Playa Vista Elementary School

LAUSD-LMU Demonstration School



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Playa Vista Elementary School - Overview



- Public, neighborhood school for grades K-5
- LMU-LAUSD Partnership School
- Located in Playa Vista (Los Angeles County)
- Demonstration school featuring STEM education
- Accomplished through an alliance with LMU, LAUSD and the community
- Integrated STEM instruction, goal to be “bell-to-bell STEM”
- Utilize field experience and hands-on urban ecology projects in the neighboring Ballona Wetlands and Ballona Discovery Park
- Platinum LEED Certified building



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PBL Overview

Driving Question:

What makes an ideal playground?

Supporting Questions:

Week 1: *What happens when you push or pull an object?*

Week 2: *How do forces affect us?*

Week 3: *What are simple machines?*

Week 4: *How do simple machines make work easier?*

Week 5: *Where do we see simple machines on the playground? Why?*

Week 6: *What forces do the playground structures use?*

Week 7: *Why and how do engineers use force and simple machines to create a playground?*

Week 8: *Can you describe an ideal playground? How does it incorporate force?*



NGSS Standards

Performance Expectation: K-PS2-1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

K-PS2-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.*

PS2.A: Forces and Motion

- Pushes and pulls can have different strengths and directions. (K-PS2-1),(K-PS2-2)
- Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. (K-PS2-1), (K-PS2-2)

PS2.B: Types of Interactions

- When objects touch or collide, they push on one another and can change motion. (K-PS2-1)

PS3.C: Relationship Between Energy and Forces

- A bigger push or pull makes things speed up or slow down more quickly. (*secondary to K-PS2-1*)

ETS1.A: Defining Engineering Problems

- A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. (*secondary to K-PS2-2*)

NGSS - Crosscutting Concepts, Science & Engineering Practices

Crosscutting Concept: Cause and Effect

- Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K-PS2-1),(K-PS2-2)

Science & Engineering Practice:

ETS1.A: Defining Engineering Problems

- A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. (*secondary to K-PS2-2*)

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.

- With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1)

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-PS2-2)



Learning Targets

Science:

I can describe that force is a push or a pull.

I can explain how force can cause, change, or stop motion.

I can describe that how the amount of force can change the speed and distance traveled.

I can describe how simple machines work.

I can use a simple machine to put an object in motion.

I can explain show where simple machines are used in the playground.

Reading:

I can identify main idea and details in the books related to Force & Motion.

I can give a summary of what I have read for this unit.

I can defend an argument.

Engineering:

I can describe Engineering Design Process and steps involved when I build my ideal equipment



Common Core Standards

Reading:

RI.K.1 With prompting and support, ask and answer questions about key details in a text. (K-PS2-2)

W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-PS2-1)

SL.K.3 Ask and answer questions in order to seek help, get information, or clarify something that is not understood. (K-PS2-2)

Kid friendly language specific to this unit:

Students will read and listen to non-fiction text and identify Main Ideas and Details.

Common Core Math Standards

Math:

K.MD.A.2 Directly compare two objects with a measurable attribute in common, to see which object has “more of”/”less of” the attribute, and describe the difference. (K-PS2-1)

MP.2 Reason abstractly and quantitatively. (K-PS2-1)

Kid friendly language specific to this unit:

Students will count to 20, build numbers to 10, and graph data.

Playground Design



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- *In this unit, students will learn how forces affect our daily lives and how we can create simple machines to make work and life easier if we know how to use the principles of force.*
- *Students will then explore the community by critically observing playgrounds to learn how engineers use force to create fun and safe playgrounds and playground equipment.*
- *Once students make these observations, they will work in groups of four to engineer one playground structure that highlights what they have learned about force.*
- *Then, they will design the ideal playground that is not only fun, but also, safe for all children.*
- *Students will end the unit by creating a persuasive video to present to LMU civil engineers that describes their playground in depth which includes the safety features, use of force, and design features that make it the ideal.*



Hands-On Activities



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Four hands on stations to walk you through our unit. Each station will focus on one element of our lesson and one supporting question.

We will have 5-10 minutes to work on each station.

The materials are labeled and located in the tubs on the tables.

1. Pushes and Pulls
2. Simple Machines
3. playground structures and desing
4. Design and engineer a playground structure



Pushes and Pulls

What happens when you push or pull an object?

- I can describe force as a push or a pull.
- I know that pushes and pulls can start or stop motion.

Let's find out:

Push the ball. What happened?

Push the block. What happened?

Which direction do things go when you push them?

Pull string attached to the car. What happened?

Which direction do things go when you pull them?



Now for the fun stuff! Marshmallow Poppers!

Marshmallow poppers use both pushes and pulls. They are a fun way to demonstrate force

Vocabulary: push, pull, increase, decrease, speed, distance, stop, start, direction.



Station One - Make and Take

Marshmallow Popper

1. Cut the bottom off the plastic cup.
2. Tie a knot at the end of the balloon.
3. Cut the tip of the balloon off.
4. Stretch the balloon over the strong top end of the cup.
5. tape if necessary.
6. Place marshmallow inside the cup.
7. Pull the balloon back from the knot you tied.
8. Let go.
9. What happened? Why? Did the balloon push or pull the marshmallow?
10. Increase or decrease the amount of force you put on the balloon. What happens?



Station 2 Simple Machines



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What are simple machines?

How do simple machines make work easier?

- *I can describe how simple machines work.*
- *I can use a simple machine to put an object in motion.*

Let's find out:

Simple Machines use “human power”.

They make work easier.

An incline plane let's us move heavy objects up without breaking our backs. How does it help us when we use it to move objects down?

1. Place the marble on the table. What happens?
2. Build an incline plane. with a flat board and a wedge.
3. Place the marble on top of the incline plane. What happens?
4. How did the incline plane make the work easier?



What if?

What if the Big Bad Wolf decided not to “Huff and Puff and blow the house in?”

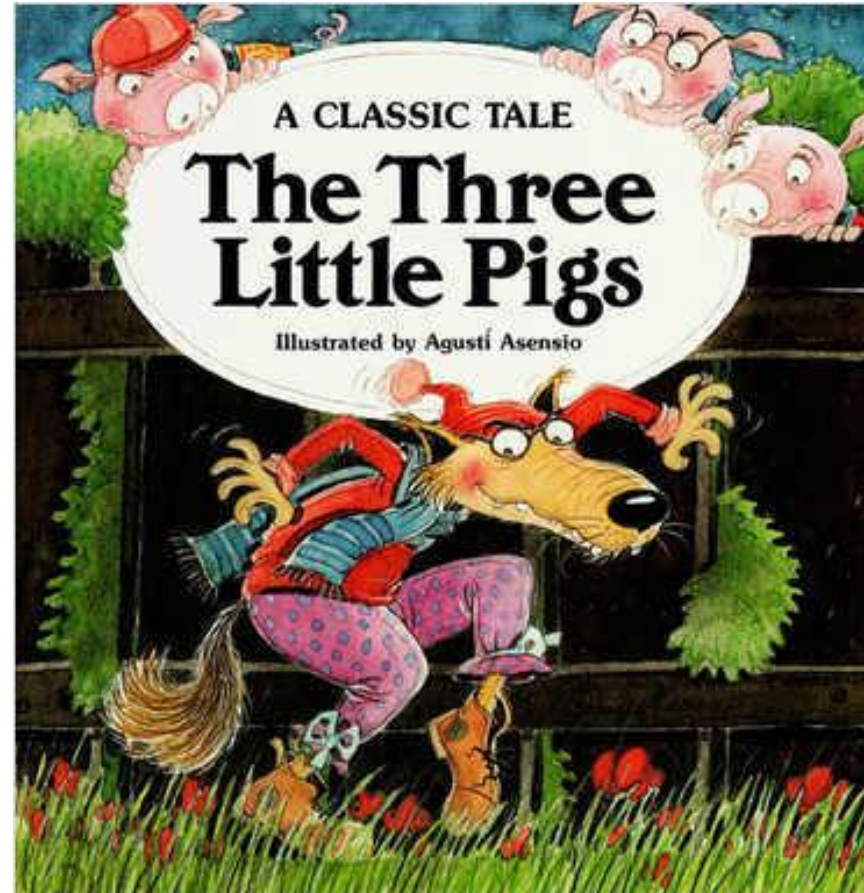
What if he decided to knock the house walls down with a simple machine... maybe... a lever?

How would he do it?

Would it work?



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Station 2 Make and Take

The Lever of Destruction!

There are many types of levers. Screwdrivers, wheelbarrows, spoons, catapults and seesaws are all leavers. The pivot of a lever comes from the fulcrum. This is a great way to explore and discover what happens when you change the position of the fulcrum.

Goal: To use a lever to knock down a wall of marshmallows.

1. Use the marshmallows to build a wall.
2. Cut the straw into six pieces and tape them together in a stack, Three rows of 2.
3. Place the tongue depressor on the straw stack so that it is balanced.
4. Put the bottle cap on one end of the tongue depressor. Aim for the wall. Add “Human Power” by pressing on the opposite end of the tongue depressor. What Happened?
5. Change the position of the fulcrum. move the fulcrum toward the red end of the tongue depressor. Repeat. What happened? What if you change the fulcrum size?
6. What do you need to do to knock down the wall?
7. Now try it with the spoon catapult. Place the bottle cap on the end of the spoon. Use, “Human Power” on the other end.
8. Is there a better simple machine to use? What and why?

The Ideal Playground

What does the ideal playground look like?

Hmm...

Why?



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Activity 3 - Design and engineer a playground structure

Why and how do engineers use force and simple machines to create a playground?

- I can describe Engineering Design Process and steps involved,



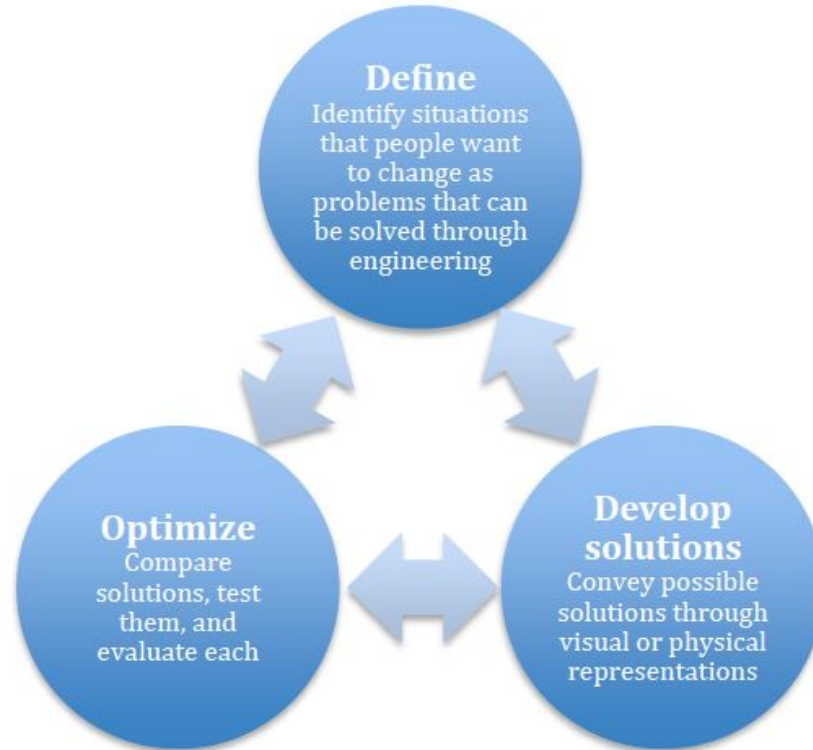
Put on your engineer cap and think... What could I design to make an ordinary playground extraordinary?

Working through the engineering design process design and create a model of a playground structure that incorporates what you have learned about force.

Constraints: You can only use the materials supplied. You have 5 minutes to design and 5 minutes to build.



Engineering Design in the NGSS



Design Title_____ **Group**_____

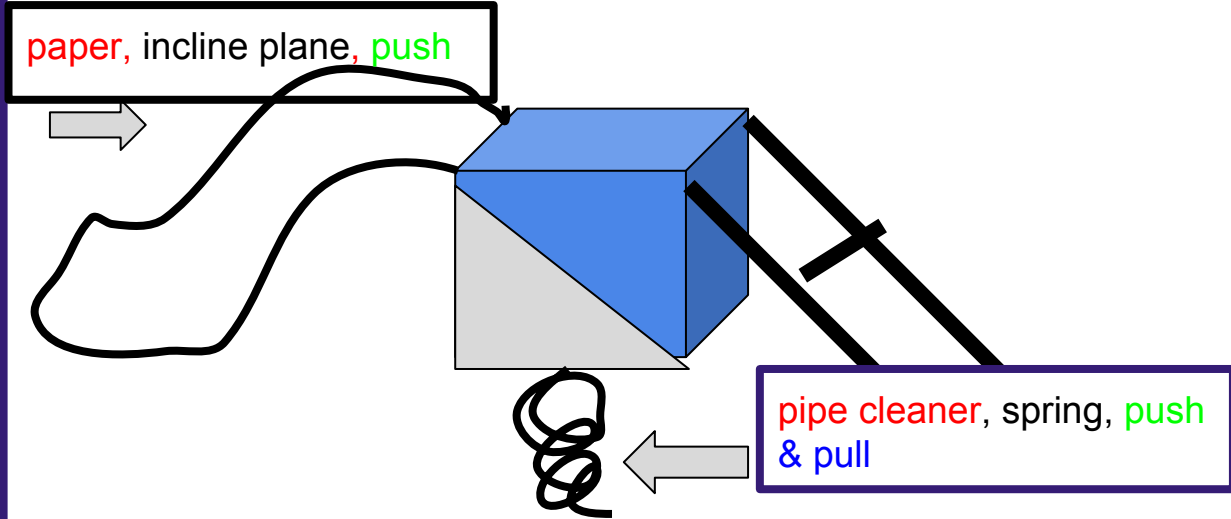
Use this space to sketch your model. Label materials used in red. Label pushes in green. Label pulls in blue. Label any simple machines used.



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Design Title Sample Group 1

Use this space to sketch your model. Label materials used in red. Label pushes in green. Label pulls in blue. Label any simple machines used.



Create it!

Using the materials supplied create your playground structure. You have 5 minutes to build the structure your team designed.

Good luck!



Activity 4 - Playground Structures

What makes an ideal playground?

Where do we see simple machines on the playground? Why?

What forces do the playground structures use?

Can you describe an ideal playground? How does it incorporate force?

- I can show you where the simple machines are found on the playground.
- I can explain how force (pushes and pulls) are used in the playground equipment.
- I can defend my argument.

Test your knowledge!

- Take out the pictures of the playground structures.
- Label the picture. By writing Push, pull or both.
- Label the picture by writing the type of simple machine.



Design the Ideal Playground

*Use your labeled pictures to create the ideal playground.

1. Arrange and glue your pictures onto the empty playground paper.
2. Draw any structures that should be added. Include the playground structure your group engineered.
3. Label all pictures.

On the lines provided explain why this is the best playground design. Be ready to defend your argument with the class.

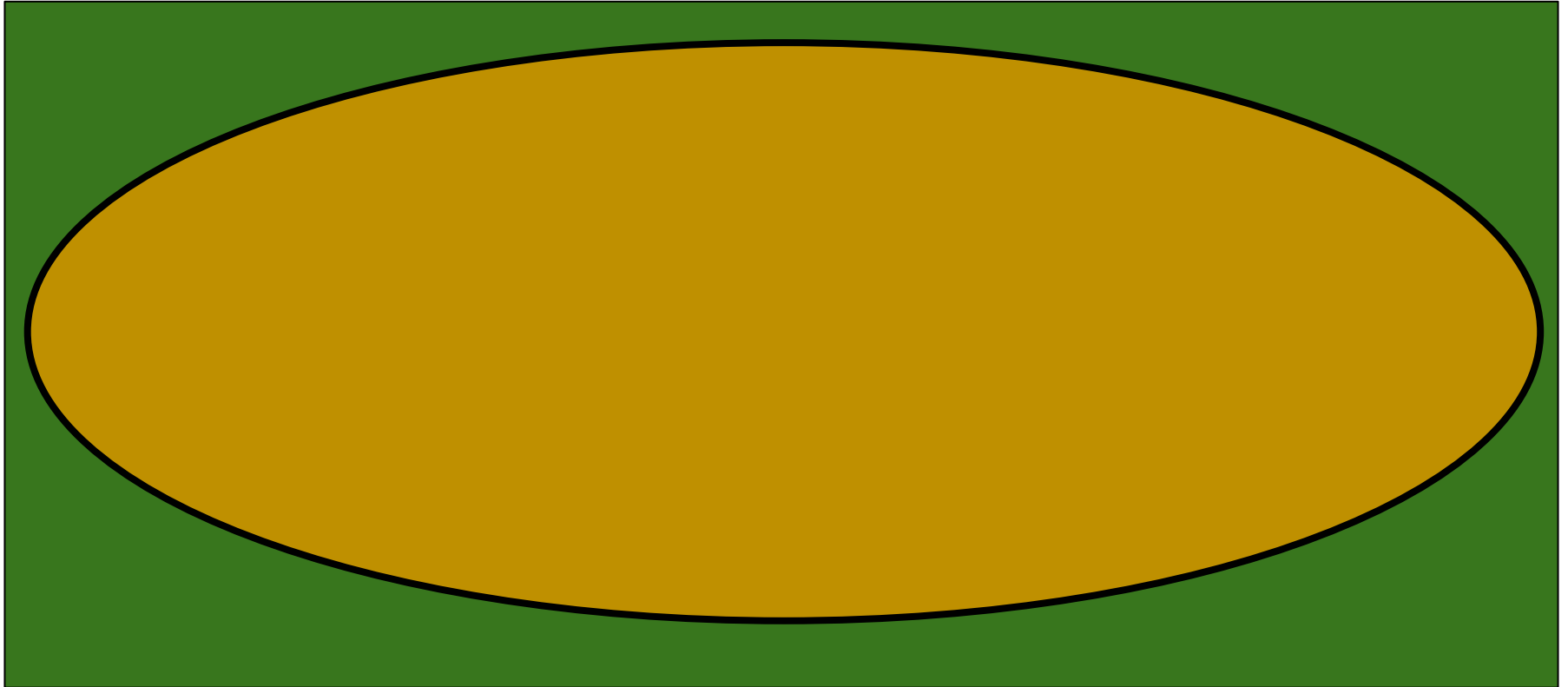


The best Playground

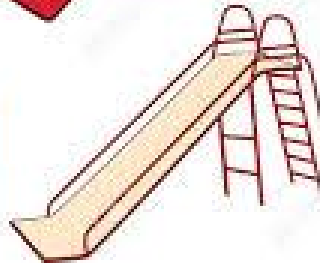
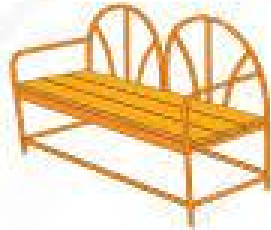
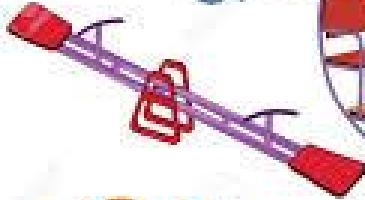


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Group _____



Playground Structure pictures for cut and paste



Defend Playground Design

SEP 7: Engaging in argument from evidence

SEP 8: Obtaining, evaluating, and communicating information

Each group will have one minute to share their engineered playground structure and explain why their playground design is the best. There will be one question posed by a class member that the group will defend.



Engaging in Argument from Evidence

Discussion Guidelines

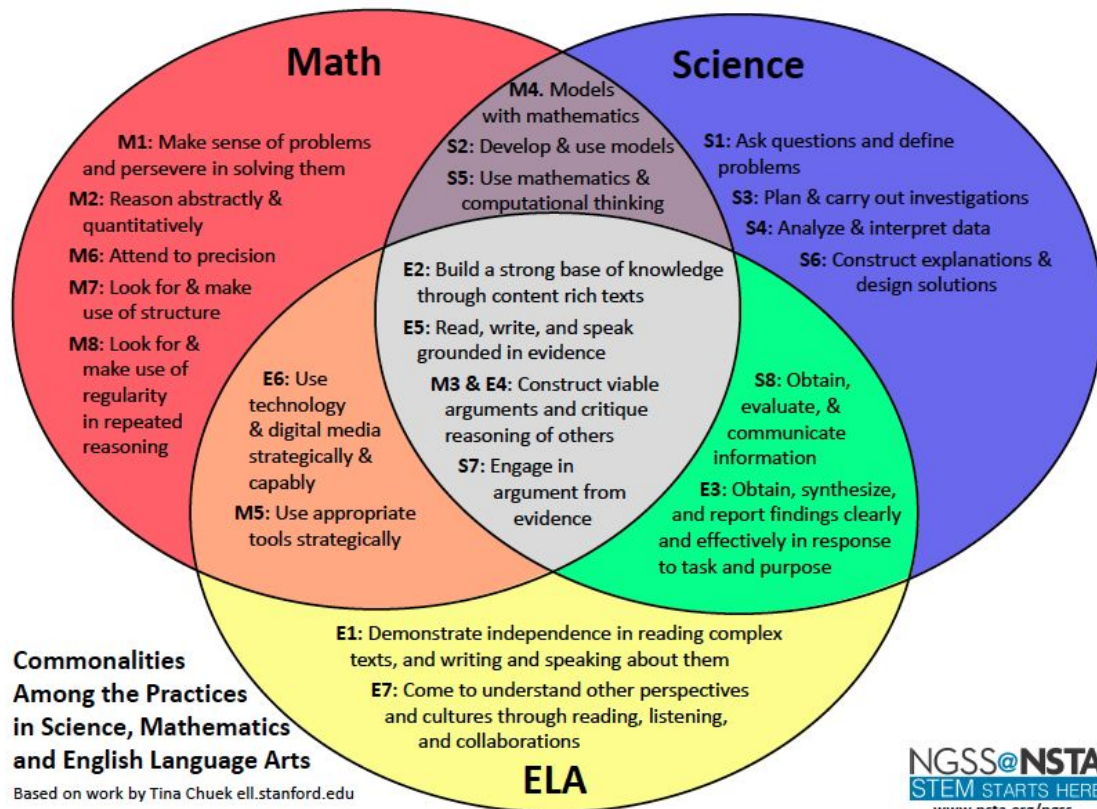
- I think you need further evidence because...
- I don't think your claim matches your evidence because...
- I think you should also consider...
- Tell me more...how/why did you...
- I don't think your argument is accurate because...



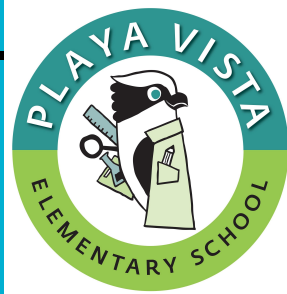
Additional Integration

CCSS ELA:

CCSS Math:



Thank you!
What questions do you have?



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