Engineering Design Process Volcano Shelter 1st Grade

Grade: 1st

Subject: STEM (engineering), ELA

Materials: coffee filters, paper towels, tin foil, tape, Lego people, plastic table cloth, straws, any materials that I can find

Technology Needed: active board, audio, Google Classroom

Instructional Strategies:

- ☐ Direct instruction
- ☐ Guided practice
- ☐ Socratic Seminar
- ☐ Learning Centers
- ☐ Lecture
- ☐ Technology integration
- ☐ Other (list)
- ☐ Peer teaching/collaboration/ cooperative learning
- ☐ Visuals/Graphic organizers
- ☐ PBL
- ☐ Discussion/Debate
- ☐ Modeling

Guided Practices and Concrete Application:

- ☐ Large group activity
- ☐ Independent activity
- ☐ Pairing/collaboration
- ☐ Simulations/Scenarios
- ☐ Other (list)
- ☐ Hands-on
- ☐ Technology integration
- ☐ Imitation/Repeat/Mimic

Explain:

Standard(s)

K-2-ET1-2- 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.

1.SL.4- Describe people, places, things, and events with relevant details, expressing ideas and feelings clearly.

Objective(s)

By the end of the lesson, students will understand the steps of the Engineering Design Process by creating a shelter for Lego people and analyzing if it withstands a "pumpkin" volcanic eruption simulation.

By the end of the lesson, students will be able to describe things and events with relevant details by writing a short journal entry about how their volcano shelter performed during the pumpkin volcanic eruption, and what they would do improve their shelter if they did it again.

Bloom's Taxonomy Cognitive Level: Creating

Differentiation

Below Proficiency: Students create less complex, simpler shelters. Students are paired with those approaching/above proficiency to help them develop their ideas. Students fill out their organizer about the engineering design process just to a lesser extent. Teacher provides additional support.

Above Proficiency: Students add more detail and thought into their volcano shelters. Students are detailed in filling out their engineering design process organizer.

Approaching/Emerging Proficiency: Students are paired with those above or below proficiency to help encourage the low proficiency students or to learn from the above proficiency students. Teachers assist where needed.

Modalities/Learning Preferences:

Kinesthetic: Students are actively creating their volcano shelters, and students compose journal entries that outline the improvements they'd make to their shelter

Auditory: Students are listening to the videos from their classmates of the day before, listening to the teacher describe the process, and listening to their peers during the review process

Visuals: Students have the organizer to organizer their thoughts, students see the videos of their classmates and read their own writing about the improvements they would make

Classroom Management- (grouping(s), movement/transitions, etc.)

- Students create shelter at their team tables to keep students separate and manageable. Teacher can walk around the room easier.
- Students turn-and-talk with a person they can work well with, near them.
- Teacher has many students asking and answering questions during the lesson.
- Students sit close to the teacher.
- Students get some movement when transitioning to different parts of the activity and creating the volcano shelters
- Teacher engages students with visuals.
- Team tables are already grouped for students who work well together.
- Students are put in pairs of students who work well together

Behavior Expectations- (systems, strategies, procedures specific to the lesson, rules and expectations, etc.)

- Students sit quietly, level zero, on the imaginary carpet unless told otherwise.
- Students actively participate while turn-and-talking with a partner and asking and answering questions in the discussion.
- During discussions, students use appropriate language and volume, raise their hand instead of blurt and give others a chance to speak.
- During the game, students include all members of their team.
- Students move about the room safely.
- When I say "class class" the class says "yes yes" and then are silent after
- Students use the materials provided for the activity the correct way and safely.

Minutes	Procedures

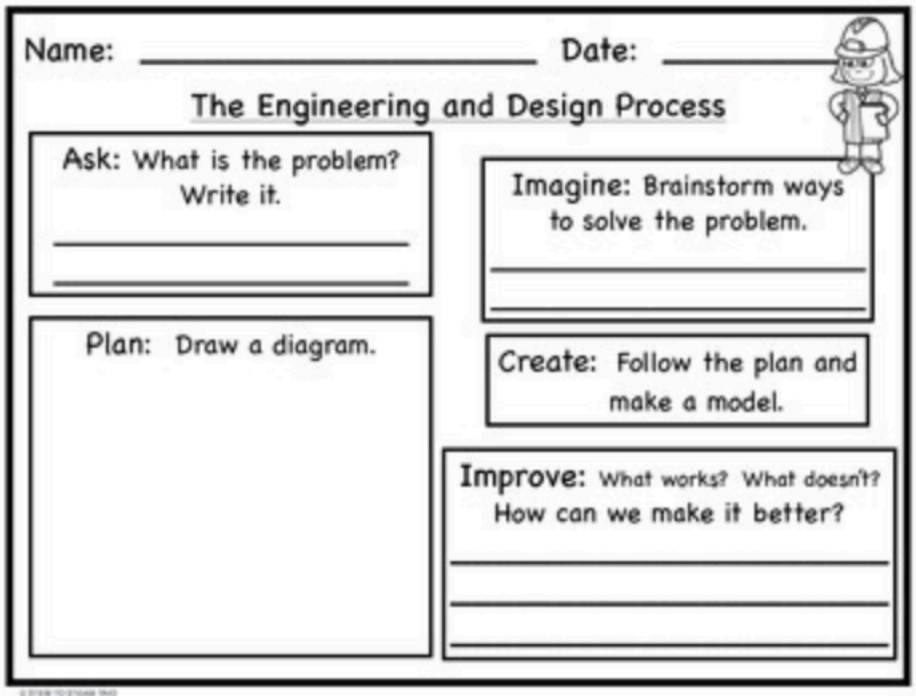
Engineering Design Process Volcano Shelter 1st Grade

	Set-up/Prep: - Get materials ready: string, yarn, coffee liners, paper plates, fan, glue, tape, straws, tin foil etcetera - Create the supplies bags - Print off the engineering design process organization worksheets - Get and gut the pumpkin - Hook up the active board and audio - Set up way to present the students' videos from the engineering lesson from the day before

8	**Engage: (opening activity/ anticipatory Set – access prior learning / stimulate interest /generate questions, etc.)**
	
	I DO
	
	- To start, I will have the students sit on the carpet by the active board.
	
	- "Today, we are going to take the knowledge we have about the engineering design process that we learned about yesterday to be engineers again today. This time, we are actually going to be building shelters.
	
	- Before we start though, we are going to view some of the videos that our classmates made about the homes they designed and why they did what they did.
	
	- During the videos, we are going to continue to ask questions, make observations, and gather information about these designs. This may help us make our shelters today.
	
	- Teacher draws five student sticks and asks they if they'd be comfortable sharing their video with the class.
	
	- Teacher shows videos and guides discussion.
	
	- Teacher models positive feedback, generates questions, and accesses the prior learning
	
	  - Did anyone do something similar in their house design? Why did you choose to do it that way?
	  - Why did you choose to make ____ that way?
	  - How was ____ being like an engineer when he designed the ____ part of the house?

20	**Explain: (concepts, procedures, vocabulary, etc.)** **WE DO** - Teacher has all students get their clipboards from their cubbies and a pencil and come back to the carpet. Give them 30 seconds to do this. - While students are getting their supplies, teacher sets up the foil tin, gutted pumpkin, supplies bags, and experiment, cover the table with a plastic table cloth - Teacher has the "paper passer" hand out the engineering design process handouts and students attach it to their clip boards.

Engineering Design Process Volcano Shelter 1st Grade



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- Teacher talks the students through the simulation
    - Today, we are going to be engineers by designing volcano shelters, because in some areas there are people who live very close to volcanoes. If we are going to do that, we need to first look at our engineering design process. The first part of the process is understanding what our problem is.
- Turn-and-talk with the person closest to you, what is the problem we are trying to solve?
- Students share out, and teacher writes it on the board. Students then fill in their "What is the problem?" box on their organizer.
- Before we brainstorm solutions to this problem, we should first see how the "volcano" erupts. Come kneel and stand around this table to observe the explosion.
- Teacher walks the students through the components of the explosion.
    - "Vinegar is an acetic acid that is dissolved in water (Point to vinegar). Baking soda is a base called sodium bicarbonate (point to the baking soda). When they are mixed together, the reaction makes what we call carbonic acid, which is a very unstable combination. This breaks down into carbon dioxide (what we breathe OUT of our lungs) and water, causing the gas to rapidly leave the water creating foam and bubbles along the way."
    - We are going to put ____ tbsps. Of baking soda in this empty pumpkin. (put it in the pumpkin) Then, we will put ___ tbsps. Of vinegar in the pumpkin. (ration should be 12:1 roughly)
    - Students observe the eruption, thickness of "lava" that comes out, how it travels, how watery it is, how fast it happens and discuss this as a class.
    - As we are creating our volcano shelters, we need to think of all these components in how to create the best shelter to protect form this "lava".
    - Students return to the carpet with their clipboards and pencils.
    - Now, turn-and-talk with somebody near you, and brainstorm ways to solve this problem. REMEMBER: out problem is how to protect the Lego people who are living near the volcano. So, brainstorm ways you could solve this problem.
    - Students share out brainstorm strategies and teacher write some on the board.

Engineering Design Process Volcano Shelter 1st Grade

	○ "Choose at least one strategy from our brainstorming session and write it in the "imagine" box of your organizer."
25	**Explore: (independent, concreate practice/application with relevant learning task -connections from content to real-life experiences, reflective questions- probing or clarifying questions)** **YOU DO** - The next part of this process is going to require you to draw out your shelter plan, create the shelter, test your shelter, and plan to improve your shelter. - "Each of you will be in partners" (Pre-selected partners that work well together) - "Each group will get a bag of materials. This is all the supplies you have. " ○ "Real engineers have budgets, or a specific amount of money, to create their designs, so you will also only be able to use the materials that are in YOUR bag. You will not be able to get anything extra." - "In addition, you will have to complete your shelter in 20 minutes. This is not much time, but real engineers have a set amount of time to create their designs." - "After the 20 minutes is up, we will test all the shelters with the pumpkin volcano an discuss what worked well and what didn't." - "You will be responsible for drawing a diagram of your shelter BEFORE you build it. This is your engineering "plan", and there is a box for this on your organizer. We will fill out the improve section after we test the shelters." - Put students in partner groups and designate them a spot at a table. - Students go to their table spots and the teacher distributes the materials and sets a 20 minutes timer on the Activeboard so students can see how much time they have left. - REMEMBER: your shelter will have to be moveable because you will have to set it in the tin near the pumpkin volcano. - After the 20 minutes, students will bring their shelters to the volcano area and their clipboards with the engineering design process sheets on it and pencils. - After each eruption, teacher guides positive, constructive discussion about what could be done differently to improve each shelter. - Students will have a few minutes following the eruptions to describe in their organizer what they would improve on if they made another shelter. (If I wasn't doing this lesson during my practicum experience, I would have the students revise their shelters, but in this case, I am going to have them write about what they'd improve).
20	**Review (wrap up and transition to next activity):** - "Remind me, what are the steps of the engineering design process" ○ Ask ○ Imagine ○ Plan ○ Create ○ Improve - "How did you work as a team as you were going through the engineering design process?" - "What worked with your shelter and what needed to be improved upon?" - "How could you use the engineering design process in the future? For what kinds of problems?" - Have students share out their thoughts, and tell them to keep the answers they had to these questions in mind as they complete the next portion of the activity.

Engineering Design Process Volcano Shelter 1st Grade

	- "Now that all the eruptions have happened, you are all going to be making a short video about what happened throughout your engineering design process." - Part of being an engineer, is communicating what your design means, how it worked, and how you would improve it. You are going to demonstrate your understanding of the engineering design process by typing out a short journal entry on the computer about how well your shelter worked, if it protected the Lego people, and what you would improve about it. - Students turn in their journal entries through google classroom.

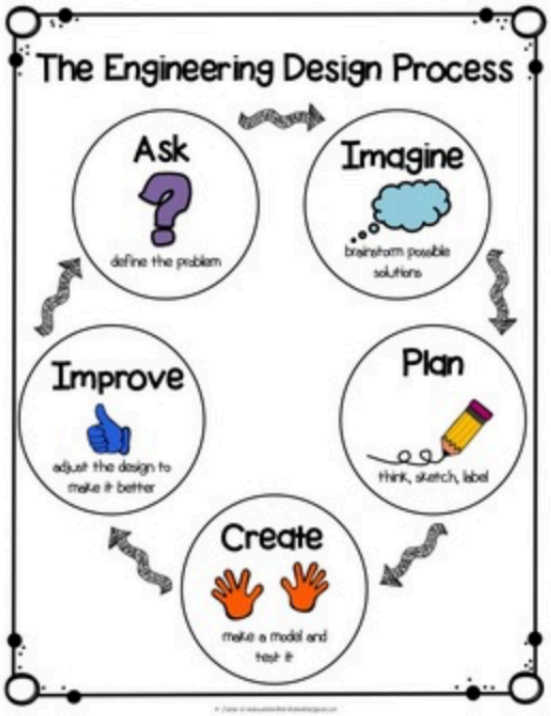
Formative Assessment: (linked to objectives)

Progress monitoring throughout lesson- clarifying questions, check-in strategies, etc.

- Teacher takes anecdotal notes on who is participating in discussion and responding about the engineering design process
- Teacher collects the engineering design process organizers to see which students accurately filled it out and were able to complete it
- Teacher observes the partner work and the responsibilities of each person in the group in creating the shelter
- Teacher questions the students during the creation phase to try to understand their thinking and reasoning
- Teacher notes who was able to articulate their findings and design process, as well as who was able to come up with improvements for their design in the journal entries each student composed

Consideration for Back-up Plan:

- If the teacher cannot show the video, she will make an anchor chart to explain the engineering design process



Summative Assessment (linked back to objectives)

End of lesson:

If applicable- overall unit, chapter, concept, etc.:

- Not applicable at this time

- Students put in larger groups if there are time constraints that make it too hard to test that many shelters	

Reflection (What went well? What did the students learn? How do you know? What changes would you make?):

The lesson today went incredibly well. The students were so excited to build using the unconventional materials, and the shelters they came up with were amazing. Every pair of students' shelters survived the volcano, and this was very fortunate as to avoid any meltdowns or negative comments. They really put their creativity to the test, and I am so appreciative for how well they worked. The students learned more about the engineering design process by filling out a graphic organizer that required them to input information for each step of the process. The graphic organizer was extremely helpful to me as a teacher, for it demonstrated which students were understanding the concepts. In addition, they filled these sheets out on their own, so it was a good formative assessment. The students also learned how vinegar and baking soda reacts together to form carbon dioxide bubbles by observing a pumpkin volcano. Here, we discussed what was happening in the pumpkin, and we watched it explode. Then, I asked the students multiple times throughout the testing phase of the engineering design process what I was adding to the pumpkin, what was happening between the two components, and what happened as a result. This helped to reinforce the topic. I wanted to be careful not to get into depth too much about volcanos because I wanted to focus on the engineering design process itself; however, the volcano simulation was definitely simple enough where it was appropriate to articulate what was happening in the experiment. I also know that the students learned how describe things and events with relevant details by writing a short journal entry about how their volcano shelter. The students had to explain what happened with the pumpkin volcano and what they would change about their shelter if they made it again. This also indicated whether or not the students understood the final step of the engineering design process by being able to write about what they'd do differently and how they'd make improvements.

If I did this experiment again, I would keep many elements the same, such as the materials I included in the bag, the demonstration of how a volcano erupts prior to the creation phase, and how I documented their learning. If I did it again, though, I would make sure to have better technology available. This school does not have as much accessible computers/technology, and I wish I could have had them writing about their volcano on the computer or another digital resource. This would help me hit more standards. In addition, I would split this lesson into two parts/days if I had my own classroom. Because I had time constraints, though, I needed to fit it all in today, increasing the challenge of keeping students on task. I was very fortunate, though, that my teacher was flexible in allowing me to use extra time to do this science lesson. In addition, I would have liked to have working Activeboard that I could write on. It would have helped so much in communicating what I wanted the students to do, as well as making illustrations. Many students did not know the proper vocabulary for many of the components of engineering and science in general, so I would have loved to incorporate more visuals, spend extra time explaining the vocabulary, and maybe even creating vocab booklets for them. I would also come with better tape. The students loved the lesson, and they were super excited to use their creativity and difficult materials to make the shelters. They said that it made it more real life when they included the Lego people in the volcano simulation. Overall, I would do this lesson again, and I now have the creation materials which would make the prep even easier.