Q405: Saturday Science FS21

Instructor Names: Katie Brammer, Madison Pittman, Shauntell Harris, Caitlyn Baker

Grade level: 3rd-4th grades

Anchoring Question/Phenomena for the unit: How does energy move through matter?

Lesson Plan # 1

<table>
<tr><th colspan="3">Desired Results</th></tr>
<tr><td colspan="3">Driving Question for this week's Saturday Session
What are different ways that waves move?</td></tr>
<tr><td>DCI Addressed in lesson:
PS4.A: Wave Properties: Sound waves cause vibrations in matter and those vibrations make the sound.
PS4.A: Wave Properties
Waves are patterns that can be made in water when the surface of the water is changed or disturbed. If the water is deep, the waves move up and down in the same place across the surface. The motion does not move anywhere other than up and down until it comes in contact with the beach.</td><td>SEPS Addressed in Lesson:
Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4-PS4-1)
Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.
Ask questions about what would happen if a variable is changed.</td><td>CCCs Addressed in Lesson:

Patterns
Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena. (4-PS4-1)</td></tr>
<tr><td colspan="3">Besides science, what other disciplines of STEM will be included in this lesson?
Technology</td></tr>
<tr><td colspan="3">Learning objectives (outcomes):
Students will be able to explain/state:
Students will be able to explain how waves are seen in the natural world.
Students will be able to describe the characteristics of waves.
Students will be able to sketch a basic model of a wave.</td></tr>
<tr><th colspan="3">Timeline of Activities for the Day</th></tr>
<tr><td colspan="3">Engage - beach party, toss a beach ball to get to know each other (9:30-9:45) (15 minutes)
Going over class expectations (9:45-9:55) (10 minutes)
Stations (9:55-10:35) (40 minutes - 10 minutes per station) (only need to record the first 10 min rotation, a few minutes of each station)
Explain phase (10:35-10:50) (15 minutes - small group 10, large group 5)</td></tr>
</table>

- Phet simulation (10:50-11:05) (15 minutes) -each of us will be working with a small group during the simulation so video of each person with their group (**Group teacher will record a snippet of this on their phone)**
- Explain phase (11:05-11:20) (15 minutes)
- Lesson about sketching and model making (11:20-11:25) (5 minutes)
- Sketching a rough model of a wave (11:25-11:30) (5 minutes)
- Telephone game (11:30-11:40) (10 minutes)
- Designing their science journal (until they get picked up)

Learning Plan

ENGAGE

- Walk-in with a speaker and beach apparel playing beach music to introduce the *Ride the Waves with Us* theme for the next 5 weeks
    - dance with arm waves
- Play the beach ball game - toss beach ball with questions and answer what you catch as an icebreaker
    - Answer the question that is closest to your right thumb
- Classroom expectations - make classrooms expectations as a group, community rules, chart and hang up on big paper

EXPLORE 1

- Stations with the teacher covering waves (4 students per group - 4 groups) They will be filling out the 4 section grid within the science journal. They will start the group work by drawing a wave in their science journals.
    - Station 1: Water Waves
        - A clear tub of water will be placed at a table.
        - The students will take turns touching the water using their index finger.
        - They will wait until the water becomes still, and then the next student will touch the water.
        - The teacher will ask questions such as:
            - “How is the water moving?”
            - “Is this a pattern?”
        - Then they will investigate other ways to make wave patterns, can they do other things besides touching the waves to make them appear? Do these waves look different from the others?
    - Station 2: Towel Waves
        - Students will be partners.
        - One student will hold one end of the towel, and the other student will hold the other end.
        - The groups will take turns making waves with the towel. The teacher will give them cues like “make the wave smaller,” “make the wave bigger,” “make it smaller,” “make it longer.”
        - Students will reflect on what they have to do to make a wave bigger or smaller. How did the actions change the wave?
    - Station 3: Slinky waves
        - Students will each be given a slinky. They will be given 20 seconds to play with their slinky, and then they will be asked to stop touching the slinky.
        - They will then be asked to hold their slinky parallel with the table, and then they will be asked to move the right side of the slinky from side-to-side while holding the left side stationary.
        - Again students will be looking at the waves made, how do they look different or the same as the other waves explored? Can they make multiple waves on the slinky? Can they make only 1 wave? How can they make the waves bigger or smaller? Does this change how many waves are present at a time?
        - Then the teacher will ask the students to push the right side of the slinky toward the left side of the slinky while holding the other side in place.
            - How is this new model similar or different to the wave model explored previously? Is it still a wave?
    - Station 4: Rope Waves

- Students will go down to the first floor where there will be long yellow rope. Each student will go to the end of one of the ropes and make different types of waves
    - big waves, little waves, lots of waves, not a lot of waves
    - students are seeing what they have to physically do to change how the waves looks
- then one student will be on one end of the rope and one student on the other and they will experiment what happens when they both send waves at the same time
    - what happens in the middle when the waves crash into each other? What if one person goes really fast and one slow? Etc.

EXPLAIN 1

- Students will carry a graphic organizer with them throughout the stations and will be given a few minutes to write a response to each station and answer any questions asked by the teacher.
    - "What similarities did you find between the stations?"
    - "What differences did you find between the stations?"
- Once the students have gone through all of the stations, they will be having a small group discussion for 10 minutes in the group they are already in. One teacher will still be with each group to facilitate the discussion. They will talk about what each of them wrote as their response to the stations on the graphic organizer. They should also talk about their understanding of waves thus far and what these stations have taught them about waves.
    - discussion should focus on similarities the students found between the stations and differences
    - What are common words they found?
    - Did they make different-sized waves/different amounts the same way at each station?
- We will then come back together as a whole class. Each group will have nominated a member as the speaker of their group for the day. The speaker of each group will share what they talked about in their discussion and their understandings of the stations and waves.
    - we will chart the discussion on chart paper that can be returned to at the next discussion time

EXPLORE 2

- Students will be working in small groups (4 students, 1 teacher) exploring the phet simulation.
    - https://phet.colorado.edu/sims/html/wave-on-a-string/latest/wave-on-a-string_en.html
- They will be filling out the graphic organizer as they explore (linked). They will be adjusting frequency, and amplitude and writing/drawing how this changes the wave. Each student will have a chance to adjust the simulation.
    - https://docs.google.com/document/d/11G3zSunWUSSo81YNHGuesvbPBpvWLSJAk5McTv06CT0/edit?usp=sharing
- Introduction by talking about amplitude and frequency - do not tell students what these words mean, they will make their own definitions through their findings "today we will be looking at amplitude and frequency. We are going to look at this wave simulation to explore what these words mean"
- For each box on the graphic organizer, they will write and draw what they see, continually talking and comparing what they find with others
    - do the first box with the students
    - ideally this lesson is done with each student on their own device, but if that is not available we will work with each group on a device (laptops of the teachers or computers in the back of the class)
- Questions to ask:
    - "What do you notice about the wave when the frequency is high?"
    - "How does the wave change when the frequency is low?"
    - "What does the wave look like when the amplitude is high?"
    - "What do you notice when the amplitude is low?"
    - "What do you notice when the amplitude and frequency is high?"
    - "How does it change the wave when the amplitude and frequency are both low?"
    - "What does the wave look like when the amplitude is high but the frequency is low?"
      "What does it look like when the frequency is high but the amplitude is low?"
- After the students are done with the simulation, let them have a minute or so to wrap up their thoughts in the journal before transitioning to the explain phase.

EXPLAIN 2

- Do an example of labeling a wave with class first -high frequency, medium amplitude
- For the first 10 minutes, students will be talking as a group to figure out what they noticed about frequency and amplitude. There will be 4 drawings on the board. Low frequency, low amplitude and low frequency, high amplitude and high frequency, high amplitude and high frequency, low amplitude. The students will discuss what they would label the waves based on their drawings and observations from their graphic organizers. They will come up with their answers and discuss the questions
    - "How does amplitude change a wave?"
    - "How does frequency change waves"
- After the groups have come up with their answers, each group will go up and label the drawings. As a class, we will look at how the drawings are labeled and talk about if we as a class agree or disagree
- as a class we will answer these questions on chart paper
    - "How does amplitude change a wave?"
    - "How does frequency change waves"
- As a class, the students and teachers will come to a general understanding of the definition of amplitude and frequency
    - Draw on the board or show phet simulation of how waves change with frequency and amplitude
    - Ask how high-frequency changes a wave, have students come up and draw
    - ask how low frequency changes a wave and have a student come up and draw
    - repeat for high and low amplitude
- Have students record in their journals the class definitions and drawings of amplitude and frequency
    - they will add to their wave drawings to add in frequency and amplitude

ELABORATING/EXTENDING Understanding

- have them answer the anchor question of the week, " How do we see waves in our everyday lives?" **This will be their exit ticket!**
- The telephone game will be used at the end of class to introduce next week's topic of sound. Students will talk/listen into a cup tied to a string connected to another cup and make observations and inferences about what they noticed, saw, and heard during the game.
    - record thoughts in the "looking into next week" part of their journal
    - for covid- students will be 6 feet apart and not near each other when talking

- Building science journal - explain and give an example of what a science journal is and what they are used for
    - Pass out journals and allow some time for designing journals

Formative Assessment Evidence

- Teachers will work in small groups during the explain phase 1 and will gauge each student's understanding of the lesson plan and take notes of student learning during their small group discussion.
- Teachers will collect student journals at the end of the lesson and look over them to gauge how well students understood the lesson.
- exit ticket: On a small slip of paper answer: "How do we see waves in our everyday lives?"

Individual Student Accomodations

Accommodations/Modifications for Individual Students

- Accommodations
    - IEP - allow for longer time to work, working one on one with a teacher if needed, allow breaks, allow student to only do part of the questions
    - ADHD/anxiety/gifted - (homeschooled) - working one on one with teachers, allow any fidgets students may bring in, allow for cool downtime if need, allowing breaks if overwhelmed, asking more difficult probing questions they can write about in the journal
    - Asthma - allow breaks or sitting out if physical activity is too much
    - Allergies: amoxicillin/penicillin, pistachios, cashews

Materials + Quantity:

- Beach ball (1) the one with questions on it
- File Folders - 20 folders (4 sets of colors)
- Markers - (enough for 4 groups of 4 to have to use for decorating)
- Colored pencils (4 sets)
- Pencils - enough for each student (16)
- iPads if available - one for each student
    - if not available we will have students use a teacher's laptop
- Beach towel
- 8 paper cups
- Fishing line/String (as long as possible)
- Slinkies (4)
- Clear Plastic Basin (big enough to store water in)
- Big chart paper and marker to write on it (Big markers in multiple colors)
- Lei (flower necklaces) (20)

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Anchoring Question/Phenomena for the unit: How does energy move through matter?

Lesson Plan # 2

<table>
<tr><th colspan="3">Desired Results</th></tr>
<tr><td colspan="3">Driving Question for this week's Saturday Session
How do our voices travel across the room?</td></tr>
<tr><td>DCI Addressed in lesson:
PS4.A: Wave Properties: Sound waves cause vibrations in matter and those vibrations make the sound.
PS4.A: Wave Properties
Waves are patterns that can be made in water when the surface of the water is changed or disturbed. If the water is deep, the waves move up and down in the same place across the surface. The motion does not move anywhere other than up and down until it comes in contact with the beach.</td><td>SEPS Addressed in Lesson:
Ask questions about what would happen if a variable is changed.
Collaboratively develop and/or revise a model based on evidence that shows the relationships among variables for frequent and regular occurring events.
Develop and/or use models to describe and/or predict phenomena.
Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation.
Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard).</td><td>CCCs Addressed in Lesson:
Patterns
4-PS4-3 Similarities and differences in patterns can be used to sort and classify designed products.</td></tr>
<tr><td colspan="3">Besides science, what other disciplines of STEM will be included in this lesson?
The STEM infusion will be Math, and it connects with science because they will be analyzing the movements of waves. They will be looking at the movement of the amplitude and the frequency of the waves.</td></tr>
<tr><td colspan="3">Learning objectives (outcomes):
Students will be able to explain/state:
Students will be able to explain how sound travels through waves and is transferred into different types of matter
Students will be able to describe the pattern in which sound waves travel</td></tr>
</table>

- Students will be able to measure the length and distance of amplitude and frequency

Timeline of Activities for the Day

- measuring amplitude and frequency (15 min) (9:30-9:45)
- telephone game (10 min) (9:45-9:55)
- stations (40 min - 10 min each station) (9:55-10:35) a few minutes of each station
- explain (20 min) (10:35-10:55)
- phet simulation and explaining it (25 min) (10:55-11:20)
- looking into light (5 min) (11:20-11:25)
- designing notebooks (until pickup)

Learning Plan

ENGAGE

- pick up last week with measuring amplitude and frequency
- We will begin the lesson by picking up where we left off last week. One teacher will hang up the chart papers from the last class and briefly go over them.
    - Once we have refreshed their thoughts about amplitude and frequency, we will move into measuring amplitude and frequency.
        - we will have the same 4 examples of low frequency high amplitude, high frequency high amplitude, etc. As a whole class we will go over measuring the distance of the amplitude and frequency. The teacher will demonstrate how to measure for the first example, then the teacher will have the students look and write down the distances in their notebooks.
        - Each group will come up and write the distance for frequency and amplitude on the board and as a class we will compare the answers
- After measuring amplitude and frequencies, we will transition into looking at sound through the telephone game
    - each group will have a telephone on a string and will whisper to each other
        - strings are 12 feet apart and students will be around a corner for covid safety

EXPLORE

- There will be four stations, one with each teacher, looking at sound waves and what they look like.
    - Station 1 - Speaker Playing Music With Sprinkles on Top
        - Play 4 different songs, 1 that's fast, one that's slow, one with lots of bass, and one that's high pitched etc.
            - Flight of the bumblebee
            - Sail by awolnation
            - Lav vie en rose by Louis Armstrong
            - I like to move it by will.I.am
        - During each song, the students will observe what the sprinkles do
            - " Do the sprinkles jump high or not at all?"
            - " Why do you think the sprinkles jumped on this song but not the other one?"
            - "What do you think the sound wave would look like based on the way the sprinkles jumped?"
        - The students will discuss the similarities and differences between what they observed the sprinkles do with the different types of songs.

    - Station 2 - Tuning Fork in Water/Ping Pong Ball on string
        - Gather students around the table and show them what the tuning fork looks like
        - Give instructions that the tuning fork can only be hit off of rubber surfaces. (Teacher should demonstrate this to the students)
        - For each student, the teacher will have one cup of water, a tuning fork, and a ping-pong ball connected to a piece of string
        - Students will hit the tuning fork off of the bottom of their shoe and will quickly dip the tips of the tuning fork into the water and observe what happens
        - They will do the same with the ping pong ball

        - Students will write in their journals after 7 minutes of exploration

    - Station 3 - Musical Instruments
        - Bring in a bag of different musical instruments
        - the students will play around with each instrument, looking at how they each make sound
            - Ask questions like: “how do the instruments make different sounds”
            - “How do the different instruments make the sounds?”
              “How can you feel the sounds in the instruments”
        - After playing with the instruments for 5 minutes, they will have 5 minutes to write and discuss it.

    - Station 4 - Slow Motion Guitar String
        - https://youtu.be/8YGQmV3NxMI
        - Play this video on personal laptop for all of the students in the group. Students will watch through the whole video one time, just observing the guitar strings.
        - The second time watching the video, it will be played in a slower speed so that they can observe the waves better.
        - After the second time, I will ask the questions:
            - What did you see?
            - Why were different strings moving differently?
            - How do you think the guitar strings make the sound?
            - What do waves have to do with sound?
            - Is there anything you notice about amplitude or frequency?
        - They will then be given time to write in their journals and discuss what they wrote.

EXPLAIN

- The teachers will sit at the groups and one teacher will be at the front of the class going over what the groups noticed during the four stations. They will be asked the questions, they will discuss in the small groups, and then they will share their ideas to the whole class.
    - Questions:
        - What did you notice about the stations?
        - What did you observe during the tuning fork station and the sprinkles station? How did the waves/sound/energy move?
        - What did you notice during the instrument station and the guitar station? How did sound/waves/energy move during those stations?
        - Did you make any connections to things you’ve seen in your own lives? How have you interacted with sound waves?
    - The teacher will then explain that sound waves move through different types of matter. The movement of the ping-pong ball, the water, and the guitar strings all show the ways that the sound waves transfer through different types of matter.
- We will then discuss it as a whole class. Each group will share a few things that they talked about in their small group.
    - Questions:
        - What were some things that your whole group noticed about the stations?
        - What were some connections to your own lives that you talked about in your groups?

ELABORATING/EXTENDING Understanding

- Teachers will bring the group back together and students will be sitting with their tables. The teachers will each have a group that they sit with while one teacher presents at the front.
- The teacher will project the Phet simulation on the board and will adjust the settings of the amplitude and frequency and will discuss the rest of the class
    - questions: “What happens to the sound when amplitude is increased? What happens when the frequency is changed? Can you see the frequency and amplitude changing in the wave graphs as well? How does frequency and amplitude change a sound?
    - the simulation can look overwhelming at first so the teacher will be sure to demonstrate what is happening in the simulation

    - as questions are asked, the students will write down their thoughts in small groups first, then as a class we will talk about what happened
    - Students will be provided with a graphic organizer with the questions on it to help keep track of their thinking
- Once students have figured out through listening to the simulation that frequency changes pitch and amplitude changes volume, the students will write this down in their notebooks
- To test their knowledge, the students will be shown a picture of a wave with a high amplitude and frequency and will be asked to discuss whether the sound would be loud or quiet and what the pitch would be. This process can be repeated with different types of waves until it is clear that students understand

MOVING TO NEXT WEEK

- Next week we will be looking at light, to get students interested we will have a "light show"
- Bring in a light projector that has all different colors and shapes of laser lights that project out of it. We will turn off the class lights and turn on the light projector. We will ask students to think about how the light is moving across the room.
- Then we will wrap up by letting students continue to design their science journals until they are picked up.

Formative Assessment Evidence

- Teachers will work in small groups during the explain phase and will gauge each student's understanding of the lesson plan and take notes of student learning during their small group discussion.
- Teachers will collect student journals at the end of the lesson and look over them to gauge how well students understood the lesson.
- doing thumbs up, down, middle to gauge understanding
- having students go back and revise their models

Individual Student Accomodations

Accommodations/Modifications for Individual Students

- Accommodations
    - IEP - allow for longer time to work, working one on one with a teacher if needed, allow breaks, allow student to only do part of the questions
    - ADHD/anxiety/gifted - working one on one with teachers, allow any fidgets students may bring in, allow for cool downtime if need, allowing breaks if overwhelmed, more prompting to keep him on task
        - potentially taking him out of the room where there are too many distractions and working through the science thinking one on one with him for 5-10 minutes
    - Asthma - allow breaks or sitting out if physical activity is too much
- Allergies: amoxicillin/penicillin, pistachios, cashews

Materials + Quantity:

- 4 Tuning forks
- Ream of printer paper
- 16 science journals
- 20 pencils
- 4 packs of markers
- 5 expo markers
- 1 pack of chart paper
- 1 pack of chart graph paper
- 4 cup telephones
- 4 cups
- 2 ping pong balls
- 1 roll of string
- 1 container of sprinkles

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Anchoring Question/Phenomena for the unit: How does energy move through matter?

Lesson Plan # 3

<table>
<tr><th colspan="3">Desired Results</th></tr>
<tr><td colspan="3">Driving Question for this week's Saturday Session
What happens to light as it moves through matter?</td></tr>
<tr><td>DCI Addressed in lesson:
PS4.A Wave Properties
Waves are patterns that can be made in water when the surface of the water is changed or disturbed. If the water is deep, the waves move up and down in the same place across the surface. The motion does not move anywhere other than up and down until it comes in contact with the beach.</td><td>SEPS Addressed in Lesson:
Ask questions about how the light is moving and defining general rules they observe about the movement of light
Develop and/or use models to describe and/or predict phenomena about light waves.
Make observations to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
Analyze and interpret data to make sense of phenomena, using logical reasoning.
Construct an explanation of observed relationships (e.g., the distribution of plants in the backyard).
Engaging in an argument from evidence</td><td>CCCs Addressed in Lesson:
Patterns
4-PS4-3 Similarities and differences in patterns can be used to sort and classify designed products.</td></tr>
<tr><td colspan="3">Besides science, what other disciplines of STEM will be included in this lesson?
The STEM infusion this week is engineering because students will be designing and building a mirror maze to get light to travel to an object.</td></tr>
<tr><td colspan="3">Learning objectives (outcomes):
Students will be able to explain/state:
Students will understand and explain how light moves and how it changes.
Students will understand that light moves in wave-like behavior.
Students will be able to explain that refraction occurs as a result of light waves having to change their course.</td></tr>
<tr><th colspan="3">Timeline of Activities for the Day</th></tr>
<tr><td colspan="3">Cool light activity (10 minutes) (9:30-9:40)
Review with Guitar (5 minutes) (9:40-9:45)
Light scavenger hunt (40 minutes) (9:45-10:25) (each of us working in a different location)
Explanation of light scavenger hunt (25 minutes) (10:25-10:50)</td></tr>
</table>

- Making a coin appear (10 minutes) (10:50-11:00)
- Mirror Maze Exploration (20 minutes) (11:00-11:20)
- Drawing particles (10 minutes) (11:20-11:30)

Learning Plan

ENGAGE

- Light show
    - The lights will be turned off and we will use a light projector onto the ceiling.
    - After they have spent a little time observing, we will ask, “How does the light get from this machine to the ceiling? What do you think is happening?”
- We will show the guitar video from last week as a short review of what we did last week with sound waves, amplitude, and frequency.

EXPLORE

- Go over definitions:
    - Reflect: when light bounces off of an object
    - Refract: the bending of light when it passes from one transparent material to another
    - Opaque: not being able to see through, the light cannot pass through
    - Translucent: being able to see through an item, light can partially pass through an item
- As a class, we will go over the definitions by showing an example of an object that reflects and refracts light and an opaque and translucent object. The teacher will hold up a textbook and shine a flashlight at it showing that light does not go through the notebook then write the definition for opaque on the board. The teacher will do this for each definition with a different object. Once the definitions have all been written on the board, the students will be ready to start their light scavenger hunt.
- Light scavenger hunt
    - To begin the light scavenger hunt, the students will turn to their list of items and predict what category they think the item will go in. This should be done individually, not with their groups or the whole class
    - After they are done writing the predictions, the students will then move around the room, looking at the different objects. They will carry a flashlight and will see how the light reacts with the objects. As they do this, they will be writing the objects in their categories on the Light Scavenger Hunt graphic organizer.

Materials in light scavenger hunt:

- Reflect
    - Mirror
    - Tin pie dish
    - metal silverware
    - convex/concave sheets
- Refract
    - Pencil in a cup
    - Paper with arrows
    - Prism
- Opaque
    - Book
    - Shoe
    - cardboard
    - big yellow disk
- Translucent
    - Thin cloth
    - Tissue paper
    - Plastic cup
    - Fingertips
    - orange plastic cup
    - glass beaker
    - purple basket

EXPLAIN

- Students will start by having one person from their color group join together in a group of each color. They will discuss how their group categorized the items.
- Teachers will explain light scavenger hunt in the big group. Each teacher will sit in a group and listen to their responses. The teacher will then demonstrate the light interacting with each object that was on the list. The students will say what category they placed the object in. They will talk about why the objects fall under each category. The teachers will ask these questions:
    - What does the light look like when it goes through a translucent object?
    - What happened when you shined the light through the book?
    - What did you see when you looked at the pencil in a cup, the paper with arrows, and prism?
    - What do the objects in the same categories have in common?
- If we have more time, the students will use one of their blank pieces of paper to revise their initial categorizations. They will write about if they categorized any of them wrong or had to change their initial thoughts and explain why.

EXPLORE

- Making a coin appear (using refraction)
    - Each group will have a mug, a coin and blue ticky-tack,
    - A student from each group will place the ticky-tack on the bottom of the coin and place it on the bottom of the mug.
    - Everyone in the group will step back until they can no longer see the coin
    - Next, the teacher will go around to each group and pour water into the mug until they can see the coin from the spot where they stopped.
    - Everyone will discuss what they saw and come up with an explanation for how that was possible.
        - Thinking about all the activities we've done so far and our vocabulary for the day, what role did light play in this trick?
        - What activity did we do that is similar to this trick?
- Building light maze
- https://www.beano.com/games/lazer-maze
    - Teachers will project the virtual version of the light maze on the board, and the class will give tips on how to create the maze. They will go through one round while explaining the reasoning behind each of the mirror placements. They will then be given physical mirrors to create an actual mirror maze with the teacher. The groups will go to the station at the back of the classroom for 5 minutes of exploration with actual mirror mazes. The groups that are waiting will be using ipads to explore the virtual mirror maze.
    - Each group will create one mirror maze, and they will be asked to share their creation with the whole class.

ELABORATING/EXTENDING Understanding

- Draw particles in different mediums to prepare for next week.
- The students will draw these on their worksheet while the teacher leads the discussion

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

- We will collect their journals and look at their ideas they have been collecting throughout the day
- While students are discussing in both small and large groups, the teachers will listen to what the students are and aren't discussing.
- Looking at how high students get on the levels for the mirror game
- using thumbs up thumbs down for a quick check

Individual Student Accomodations

Accommodations/Modifications for Individual Students

- Accommodations
    - IEP - allow for longer time to work, working one on one with a teacher if needed, allow breaks, allow student to only do part of the questions

- ADHD/anxiety/gifted - working one on one with teachers, allow any fidgets students may bring in, allow for cool downtime if need, allowing breaks if overwhelmed, more prompting to keep him on task
  - potentially taking him out of the room where there are too many distractions and working through the science thinking one on one with him for 5-10 minutes
- Asthma - allow breaks or sitting out if physical activity is too much
- Allergies: amoxicillin/penicillin, pistachios, cashews

Materials + Quantity:

- 4 flashlights (1 for each group)
- iPads -16
- Laser Pointer
- Mirrors
- Tin pie dish
- metal silverware
- convex/concave sheets
- Pencil in a cup, Paper with arrows, Prism , Yellow disk, Book, Shoe
- cardboard
- big yellow disk
- Thin cloth, Tissue paper, Plastic cup
- Fingertips
- orange plastic cup
- glass beaker
- purple basket
- 4 mugs
- jug of water
- 4 coins
- ticky-tack
- particle worksheets

Link to predictions worksheet:
https://www.canva.com/design/DAEt-a2XYcw/xAjY4e0dbNbyAcW3n9IH8A/view?utm_content=DAEt-a2XYcw&utm_campaign=designshare&utm_medium=link&utm_source=publishsharelink
link to light scavenger hunt worksheet:
https://www.canva.com/design/DAEt-Q0-o5M/pWbouhYvvJ2SZ70PWgLCfQ/view?utm_content=DAEt-Q0-o5M&utm_campaign=designshare&utm_medium=link&utm_source=publishsharelink
Link to Scavenger Hunt Worksheet and Particles Worksheet:
https://www.canva.com/design/DAEt-pbj6-E/vaiZ7_BWE8H47bOm3FuTFA/view?utm_content=DAEt-pbj6-E&utm_campaign=designshare&utm_medium=link&utm_source=publishsharelink

Q405: Saturday Science FS21

Instructor Names: Katie Brammer, Madison Pittman, Shauntell Harris, Caitlyn Baker

Grade level: 3rd-4th grades

Anchoring Question/Phenomena for the unit: How does energy move through matter?

Lesson Plan # 4

<table>
<tr><th colspan="3">Desired Results</th></tr>
<tr><td colspan="3">Driving Question for this week's Saturday Session
How do different types of waves move through matter?</td></tr>
<tr><td>DCI Addressed in lesson:
PS4.A Wave Properties
Waves are patterns that can be made in water when the surface of the water is changed or disturbed. If the water is deep, the waves move up and down in the same place across the surface. The motion does not move anywhere other than up and down until it comes in contact with the beach.</td><td>SEPS Addressed in Lesson:
Asking scientific questions
Planning and carrying out investigations
Analyzing and interpreting data
Constructing scientific explanations
Engaging in argument from evidence
Obtaining, evaluating, and communicating information.</td><td>CCCs Addressed in Lesson:
Structure and Function: the way an object is shaped or structured determines many of its properties and functions</td></tr>
<tr><td colspan="3">Besides science, what other disciplines of STEM will be included in this lesson?
Engineering - they will start a prototype for the building of their model for the final project. They will sketch the three different types of matter and movement of waves through the matter.</td></tr>
<tr><td colspan="3">Learning objectives (outcomes):
Students will understand how waves change when going through solids, liquids, and gases. (gas is the slowest, liquid is in the middle, and solids are the fastest).</td></tr>
<tr><th colspan="3">Timeline of Activities for the Day</th></tr>
<tr><td colspan="3">Slinkies - transverse and longitudinal waves - (10 minutes) 9:30-9:40
Exploring and explaining transverse and longitudinal through familiar materials (20 min) 9:40-10:00
Matches in a cup - (10 minutes) 10:00-10:10
Explain 2 - (30 minutes) 10:10-10:40
Sound and light through different materials - (10 minutes) 10:40-10:50
Explain 3 - (30 minutes) 10:50-11:20
Sketching and preparing for model next week (10 minutes) 11:20-11:30</td></tr>
<tr><th colspan="3">Learning Plan</th></tr>
</table>

ENGAGE

- We will start the lesson by having students experiment with slinkies again. They already made 2 types of slinky waves in week 1 and we will ask them to think back to that first week and see what waves they remember they can make. After a couple minutes of this, students will watch a youtube video explaining transverse and longitudinal waves through a slinky. Then we will ask students to make a sound wave with their slinky and a light wave with their slinky. The goal is to get students to understand that light waves and sound waves look different.

EXPLORE 1

- Students will be sitting in their groups
- They will have a piece of yarn, a slinky and a cup of water and a tuning fork
- The students will have to explore with the materials, and the teachers will sit at each station to help them manipulate the materials in ways that demonstrate transverse waves and longitudinal waves.
- We will then move into a whole group debrief

EXPLAIN 1

- Teachers will go over each item and will explain what type of wave each material created
    - Slinkies and string are transverse - light
    - Slinkies and water with tuning fork are longitudinal - sound

EXPLORE 2

- Experiment with matches in cup
    - https://www.physicscentral.com/experiment/physicsathome/space-sound.cfm

EXPLAIN 2

- Explain that waves need a medium to travel thought, transition into what mediums do waves travel through
- Question to start discussion: What happened to the sound of the bell after the matches were added to the cup?
    - ans: you couldn't hear the bell or the bell got quieter
- Why is this happening? - have students suggest what they think and chart answers on the board
- Explain what happens when you light a match in the bottle- you are burning up oxygen and eventually the matches go out because there is no more oxygen
    - We can explain by asking if students have every started a fire and been told to fan the fire
- Without the oxygen, there is less matter in the bottle
- Without matter, the sound waves have less matter to vibrate off of, meaning it is creating different sounds
- Now that we understand waves need matter to travel through, we can transition to how waves travel through different matters
- look at their sketches of what particles in matter look like from last week, how would a wave travel through the different types of matter. What matter has closer vs spaced apart particles and how will this change how the wave travels based on the vacuum

EXPLORE 3

- Students will be in groups of 2. Each group will be given 2 baggies and 2 wooden blocks. The students will fill one baggie with air by blowing into the baggie. They will then fill the second baggie with water
- The students will hold the baggies up to their ear and tap the baggies with the pencil. They will then hold the wooden blocks to their ears and will tap the block with a pencil. They will go through this several times each in order to hear the differences in sound when the waves are traveling through the different mediums. They will use a stethoscope to listen to the different objects when they are tapping the objects.
- They will then go through all of the materials and shine a light on the objects.
    - solids - light will bounce off of the block
    - liquids - light will refract
    - gases - light will go straight through
- The teachers will float around to the different groups to monitor the students' conversations.
- Questions to ask:
    - What are you hearing when you tap on the liquid? The gas? What about when you tap the blocks together?
    - How do these sound different?
    - Why do you think that they sound different?
        - If the student doesn't hear a difference, have them hold the bag to their ear and then tap the three bags for them.
    - How did the light react with the different types of matter?

EXPLAIN 3

- Teachers will bring the group back together and will have the students keep their baggies. The teacher will have her own set of baggies up front on the small table.
- The teacher will go through each type of matter and will ask those four main questions once again, but will connect it to the movement of the energy through the different types of matter for both sound and light.
    - Solids will sound clearer than the liquids and gases. Liquids will be clearer than gas, and gas is not as clear as solids or liquids

ELABORATING/EXTENDING Understanding

- Students will start to sketch the three different types of matter and movement of waves through the matter. They will use these sketches as references for the project and presentation during the final week 5.
- Students should have enough information to answer the overarching question, "how does energy move through different types of matter?"
- Students will come to the board to draw the particles for solids, liquids, and gases.
- https://www.youtube.com/watch?v=bSA4gfiahNw

Formative Assessment Evidence

What evidence will you gather to understand if ALL your students met the learning outcome (see green box above)?

- We will collect their journals and look at their ideas they have been collecting throughout the day.
- While students are discussing in both small and large groups, the teachers will listen to what the students are and aren't discussing.
- Using thumbs up thumbs down for a quick check of understanding.

Individual Student Accomodations

Accommodations/Modifications for Individual Students

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    - ADHD/anxiety/gifted - working one on one with teachers, allow any fidgets students may bring in, allow for cool downtime if need, allowing breaks if overwhelmed, more prompting to keep him on task
        - potentially taking him out of the room where there are too many distractions and working through the science thinking one on one with him for 5-10 minutes
    - Asthma- allow breaks or sitting out if physical activity is too much
    - Allergies: amoxicillin/penicillin, pistachios, cashews

Materials + Quantity

- 1 roll of yarn
- 4 tuning forks
- 4 plastic cups
- 1 empty soda bottle
- 1 small/medium sized bell
- 1 box of matches
- 1 roll of Scotch tape
- 1 Popsicle stick
- 1 thick rubber band
- Stethoscopes
- 8 flashlights
- 16 Ziplock baggies sandwich sized
- 16 slinkies
- 16 wooden blocks (small ones in the materials room)
- Bottle of rubbing alcohol
- Cotton balls - 30
- Worksheet - circle fast, medium, slow for baggie activity

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Anchoring Question/Phenomena for the unit: How does energy move through matter?

Lesson Plan # 5

<table>
<tr><th colspan="3">Desired Results</th></tr>
<tr><td colspan="3">Driving Question for this week's Saturday Session
How can we make a model of waves?</td></tr>
<tr><td>DCI Addressed in lesson:
PS4.A Wave Properties
Waves are patterns that can be made in water when the surface of the water is changed or disturbed. If the water is deep, the waves move up and down in the same place across the surface. The motion does not move anywhere other than up and down until it comes in contact with the beach.</td><td>SEPS Addressed in Lesson:
Asking questions and defining problems
Developing and using models
Analyzing and interpreting data
Using mathematics and computational thinking
constructing explanations and designing solutions
Engaging in argument from evidence</td><td>CCCs Addressed in Lesson:
Energy and Matter
Energy can be transferred in various ways and between objects.</td></tr>
<tr><td colspan="3">Besides science, what other disciplines of STEM will be included in this lesson?
They will use math to measure the amplitude and frequency of their wave and graph it.
They will use engineering by building a model, presenting it, and revising it.</td></tr>
<tr><td colspan="3">Learning objectives (outcomes):
Students will compare and contrast how waves look in different mediums through models
Students will be able to graph waves and change the graph related to different sounds played
Students will be able to model and exhibit their understanding of everything they have learned about waves and movement through particles in different forms of matter from all four weeks.</td></tr>
<tr><th colspan="3">Timeline of Activities for the Day</th></tr>
<tr><td colspan="3">Engage 1 - Review of topics with a Kahoot game (30 minutes) 9:30-10:00
Explore 1 - Playdoh waves (20 minutes) 10:00-10:20
Explain 1 - Manipulating the waves (15 minutes) 10:20-10:35
Engage 2 - video (5 minutes) 10:35-10:40
Explore 2- build model (20 minutes) 10:40-11:00
Explain 2- present and jigsaw game (20 minutes) 11:00-11:20
Elaborating and understanding (10 minutes) 11:20-11:30</td></tr>
<tr><th colspan="3">Learning Plan</th></tr>
</table>

ENGAGE 1

- Kahoot to review everything we have learned in the past four week - amplitude, frequency, particles, matter, transverse, longitudinal, sound, light
    - Amplitude-height of wave, correlates with volume
    - Frequency-number of wavelengths passing through a certain point, correlates with pitch
    - Particles-all types of matter are made up of particles, and all particles move
    - Matter-solids, liquids, gases
    - Transverse-light waves
    - Longitudinal-sound waves

EXPLORE 1

- Playdoh waves!
    - Students will be creating models of different types of waves. The teacher will give pairs of students graph paper and a can of play doh
    - the teacher will ask students to shape their play doh into a wave. They will need to measure the frequency and amplitude of the wave
    - We will have an example up on the screen but, they cannot make their wave look exactly like the example
    - students will need to plot their point first, then arrange the shape of their wave, then measure the frequency and amplitude.

EXPLAIN 1

- After making the waves, the students will show the waves to their table partners. Then, the teacher will tell them we are going to change the way our wave looks by changing the pitch and volume of the wave
- The teacher will play a high pitched noise at a high volume first and have the partner pairs change their waves to accommodate the sound (should be high frequency and high amplitude waves). Then the teacher will play a low pitched and low volume sound (the wave should have low frequency and low amplitude) the teacher will then play the rest of the sound combinations (4 total) and have students change their play doh waves to make the correct sound waves.

ENGAGE 2

- Show the video from last week demonstrating the movement of energy through solids, liquids, and gases
    - Explain that this is what we will be creating this week
    - https://www.youtube.com/watch?v=bSA4gfiahNw

EXPLORE 2

- Make model of particles and waves interacting with entire group
    - There will be three groups, each having a different form of matter (solid, liquid, and gas).

EXPLAIN 2

- During this phase, the students will first show their models to the class. One group will have air, liquid, and solid. The students will point out what medium they have and why theirs looks different than the others
- Then students will play a jigsaw game with the mediums
    - The teacher will call out “what does it look like when sound travels from a solid then a liquid? The solid and liquid groups will stand up and put their boards together to show the difference of how fast the sound travels through the mediums. The teacher will continue to call out pairs until all the pairs have been called.
    - ex of pairs:
        - liquid-air
        - liquid-solid
        - air-solid
        - air-liquid
        - solid-liquid
        - solid-air

ELABORATING/EXTENDING Understanding

- Pass out certificates
- Have each student share one of their favorite activities we did in the past 5 weeks
- Have students answer in their journal the anchor question, “How does energy move through matter?” and can they think of any way they see it in everyday life that we haven’t touched on.

Formative Assessment Evidence

- The students will be building a model of particles and waves interacting then presenting their wave models to the entire class.
- We will do a Kahoot to quiz them and evaluate what each individual student has learned throughout the five weeks.

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Materials + Quantity

- 16 iPads
- 3 poster boards (bristol board)
- 2 bags of 400 count cotton balls
- https://www.target.com/p/jumbo-cotton-balls-up-up/-/A-81906605?preselect=11031092#lnk=sametab
- 2 bags of 100 count pom pom craft balls https://www.target.com/p/200ct-mini-pom-poms-mondo-llama-8482/-/A-81212413#lnk=sametab
- the graph poster board that is in the materials room
- 8 bottles of white elmer's liquid glue
- 8-16 cans of play doh (from the 5-8 group)