

Teacher Candidate: Evangelin Milonas	Date: Monday, April 22th, 2024
Grade Level(s): 4/5	Subject/Strand: Science (C. Matter and Energy)
Lesson Title: The Magic of Refraction Through Matter & Space	Unit of Study: Refraction of Light in Light and Sound (4) Properties of and Changes in Matter (5)
Lesson Overview: Students will observe and understand how light is refracted through a medium of mass, such as water.	

PART 1: PREPARING THE LESSON

Ontario Curriculum Overall Expectations: <p>C2. By the end of Grade 4, students will demonstrate an understanding of light and sound as forms of energy that have specific characteristics and properties.</p> <p>C2. By the end of Grade 5, students will demonstrate an understanding of the properties of matter, changes of state, and physical and chemical change.</p>	Ontario Curriculum Specific Expectations: <p>C2.3 By the end of Grade 4, students will describe properties of light, including that light travels in a straight path and that light can be absorbed, reflected, and refracted (e.g. use a demonstration of how light is refracted)</p> <p>C2.1 By the end of Grade 5, students will describe matter as everything that has mass and occupies volume (e.g. describe how the medium (water) has mass and fills the cup in the refraction demonstration)</p>
Big Idea/Enduring Understanding: <p>Grade 4 students will leave the lesson with the knowledge and understanding as to why light refracts at various angles depending on the medium it is projected through.</p> <p>Grade 5 students will leave the lesson with the knowledge and understanding as to why all matter has mass and takes up space/volume.</p>	
Essential/Key Question(s) <p>Why does the speed of light change depend on the material it passes through?</p> <p>How is the “refractive index” helpful to understand this?</p> <p>Why does the mass of matter take up space/volume?</p>	
Student Learning Goal(s): <p>We will understand why light refracts when passed through mediums, specifically water in this case. (Grade 4)</p> <p>We will understand why matter has mass and takes up space/volume. (Grade 5)</p>	
Student Success Criteria: <p>Grade 4:</p> <p>I can hold a paper with two arrows pointing in the same direction directly behind the filled glass.</p> <p>I can observe the outcome of the experiment and record it.</p> <p>I can see how light refracts as it passes through the water and record at least two thoughts behind it on my worksheet (Appendix).</p> <p>Grade 5:</p> <p>I can measure the mass of the glass with or without water and record it.</p>	

I can record at least two thoughts on my worksheet (Appendix) about how matter has mass and occupies space/volume.

I can calculate the volume of water in the glass using litres.

Learning Skills and Work Habits:

- ✓ Responsibility
- ✓ Organization
- Independent Work

- ✓ Collaboration
- ✓ Initiative
- Self-Regulation

Necessary Prior Knowledge, Skills, and/or Previous Lesson:

Grade 4s must know what light is, how it may appear to us as humans, and that it can be affected depending on what it is travelling through.

- Based on past experiences - I will show examples of this in the minds-on

Grade 5s must know that matter can be in any state (e.g. solid, liquid, or gas).

- I will show examples of this in the minds-on to refresh their learning

New Vocabulary:

I will introduce the following words by listing them in an envelope with their definitions randomly organized. The students will have to get into groups of four and match the words to their definition.

- Refraction
- Matter
- Volume
- Mass

Inclusive Design Considerations:

- This lesson will be inclusive of all my students as they will work together in conducting this experiment and brainstorm reasons as to why the outcome is the way it is. Considering their age, it will take them by surprise when they see how light is refracted in water. My aim is to engage all my students with this activity as they will think it is pure magic. Using magic as the driving force of this lesson is how I plan on using "Culturally Responsive and Relevant Pedagogy" and making the lesson relative to their own lives. They are young children and regardless of their past experiences, they will all be able to relate to this as it involves light.
- Equitable learning opportunities: this experiment involves being hands on and the students will be given plenty of resources to practice their learning. I will ensure to give them enough time when conducting this experiment (it is very short - the majority of it will be based on discussion).
- This topic does not directly connect to any current events, but it is connected to everything that is seen in life. Light is needed for all visuals.
- This topic also involves measuring and recording mass/volume which is relative in everyday life. At the grocery store, we often measure the mass of our fruits and vegetables, or when we are cooking. Specific proportions are required when making certain meals or drinks.

Learning Environment and SAFETY Considerations:

To support our learning goal, the students will be working together in their small groups of four. All materials will be found at the back sink of the classroom so that the students can ensure they have collected all the needed materials from one section (I will be standing there to help them if they have any questions. Each group will pick two people to come up and get their materials. I will call each of the members up in 60 second increments to prevent them from rushing to the back and injuring themselves, spilling water, or breaking the glass on their way there. Before we begin, I will inform the students that if any accidents occur, they should let me know immediately and ensure that no one steps near the accident site. We must prevent any injuries at all costs as safety is our top priority. If glass breaks, the students are to call me over as I will dispose of it in the broken glass bin.

****classroom lights must be on at all times and as always, students cannot run in the classroom.**

(x6 - except food scale and measuring cup - of each because there are 6 groups)

Materials needed for the experiment:

- 1) Envelope with vocabulary and definitions
- 2) Food scale
- 3) Measuring cup
- 4) Tall glass
- 5) Paper with two arrows pointing in the same direction (one at the top of the paper, one at the bottom).
- 6) Lights must be on in the class or sunlight must shine through.

Paper towels will be readily available in case any one makes a mess.

Students will be given a worksheet to record their hypothesis ahead of time and record their observations and discoveries.

Resources: I did not use any resources for this experiment, it is one that I remember from when I was in school.

ASSESSMENT:

- **Assessment FOR Learning**
- Students will be given an exit ticket at the end of class to state what they learned today and ask a question on what they are most curious about. I can reflect on their questions and answer them as best as I can in the following lesson.
- **Assessment AS Learning**
- **Assessment OF Learning**

Specific Assessment Tool(s):

- I will be recording and tracking my assessment through an anecdotal record that I have for each student in my class.
- The students will be assessed based on the exit ticket that they fill out at the end of the day. This type of assessment of triangulation fits under the category of "Products".
- The categories of achievement would be Thinking and Communication, this way I will know what they understand or do not understand from this lesson that needs to be further explored.
- Responsibility, Organization, Collaboration, and Initiative will be assessed during this lesson. Due to the fact that the students will be conducting an experiment together in small groups and hazardous materials are being handled, these skills appeared to be the most appropriate for assessment. Each member must take part in this activity and serve their role.
- During this lesson, I will be assessing two groups in the classroom (roughly 10 students). I will be observing their work throughout the experiment and taking notes.

DIFFERENTIATED INSTRUCTION:

Strategic seating, great lighting, and lastly reduction in the number of tasks used to assess a concept or skill (by having each student in a group splitting up the tasks) are the ways in which the accommodations for students will be most successful. Each group will have a mix of grade 4 and 5 students.

Lesson Plan Template (Grades 1 to 10)

LESSON Accommodations and/or Modifications

- Content
- Process
- Product

ASSESSMENT Accommodations and/or Modifications:

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Accommodations for those who need help with the set up/understanding of the experiment will be placed in the same group with someone who can verbally explain the process as they are conducting the experiment. I will assist if need be.

For students who prefer to orally communicate their answers from the exit ticket, I will give them the opportunity to come to my desk at the end of class and I will ask them the same questions that are on the exit ticket. I will record their response on my computer.

Student IEP Related Differentiation:

The students with IEPs will be accommodated by working in groups with others as well as having a visual aid (video).

PART 2: TEACHING THE LESSON

Lesson Plan Template (Grades 1 to 10)

<p>Total Length of Period: 60 minutes</p> <p>Estimated Time: Minds on - 15 minutes Action - 25 minutes Consolidation - 20 minutes</p>	<p>Instructional Strategy</p> <ul style="list-style-type: none"> ● Think/Pair/Share ● Experiment worksheet (materials will be at the sink) ● Write on paper to share our thoughts with the class ● Exit Pass <p>The variety of instructional strategies will aid all learners as differentiation has been considered. Students will be placed in groups with those that they sit with.</p>	<p>Differentiation</p> <p>I will differentiate the instruction of the minds on portion by verbally stating what needs to be done in their groups with the envelopes of terms and definitions. The instructions will also be written on the envelope and the students will be working together to complete this task.</p> <p>I plan to differentiate instruction by providing the procedure not only on paper but also showing a video of the setup for those who are visual learners.</p> <p>I plan to differentiate the exit ticket by giving my students the opportunity to share their responses orally while I take note of them.</p>	<p>Assessment</p> <p>I will be assessing two groups (10 students) during the “action” portion of the lesson. I will be evaluating their skills in how they are being responsible, taking initiative, collaborating, and staying organized within their group. This would be during the observation period being assessed for learning.</p> <p>I will be assessing each student using assessment for learning. They will each receive an exit ticket at the end of class (product) where they can share what they learned and ask me any questions that they may have about this lesson.</p>
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<p>MINDS ON (Before): 10 minutes</p> <p>Prior knowledge</p> <ul style="list-style-type: none"> ● Students should know that light travels in a path (grade 4) ● Students previously learned about examples of matter and the forms they take (grade 5) <ul style="list-style-type: none"> ○ I will refresh their memory <p>Student Learning goal:</p> <p>We will understand why light refracts when passed through mediums, specifically water in this case. (Grade 4)</p> <p>We will understand why matter has mass and takes up space/volume. (Grade 5)</p> <p>Hook</p> <ul style="list-style-type: none"> ● Students will be in their groups of ~6 and given an envelope with terms and definitions ● Students must work together in their group to match each word to their definition ● We will take it up together as a class <p>Student Success Criteria:</p> <p>Grade 4:</p> <p>I can hold a paper with two arrows pointing in the same direction directly behind the filled glass.</p> <p>I can observe the outcome of the experiment and record it.</p> <p>I can see how light refracts as it passes through the water and develop the knowledge behind it.</p> <p>Grade 5:</p> <p>I can measure the mass of the glass with or without water and record it.</p> <p>I can develop the knowledge to see how matter has mass and occupies space/volume.</p> <p>I can measure the volume of water in the glass using litres.</p>	<ul style="list-style-type: none"> ● Think/Pair/Share 	<p>I will differentiate the instruction of the minds on portion by verbally stating what needs to be done in their groups with the envelopes of terms and definitions. The instructions will also be written on the envelope and the students will be working together to complete this task.</p>	
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<p>ACTION (During): 20 minutes</p> <ul style="list-style-type: none"> ● The students will remain in their groups. Each student will receive an “Experiment Worksheet” and write their hypothesis as to what they think is going to happen once they conduct the experiment. ● Students will be told where they can gather their materials per group. I will be standing by the sink with the materials to aid the students if needed. (Grade 5s have a few extra steps as they must measure the mass of the glass and water to record their observations). <p>Procedure Grade 4:</p> <ul style="list-style-type: none"> ● Each group must gather a glass, add water in it (about half way) and a piece of paper with both arrows. One student can hold the paper behind the glass full of water and ask the rest of the group to record their observations. The students can take turns with this so that everyone can observe the experiment. ● Grade 5: Will conduct the same experiment, however, they must measure how heavy the glass is in g using the scale (by the sink) and measure one cup of water to pour in the glass. The measuring cup is also placed at the sink. ● The students will work together with the members of their group to conduct the experiment together. The instructions and procedure are posted on the “Experiment Worksheet”. Students can each take on a role in the experiment. ● If the students need additional aid in setting up their experiments, I will provide them with a video that they can watch (without showing the experiment itself). ● I will be stationed at the sink and students may approach me at any 	<ul style="list-style-type: none"> ● Experiment worksheet (materials will be at the sink) 	<p>I plan to differentiate instruction by providing the procedure not only on paper but also showing a video of the setup for those who are visual learners.</p>	<p>I will be assessing two groups (10 students) during the “action” portion of the lesson. I will be evaluating their skills in how they are being responsible, taking initiative, collaborating, and staying organized within their group. This would be during the observation period being “assessment for learning”.</p>
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<p>time if they have questions. I will be observing each table with my eyes. Grade 4s can ask Grade 5s for help or ask a classmate.</p> <ul style="list-style-type: none"> I will ask the students what they noticed as they conducted the experiment and let them know what they succeeded with and didn't. 			
<p>CONSOLIDATION (After): 15 minutes</p> <ul style="list-style-type: none"> The students will discuss with their groups as to why they think the outcome is the way it is. They will jot down some reasons on a piece of paper to share with the class in our group discussion and share their thoughts on chart paper for everyone to see. We will regroup with the class and talk about what we saw happened. Grade 5s can reflect on the state of the water and the space it took up in the glass. How much of it was filled? How much of it was not? How do our observations link to our learning goal? Have we followed the success criteria? Students will be given a blank sheet of paper (this will be their exit ticket) to state one thing that they learned today and ask a question about one thing that they are most curious about. I can reflect on their questions and answer them as best as I can in the following lesson. 	<ul style="list-style-type: none"> Write on paper to share our thoughts with the class Exit Ticket (blank sheet of paper) to state one thing that they learned today and ask a question about one thing that they are most curious about. 	<p>I plan to differentiate the exit ticket by giving my students the opportunity to share their responses orally while I take note of them.</p>	<p>I will be assessing each student using assessment for learning. They will each receive an exit ticket at the end of class (product) where they can share one thing that they learned and ask one question based on this lesson.</p>

Lesson Plan Template (Grades 1 to 10)

Lesson Extension:

As an extension, I would assign optional readings/videos if they would like more information about refraction of light (grade 4) or matter and its mass (grade 5).

One strategy I would want the grade 5 students to keep in mind to consolidate their learning is to begin weighing differing fruits or drinks at the grocery store using a food scale. I'd ask them to think about comparing sizes and those that feel heavier than others, hoping that they would share their thoughts with the class the next day.

Grade 4s can try the experiment with light refraction at home to show their parents using similar materials. Maybe they can try it using other shapes or drawings to see what will happen. They can share their observations the next day in class.

I will encourage the students to not only look online but check the school or local library for any findings based on this lesson.

Although not an assessment, students can take a deeper look into the posted readings of the same topic.

Appendix:**Science Lab Report**

Name: _____

Part 1: - Please read the procedure first and follow the instructionsPurpose: (Why are we conducting this experiment?)

_____Hypothesis: (What do you think is going to happen?)

Materials: (What are you using?)

At the sink:

- jar filled with water (at the sink)
- food scale (to weigh the mass of water in the cup)
- measuring cup

At the big table in the middle of the classroom:

- paper with two arrows on it (one for each group)

Procedure: (What order are you conducting the experiment in?)

1. You will be working with your groups so one experiment will be conducted per group. However, each member of the group will receive an experiment sheet to fill out.
2. Write your name at the top of this sheet.
3. Fill out "Purpose".
4. Write out your hypothesis, remember that a hypothesis is a statement (don't use the words "I think", use phrases like "_____ will happen")
5. Choose two people (preferably one grade 4 and one grade 5 student) to gather your materials for the group. I will be at the sink to help.
 - For the measuring portion, please choose a grade 5 member from your group to complete this step. They will record the mass and volume of water in your jar and share it with you to fill out under the "Observations" section.
 - any amount of water can be filled in the jar, there are no rules for this
 - try not to fill it too high or too little as it can be a safety hazard or affect your results

Lesson Plan Template (Grades 1 to 10)

6. When materials are gathered at your table group, choose a new person to hold the paper with the arrow behind the glass filled with water.
 - the bottom arrow should be below the level of water in the jar (you are looking at it through the water) and the top arrow should be above water level
7. Switch with other members of your group so that everyone has a chance to observe.
8. Record your observations below.
9. Discuss with your group members and fill out the "Discovery" portion below.
10. Please do not fill out Part 2 yet.

Observations: (What did you see, what happened?)

Mass of water in the jar: _____ grams (g)

Volume of water in the jar: _____ mL (milliliters)

Discovery: (Why do you think the results happened? Was your hypothesis right?)

Part 2: Please do not fill this out until I tell the class to.

Conclusion: (Why the results actually happened. What else can we learn?)
