GRADE 2 BRINGING IT TOGETHER

ENERGY & SCIENTIFIC METHODS

Example:
“Behaviour of Light Affects Its Path

Nicole Lamoureux, M.Ed.
Designer of Professional Learning Consultant, ARPDC

Land Acknowledgement

In the spirit of reconciliation, we want to acknowledge that this gathering is taking place on traditional lands across the province of Alberta, home to many diverse First Nations, Métis and Inuit peoples. We acknowledge that this land is a traditional meeting ground giving voice to its original peoples and the story of creation of this country in a way that history has forgotten.

GOALS

1.Review Subject Introduction to Scientific Methods

2. Key verbs to look for as cues for integrating

3. Walk through “Planning Guide” Resource

4. Sample beginning of plan with “Behaviour of Light affects its path.”

Session & Resources

School or division leaders can share slides and information from session sourcing as follows: ARPDC (2023)

TQS Alignment
Demonstrates a Body of Knowledge

A teacher applies a current and comprehensive repertoire of effective planning, instruction, and assessment practices to meet the learning needs of every student.

a) planning and designing learning activities that:
- address the learning outcomes outlined in programs of study (curriculum);

reflect short, **medium** and long range planning;

b) applying student assessment and evaluation practices that:
- accurately reflect the learner outcomes within the programs of study (curriculum);

Do the best you can
until you know better.
Then when you know better,

do better.

(Maya Angelou)

KEY IDEAS

Scientific Methods	Integrated in all other organizing ideas. Way students should build knowledge in each organizing ideas. “Explore before Explain”
Teacher Clarity of Curriculum	Taking time to unpack the curriculum empowers you to choose activities & resources that truly align with curriculum.
Learning Sequence	Logical flow and sequence of knowledge & skills to **intentionally plan** for including the scientific methods.
Planning Guide	Resource developed to assist with intentionally integrate scientific methods in other organizing ideas

Integrating The Scientific Methods

"The Science curriculum engages students in active investigation to build scientific knowledge and develop critical-thinking and problem-solving skills....Students will have opportunities to **integrate these skills into all other areas of the Science curriculum."**

Science Curriculum Subject Introduction

Learning Outcomes in Every Organizing Idea Begin With

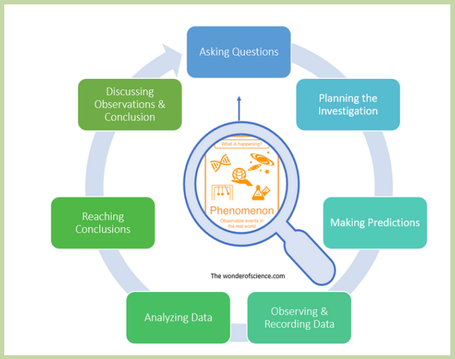
"Students investigate…."

Grade 2 Knowledge Statement

Procedures scientists use to guide investigations include

- asking questions
- making predictions
- planning the investigation
- observing and recording data
- analyzing data
- reaching conclusions
- discussing observations and conclusions

https://curriculum.learnalberta.ca/curriculum/en/c/sci2?s=SCI



Glossary for Student Action Verbs ~ Alberta's K-6 Science Curriculum

This glossary was developed to help provide clarification, context and support for teaching of the student actions in Alberta's K-6 Science Curriculum (2023).

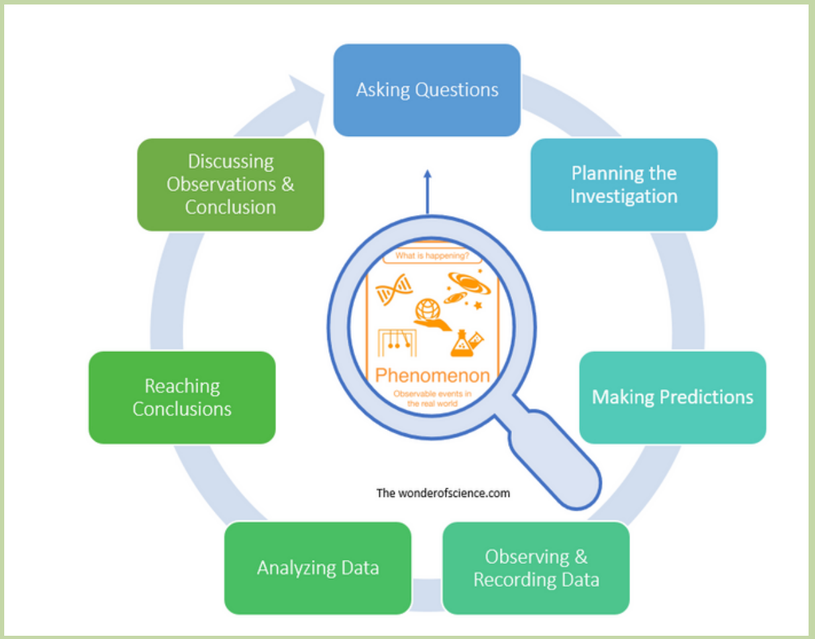
Grades found as LO	Grades found within Ss & Ps	Verb	Definition
1, 2, 3, 4, 5, 6	1, 2, 3, 4, 5, 6	investigate	To use a process of inquiry or exploration to gain deeper understanding.

Students investigate (process to find answers or build knowledge)

Explore Before Explain

Explore First

- Students go through process to reach conclusions and explain their thinking.



Explain:

- Students confirm conclusions and introduced to vocabulary to connect with videos, books, teacher explanations

Integrating The Scientific Methods With Other Organizing Ideas

Key words in the skills and procedures in other organizing ideas. Indicates students need to integrate aspects of the scientific methods

Predict	Explore	Investigate
Test	Observe	Examine

Integrating The Scientific Methods With Other Organizing Ideas

KNOWLEDGE	UNDERSTANDING	SKILLS & PROCEDURES
Sources of light include • the Sun • electricity • fire • some plants and animals (bioluminescence) Light behaves in various ways, including • travelling in a straight line from its source • bouncing off a surface (reflection) • bending as it travels from one material to another (refraction) • splitting into colours (dispersion) Light travels through objects that can be seen through (transparent). The path of light is affected by mirrors, prisms, and water. The path of sunlight can be affected in a variety of ways by natural objects, such as • leaves • trees • bodies of water • mountains	Behaviours of light affect its path.	Identify sources of light. Conduct an investigation to determine how the path of light can be affected. Examine how natural objects affect the path of sunlight.

https://curriculum.learnalberta.ca/curriculum/en/c/sci2?s=SCI

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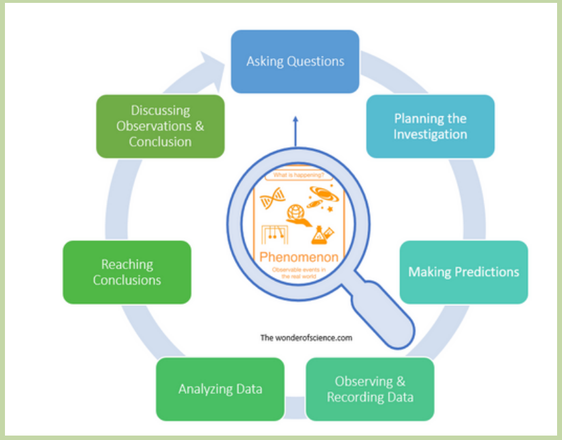
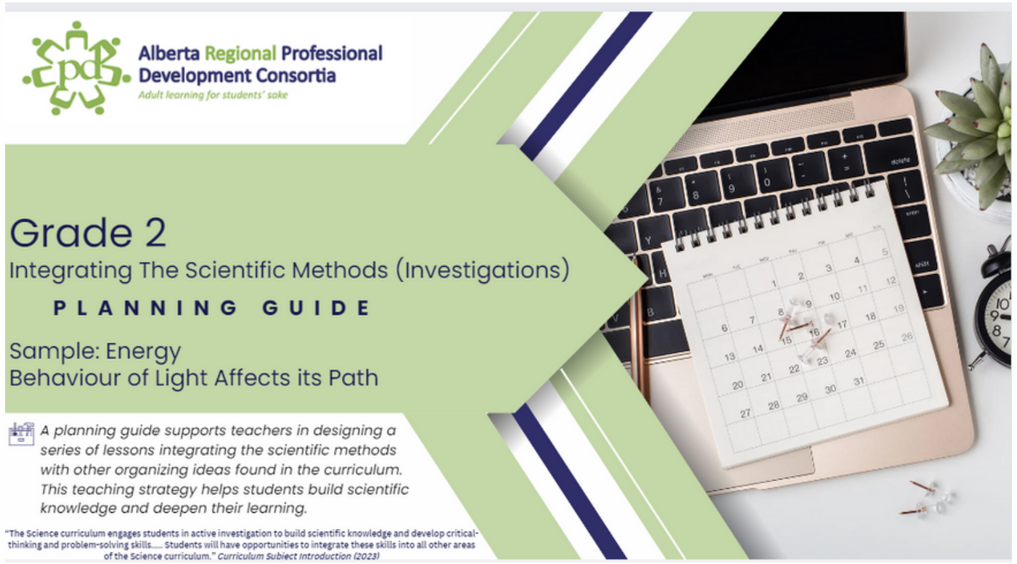
	1, 2, 3, 4, 5, 6	conduct	To engage in the process of planning and carrying-out (such as for an investigation).



Resource Documents



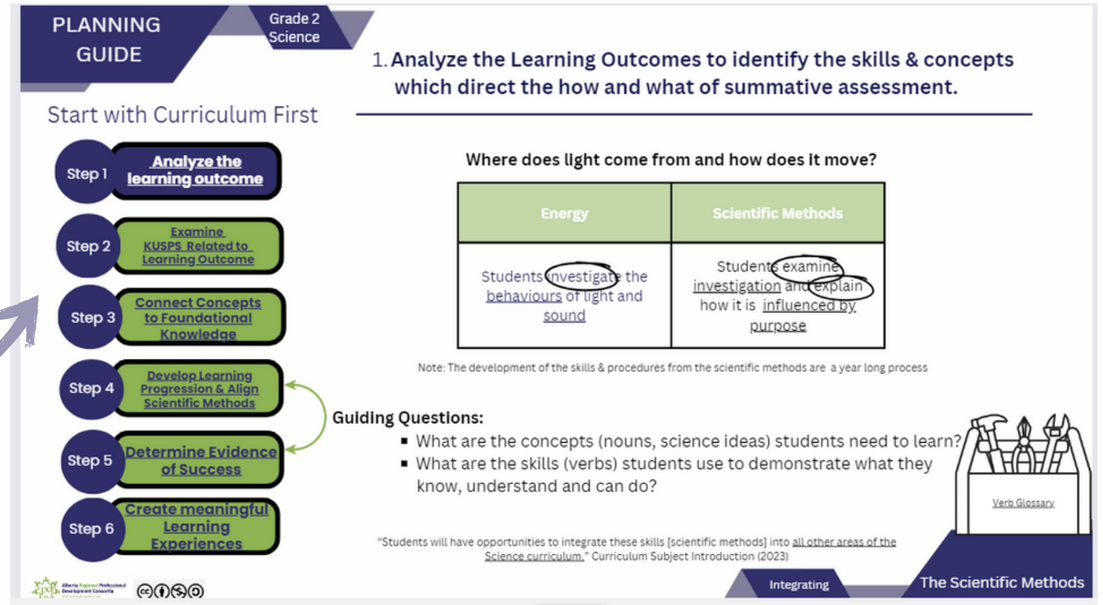
Toolbox Contains:

Hyper linked resources to assist with each phase

- Science Verb Glossary
- ARPDC Planning & Assessment Document
- CMASTE
- Blank Planner Template

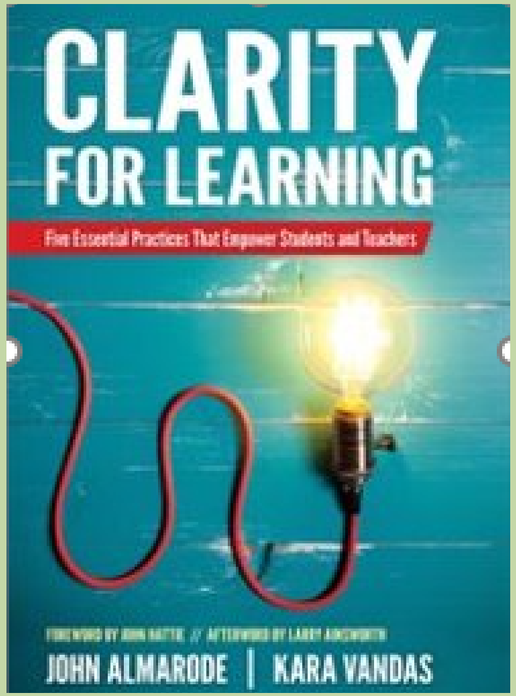
Linked Planning Steps

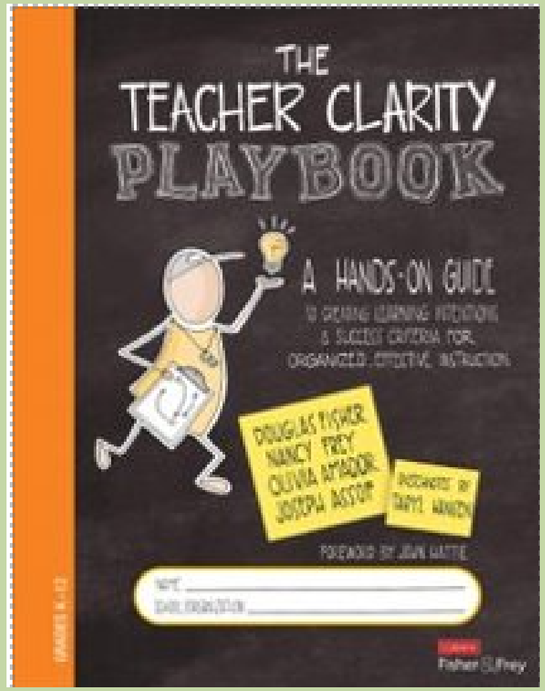
Planning Guide to assist when planning: Exemplar to refer to

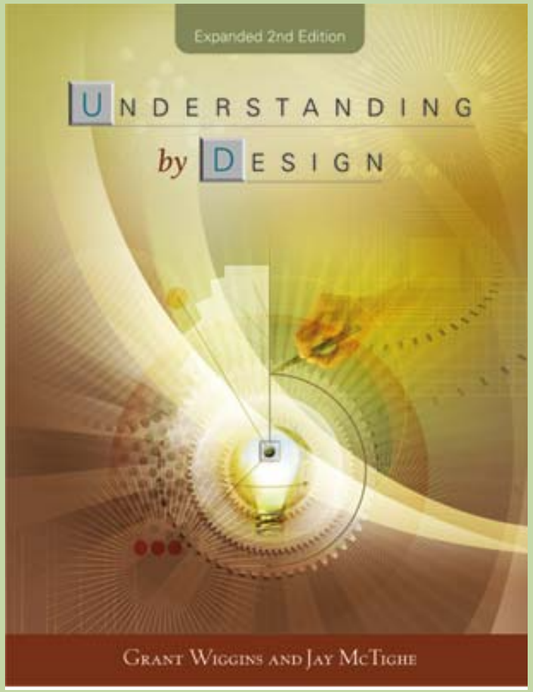


Guiding questions to consider at each phase of planning

Sources for Planning Guide

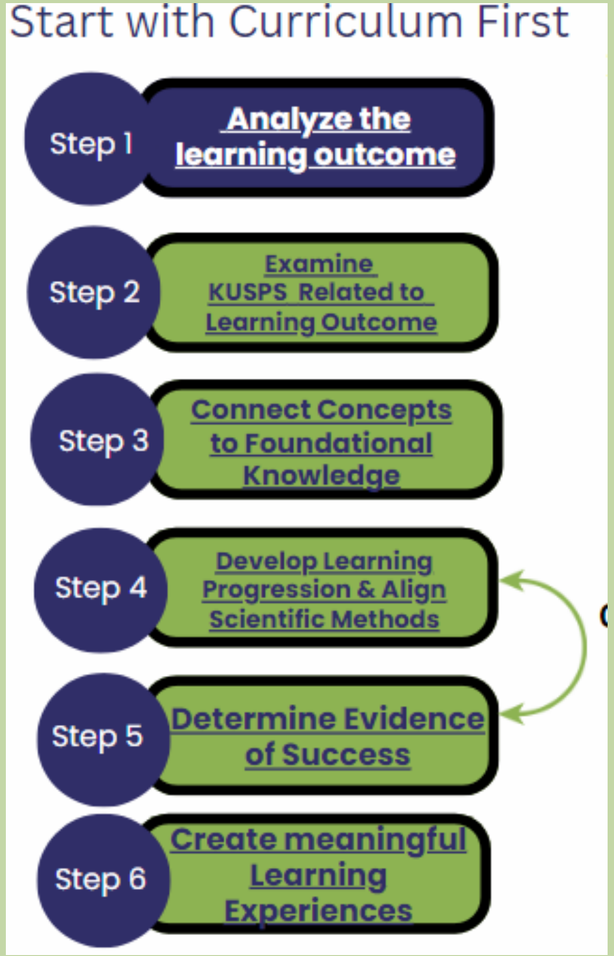






Planning Guide Begins to Focus On Clarity By Starting With

Unpacking The Curriculum:



1. Sequence Learning Progressions beginning, middle and end of learning journey

Alberta Regional Professional Development Consortia

Adult learning for students' sake

Grade 2

Integrating The Scientific Methods (Investigations)

PLANNING GUIDE

Sample: Energy
Behaviour of Light Affects its Path

A planning guide supports teachers in designing a series of lessons integrating the scientific methods with other organizing ideas found in the curriculum. This teaching strategy helps students build scientific knowledge and deepen their learning.

"The Science curriculum engages students in active investigation to build scientific knowledge and develop critical-thinking and problem-solving skills..... Students will have opportunities to integrate these skills into all other areas of the Science curriculum." *Curriculum Subject Introduction (2023)*

1. Analyze the Learning Outcomes to identify the skills & concepts which direct the how and what of summative assessment.

Start with Curriculum First

- Step 1: Analyze the learning outcome
- Step 2: Examine KUSPS Related to Learning Outcome
- Step 3: Connect Concepts to Foundational Knowledge
- Step 4: Develop Learning Progression & Align Scientific Methods
- Step 5: Determine Evidence of Success
- Step 6: Create meaningful Learning Experiences

Where does light come from and how does it move?

Energy	Scientific Methods
Students investigate the behaviours of light and sound	Students examine investigation and explain how it is influenced by purpose

Note: The development of the skills & procedures from the scientific methods are a year long process

Guiding Questions:

- What are the concepts (nouns, science ideas) students need to learn?
- What are the skills (verbs) students use to demonstrate what they know, understand and can do?

"Students will have opportunities to integrate these skills (scientific methods) into all other areas of the Science curriculum." Curriculum Subject Introduction (2023)

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Grades found as LO	Grades found within Ss & Ps	Verb	Definition
K, 1, 2, 4, 6	K, 2, 3, 4, 5, 6	examine	To carefully and in detail consider the nature and characteristics of something in order to find out more about it.
2, 3, 5, 6	2, 3, 4, 5, 6	explain	To describe the how or why of something; give the cause or reason for.

PLANNING GUIDE

Grade 2 Science

Understanding: Behaviours of light affect its path.

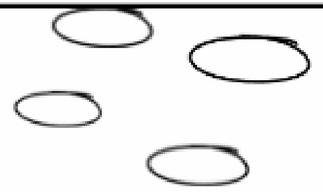
Start with Curriculum First

1. **Examine the KUSPS to identify important concepts (science ideas) , and the skills students will use to demonstrate successful learning**

- Step 1: Analyze the outcomes
- Step 2: Examine KUSPS Related To Learning Outcome.
- Step 3: Connect Concepts to Foundational Knowledge
- Step 4: Develop Learning Progression & Align Scientific Methods
- Step 5: Determine Evidence of Success
- Step 6: Create Meaningful Learning Experiences

Knowledge: Sources of light include
- the Sun
- electricity
- fire
- some plants and animals (bioluminescence)

Skills: Identify sources of light.



Knowledge: Light behaves in various ways, including
- travelling in a straight line from its source
- bouncing off a surface *(reflection)
- bending as it travels from one material to another *(refraction)
- splitting into colours (dispersion

Knowledge: Light travels through objects that can be seen through *(transparent).

Skill: Conduct an investigation to determine how the path of light can be affected

Knowledge: The path of light is affected by mirrors, prisms, and water

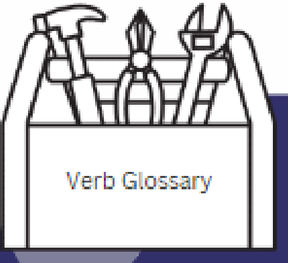
The path of sunlight can be affected in a variety of ways by natural objects, such as
- leaves
- trees
- bodies of water
- mountains

Skill: Examine how natural objects affect the path of sunlight.

*Note: parenthesis is for teacher, not the student
Include means must teach, such as is sampling but not all

Guiding Questions:

- What concepts (nouns, science ideas) in the knowledge & Understanding statements are integral to student understanding?
- What skills (verbs, verb definitions) will students use to show what they know and can do?



Integrating Scientific Methods & Energy (Light)

PLANNING GUIDE

Grade 2 Science

Understanding: Behaviours of light affect its path.

Start with Curriculum First

1. **Examine the KUSPS to identify important concepts (science ideas) , and the skills students will use to demonstrate successful learning**

- Step 1: Analyze the outcomes
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- Step 6: Create Meaningful Learning Experiences

Knowledge: Sources of light include
- the Sun
- electricity
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- some plants and animals (bioluminescence)

Skills: Identify sources of light.

Knowledge: Light behaves in various ways, including
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	K, 1, 2, 3, 4, 5, 6	identify	To recognize by naming and/or indicating.
	1, 2, 6	determine	To find a conclusion and/or solution using reasonable strategies, procedures, and/or calculations.

PLANNING GUIDE

Grade 2 Science

Start with Curriculum First

- Step 1: Analyze the outcomes
- Step 2: Examine KUSPS related to learning outcome
- Step 3: Connect Concepts to Foundational Knowledge
- Step 4: Develop learning progression & align Scientific Methods
- Step 5: Determine Evidence of Success
- Step 6: Create Meaningful Learning Experiences

Understanding: Behaviours of light affect its path.

- **Determine essential science ideas for teacher clarity to enhance student learning**

Look for sources of information connected to:

- Sources of light
- Light travels in a straight line
- Light bounces off surfaces (Teacher: Reflection)
- Light bending as it travels from one material to another light path affected by water and prisms(Teacher: Refraction)
- Light splitting into colors light path affected(Teacher: Dispersion)

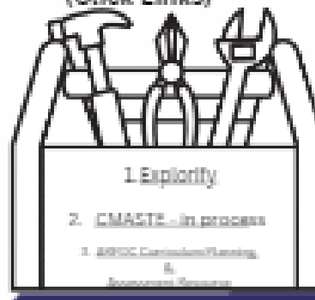
Note: Absorption of light and shadows cast is not a curricular expectation. The terms reflect, refract and dispersion are not curricular expectations for students.

- **Determine potential student misconceptions to consider when teaching and assessing**
  - Reflective surfaces emit light
  - Only shiny surfaces or water reflect light (bounce off surfaces)
  - Confusion about materials that are reflective and surfaces reflecting light (light bouncing off surfaces)
  - Children need multiple experiences with observing light reflecting off objects (colored paper, mirror, flower, baking pan etc.)
  - Opaque objects do not reflect light
  - Opaque surfaces give out colour or 'darkness'

Guiding Questions:

- What terms and science ideas do I understand and what do I need to learn more about?
- What concepts in this learning outcome are connected to previous grade?
- What science vocabulary that might be used in a non-science context that may potentially confuse students? (Ex: force, reflection etc.

Teacher Background Builder (Click Links)



CONNECTING CURRICULUM

TO FOUNDATIONAL SCIENCE IDEAS
&
CONSIDER POTENTIAL MISCONCEPTIONS

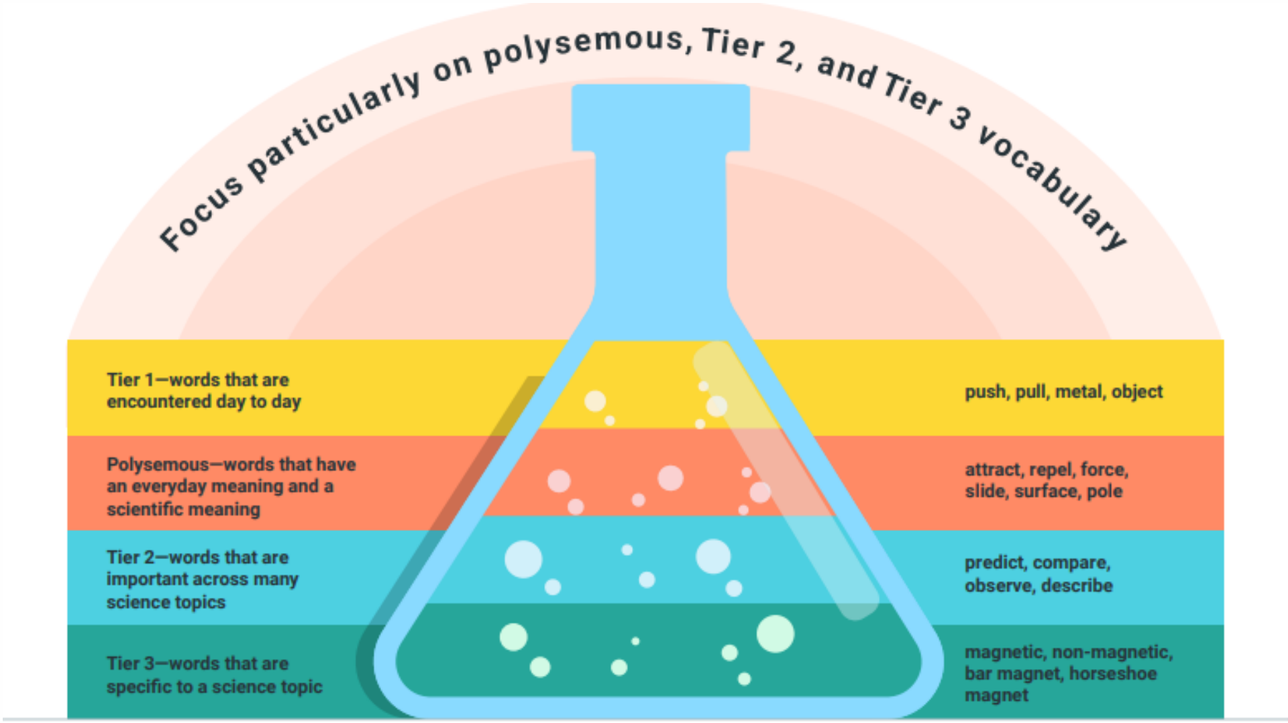
"teachers who know their students' most common misconceptions are more likely to increase their students' science knowledge than teachers who do not. Having a teacher who knows only the scientific "truth" appears to be insufficient. It is better if a teacher also has a model of how students tend to learn a particular concept, especially if a common belief may make acceptance of the scientific view or model difficult." (Sadler & Sonnert 2016)

Source: CMASTE Site, 2023

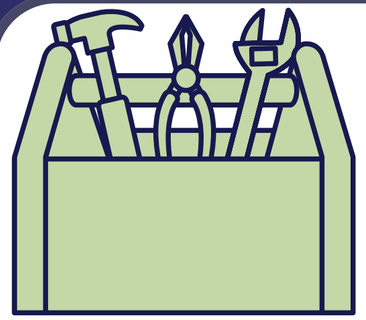
SCIENCE VOCABULARY

Polysemous - Words that have everyday meaning but different Science meaning can cause confusion for students

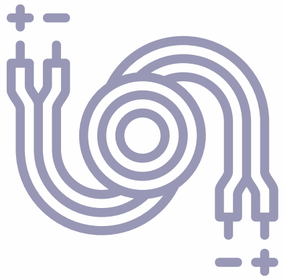
Word	Common meaning	Science Meaning
Attract	cause someone to have a liking or interest	draw by physical fore to cause to approach or adhere or unite
Force	coercion, compulsion	push or pull
pole	a stick	polarity - state of an atom or molecule inherent



Source: Education Endowment Foundation



LINKS TO FIND FOUNDATIONAL SCIENCE IDEAS & MISCONCEPTIONS



EXPLORIFY

Tackle the Tricky Bits
Uk site

CMASTE

Center For Mathematics Science, and Technology Education.
Misconceptions are being updated

NSTA.ORG

Can search without a membership
Paige Keeley's.
Formative Assessment Probes based on research

DETERMINE HOW THE PATH OF LIGHT CAN BE AFFECTED

TEACHER BACKGROUND BUILDER

@pixaby canva.com

Light travels in a straight line

- Luminous objects such as lamps,

flames and the Sun are sources of light, some are natural and some artificial.

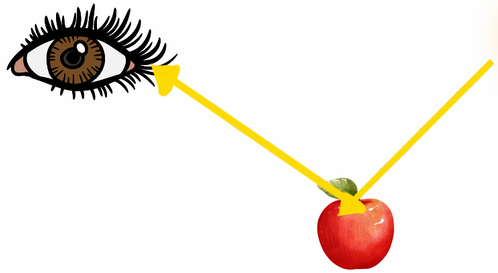
- Light is given out from a light source.
- Light travels out in straight lines in all directions from a light source.
- Darkness is the absence of light.

Consider: Light pollution some students may never have seen total darkness

DETERMINE HOW THE PATH OF LIGHT CAN BE AFFECTED BY DIFFERENT SURFACES

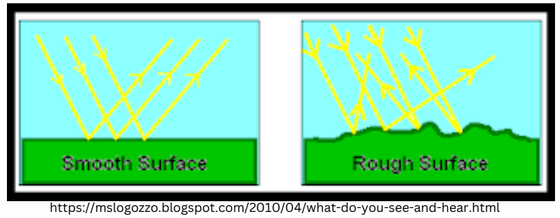
TEACHER BACKGROUND BUILDER

Light bounces off surfaces



@auriels_gallery
@shawnfighterlin
@chonnieartwork
@heyrabbiticons
canva.com

- light travels in a straight line and hits an object
- some of the light bounces (reflects) into our eyes
- Rough surfaces light bounces off will scatter
- Smooth surfaces light bounces more direct angles



https://mslogozzo.blogspot.com/2010/04/what-do-you-see-and-hear.html

Challenges for Young Children:

- Confusing the every day term reflection (mirror image) or reflective materials with how we see objects
- Use the term “bounce” as indicated in our curriculum to avoid misconceptions
- Shiny objects emit light
- Need multiple exposure with light bouncing off different surfaces (colored paper , flower, baking pan, mirror}
- Students should draw and label (record) path of light as it interacts with different surfaces

DETERMINE HOW THE PATH OF LIGHT CAN BE AFFECTED BY DIFFERENT SURFACES

TEACHER BACKGROUND BUILDER

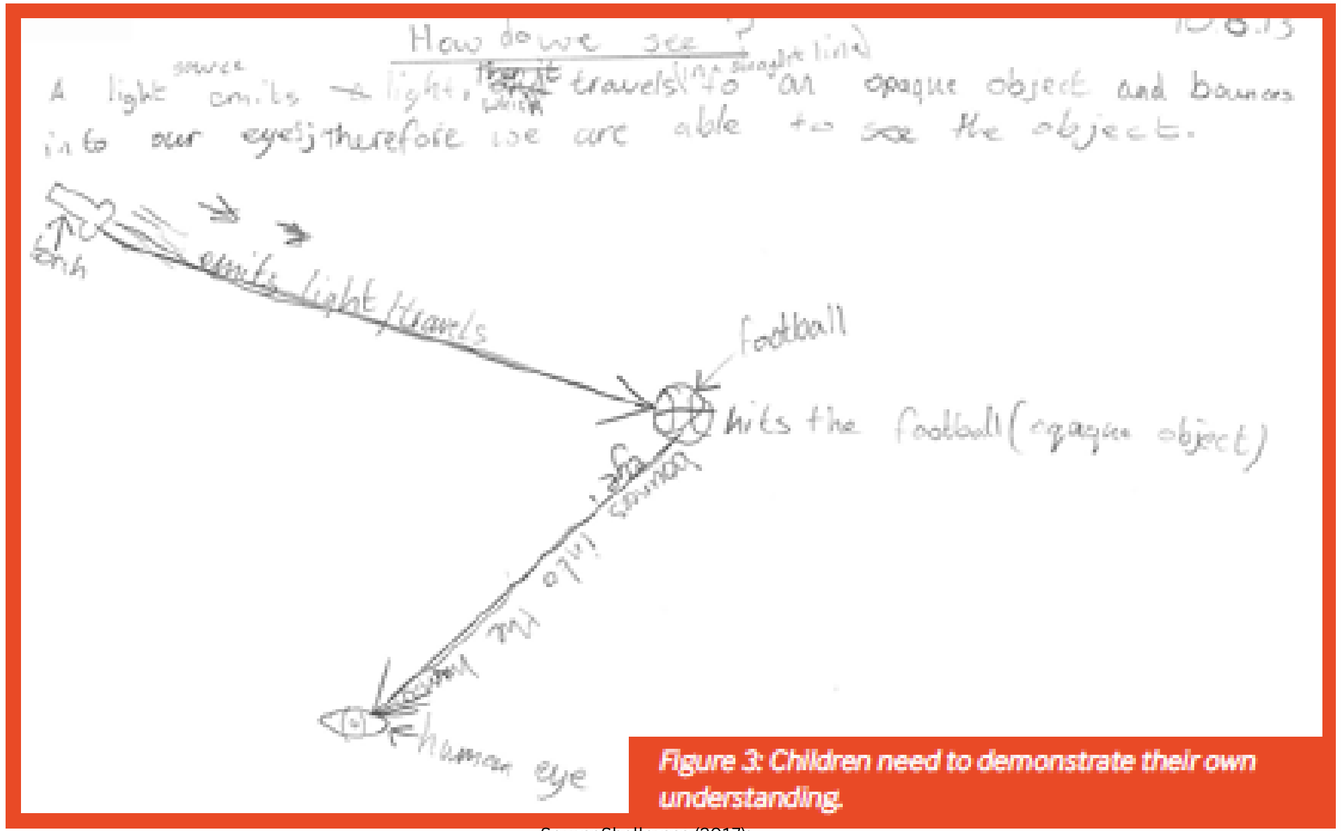


Figure 3: Children need to demonstrate their own understanding.

SourceShallcross (2017):

Our curriculum do not use opaque

DETERMINE HOW THE PATH OF LIGHT CAN BE AFFECTED

TEACHER BACKGROUND BUILDER

@aleximxcanva.com

Light bends as it travels from one material to another

- Light changes direction when it travels from one medium to another
  Ex: from air to plastic prism or air to water
- Different mediums slow how the light travels differently (teacher only)

Consider:

- Choosing hands experiences that help students determine the path of light

DETERMINE HOW THE PATH OF LIGHT CAN BE AFFECTED BY WATER

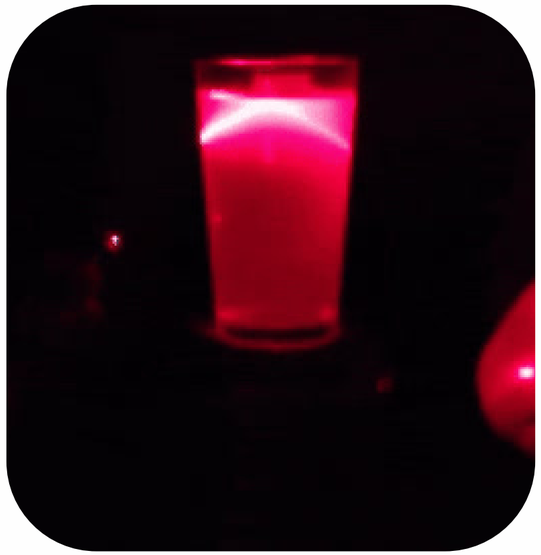
Light bends as it travels from one material to another

Which hands on investigation will **best** help students to
"determine how the path of light can be affected as it goes through water"?

1)

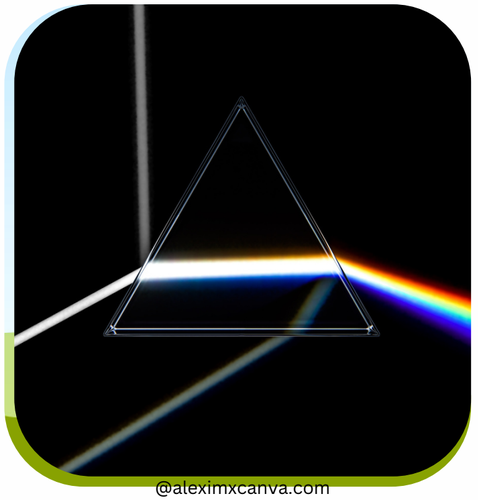
@digg, giphy

2)



DETERMINE HOW THE PATH OF LIGHT CAN BE AFFECTED

TEACHER BACKGROUND BUILDER



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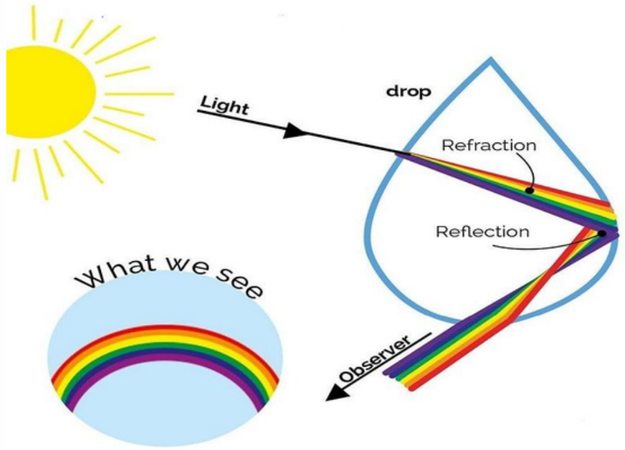
Light splits into different colors

Path of light is affected by water and prisms

- Water - droplets, bubbles
- Prisms



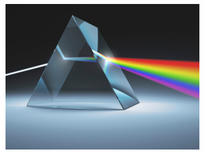
t@https://studiousguy.com/dispersion-light-examples/

Consider:

- Choosing hands experiences that help students determine the path of light

Does this activity allow students to determine how the **path of light** is affected by surfaces, mirrors, water and prisms?

Reflect	Refract	Dispersion



PLANNING GUIDE

Grade 2 Science

1. **Develop learning progressions that have a logical sequence from the perspective of the student. Combine the skills with knowledge statements.**
2. **Consider how the scientific methods will be integrated in the progression**

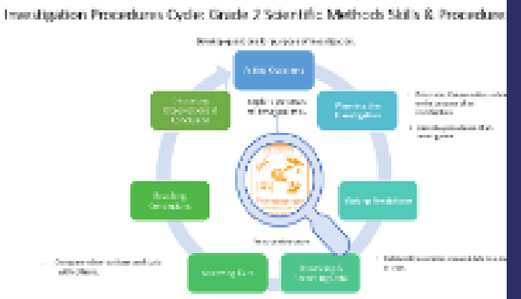
Start with Curriculum First

- Step 1: Analyze the outcomes
- Step 2: Examine the KUSPS Related to the Learning Outcome
- Step 3: Connect Concepts to Foundational Knowledge
- Step 4: **Develop learning progression & align Scientific Methods**
- Step 5: Determine Evidence of Success
- Step 6: Create Meaningful Learning Experiences

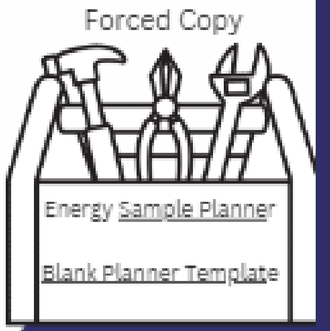
Understanding: Behaviours of light affect its path.

Behaviour of Light Affects Its Path Connect skills and procedures with concepts	Scientific Methods investigation procedure steps Skills/procedures from KUSPS
1. **Identify sources of light include the Sun, electricity fire, some plants and animals** **Explore:** Mini dark Box, Prism activity **Explain:** Sit, make conclusions about light. Book: What are light Wave, p.: 4-9, 22 & Video	**Steps:** observations, predict, record observations, making conclusions, asking Questions **Skills:** Compare observations and data with others.
2.**Conduct an investigation to determine the path of light** • **Travels in a straight line** • **Travels through objects that can be see through** Explore: Explain	**Steps:** Ask questions, plan the investigation, predicting, make & record observations, reach conclusions, **Skills:** Develop questions for the purpose of an investigation, Determine if observations relate to the purpose of the investigation. Compare observations and data with others.
3. **Conduct an investigation to determine the path of light is affected by different surfaces** • **bouncing off surfaces** • **affected by mirrors** • **examine how natural objects such as bodies of water affect path of sunlight**	**Steps:** Ask questions, plan the investigation, predicting, make & record observations, reach conclusions **Skills:** Develop questions for the purpose of an investigation, Determine if observations relate to the purpose of the investigation. Compare observations and data with others.
3. **Conduct an investigation to determine the path of light is affected as it travels from one material to another** • **bending light** • **affected by mirrors, prisms and water**	**Steps:** Ask questions, plan the investigation, predicting, make & record observations, reach conclusions **Skills:** Develop questions for the purpose of an investigation, Determine if observations relate to the purpose of the investigation. Compare observations and data with others.
4. . **Conduct an investigation to determine the path of light is affected as it travels from one material to another** • **splitting into colors** • **affected by mirrors, prisms and water**	**Steps:** Ask questions, plan the investigation, predicting, make & record observations, reach conclusions **Skills:** Develop questions for the purpose of an investigation, Determine if observations relate to the purpose of the investigation. Compare observations and data with others.

Note: Progressions are sequencing of concepts, not lesson plans



Linked Resource



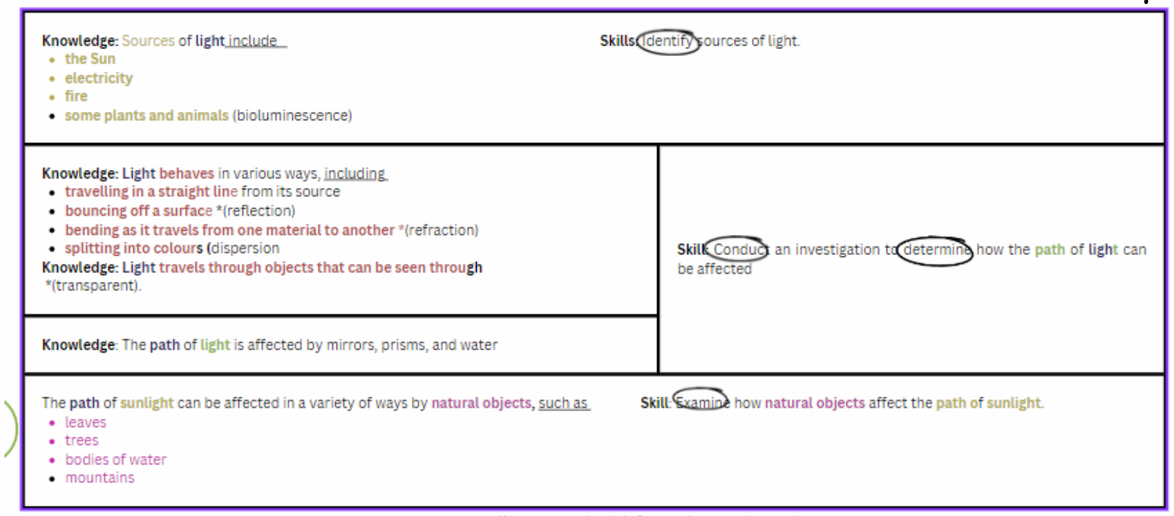
Guiding Questions:

- How will the concepts & skills be combined and sequenced in a way that is cohesive from the students' perspective to build on each idea (flow)?
- How will students use "explore before explain" to integrate the scientific methods to build knowledge?
- What resources would support student learning engagement with both the "explore and explain" phase of concept development?

4a) Learning Sequence:

Combine skills with knowledge

Note: these are NOT lesson plans and each step may take several lessons for students to work through. Sequencing provides the order or flow to develop lessons from



1.Identify sources of light include the Sun, electricity fire, some plants and animals

2.Conduct an investigation to determine the path of light

- **Travels in a straight line**
- **Travels through objects that can be see through**

3.Conduct an investigation to determine the path of light is affected by different surfaces

- **bouncing off surfaces**
- **affected by mirrors**
- **examine how natural objects such as bodies of water affect path of sunlight**

4.Conduct an investigation to determine the path of light is affected as it travels from one material to another

- **bending light**
- **affected by mirrors, prisms and water**

5. Conduct an investigation to determine the path of light is affected as it travels from one material to another

- **splitting into colors**
- **affected by mirrors, prisms and water**

4b) Learning Sequence: Combine Scientific Methods
Gather Resources to Use “Explore before Explain”

Behaviour of Light Affects Its Path Connect skills and procedures with concepts	Scientific Methods Investigation procedure steps Skills/procedures from KUSPS
1.**1.Identify sources of light include the Sun, electricity fire, some plants and animals** **Explore:** Mini dark box, Pinhole box **Explain:** St. make conclusions about light. Boo**k:** What are light Wave, p.-,4-5, 12 & Video	**Steps**: observations, predict, record observations, making conclusions, asking questions **Skills**:Compare observations and data with others.
2.Conduct an investigation to determine the path of light • **Travels in a straight line** • **Travels through objects that can be see through** **Explore: Light Beam, Light traveller** **Explain:**	**Steps**: Ask questions,plan the investigation, predicting, make & record observations, reach conclusions, **Skills**, Develop questions for the purpose of an investigation, Determine if observations relate to the purpose of the investigation. Compare observations and data with others.
3. **Conduct an investigation to determine the path of light is affected by different surfaces** • **bouncing off surfaces** • **affected by mirrors** • **examine how natural objects such as bodies of water affect path of sunlight** **Explore:** Explain:	**Steps**: Ask questions,plan the investigation, predicting, make & record observations, reach conclusions **Skills**:Develop questions for the purpose of an investigation, Determine if observations relate to the purpose of the investigation. Compare observations and data with others.
3. **Conduct an investigation to determine the path of light is affected as it travels from one material to another** • **bending light** • **affected by mirrors, prisms and water**	**Steps:** Ask questions,plan the investigation, predicting, make & record observations, reach conclusions **Skills**:Develop questions for the purpose of an investigation, Determine if observations relate to the purpose of the investigation. Compare observations and data with others.
4. . **Conduct an investigation to determine the path of light is affected as it travels from one material to another** • **splitting into colors** • **affected by mirrors, prisms and water**	**Steps:** Ask questions,plan the investigation, predicting, make & record observations, reach conclusions **Skills**:Develop questions for the purpose of an investigation, Determine if observations relate to the purpose of the investigation. Compare observations and data with others

Start with Curriculum First

Step 1 Analyze the outcomes

Step 2 Examine the KUSPS in the Organizing idea

Step 3 Connect Concepts to Foundational Knowledge

Step 4 Develop Learning Progressions & Align Scientific Methods

Step 5 **Determine Evidence of Success**

Step 6 Create Meaningful Learning Experiences

5. Determine evidence of what students know, understand, and are able put in action in an unfamiliar or real life context as a result of learning in this unit.

Understanding: Behaviours of light affect its path.

Single Point Rubric: Light to A Rainbow Obstacle Course

Grade 2 Science Methods LO: Students examine investigation and relevant purpose Computer Science LO: Students apply creativity when designing instructions to achieve a desired result:	Grade 2 Organizing Idea: Energy LO: Investigate the behaviour of sound and light Understanding: Behavior of Light Affects its path
Student Name:	Date:

Glows	Met	Grows
	Skill: Determines path of light travels in a straight line and goes through materials ☐ Explains how light travels in a straight line ☐ Demonstrates when light will go through	
	Skill: Determines the path of light bends and splits into colors Knowledge: Path of light is affected by various objects and surfaces. ☐ Discovers how to change direction of light path ☐ Discovers and explains how light and split into colors or the rest	
	CS: Skill: Creates instructions using precise words, pictures or diagrams ☐ Draws and writes directions to set up obstacle course in a precise way others are able to follow	
	SM: Skill Develop Questions For Purpose of Investigation ☐ Generates a question not a statement ☐ The question relates to building an obstacle course which can that includes the 4 pathways	

Guiding Questions:

- How will students (insert verb from LO) their understanding of (insert understanding statement from KUSPs? (Ex: How will students investigate behaviour of light ?)

Scientific Methods

- How can I use the Understanding statements to develop summative assessment that assess what students know, understand? EX: How will students express the purpose of the investigation?

Desired Results: Keeping The End In Mind

Summative Assessment: Performance Task

1. **Light to Rainbow Obstacle Course**

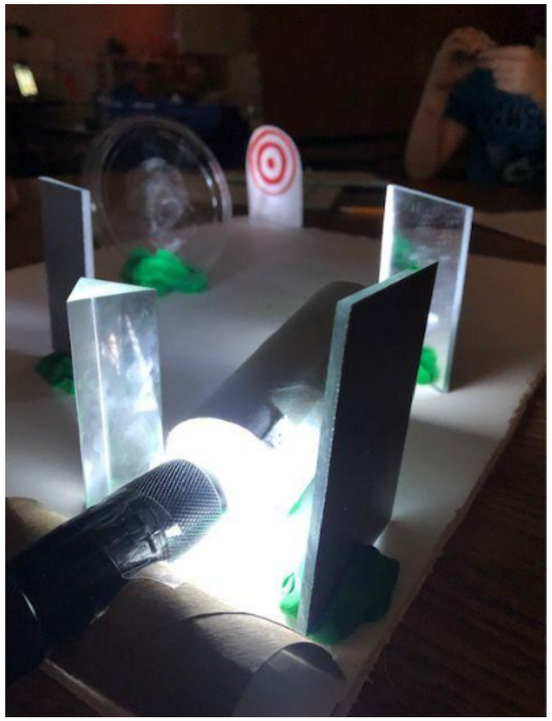
Using knowledge built over the investigation about the behavior of light, students create an obstacle course for the light to end with splitting of colors.

Criteria:(skills and procedure in Energy, Scientific Methods and Computer Science linked in the Rubric)

1. Travels in a straight line and goes through material
2. Uses Mirror(s) to change direction of the light path
3. Bends light to split into colors using water or prism(s)

Students use precise pictures, words for others to follow when replicating their obstacle course.(Computer Science Skills)

https://www.instructables.com/Light-and-Mirror-Puzzles/



Find Teaching Resources & Align Scientific Methods

Remember “Explore before Explain”

Step 5 b) Align progressions with scientific methods (procedures of investigation cycle & KUSPS)	
Energy LO:	**Scientific Methods** **Steps in investigation** **KUSPS**
1. **Identify sources of light include the Sun, electricity fire, some plants and animals (see sample lesson plans)** **Explore:** 1)Mini Dark Box,2) Pinhole Box **Explain:** Books free on **Get Epic** ☐ Robin Johnson, *What is Light?* p. 4-5 & 12. ☐ Jennifer Boothroyd, *Light It Helps Me See* p. 4-7 ☐ Video Sources of Light	**Investigation Procedure Steps:** observations, predict, record observations, making conclusions, asking questions **Skills,** Compare observations and data with others. The observations and data should be similar with others
2.**Conduct an investigation to determine the path of light** • Travels in a straight line (see sample lesson plans) **Phenomenon:** Video of Sun rays going through trees and leaves **Explore:** 1)Light Beam,2) Light Target **Explain:** Book free on Get Epic ☐ Mari Schuh, *Light: First Science* p. 10 • Travels through objects that can be see through **Explore:** 1)Now you see me **Explain:**	**Steps:** Ask questions,plan the investigation, predicting, make & record observations, reach conclusions **Skills,** Develop questions for the purpose of an investigation, Data should relate to the purpose of an investigation determine if observations relate to purpose, Compare observations and data with others
Conduct an investigation to determine how the path of light bounces off surfaces **Explore:** small group/partners	**Steps:** Ask questions,plan the investigation, predicting, make & record observations, reach conclusions **Skills,** Develop questions for the purpose of an investigation, Determine if
☐ Light Traveller ☐ Light Bouncer ☐ Light bounces - mirrors (last) **Explain: Connect/Extend/Challenge Thinking Routine would work nicely here** ☐ What is Light (video) Light reflected is used but reinforce light bounces off" surfaces ☐ Get Epic! Light It Helps us see by Alan Walker p. 14	observations relate to purpose, compare observations and data with others

Conduct an investigation to determine how light can be affected by water, prism.- will bend and be affected by water and prisms • Review meaning of bend, prism **Engage Phenomenon:** Rainbow in nature. Video **Explore:** ☐ Bendy Light ☐ Bendy Light Part 2 **Explain:** ☐ Students draw and record path of light (bend) ☐ Bll Nye demonstrates light bending through prism **(video)**	**Steps:** Ask questions,plan the investigation, predicting, make & record observations, reach conclusions **Skills,** Develop questions for the purpose of an investigation, Determine if observations relate to purpose, compare observations and data with others
5.Conduct an Investigation to determine how and when the path of light splits into colors can be affected by water and prism Phenomenon: Continue **Explore:** ☐ Make indoor rainbow ☐ Mystery Science Make A Rainbow ☐ The Color of LIght (prism) **Explain:** ☐ Book Get Epic: Jennifer Boothroyd, Light Makes Colors. P. 15-21 ☐ Book New learn Alberta Grade 2 Energy LO Light Makes A Rainbow	**Steps:** Ask questions,plan the investigation, predicting, make & record observations, reach conclusions **Skills,** Develop questions for the purpose of an investigation, Determine if observations relate to purpose, compare observations and data with others 
 ☐ How are rainbows made(video)	

PLANNING GUIDE

Grade 2 Science

1. **Plan for instruction that is cohesive from the students' perspective.**
2. **Be strategic in sequencing lessons that builds on prior knowledge and learning, as well as having the potential to extend student thinking.**

Start with Curriculum First

- Step 1: Analyze the outcomes
- Step 2: Examine the KUSPS in the Organizing idea
- Step 3: Connect Curriculum to Important Science ideas
- Step 4: Examine the KUSPS in the Scientific Methods
- Step 5: Determine Evidence of Success
- Step 6: Create Meaningful Learning Experiences

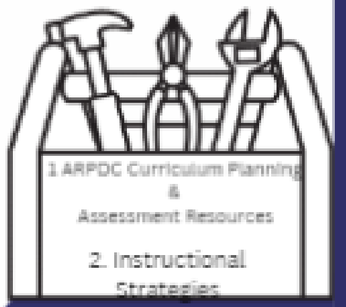
Clarity: Teacher & Learner can answer

	Where the learner is going	Where the learner is	How to get there
Teacher	Clarifying, sharing and understanding learning intentions	Engineering effective discussions, tasks, and activities that elicit evidence of learning	Providing feedback that moves learners forward
Peer		Activating students as learning resources for one another	
Learner		Activating students as owners of their own learning	

Dylan, W. (2011). *Embedded formative assessment*. Bloomington, IN: Solution Tree Press

Guiding Questions:

- What underlying prior knowledge do the students need to have from previous grades?
- How can I access what ideas students' already have (pre-assessment)?
- How can I minimize potential misconceptions with the science ideas?
- Where can I integrate cross curricular connections for students? For example KUSPs from ELAL (Ex: Oral Language, vocabulary development, text) and/or math (Ex: measuring, statistics)?
- What do I want to hear and see from students during lessons that demonstrate their progress in the Skills and Procedures? (Formative Assessment)

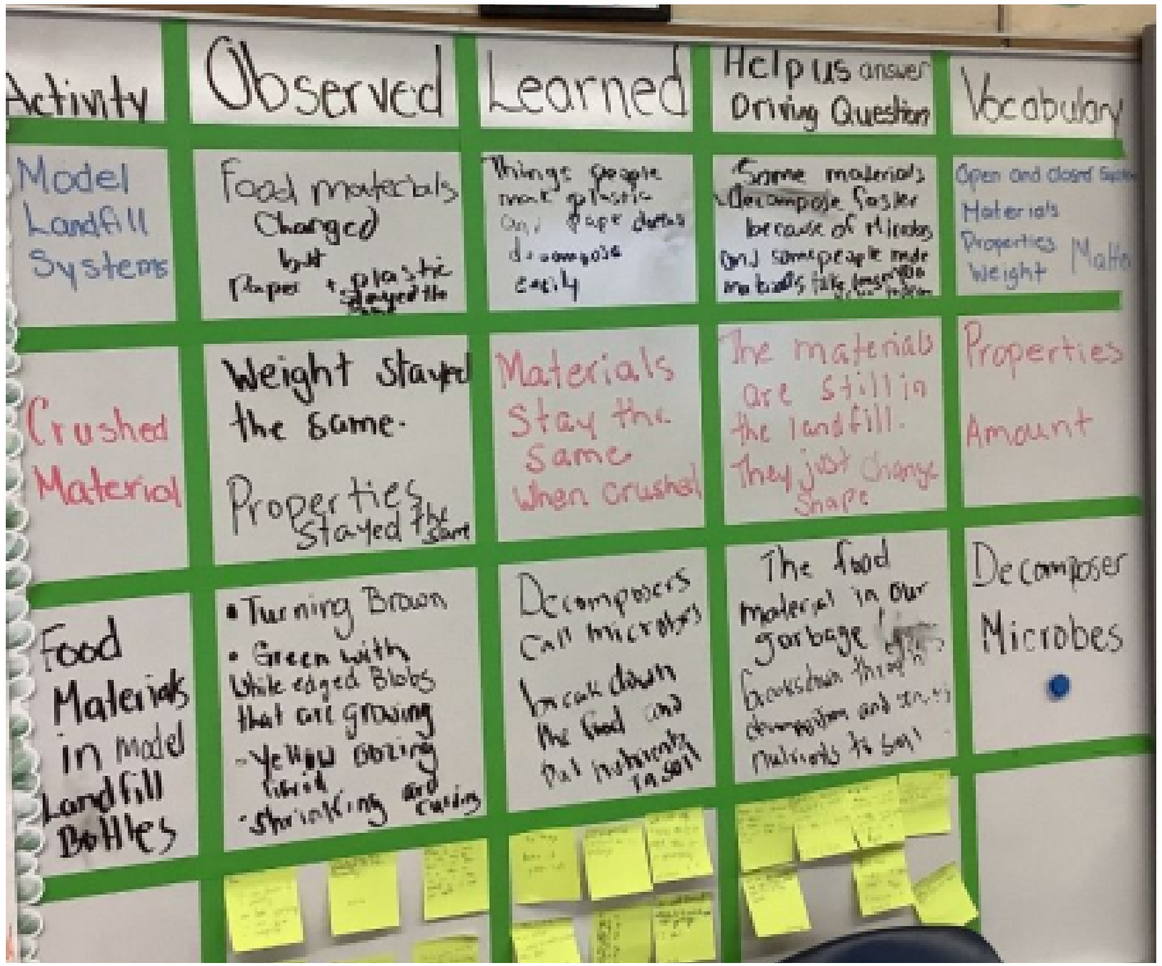


Integrating The Scientific Methods

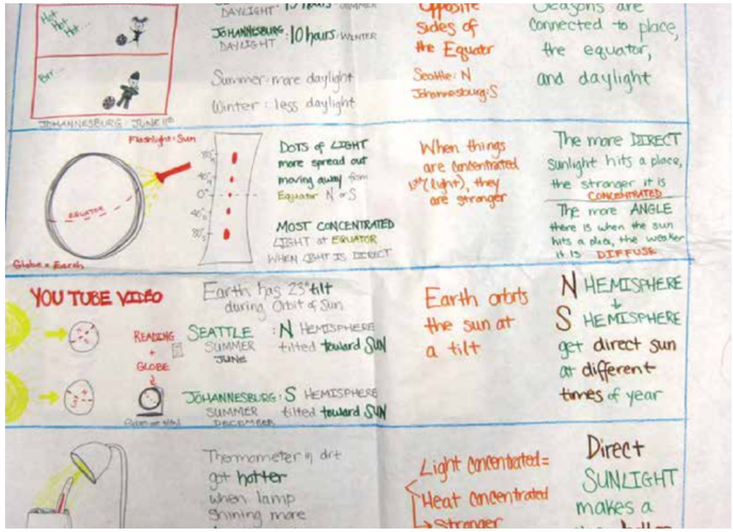
SAMPLE LESSON PLANS INCLUDED

1. Light Source 3 days
2. Light Travels in a Straight Line 5 days

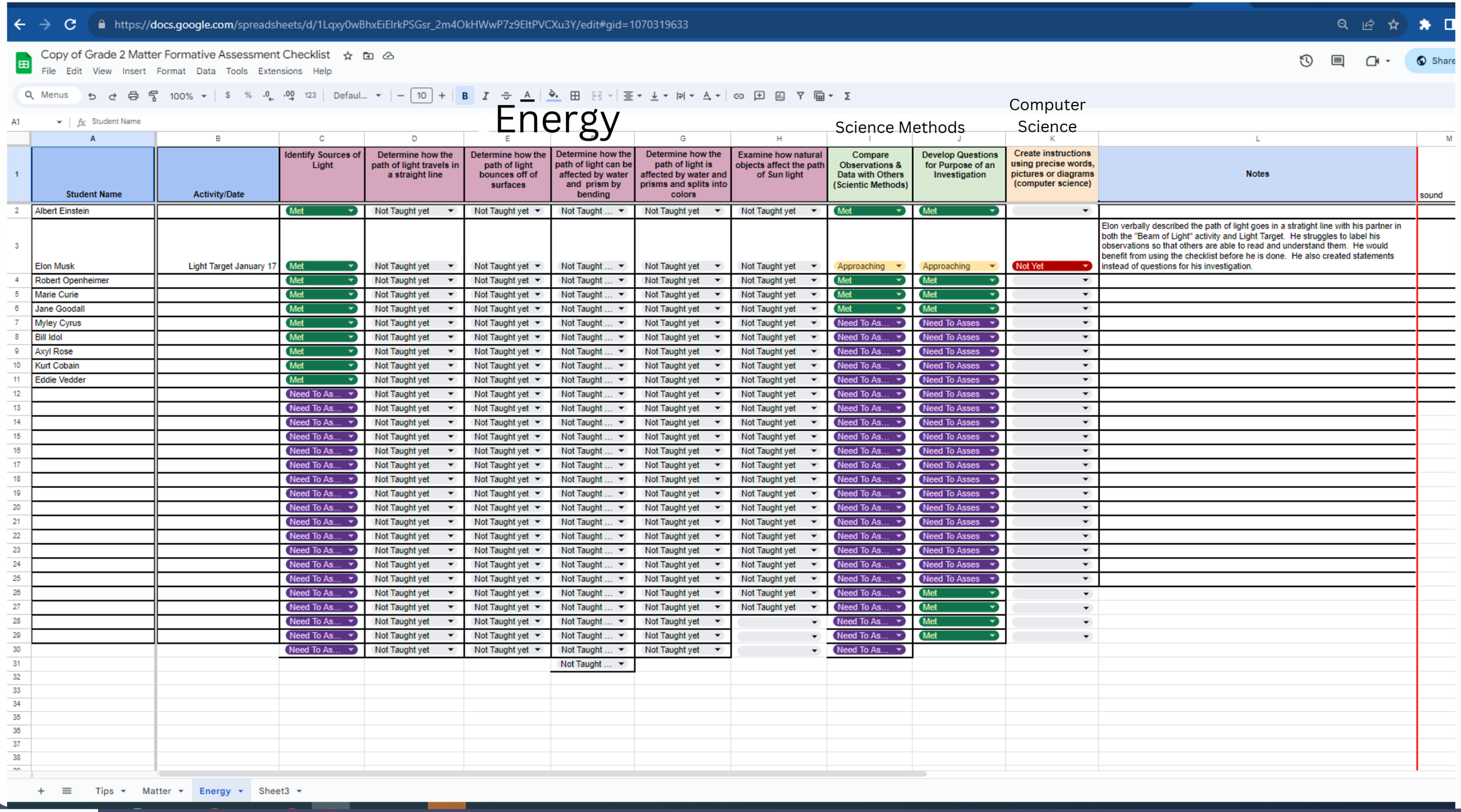
Learning Summary Tables
Consolidate Learning



Nicole lamoureux Grade 4 Classroom



Investigation Title	What did we observe?	What did we learn?	How does this help us understand how the puppet show works?



https://docs.google.com/spreadsheets/d/1Lqxy0wBhxEiElrkPSGsr_2m4OkHWwP7z9EltPVCXu3Y/edit#gid=1070319633

Copy of Grade 2 Matter Formative Assessment Checklist

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Share

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A1 Student Name

Energy

Science Methods

Computer Science

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Student Name	Activity/Date	Identify Sources of Light	Determine how the path of light travels in a straight line	Determine how the path of light bounces off of surfaces	Determine how the path of light can be affected by water and prism by bending	Determine how the path of light is affected by water and prisms and splits into colors	Examine how natural objects affect the path of Sun light	Compare Observations & Data with Others (Scientic Methods)	Develop Questions for Purpose of an Investigation	Create instructions using precise words, pictures or diagrams (computer science)	Notes	sound
2	Albert Einstein		Met	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Met	Met			
3	Elon Musk	Light Target January 17	Met	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Approaching	Approaching	Not Yet	Elon verbally described the path of light goes in a straight line with his partner in both the "Beam of Light" activity and Light Target. He struggles to label his observations so that others are able to read and understand them. He would benefit from using the checklist before he is done. He also created statements instead of questions for his investigation.	
4	Robert Openheimer		Met	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Met	Met			
5	Marie Curie		Met	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Met	Met			
6	Jane Goodall		Met	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Met	Met			
7	Myley Cyrus		Met	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Need To As...	Need To Asses			
8	Bill Idol		Met	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Need To As...	Need To Asses			
9	Axyl Rose		Met	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Need To As...	Need To Asses			
10	Kurt Cobain		Met	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Need To As...	Need To Asses			
11	Eddie Vedder		Met	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Need To As...	Need To Asses			
12			Need To As...	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Need To As...	Need To Asses			
13			Need To As...	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Need To As...	Need To Asses			
14			Need To As...	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Need To As...	Need To Asses			
15			Need To As...	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Need To As...	Need To Asses			
16			Need To As...	Not Taught yet	Not Taught yet	Not Taught ...	Not Taught yet	Not Taught yet	Need To As...	Need To Asses			
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31						Not Taught ...							
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Tips Matter Energy Sheet3

Lesson Plan Use Sequence

Engage

Lesson 2 Focus/Question: What are different ways we get light?

Estimated Time: 3 Days

Formative Assessment: "Assessment Look Fors"

What do I want to see or hear that shows me they have met the skills/procedures?

Energy Knowledge: Sources of light include: The Sun, electricity, fire, some animal and plants make their own light **Skills & Procedures:** Identify sources of light

Assessment "Look Fors": Can the students..

- ☐ Identify and label examples different sources of light
- ☐ Sort objects that that are sources and not sources of light

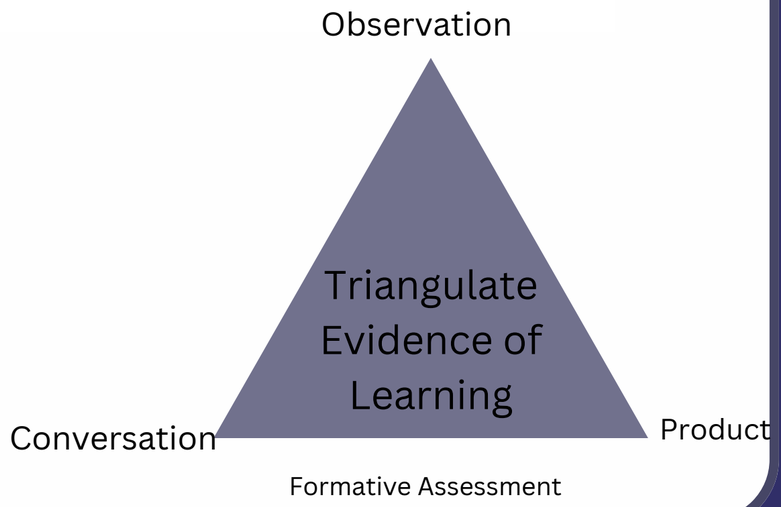
Science Methods: Investigation Procedure Step: Observations and Asking Questions

- ☐ Observe objects in dark and light using sense of sight to describe what they observe
- ☐ Generate questions

2)

4)

5)



Lesson 1 Day 1

Launch Connect With Prior Knowledge

Think/Pair/Share

2)

Have you ever been somewhere where you couldn't see anything when you woke up in the night?

4)

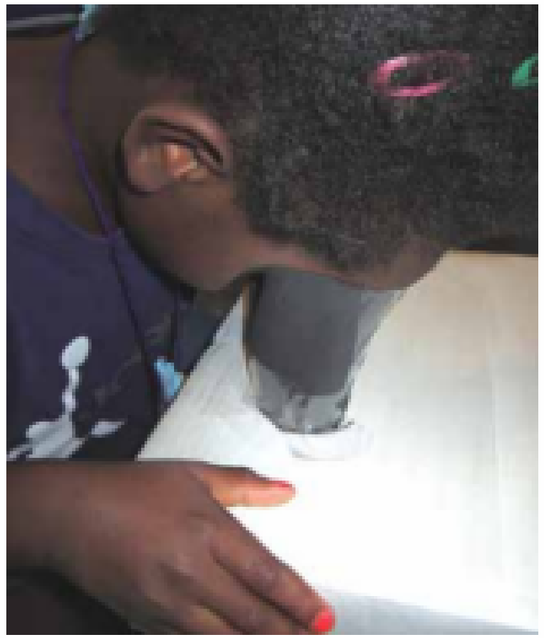
5)

Source: Explorify.uk

Can We See Objects In Total Darkness?

Predict, Explain,Observe, Explain

Mini- Dark Box



Source: Ashbrook, P. Shining Light on Misconceptions,(October 2012) Science and Children: National Science Teachers Association.

Pinhole Box

Source: Robin Johnson,(2014) What Are Light Waves?

Whole Class

Can We See Objects In Total Darkness?

Consolidate Learning

Gather students together and have a few share their descriptive observations

Share what was inside the boxes[4)]

[2)]

Think/Pair/Share:

1.What did you observe looking at the box without light and then with light?

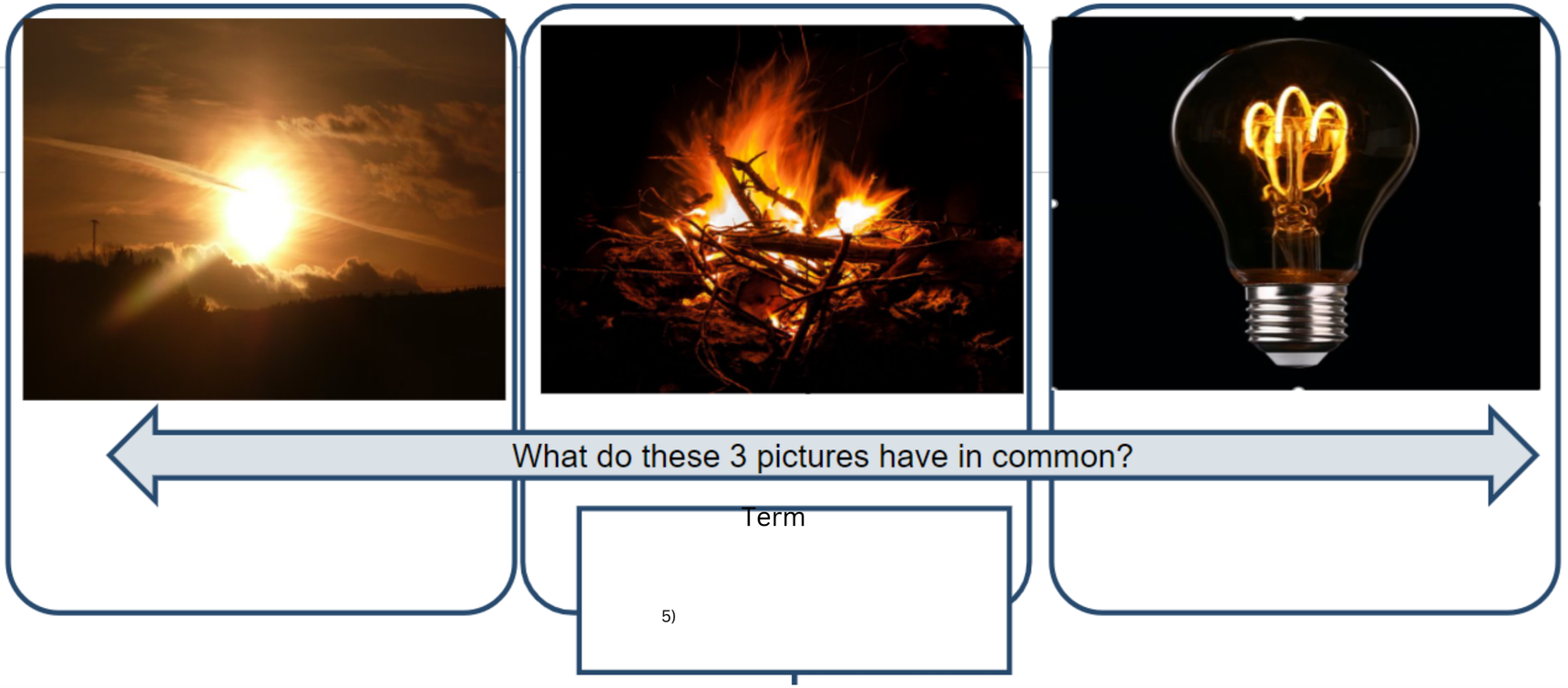
2. What makes you think this? [5)]

3. Have students write “I wonder” questions with partners

Source: Explorify.uk

Lesson 1 Day 2

Where does light come from?

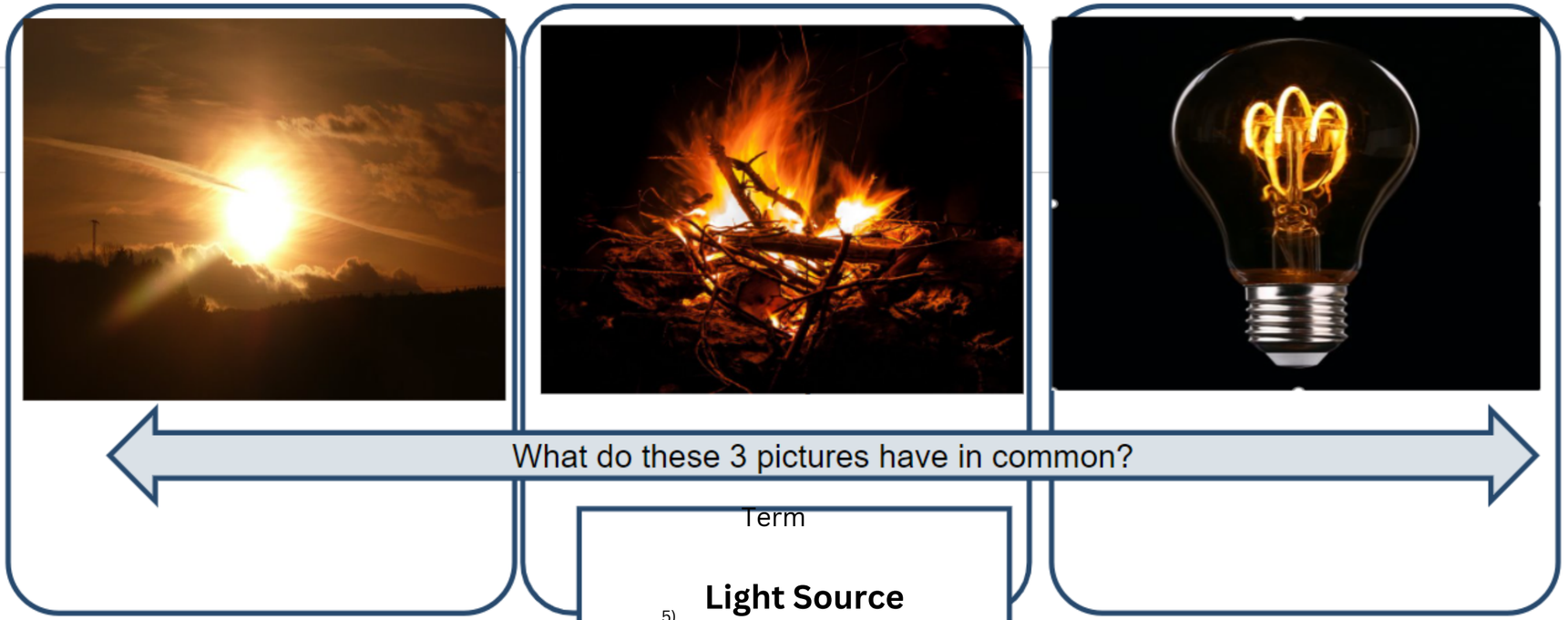


2)

5)

Lesson 1 Day 2

Where does light come from?



2)

Term

Light Source

5)

Lesson 1 Day 2

Where does light come from?

Class Chart

Frayer Model

2)

Definition:

Characteristics/features:

Light Source

Examples:

Non- Examples:

Lesson 1 Day 2 Continued

What is Light?

Read to Learn

Read to find the defintion of Light Source

2)

4)

Johns, R (2014) What are LIght Waves

Lesson 1 Day 2

Where does light come from?

Anchor Chart or Slide

Frayer Model

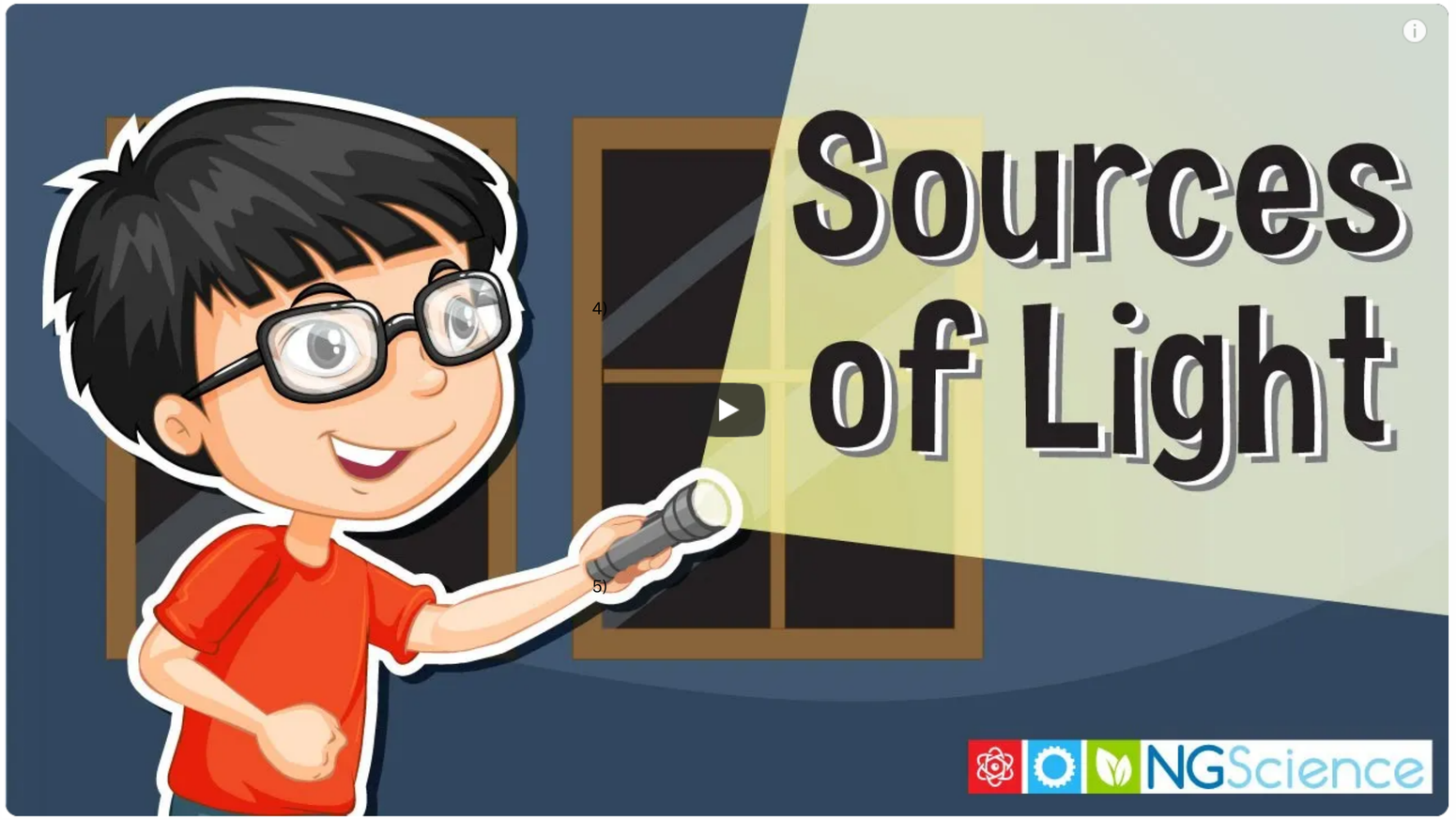
Definition: Where light comes from	Characteristics/features: • glows
Examples:	Non- Examples:

Light Source

2)

Lesson 1 Day 2 Continued

What is Light?



Lesson 1 Day 2

Where does light come from?

Students add example and non example -use picture and words

Definition:

Where light comes from

4)

Characteristics/features:

- glows
- makes light on its own

2)

Light Source

Examples:

Non- Examples:

Can research animals that make their own light after with books/ online

Lesson 1 Day 3

Where does light come from?

Think/pair/share

Which one doesn’t belong?

2)

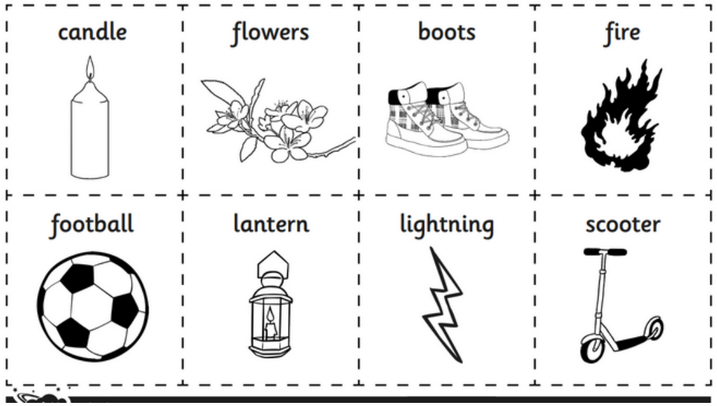
Lesson 1 Day 3

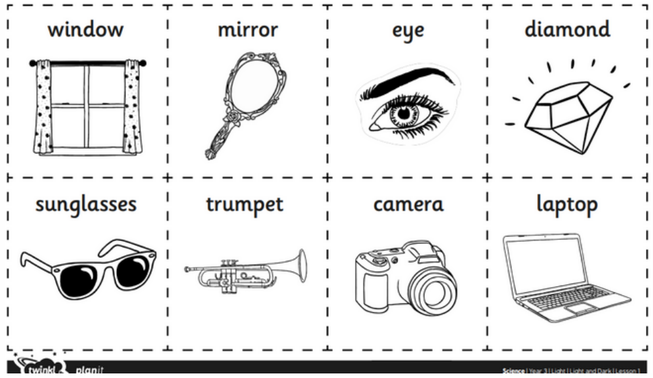
Where does light come from?

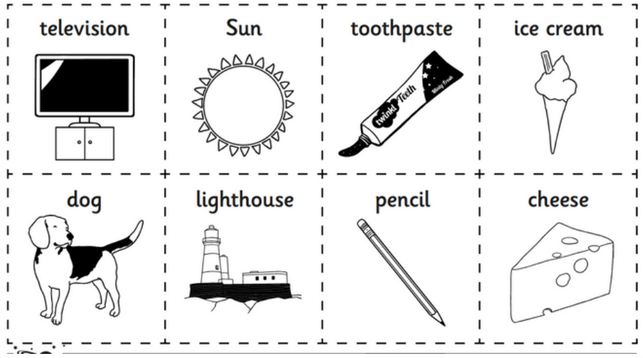
Think/pair/share

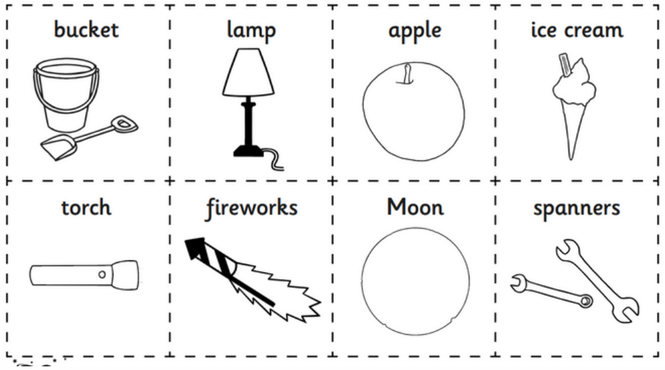
Sorting Light Source

2)









Sources of Light	Not Sources of Light

Formative Assessment Check:

Before moving on do the students:

- ☑ Identify Sources of light
- ☑ Verbally explain how they know it is a source of light
- ☑ Know that moon & mirror do not emit light

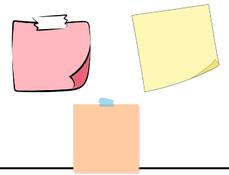
Think/pair/share

Lesson 1 Day 3

Where does light come from?

Consolidation of Learning:
Learning Summary Table

2)

Driving Question: Where does light come from and how does it move?				
Performance Task	Design A Light obstacle course			
Question Activity (Small Investigation)	Observation What did we observe?	Conclusion What did we learn from our data? reading	How does knowing this help us with what we need to include in our light obstacle course?	Questions I wonder.. Record as students ask or can be put on a sticky
Pinhole Box & Mini Dark room	We can't see objects with out light. With a light source we could see shapes and colors.	We need a light source to see objects. There are many types of sources of light human made (electricity, and from nature (Sun, fire, lightening)		

Lesson 2 Bridge Lesson & Intro Performance Task Movement

Think/pair/share

Look at the **sets** of pictures on the next slide

The "Yes" set is an **example** of **movement**, and the other set is **not an example** of **movement**

What is **movement?**

Adler,D. (2018) Light Waves

Skill:

Lesson 2 Bridge Lesson & Intro Performance Task

Think/pair/share

Review/ Access prior knowledge

Movement/ Path

Discussion:

1. What does move mean?

Let's show movement with our bodies

2. What does movement **path** mean?

Let's show different paths our bodies can take as it moves

Adler,D. (2018) Light Waves

Skill:

Think/pair/share

Introduce Performance Task

Throughout this unit we will be learning how light moves or travels from its source

What is an obstacle course?

2)

Option: Connect PEW

Students can go through or create obstacle courses

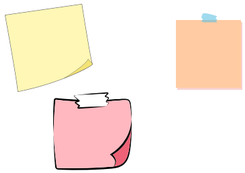
Think/pair/share

Lesson 1 Day 3

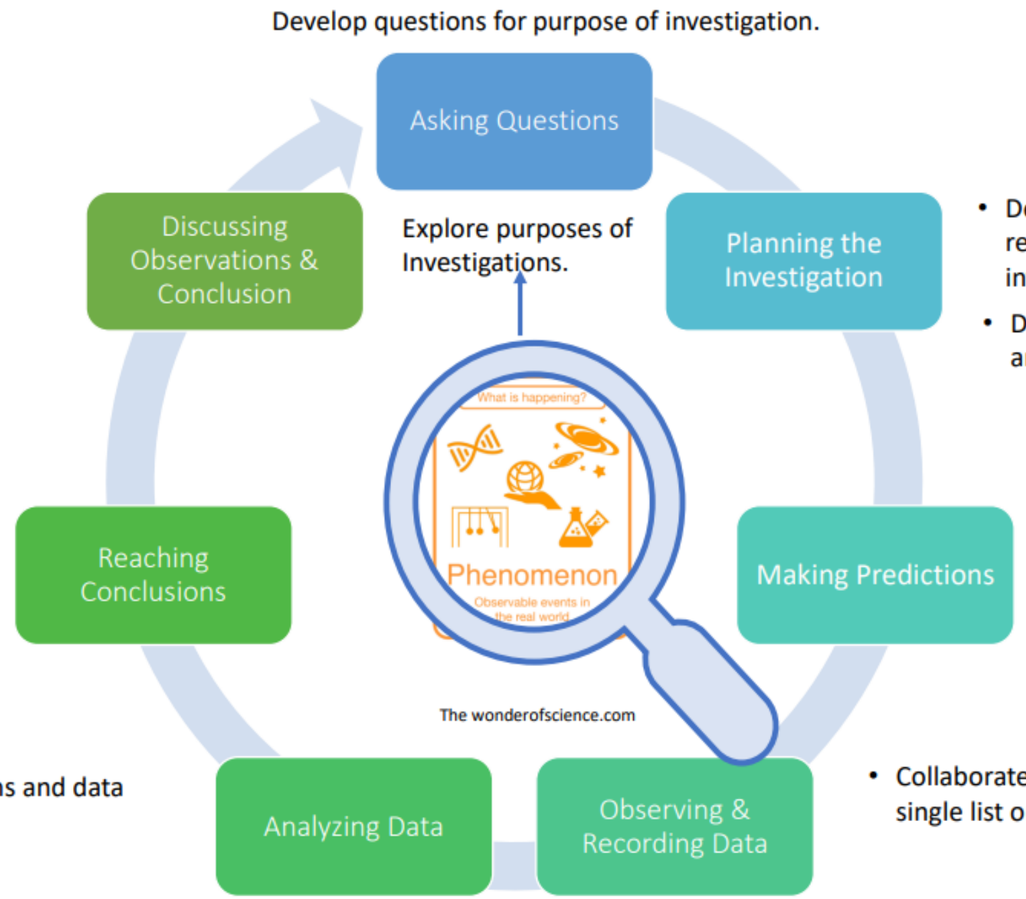
Where does light come from?

Consolidation of Learning:
Learning Summary Table

2)

Driving Question: Where does light come from and how does it move?				
Performance Task	**Design A Light obstacle course**			
Question Activity (Small investigation)	**Observation What did we observe?**	**Conclusion What did we learn from our data? reading**	**How does knowing this help us with what we need to include in our light obstacle course?**	**Questions I wonder.. Record as students ask or can be put on a sticky**
Where does light come from? Pinhole Box & Mini Dark room	Without light objects are gray, darker color With a light source we could see shapes and colors.	We need a light source to see objects. There are many types of sources of light human made (electricity, and from nature (Sun, fire, lightening)	(To be completed after day 3 when movement and the performance task is introduced: We need a light source to start our obstacle course (maze).	

LESSON 2 LAUNCH INVESTIGTATION



- Determine if observations relate to the purpose of an investigation.
- Describe procedures of an investigation.

- Collaborate to combine recorded data on a single list or chart.

. Compare observations and data with others.

Students conduct an investigation to determine how path of light can be affected travels in straight line

Lesson 2 Formative Assessment

What should I <u>see or hear</u> from students that demonstrates meeting knowledge & skills ?

Lesson 2 Focus/Question: How does light move? | **Estimated Time:** 3-4 Days (45 Minutes each)

Formative Assessment "Assessment Look Fors"

What do I want to **<u>see or hear</u>** that shows me they have met the skills/procedures?

Energy Sequence Knowledge & Skills Combined: #2: 1) Examine how trees & leaves (natural objects) affect the path of light.2) Conduct an investigation to determine the path of light (light travels in a straight line)

<u>Assessment "Look Fors":</u> Can the students..

- ☐ Observe and describe in detail how the path of light is interacting with the trees and leaves
- ☐ Use term "path of light" in discussions,drawings and/or writing about how light travels (observations & conclusions)
- ☐ Identify in recording observations & discussions/ drawings and/or writing that light travels(path) in a straight line
- ☐ Connect conclusions from "hands on" investigation in class back to the sunlight through the trees phenomenon that light travels in a straight line and does not move around objects

Science Methods Knowledge: Procedures scientists use to guide investigations include- Day 1: (Observe,Ask Questions) Day 2 (Plan the investigation, Make predictions) Day 3 (make and record observations,) Day 4 (analyze data, make conclusions

Skills/procedures: 1)Develop questions for the purpose of an investigation.2) Determine if observations relate to the purpose of the investigation

<u>Assessment "Look Fors":</u> Can the students...

Day 1:

- ☐ Observe and describe how light is interacting with the tree and leaves
- ☐ Create questions not statements- Day 1
- ☐ Connect questions to the purpose of the investigation - Day 1

Day 2:

- ☐ Expresses in discussions how observing the path of light as it travels from the flashlight (light source) through the holes should help find the answer to the question of "How light travels or moves?"

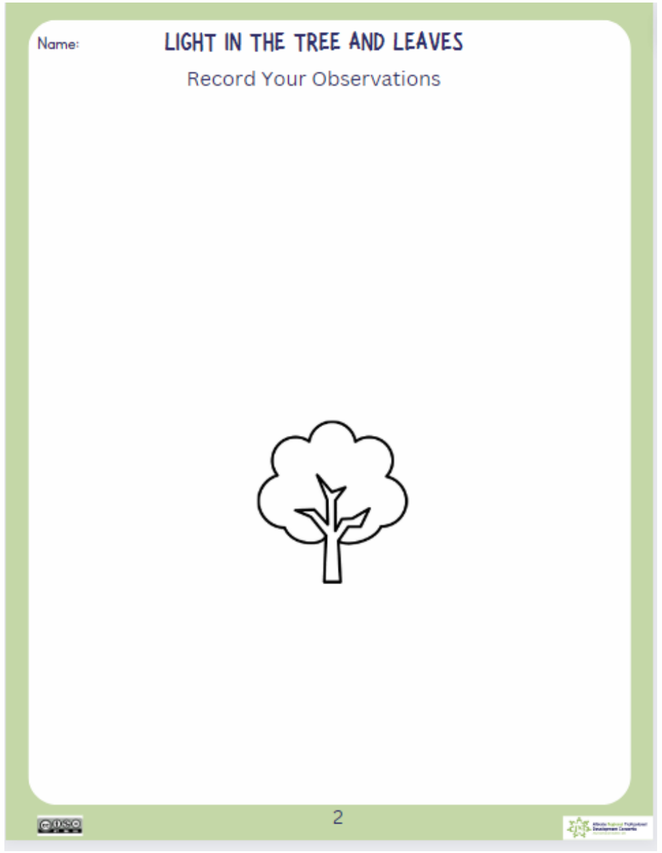
Skills: Examine how trees and leaves (natural objects) affect the path of light
Conduct an investigation to determine the path of light - light travels in a straight line

Day 1: Launch investigtion Observe phenomenon - Describe what you see (color, shapes, objects)

Skill: Examine how trees and leaves (natural objects) affect the path of light

Investigation Procedure: Making Observations

Launch Investigation: pre-assessment
draw what you think is happening as the light travels from the sun throuhgh the trees.



Skill: Examine how trees and leaves (natural objects) affect the path of light

Day 1: Launch Investigation - Question Sorts

How does light get to Earth?

Nicole Lamoureux

How far does the Sun travel?

Nicole Lamoureux

Why do we see the Sun sometimes and not other times?

Nicole Lamoureux

How does the Sun make its own light?

Nicole Lamoureux

Skill: Develop questions for the purpose of an investigation

Question Sorts

Can Investigate In Classroom

Why do we see the Sun sometimes and not other times?

Nicole Lamoureux

How does light get to Earth?

Nicole Lamoureux

How does sunlight move to the Earth?

Nicole Lamoureux

Can not Investigate In Classroom

How far does the Sunlight travel?

Nicole Lamoureux

How does the Sun make its own light?

Nicole Lamoureux

Skill: Develop questions for the purpose of an investigation

Lesson 2 Day 2 How does light move on a path?

Lesson 2 Day 2 How does light move (travel)?

Teacher Demonstration

Set the context

This marble will move or travel down this straight tube

This marble will move or travel around the bend

Lesson 2 How does light move (travel)?

Think/pair/share

Student Plan The Investigation

Does light follow a path and move around a bend?

I predict that light will/ will not move a round a bend because...

Lesson 2 How does light move (travel)?

Student Observe and Record Observations


Name:

LIGHT BEAM INVESTIGATION

Record Your Observations

Straight Tube

Bent Tube

Use lines to show the light path.

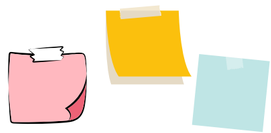
2


Adler, D (2018) Light Waves

Lesson 2 How does light move (travel)?

Consolidation of Learning

Learning Summary Table

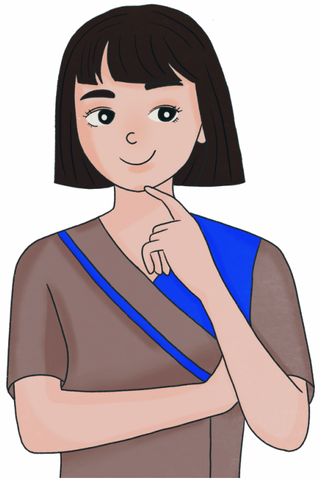
Driving Question: Where does light come from and how does it move?				
Performance Task	**Design A Light obstacle course**			
Question Activity (Small investigation)	**Observation What did we observe?**	**Conclusion What did we learn from our data? reading**	**How does knowing this help us with what we need to include in our light obstacle course?**	**Questions I wonder.. Record as students ask or can be put on a sticky**
Where does light come from? Pinhole Box & Mini Dark room	Without light objects are gray, darker color With a light source we could see shapes and colors.	We need a light source to see objects. There are many types of sources of light human made (electricity, and from nature (Sun, fire, lightening)	To be completed after day 3 when movement and the performance task is introduced: We need a light source to start our obstacle course (maze).	

LESSON 2 DAY 2

CONDUCT AN INVESTIGATION

Lesson 2 Day 2 How does light move (travel)?

Light traveller: Small scale investigation

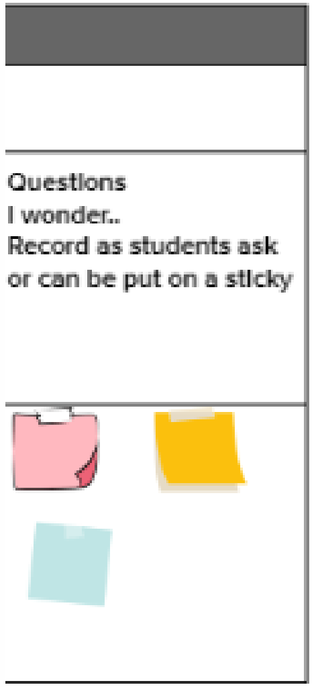


Last lesson we saw that light does not follow a path already set out like a curve but seems to travel straight.

Johnny wondered if light will move around an object when it blocks its path?

That's a great question. What do you think?

Preview questions to see if any apply



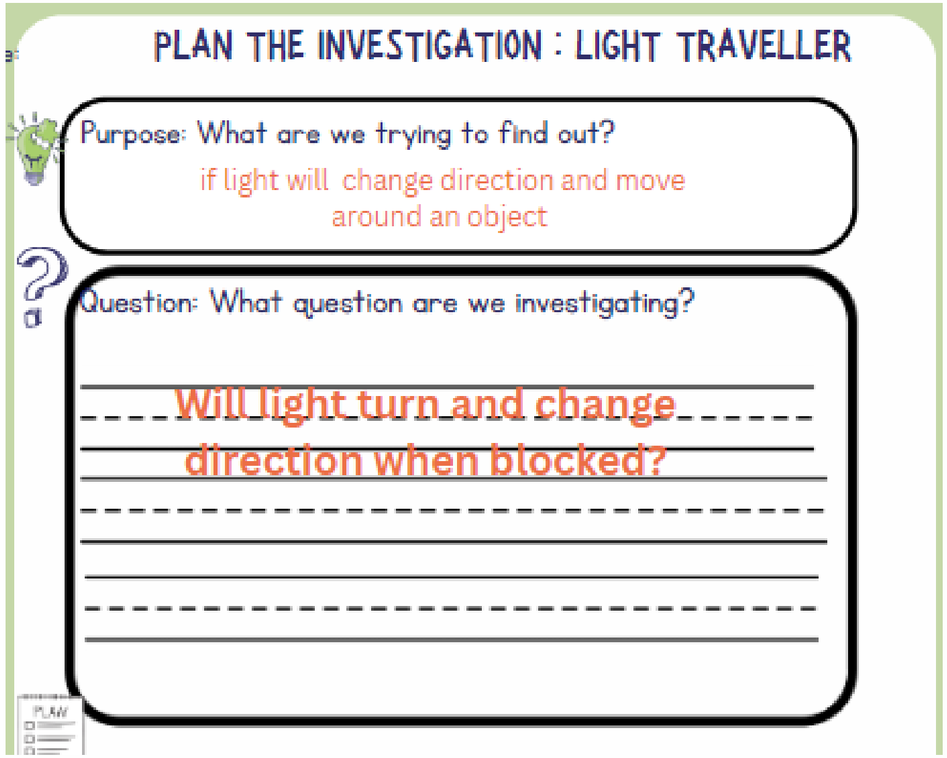
Lesson 2 How does light move (travel)?

Think/pair/share

Planning the Investigation

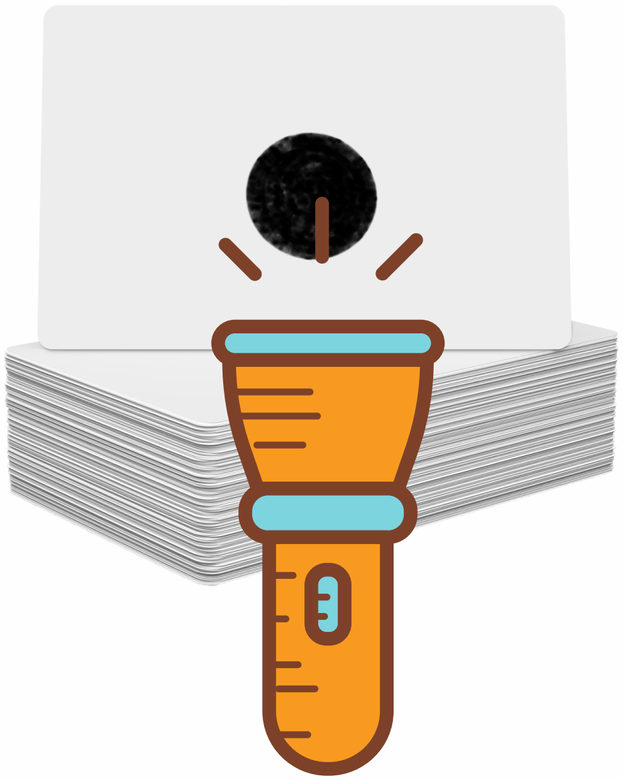
What are we trying to find out?

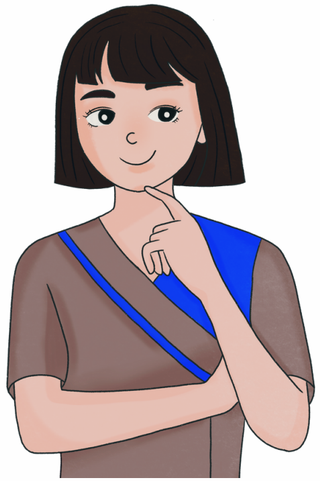
Help me write a good question we can investigate. Let's begin with will light...



Lesson 2 Day 2 How does light move (travel)?

Planning the Investigation





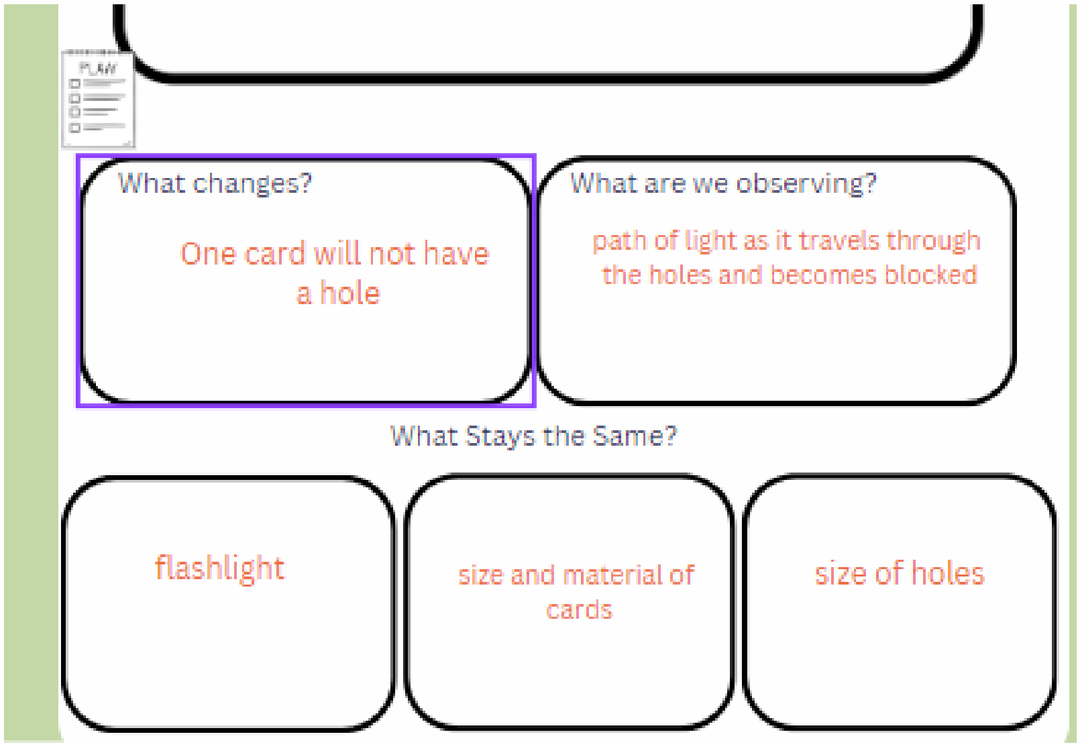
If we have holes in the cards and line them up do you think the light will shine through all the way?

What do think will happen if we block the light path with a card?
Will the light turn and change direction or stop?
Let's predict

Lesson 2 How does light move (travel)?

Think/pair/share

Planning the Investigation

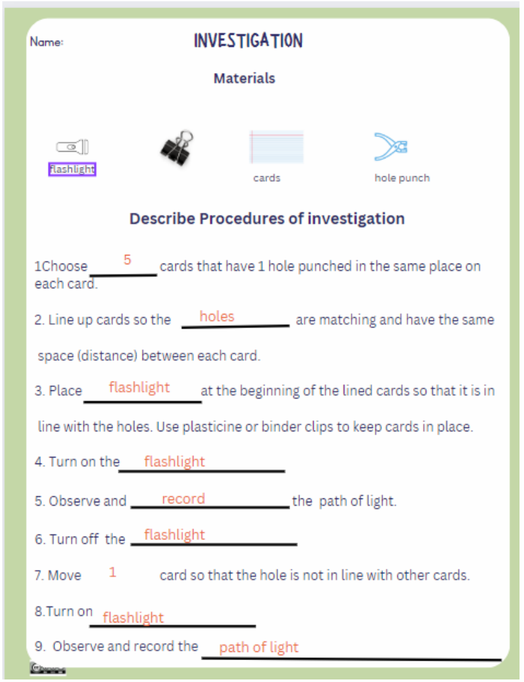


Lesson 2 How does light move (travel)?

Planning the Investigation

Scientists write down the procedures (steps) to do the investigation so other scientists

Optional:
Guided Practice
Write as a class chart or students work in pairs to complete



Name:

INVESTIGATION

Materials

flashlight cards hole punch

Describe Procedures of investigation

1Choose 5 cards that have 1 hole punched in the same place on each card.

2. Line up cards so the holes are matching and have the same space (distance) between each card.

3. Place flashlight at the beginning of the lined cards so that it is in line with the holes. Use plasticine or binder clips to keep cards in place.

4. Turn on the flashlight

5. Observe and record the path of light.

6. Turn off the flashlight

7. Move 1 card so that the hole is not in line with other cards.

8.Turn on flashlight

9. Observe and record the path of light

Lesson 2 How does light move (travel)?

Planning the Investigation

Think/pair/share

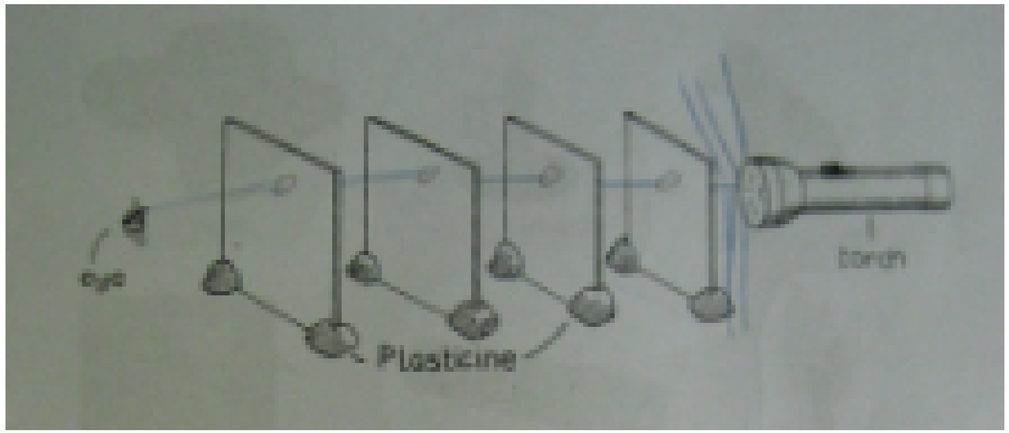
I predict that when the path of light is blocked by an object the light will turn/ stop because

Lesson 2 Day 2 How does light move (travel)?

students observe path of light

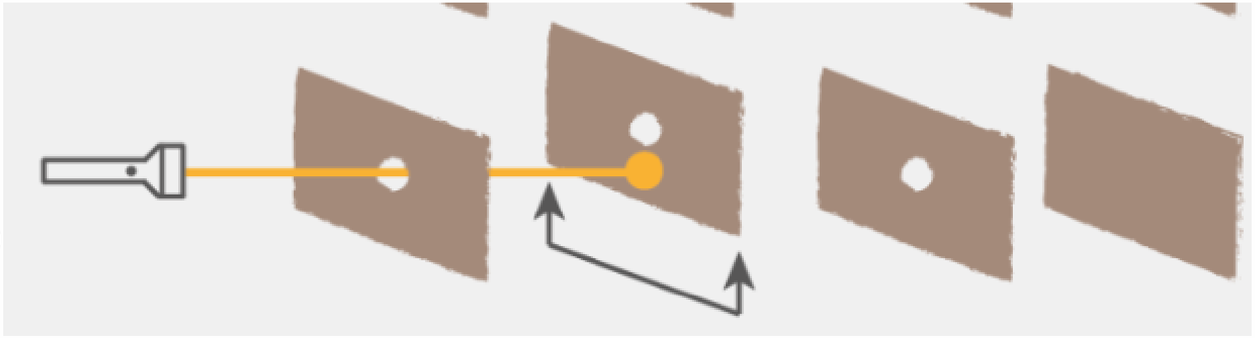
https://www.schoolsobservatory.org/learn/history/light-telescopes

students record



https://scienceehs.blogspot.com/2011/03/showing-that-light-travels-in-straight.html

Lesson 2 Day 2 How does light move (travel)?



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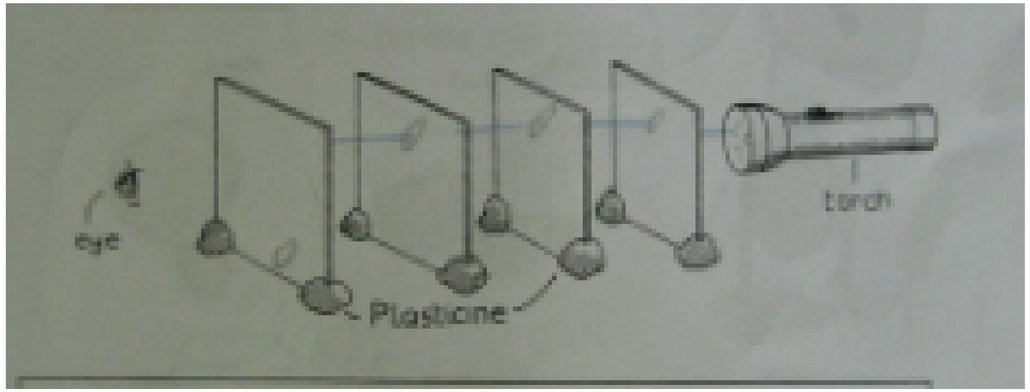
students record



https://scienceehs.blogspot.com/2011/03/showing-that-light-travels-in-straight.html

Lesson 2 How does light move (travel)?

Learning Summary Table Sample

Driving Question: What is light and how does it move?				
Performance Task	**Light obstacle course (maze)**			
Activity (Small investigation)	**Observation** **What did we observe?** Students reflect on recorded data	**Conclusion** **What did we learn from our data?** **Connect to small phenomenon "Why can we see the Sunlight in the trees at times and sometimes we can't?"**	**How can we connect to puzzling phenomena & driving question**	**Questions** **I wonder..** **Record as students ask or can be put on a sticky**
Question (small phenomenon) How does light travel from the Sun or another light source? Light Beam & Light Traveler Book , *Light: First Science* p. 10	Light traveled straight it did not curve when the tube was bent but stopped when the tube was bent. When the cards were hole punched the path of light moved through the holes. When 1 card was moved, the light path stopped.	Light travels in a straight line until it is it is blocked by object or material. Light does not move around objects. Connect to phenomenon (observing Sunlight through trees and leaves) The sunlight in the trees traveled straight but could not move around the trees and leaves so it was blocked	☐ In our obstacle course we need to show: 1. How light travels in a straight line.	

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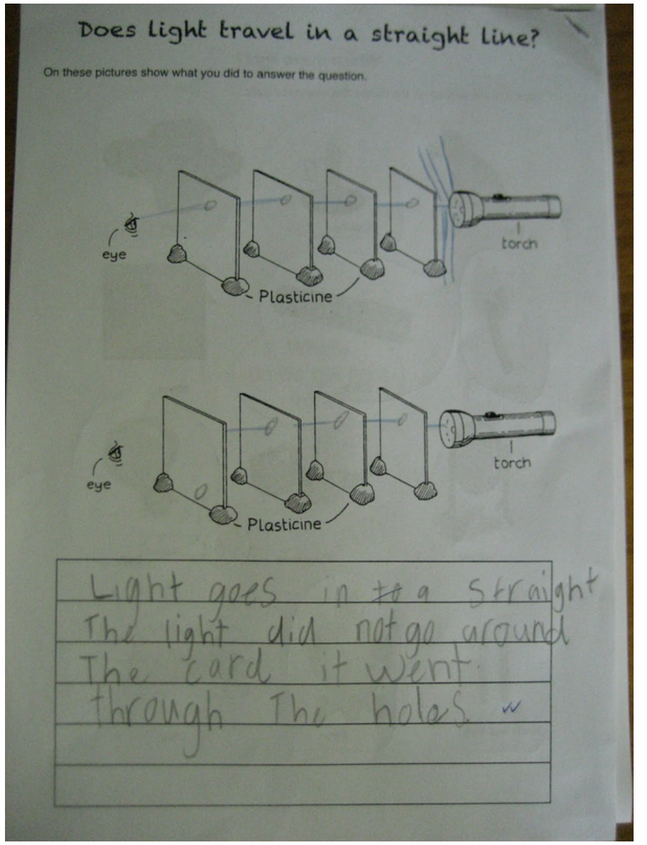

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KEY IDEAS

Scientific Methods	Integrated in all other organizing ideas. Way students should build knowledge in each organizing ideas. “Explore before Explain”
Teacher Clarity of Curriculum	Taking time to unpack the curriculum empowers you to choose activities & resources that truly align with curriculum.
Learning Sequence	Logical flow and sequence of knowledge & skills to **intentionally plan** for including the scientific methods.
Planning Guide	Resource developed to assist with intentionally integrate scientific methods in other organizing ideas

Sources

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