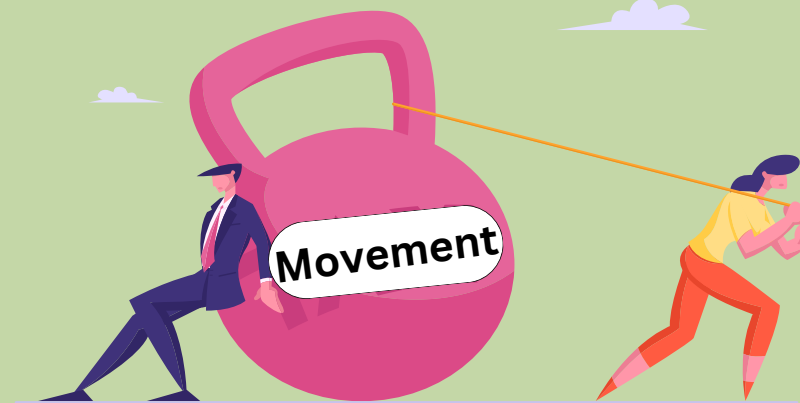


# GRADE 3 BRINGING IT TOGETHER



## ENERGY & SCIENTIFIC METHODS

Example:

“Forces can affect properties and movement of objects in different ways.”

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.**



# AGENDA

**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 “Forces can affect properties and movement of objects in different ways.”**



# Session & Resources



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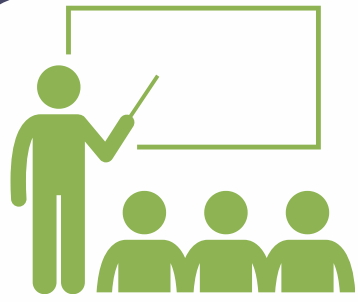
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-  **BY:** credit must be given to the creator.
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School or division leaders can share slides and information from session sourcing as follows: ARPDC (2024)



# TQS Alignment

**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);

short, **medium** 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



**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	<u>investigate</u>	To use a process of inquiry or exploration to gain deeper understanding.



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

# "Students investigate. (process to find answer or build knowledge)."

## Explore Before Explain

### Explore First

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



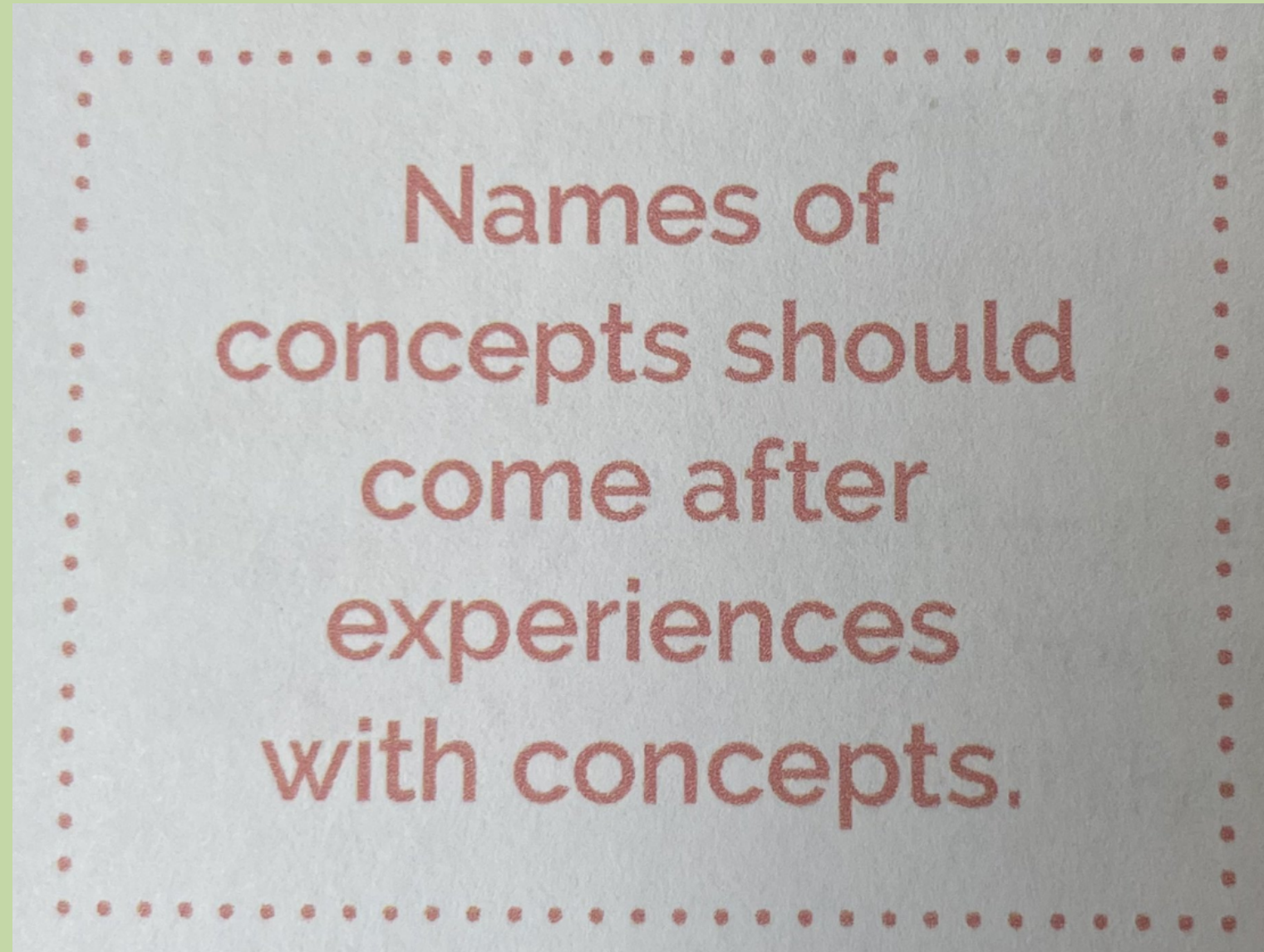
<https://curriculum.learnalberta.ca/curriculum/en/c/sci2?s=SCI>

### Explain:

Students confirm conclusions to connect with videos, books, teacher explanations



# Explore before Explain



Learning truly sticks when students engage in hands-on math[science] investigations. “Names of concepts should come after experiences with concepts.” Otherwise they are simply memorizing.

Peter Liljedahl (Building Thinking Classrooms in Mathematics, 2020)

# 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
<p>A force is a push or pull on an object resulting from an interaction with another object.</p> <p>An object that is not moving will stay still until a force makes it move, and an object that is moving will keep moving until a force stops it. (Newton's First Law)</p> <p>Contact forces occur between objects that touch each other.</p> <p>Contact forces include forces that are</p> <ul style="list-style-type: none"> <li>• applied by a person or an object on another object (applied)</li> <li>• caused by objects, surfaces, or substances sliding against each other (friction)</li> <li>• applied by pulling on a string or rope connected to an object (tension)</li> <li>• caused by a compressed or stretched object or spring (elastic or spring)</li> </ul> <p>Ways to apply a contact force to an object include</p> <ul style="list-style-type: none"> <li>• stretching</li> <li>• pulling</li> <li>• squeezing</li> <li>• pushing</li> </ul> <p>The strength of forces applied to objects can be described as</p> <ul style="list-style-type: none"> <li>• strong</li> <li>• weak</li> <li>• large</li> <li>• small</li> </ul> <p>The direction of forces applied to objects can be described as</p> <ul style="list-style-type: none"> <li>• upward</li> <li>• downward</li> <li>• from both sides</li> <li>• from all directions</li> </ul> <p>Changes to an object's movement when a force is applied include</p> <ul style="list-style-type: none"> <li>• changing speed</li> <li>• starting</li> <li>• stopping</li> </ul>	<p>Forces can affect properties and movement of objects in different ways.</p>	<p>Describe where forces may exist in everyday situations.</p> <p>Describe the strength and direction of forces applied to objects.</p> <p>Compare the strength of forces applied to objects.</p> <p>Predict how an object will be affected by different strengths and directions of forces.</p> <p>Conduct investigations to demonstrate the effects of forces on the movement of objects.</p> <p>Conduct investigations to demonstrate how forces can change the shape or size of objects.</p>

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

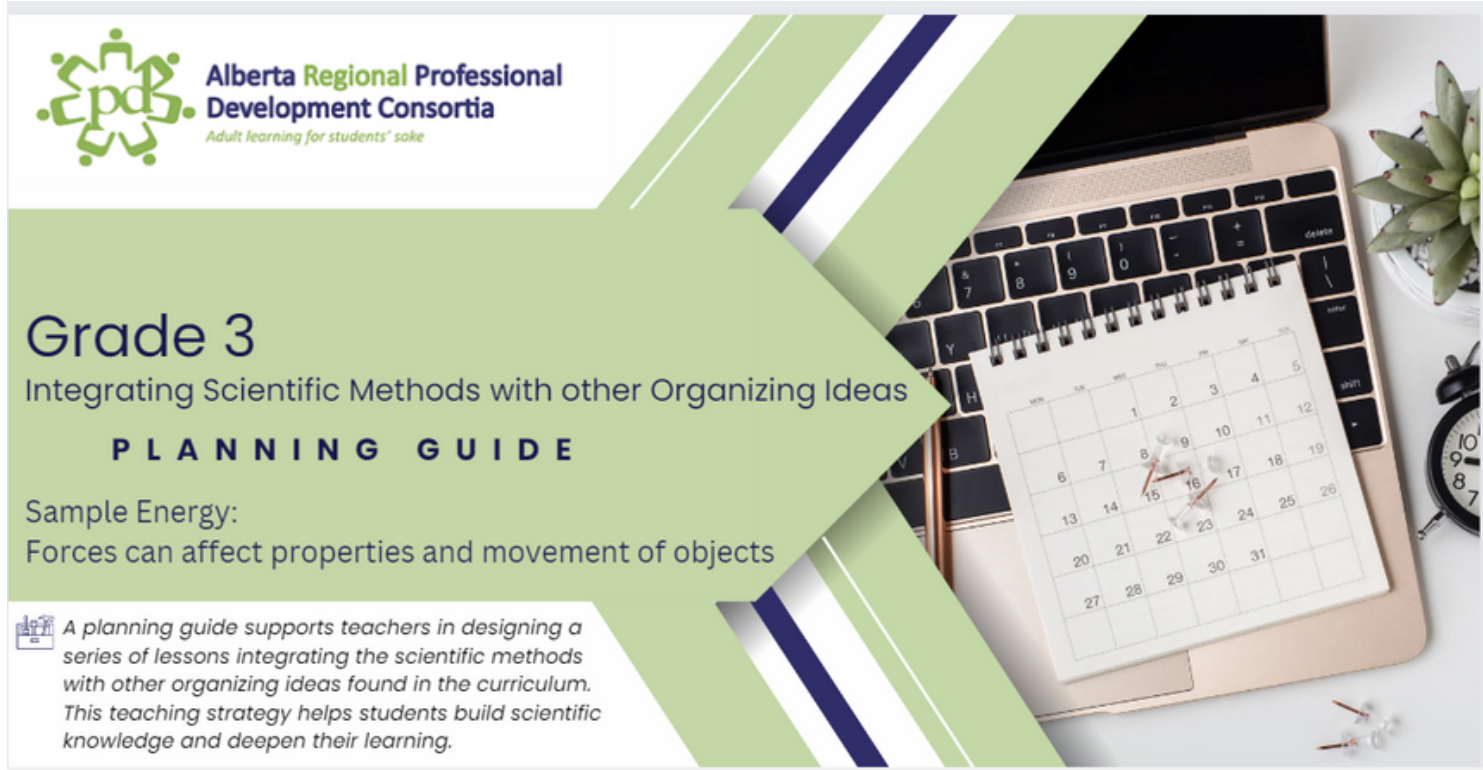
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Grades found as LO	Grades found within Ss & Ps	Verb	Definition
	1, 2, 3, 4, 5, 6	<u>conduct</u>	To engage in the process of planning and carrying-out (such as for an investigation).



# Resource Documents



Planning Guide to assist when planning:  
Exemplar to refer to

**PLANNING GUIDE** Grade 3 Science

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 KVSPE Related to Learning Outcome
- Step 3: Connect Concepts to Foundational Knowledge
- Step 4: Develop Learning Sequence & Align Scientific Methods
- Step 5: Determine Evidence of Success
- Step 6: Plan for Instruction

How can forces relate to changes in movement?

Energy	Scientific Methods
Students investigate and explain how forces affect the movement of objects.	Students relate investigation to building knowledge.

Note: The skills & procedures from the scientific methods development is 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?

Verbs Glossary

Integrating Scientific Methods

Linked Planning Steps



**Toolbox Contains:**

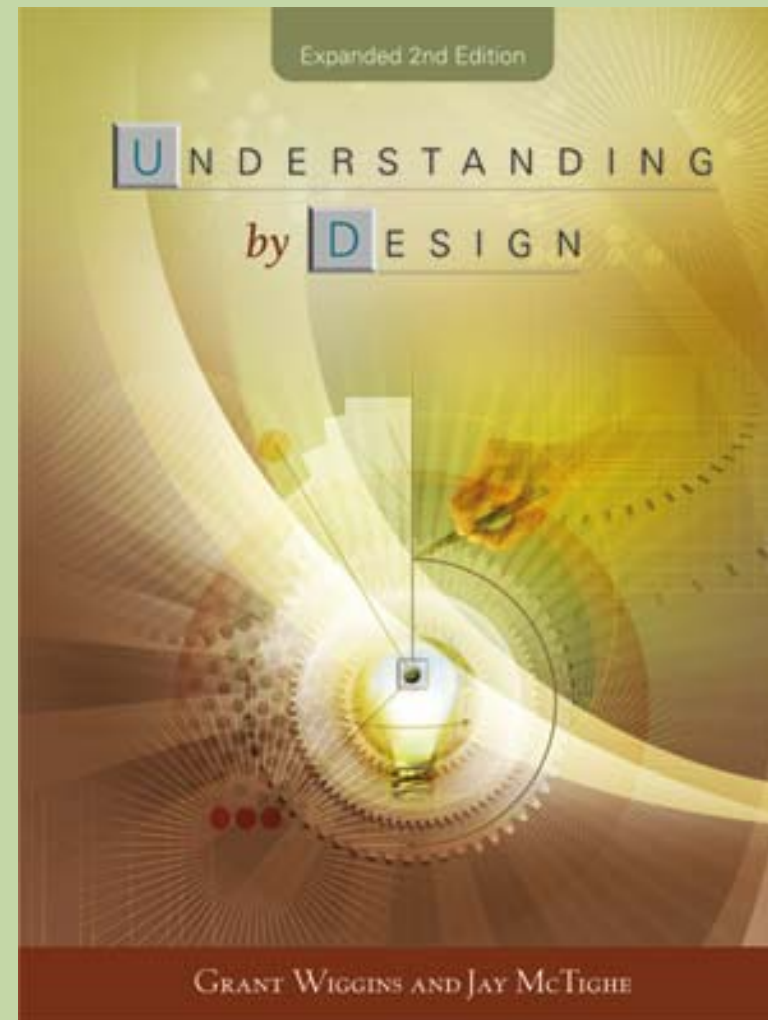
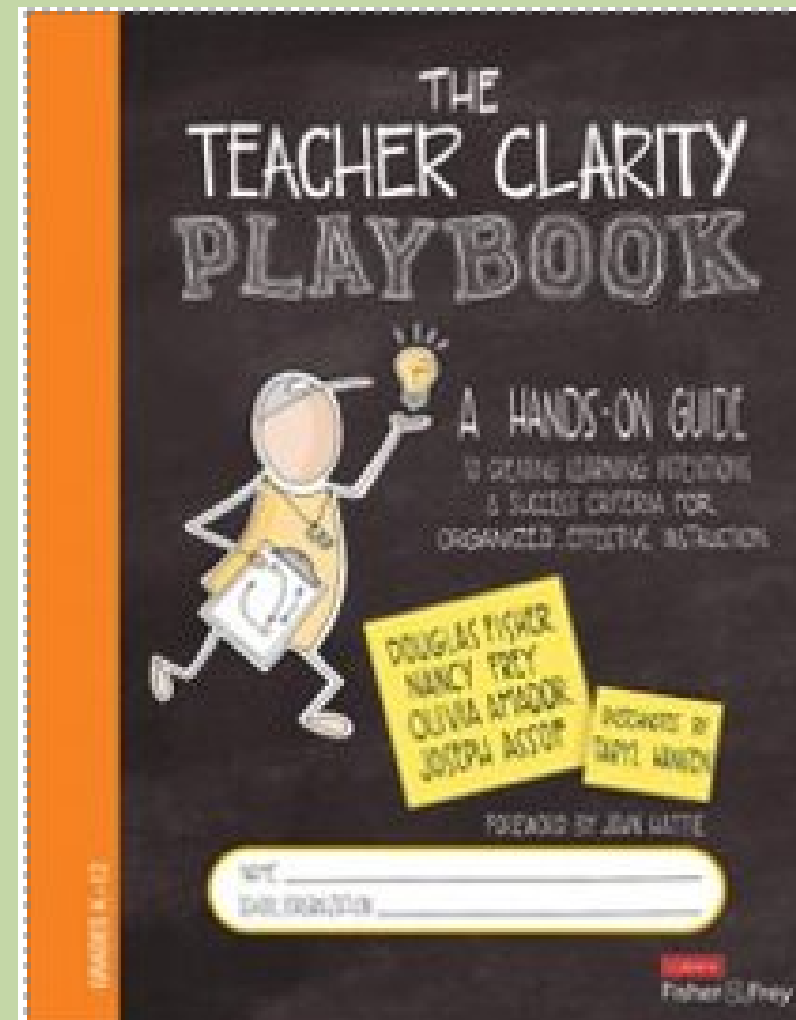
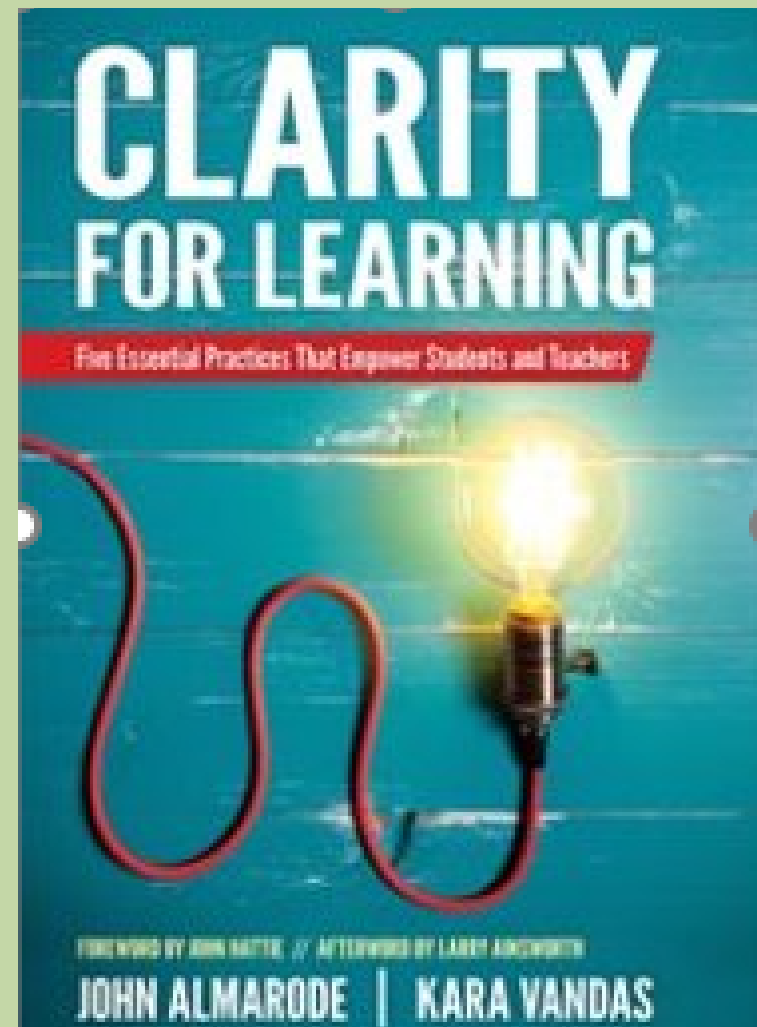
Hyper linked resources to assist with each phase

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



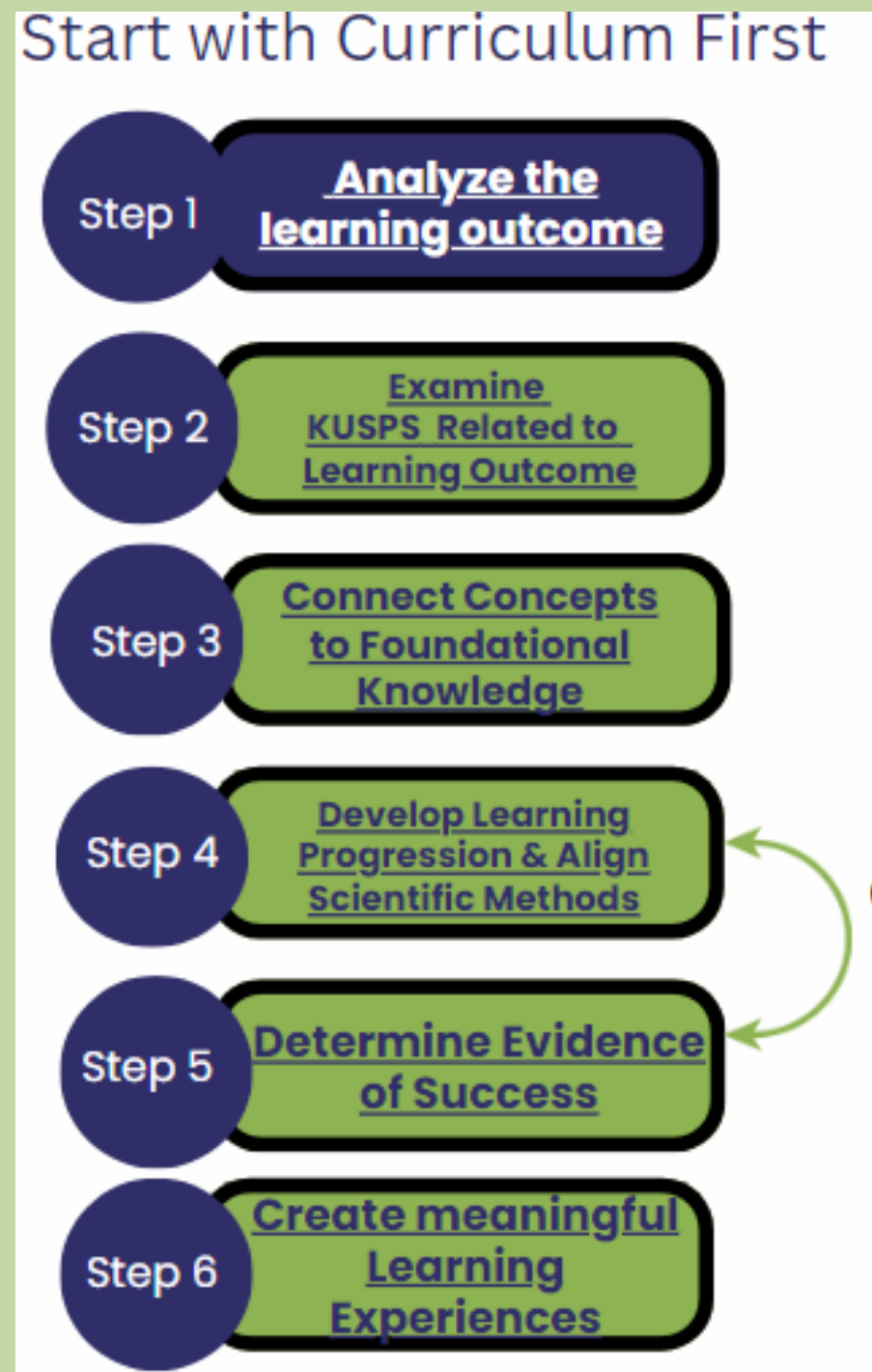
Guiding questions to consider at each phase of planning

# Sources for Planning Guide



# Planning Guide Begins to Focus On Clarity By Starting With

Unpacking The Curriculum:

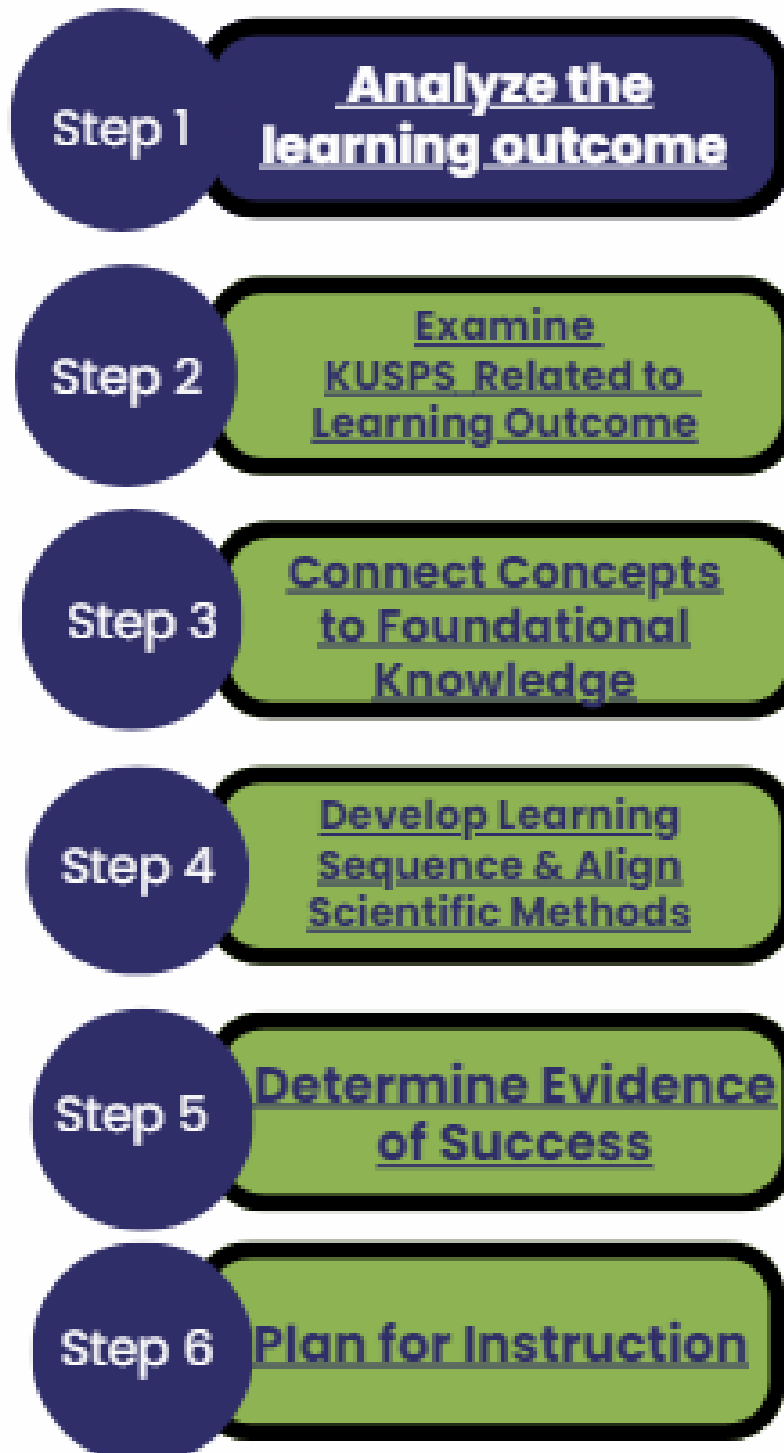


1. Sequence Learning Progressions beginning, middle and end of learning journey



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

Start with Curriculum First



How can forces relate to changes in movement?

Energy	Scientific Methods
Students <u>investigate</u> and <u>explain</u> how <u>forces</u> affect the <u>movement of objects</u> .	Students <u>relate</u> <u>investigation</u> to <u>building knowledge</u> .

Note: The skills & procedures from the scientific methods development is 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)

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

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Grades found as LO	Grades found within Ss & Ps	Verb	Definition
2, 3, 5, 6	2, 3, 4, 5, 6	<u>explain</u>	To describe the how or why of something; give the cause or reason for.

Students investigate and explain how forces affect the movement of objects

1, 2, 3, 4, 6	2, 3, 4, 5, 6	<u>relate</u>	To show or make a connection between two or more things.
---------------	---------------	---------------	--

Students relate investigation to knowledge building.

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

#### Start with Curriculum First



**Forces** can affect properties and **movement** of **objects** in different ways.

<p><b>Knowledge:</b> A <b>force</b> is a <b>push or pull</b> on an <b>object</b> resulting from an interaction with another <b>object</b>.</p> <p><b>Knowledge:</b> An <b>object</b> that is not moving will stay still until a <b>force</b> makes it <b>move</b>, and an <b>object</b> that is moving will keep moving until a force stops it. (Newton's First Law)</p> <p><b>Contact forces</b> occur between <b>objects</b> that touch each other.</p> <p><b>Contact forces include</b> forces that are</p> <ul style="list-style-type: none"> <li>• applied by a person or an object on another object (applied)</li> <li>• caused by objects, surfaces, or substances <b>sliding against each other (friction)</b></li> <li>• applied by pulling on a string or rope connected to an object (tension)</li> <li>• caused by a compressed or stretched object or spring (elastic or spring)</li> </ul> <p>Ways to apply a <b>contact force</b> to an <b>object</b> include</p> <ul style="list-style-type: none"> <li>• stretching</li> <li>• pulling</li> <li>• squeezing</li> <li>• pushing</li> </ul>	<p><b>Skills:</b> Describe where <b>forces</b> may exist in everyday situations.</p> <p><b>Skill:</b> Conduct investigations to <b>demonstrate</b> the effects of forces on the movement of objects.</p> <p><b>Skill:</b> Predict how an object will be affected by different strengths and <b>directions</b> of force.</p> <p><b>Skill:</b> Describe the <b>strength</b> and <b>direction</b> of <b>forces</b> applied to objects.</p> <p><b>Skill:</b> Compare the <b>strength</b> of <b>forces</b> applied to <b>objects</b>.</p> <p><b>Skill:</b> Conduct investigations to <b>demonstrate</b> how forces can change the shape or size of objects. (Not included in sample plan)</p>
<p>The <b>direction</b> of <b>forces</b> applied to objects can be described as</p> <ul style="list-style-type: none"> <li>• upward</li> <li>• downward</li> <li>• from the left</li> <li>• from the right</li> <li>• from both sides</li> <li>• from all directions</li> </ul> <p>The <b>strength</b> of <b>forces</b> applied to <b>objects</b> can be described as</p> <ul style="list-style-type: none"> <li>• strong</li> <li>• weak</li> </ul>	
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#### 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?



## Forces can affect properties and movement of objects in different ways

**Knowledge:** A **force** is a **push or pull** on an **object** resulting from an interaction with another **object**

**Knowledge:** An **object** that is not **moving** will stay still until a **force** makes it **move**, and an **object** that is moving will keep moving until a **force** stops it.  
(Newton's First Law)

**Contact forces** occur between **objects** that **touch each other**.

**Contact forces** include **forces** that are

- applied by a person or an object on another object (applied)
- caused by objects, surfaces, or substances sliding against each other (friction)
- applied by pulling on a string or rope connected to an object (tension)
- caused by a compressed or stretched object or spring (elastic or spring)

Ways to apply a **contact force** to an **object** include

- stretching
- pulling
- squeezing
- pushing

The **direction** of **forces** applied to objects can be described as

- upward
- downward
- from the left
- from the right
- from both sides
- from all directions

The **strength** of **forces** applied to **objects** can be described as

The **strength** of **forces** applied to **objects** can be described as

- strong
- weak
- large
- small

Changes to an object's **movement** when a **force** is applied include

- changing speed
- starting
- stopping
- changing direction

**Skills:** Describe where **forces** may exist in everyday situations.

**Skill:** Conduct investigations to demonstrate the effects of **forces** on the **movement** of objects.

**Skill:** Predict how an object will be affected by different **strengths** and **directions** of **force**.

**Skill:** Describe the **strength** and **direction** of **forces** applied to objects.

**Skill:** Compare the **strength** of **forces** applied to **objects**

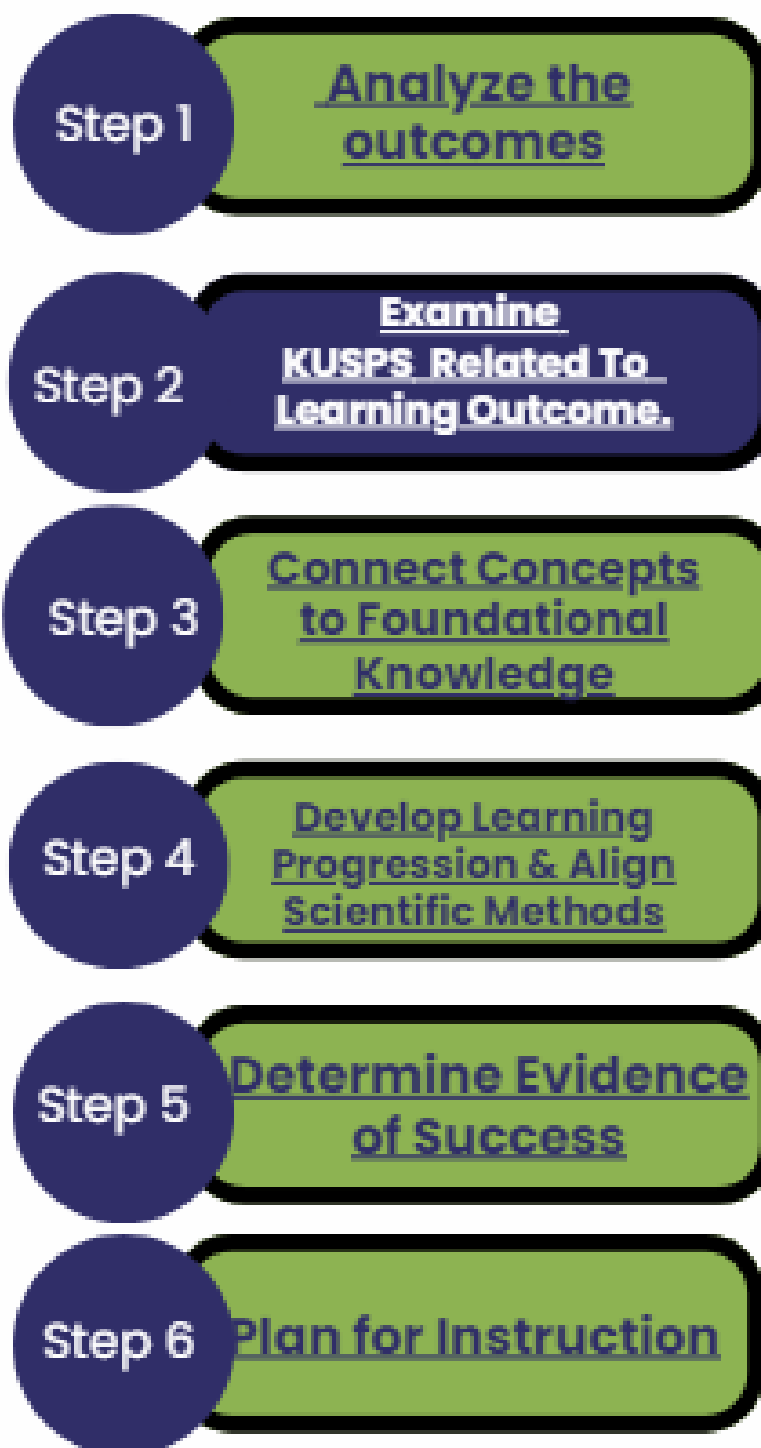
**\*Skill:** Conduct investigations to demonstrate how forces can change the **shape or size** of **objects**. (Not included in sample plan as it connects to properties)



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

**Forces** can affect properties and **movement** of **objects** in different ways.

### Start with Curriculum First



<p><b>Knowledge:</b> A <b>force</b> is a <b>push or pull</b> on an <b>object</b> resulting from an interaction with another <b>object</b>.</p>	<p><b>Skills:</b> Describe where <b>forces</b> may exist in everyday situations.</p>
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#### Guiding Questions:

- What concepts (nouns, science ideas) in the knowledge & Understanding statements are integral to student understanding?
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Grades found as LO	Grades found within Ss & Ps	Verb	Definition
	K, 1, 3, 4, 5, 6	<u>demonstrate</u>	To show or express understanding through one's actions.

Conduct investigations to demonstrate the effects of forces on the movement of objects.

Conduct investigations to demonstrate how forces can change the shape or size of objects.

K, 1, 3, 4, 6	K, 1, 2, 3, 4, 5, 6	<u>describe</u>	To communicate (orally or in writing) the qualities, attributes, features or properties of something.
---------------	---------------------	-----------------	---

Describe the strength and direction of forces **applied to objects**.

5	K, 1, 2, 3, 4, 5, 6	<u>compare</u>	To consider the qualities of two or more things or sets, in order to discover similarities or differences.
---	---------------------	----------------	--

Compare the strength of forces **applied to objects**.

CAUSE(Action): Push, Pull, Describe <u>Applied Force</u> TO Objects	EFFECT (RESULT): Describe change in movement
The <b>strength of forces applied</b> to objects can be described as strong weak large small	Changes to an <b>object's movement</b> when a force is applied include changing speed starting stopping changing direction
The <b>direction of forces applied</b> to objects can be described as upward downward from the left from the right from both sides from all directions	



## Predict how an object will be affected by different strengths and directions of force.

1, 2, 3, 6

predict

To form a likely answer using inference that is based on current understanding.

**EFFECT (RESULT):**

Describe change in movement

Changes to an **object's movement** when a force is applied include  
changing speed  
starting  
stopping  
changing direction

# Terms in Parenthesis

Knowledge	Parenthesis – For Teacher only
An object that is not moving will stay still until a force makes it move, and an object that is moving will keep moving until a force stops it.	(Newton’s First Law)
Contact forces – forces that touch each other Contact forces caused by objects, surfaces, or substances sliding against each other	(friction)
Contact forces caused by applied by pulling on a string or rope connected to an object	(tension)
caused by a compressed or stretched object or spring	(elastic or spring)

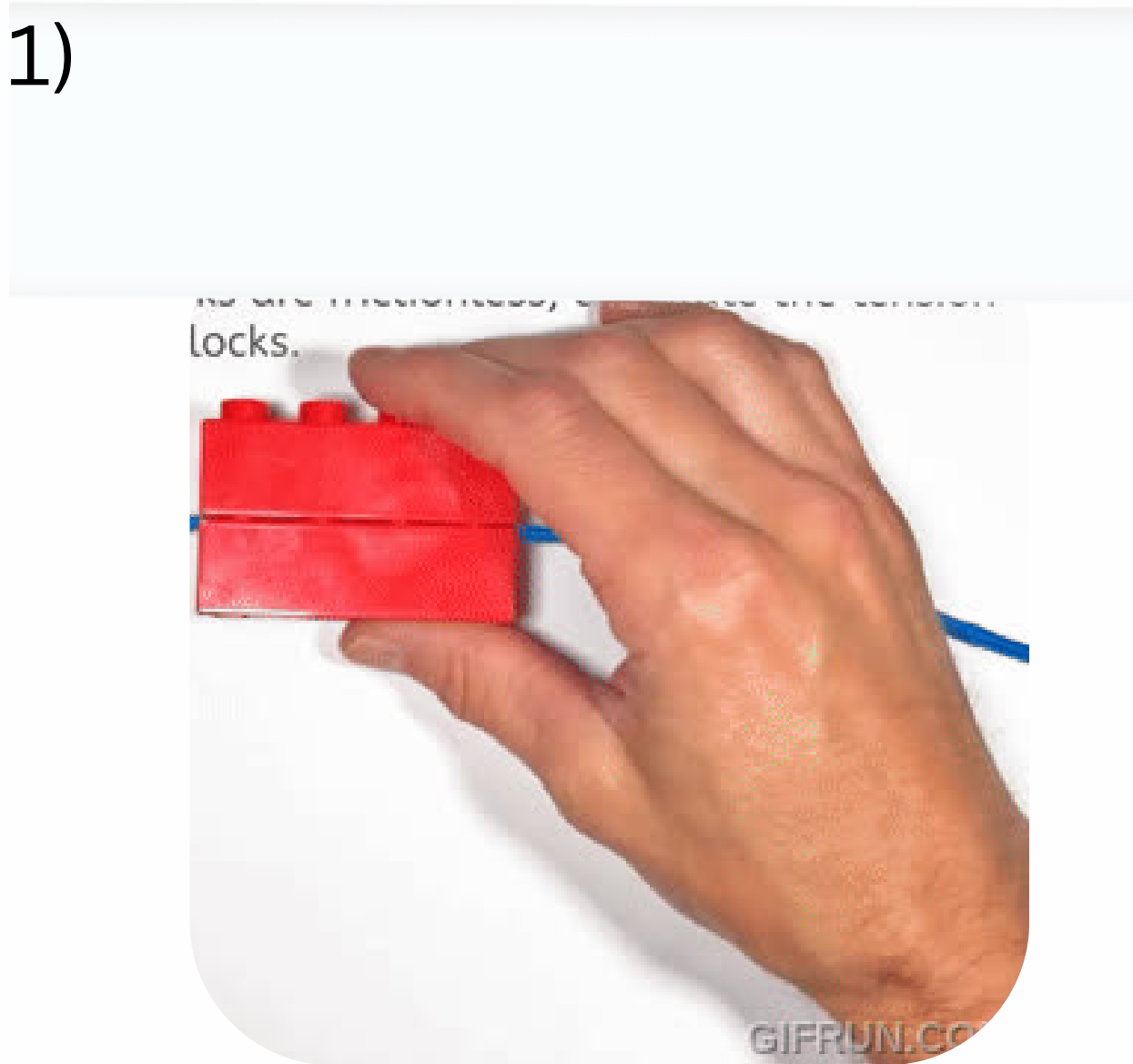
## Science concepts students should know:

Push	*Movement	*object	compress
Pull	Applied Force	*surface	stretch
Force	Contact Force	*substance	* learned in previous grades

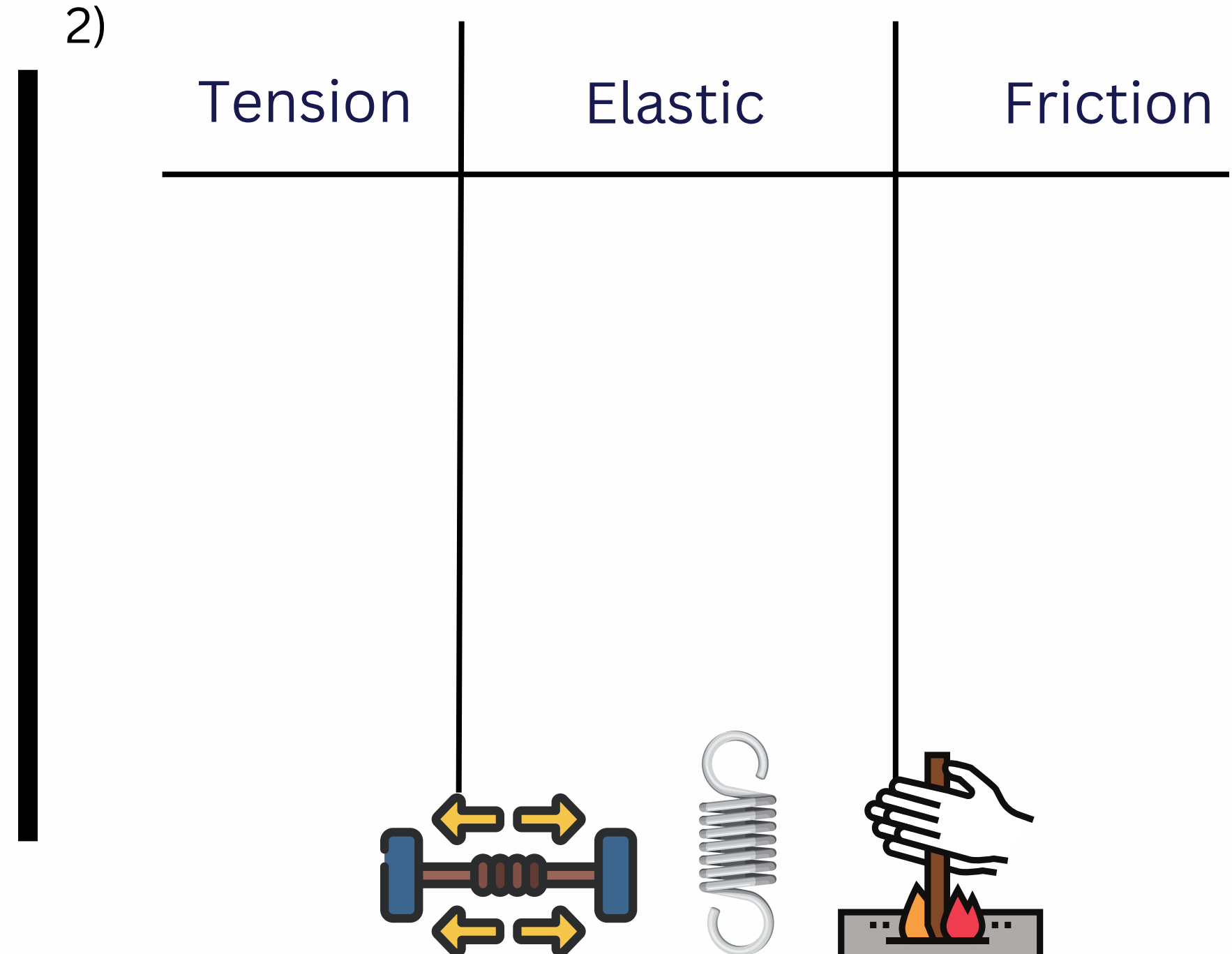
Conduct an investigation to **demonstrate** how an **applied force by pulling on a string or rope connected to an object** affects movement

Which learning engagement best allows students to **best** meet the combined knowledge, skills and procedures?

1)



2)



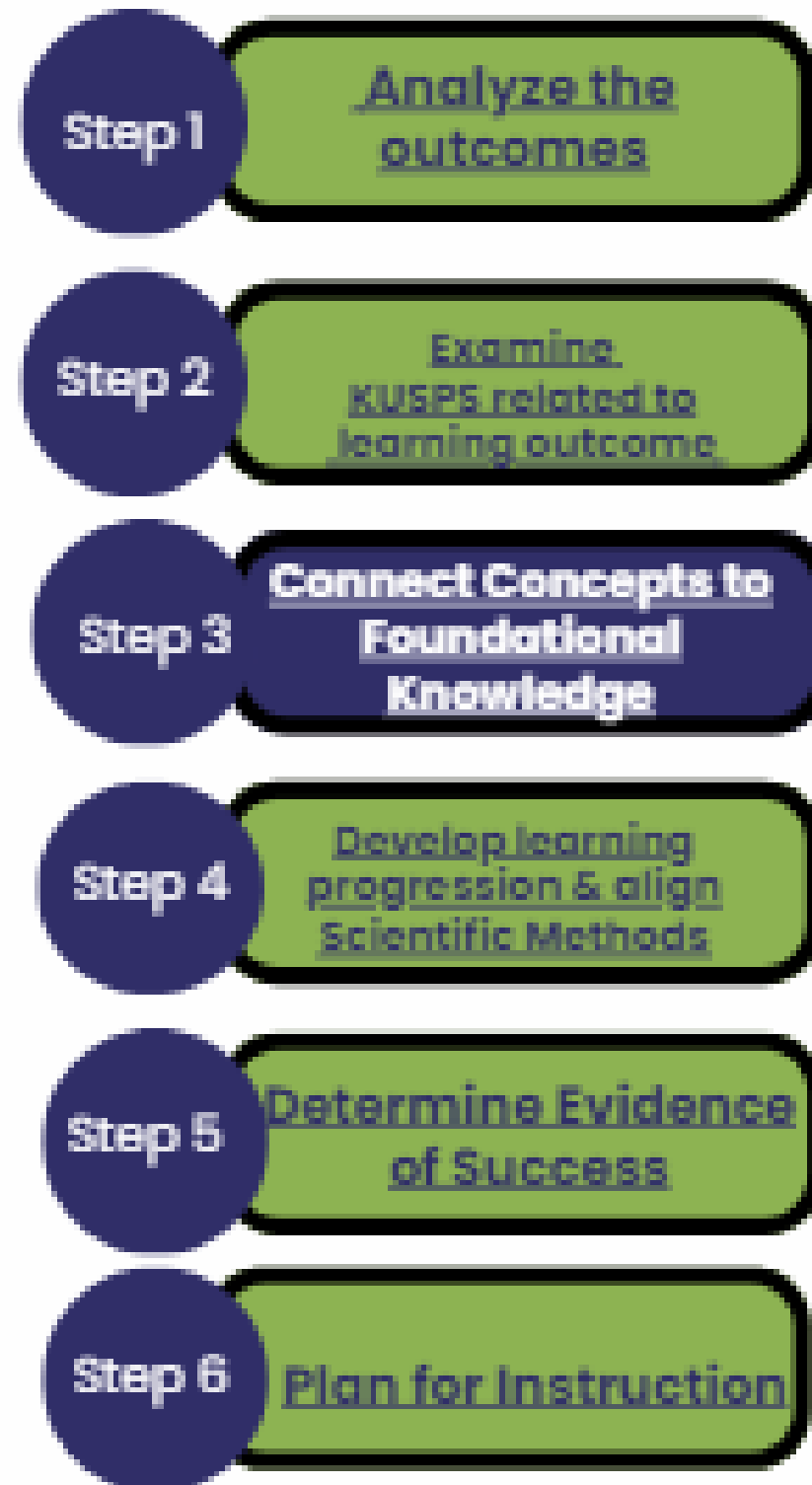
# Resources are tools in your toolbox



Understanding the curriculum enables you to pick the right tool

## Understanding: Forces can affect properties and movement of objects in different ways

### Start with Curriculum First

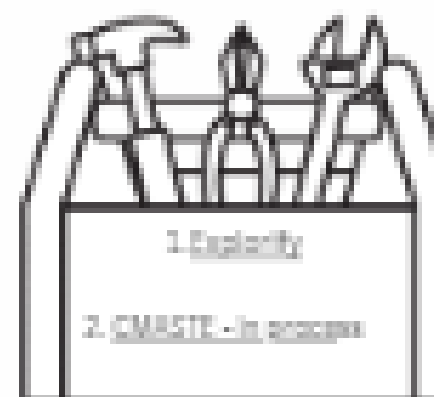


- Determine essential science ideas for teacher clarity to enhance student learning.
  - Force is a push and/or pull we cannot see it just the effect
  - Movement (speed, slow down, change direction) or change of shape is the result or consequence of force
  - Friction is a contact force caused by surfaces sliding against each other that affects movement (opposes movement)
  - To slow or stop an object a force must act on it
  - Simple machines allow small force to have greater effect by changing the direction or size of force
- Determine potential student misconceptions students may develop or bring
  - If an object is moving, a force must be acting on it. Motion implies force.
  - Forces get things going but don't stop things. An object stops because it runs out of force or energy.
  - All objects slow down and eventually stop.
  - People have the power to move things, so objects move only when people push or pull them
  - Inanimate or inert objects (like a table or chair) don't exert force.

#### Guiding Questions:

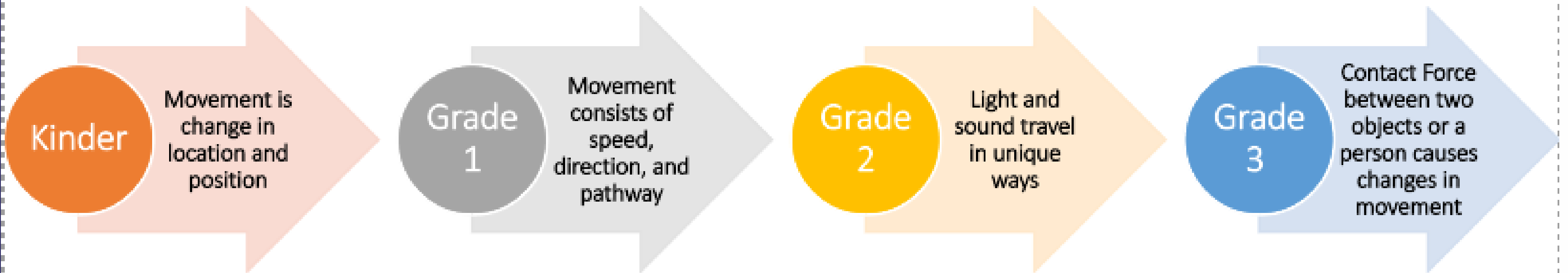
- What terms and science ideas do I understand and what do I need to learn more about?
- What concepts in this learning outcome are connected to previous grade?
- What do I need to keep in mind when planning instruction?
- What science vocabulary might be used, in a non-science context, that may potentially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

Teacher Background Builder  
(Click Links)



Scientific Methods

# Previous Grade Learning



Grade  
4

Non-contact forces  
affect materials,  
objects and  
substances

Grade  
5

- Flight of living things and objects are influenced by opposing forces
- The relationship between buoyant force and gravity can be used to explain the behaviour of an object in water

Grade  
6

- External and internal forces can change the shape, size, or position of objects that interact
- For every action force, there is an equal and opposite reaction force. (Newton's Third Law)

# CONNECTING CURRICULUM

## TO FOUNDATIONAL SCIENCE IDEAS & CONSIDER POTENTIAL MISCONCEPTIONS

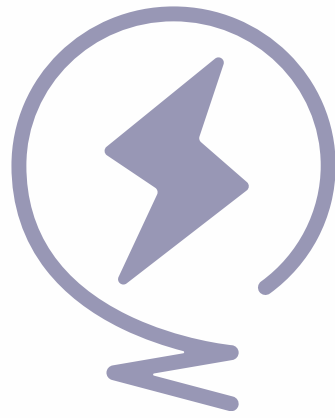


"teachers who know their students' most common misconceptions are more likely to increase their students' science knowledge than teachers who do not. Having a teacher who knows only the scientific "truth" appears to be insufficient. It is better if a teacher also has a model of how students tend to learn 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



# LINKS TO FIND FOUNDATIONAL SCIENCE IDEAS & MISCONCEPTIONS



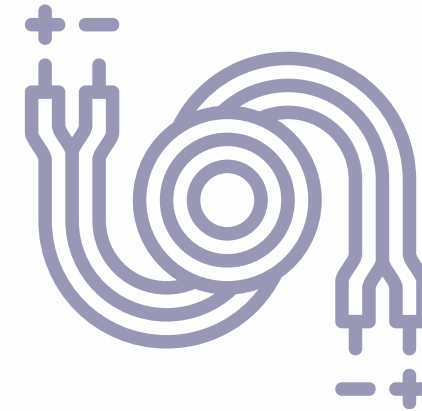
**EXPLORIFY**

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

# FORCE

- are pushes and pulls. We cannot see forces, just their effects.
- When an object changes its movement or shape, we know that a force is acting on it
- When two objects or a person are touching, it is called a contact force.



# Forces are all Around Us in Our World

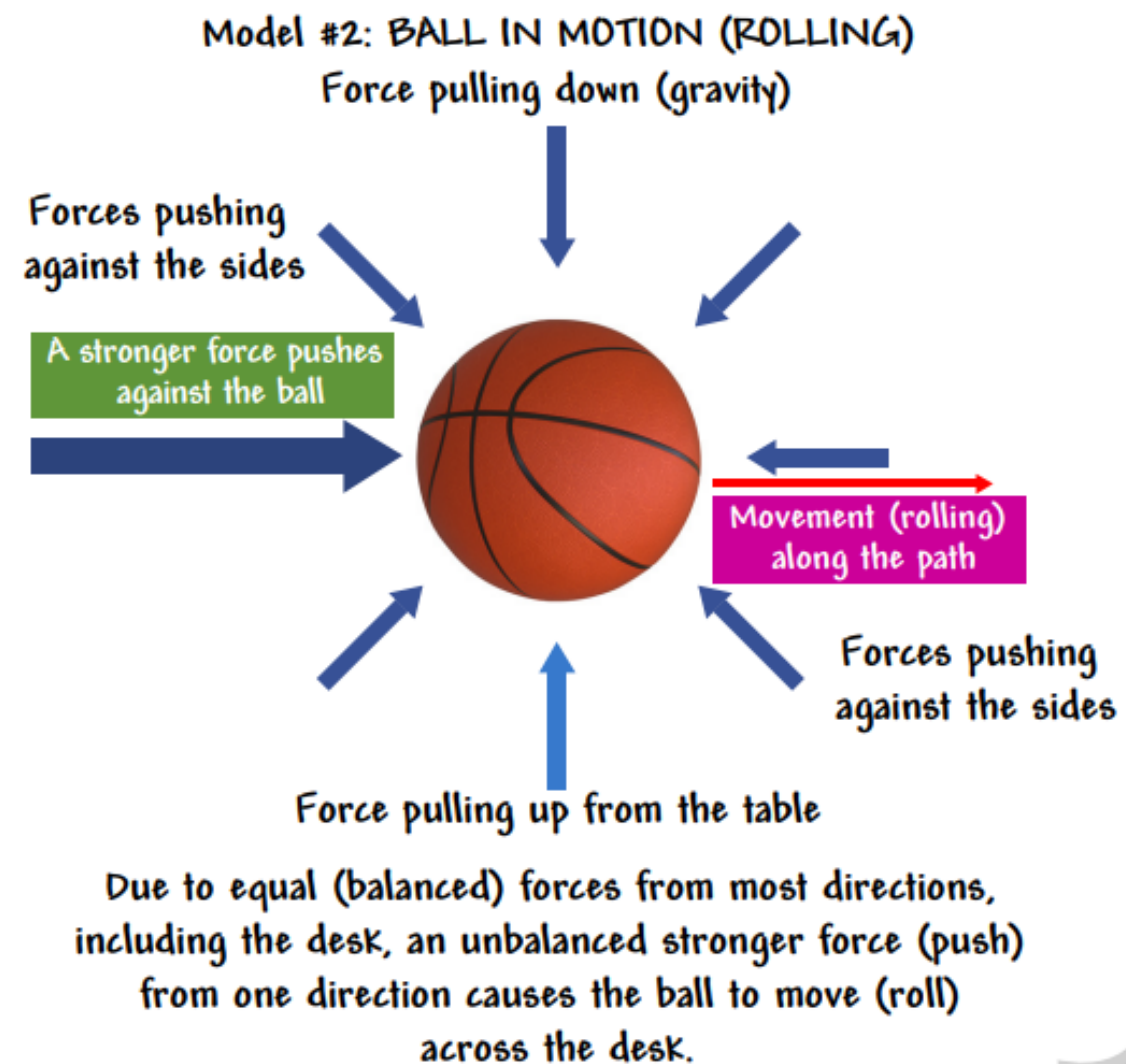
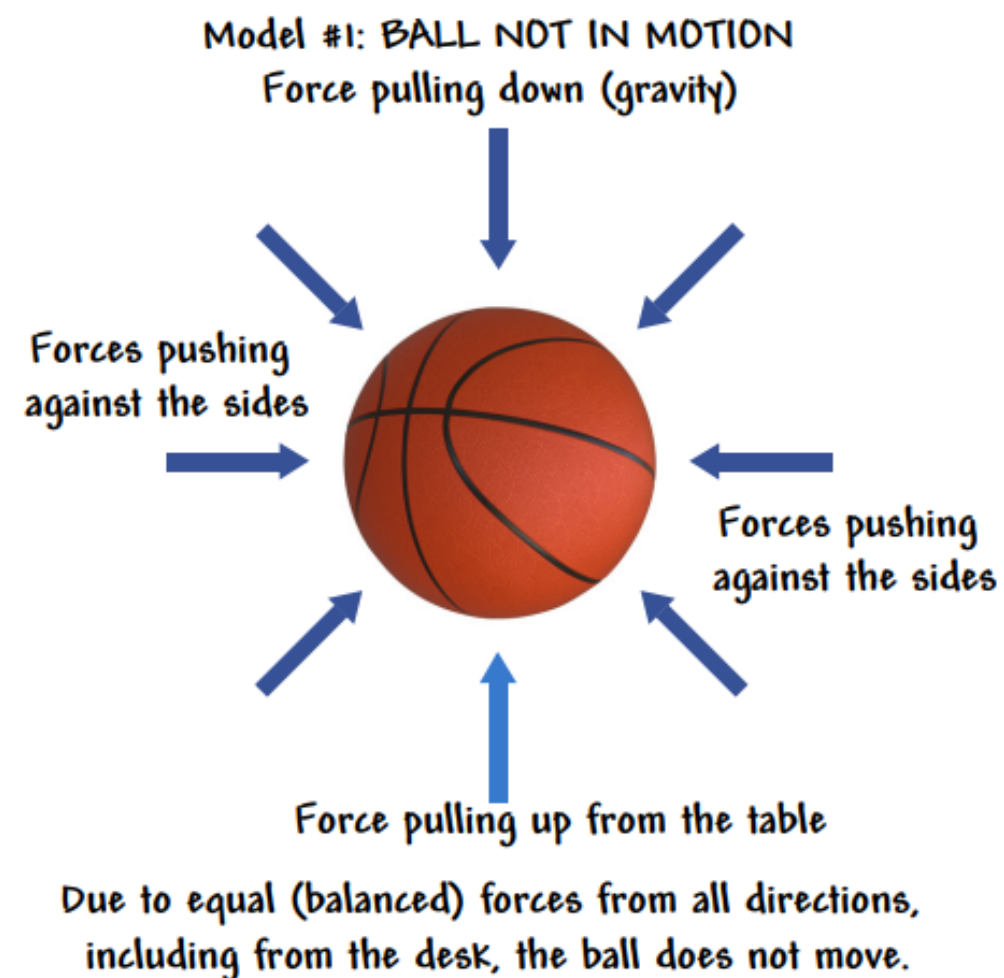
changes to Earth's  
Surface



# TEACHER BACKGROUND:

## CONDUCT AN INVESTIGATION TO DEMONSTRATE THE EFFECTS OF FORCES ON THE MOVEMENT OF OBJECTS

- An object that is not moving will stay still until an object makes it move.
- When an object changes its movement or shape, we know that a force is acting on it



## TEACHER BACKGROUND:

### CONDUCT AN INVESTIGATION TO DEMONSTRATE THE EFFECTS OF FORCES ON THE MOVEMENT OF OBJECTS

Potential Misconceptions:

- ❌ People have the power to move things, so objects move only when people push or pull them.



any two objects that interact through direct or indirect contact (such as gravity or magnetism) exert force on each other

## TEACHER BACKGROUND:

### CONDUCT AN INVESTIGATION TO DEMONSTRATE THE EFFECTS OF FORCES ON THE MOVEMENT OF OBJECTS

#### Potential Misconceptions:

- ✗ If an object is moving, a force must be acting on it. Motion implies force
- ✗ A force has to keep being applied for an object to stay in motion



Forces cause changes in motion.

If an object is moving, no force is necessary to keep it moving, but a force is needed to make it stop moving or change direction

## TEACHER BACKGROUND:

### CONDUCT AN INVESTIGATION TO DEMONSTRATE THE EFFECTS OF FORCES ON THE MOVEMENT OF OBJECTS

#### Potential Misconceptions:

- ❌ All objects slow down and eventually stop.
- ❌ Forces get things going but don't stop things. An object stops because it runs out of force or energy.



If no forces are acting on a moving object, its motion will never change or stop



Objects don't contain force, so they can't run out of force. All forces are interactions (a push or pull, a touch or tug) between two objects

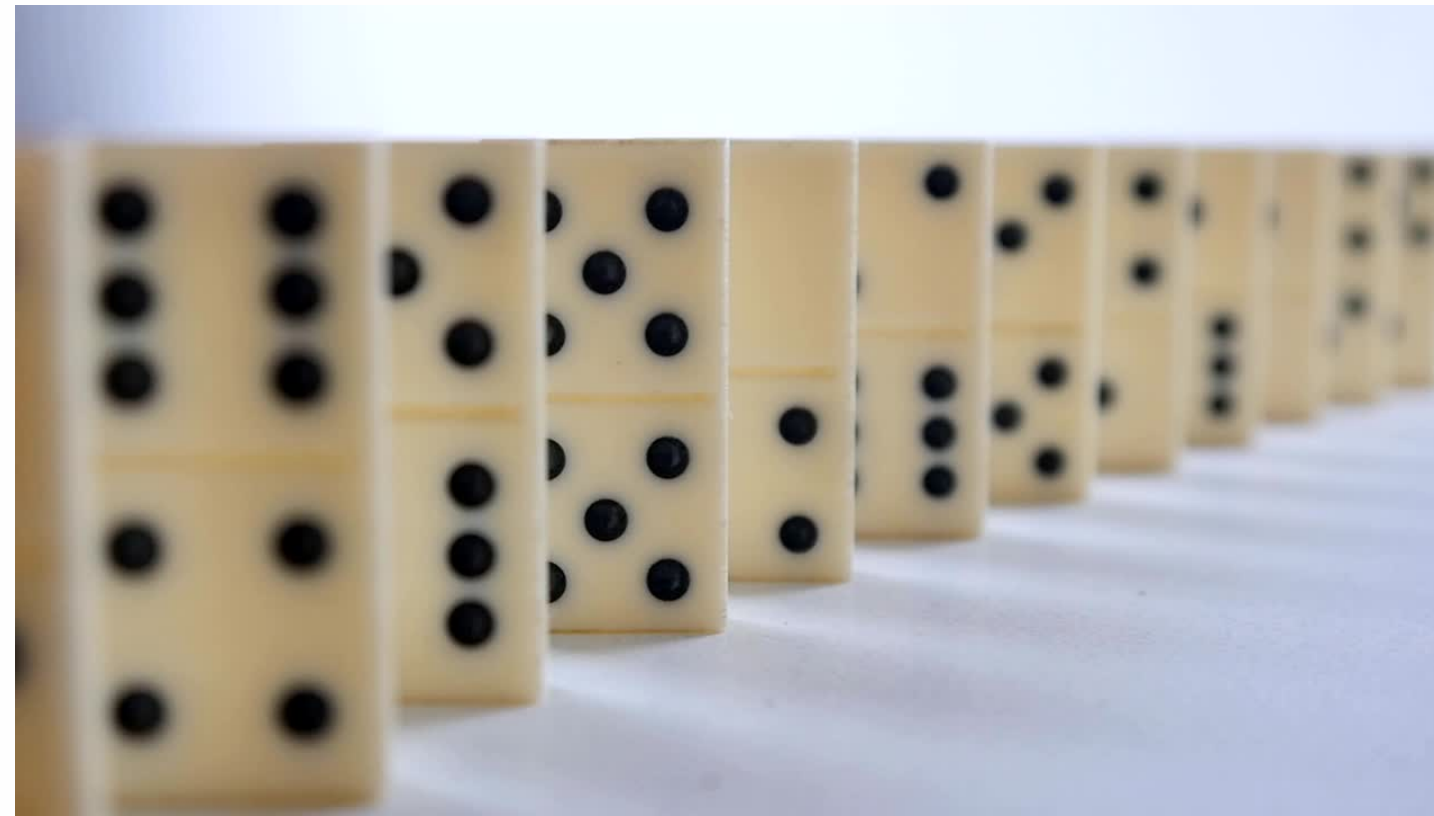
## TEACHER BACKGROUND:

### CONDUCT AN INVESTIGATION TO DEMONSTRATE THE EFFECTS OF FORCES ON THE MOVEMENT OF OBJECTS

Potential Misconceptions:

❌ Force transfers from one object to another object.

confusing force with  
energy



Force describes an  
**interaction** between 2  
objects

**AVOID BRINGING UP ENERGY 3-6 INVESTIGATE FORCES ONLY**

# TEACHER BACKGROUND: FORCE OF FRICTION

## CONDUCT AN INVESTIGATION TO DEMONSTRATE THE EFFECTS OF FORCES ON THE MOVEMENT OF OBJECTS

- An object that is moving will keep moving until a force acts on it.
  - To slow down or stop a moving object a force must act on it.
  - Friction is caused when small bumps on the surface of one object push against small bumps on the surface of another object.
  - Friction occurs whenever two objects rub, roll, slide, or glide across each other



Source: <https://explorify.uk/en/activities/zoom-in-zoom-out/all-ground-up>

# How to help with Misconceptions

It is not always possible to clear up the misunderstandings simply by presenting the “correct” information, however (Taylor & Kowalski, 2014).

- With Forces students need a lot of hands on investigations with various forces not first
- Predict-observe-explain - students make predictions of possible outcomes
- Awareness of the language we use
  - Ex: The ball is sitting on the table there is no force acting on it but when we kick the ball what force is acting on the ball?

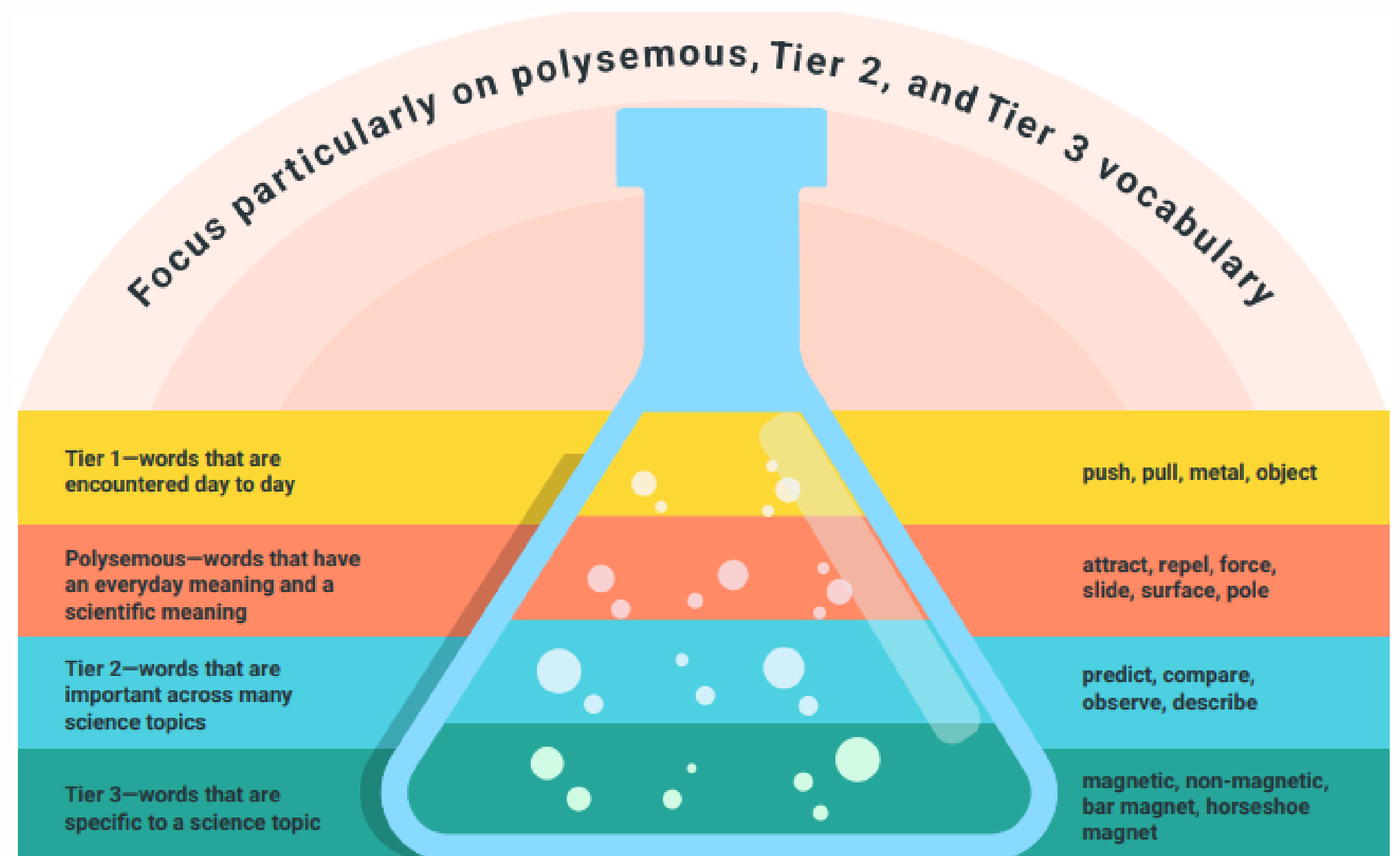
Instead say

“The ball is not moving, when we kick the ball what force is acting on the ball?”

# SCIENCE VOCABULARY

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

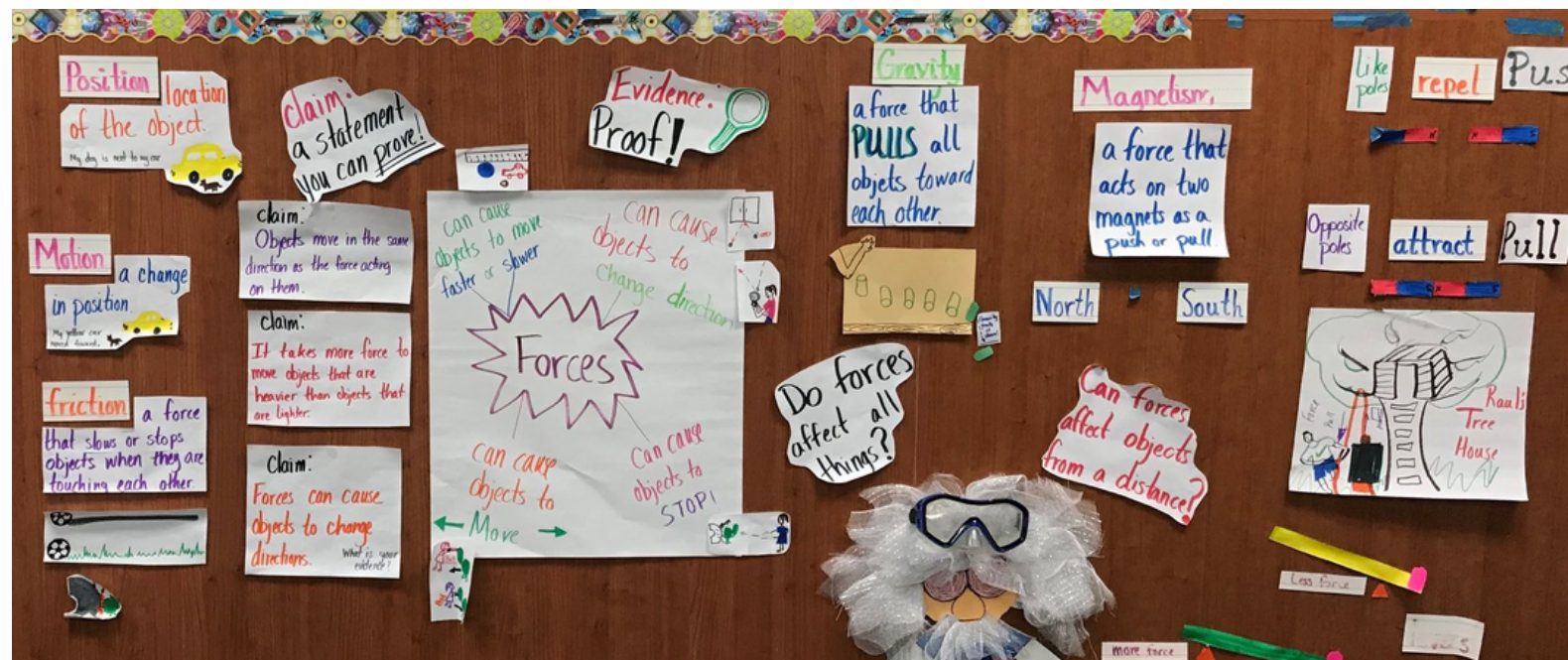
Word	Common meaning	Science Meaning
Object	goal or intention	Perceived by senses. Has mass and takes up space
Force	coercion, compulsion	push or pull
Test	An activity at school to find what students know	steps and procedures to find an answer















Source: Education Endowment Foundation

# SCIENCE VOCABULARY

## Science Word Walls



Source: CFISD Science Interactive Word Walls





FORCES AND MOVEMENT			
<b>Glossary</b>	Words we will need when describing forces and movement;	far, further, furthest	strong, stronger, strongest
<b>force</b> – a push, pull, twist or turn	 I can <b>push</b> this toy.	 	 
<b>direction</b> – the way something is moving	The magician can <b>pull</b> a rabbit out of a hat. 	<b>near, nearer, nearest</b>	<b>weak, weaker, weakest</b>
<b>distance</b> – a measure of how far something moves	In which <b>direction</b> is the <b>force</b> going?   	<b>slow, slower, slowest</b>  	<b>high, higher, highest</b> 

source: <https://www.stem.org.uk/elibrary/resource/34636>

# SCIENCE VOCABULARY

## Science Glossaries & Marzano's six steps of vocabulary instruction

1. Provide a description, explanation, or example. Include a visual representation
2. Ask students to think/pair/share to put in own words
3. Ask students to add a visual (quick sketch)

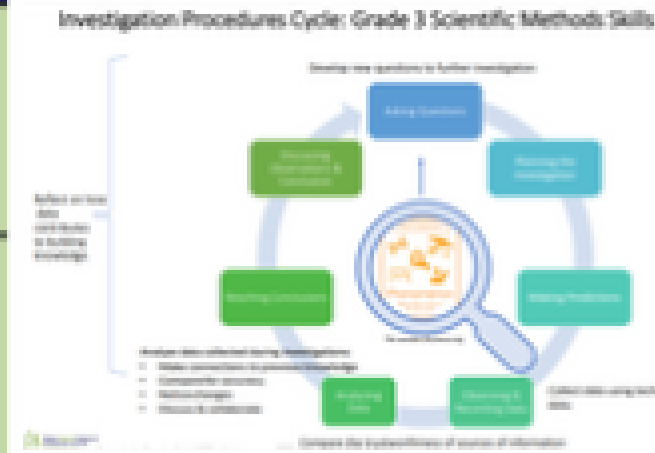
Word	Context Clue	Definition	Quick Draw	Connection
<b>loop-the-loop</b>	p. 15 One of her stunts was the loop-the-loop.	An airplane stunt		I have seen one in the air.
<b>manicurist</b>	p. 9 Bessie took a class to learn to become a manicurist.	A person who takes care of and polishes fingernails		my mom had a manicurist do her nails.
<b>mechanic</b>	p. 18 She and her mechanic william willis, took the plane up to pick out a spot for the parachute jump.	A person who fixes machines, especially cars, planes, and other moving vehicles		my dad had a mechanic fix his car.
<b>solo</b>	p. 12 Bessie was a good student, and in a few months she was ready to fly solo.	By one's self; alone		I have been solo before.

1. Develop learning progressions that have a logical sequence from the perspective of the student. Combine skills and knowledge statements **Note: Progressions are not lesson plans.**
2. Consider where scientific methods could be integrated in the progression

## 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 progression & align Scientific Methods
- Step 5** Determine Evidence of Success
- Step 6** Plan for Instruction

Forces can affect the properties and movement of objects Combine skills /procedures with knowledge statements	Scientific Methods Investigation procedure steps Skills/procedures from KUSPS
<p>1. Conduct investigations to demonstrate the effects of forces applied by a person or an object or another object on an object that is not moving or is moving at a constant velocity.</p> <ul style="list-style-type: none"> <li>Describe the strength (strong, weak, large or small) and direction (upward, downward, from the left, from the right) of forces applied to objects.</li> <li>Predict how an object will be affected (changing speed, starting, stopping and changing direction) by different strengths and directions of forces.</li> <li>Compare the strength of forces applied to objects.</li> </ul> <p>Explore: Playground equipment, Moving Book Explain: Push and pull video, Force video</p>	<p><b>Steps:</b> Asking questions, making predictions, planning the investigation, observing and recording data, analyzing data, reaching conclusions, discussing observations and conclusions.</p> <p><b>Skills:</b> Collect data using techniques to improve the accuracy of data, Analyze data collected during investigations, Develop questions to further investigation.</p>
<p>2. Conduct an investigation to demonstrate the effects of the contact force caused by objects, surfaces or substances sliding against each other (friction) affects movement or stops the object.</p> <ul style="list-style-type: none"> <li>Describe the strength (strong, weak, large or small) and direction (upward, downward, from the left, from the right) of forces applied to objects.</li> <li>Compare the strength of forces applied to objects.</li> <li>Predict how an object will be affected (changing speed, starting, stopping and changing direction) by different strengths and directions of forces.</li> </ul> <p>Explore: Different surfaces Explain: Give it a Push/Give it a Pull Book &amp; Friction video</p>	<p><b>Steps:</b> Asking questions, making predictions, planning the investigation, observing and recording data, analyzing data, reaching conclusions, discussing observations and conclusions.</p> <p><b>Skills:</b> Collect data using techniques to improve the accuracy of data, Analyze data collected during investigations, Develop questions to further investigation.</p>
<p>3. Conduct investigations to demonstrate the effects of contact forces applied by pulling on a string or rope connected to an object, on the movement of objects.</p> <ul style="list-style-type: none"> <li>Describe the strength (strong, weak, large or small) and direction (upward, downward, from the left, from the right) of forces applied to objects.</li> <li>Compare the strength of forces applied to objects.</li> <li>Predict how an object will be affected (changing speed, starting, stopping and changing direction) by different strengths and directions of force.</li> </ul> <p>Explore: Tug of War, bridge Explain:</p>	<p><b>Steps:</b> Asking questions, making predictions, planning the investigation, observing and recording data, analyzing data, reaching conclusions, discussing observations and conclusions.</p> <p><b>Skills:</b> Collect data using techniques to improve the accuracy of data, Analyze data collected during investigations, Develop questions to further investigation.</p>
<p>4. Conduct investigations to demonstrate how contact force, applied by compression (stretching) or stretched or spring, can change the properties (shape and size) of objects</p> <p>Explore: Compress &amp; Stretch Explain: Give it a Push, Give it a Pull Book, Stretch &amp; Tensile video</p>	<p><b>Steps:</b> Asking questions, making predictions, planning the investigation, observing and recording data, analyzing data, reaching conclusions, discussing observations and conclusions.</p> <p><b>Skills:</b> Collect data using techniques to improve the accuracy of data, Analyze data collected during investigations, Develop questions to further investigation.</p>



Linked Resource

See sample plan for example

### 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?
- Where do students have an opportunities to practice the steps in the investigation cycle and demonstrate the skills from the scientific methods in the learning progressions?
- When will students be conducting an investigation?



## Sample Unit Plan

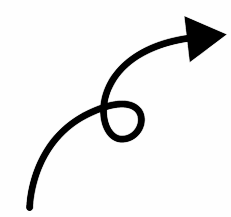


**Purpose:** The purpose of this document is to provide a sample of how to intentionally plan a unit to integrate the scientific methods by using the KUSPS to create a progression or sequence for the learning journey for the student. A sample summative assessment task and formative assessment checklist is also provided. If the educator chooses to continue using this sample, resources are linked in the progressions and sample lessons are provided to start the unit and help students conduct an investigation are also included. The educator can continue to plan subsequent lessons using the sequence outlined and linked resources.

# 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

<p><b>Knowledge:</b> A force is a push or pull on an object resulting from an interaction with another object.</p> <p><b>Knowledge:</b> An object that is not moving will stay still until a force makes it move, and an object that is moving will keep moving until a force stops it. (Newton's First Law)</p> <p>Contact forces occur between objects that touch each other.</p> <p>Contact forces include forces that are</p> <ul style="list-style-type: none"> <li>applied by a person or an object on another object (applied)</li> <li>caused by objects, surfaces, or substances sliding against each other (friction)</li> <li>applied by pulling on a string or rope connected to an object (tension)</li> <li>caused by a compressed or stretched object or spring (elastic or spring)</li> </ul> <p>Ways to apply a contact force to an object include</p> <ul style="list-style-type: none"> <li>stretching</li> <li>pulling</li> <li>squeezing</li> <li>pushing</li> </ul> <p>The direction of forces applied to objects can be described as</p> <ul style="list-style-type: none"> <li>upward</li> <li>downward</li> <li>from the left</li> <li>from the right</li> <li>from both sides</li> <li>from all directions</li> </ul> <p>The strength of forces applied to objects can be described as</p> <ul style="list-style-type: none"> <li>strong</li> <li>weak</li> <li>large</li> <li>small</li> </ul> <p>Changes to an object's movement when a force is applied include</p> <ul style="list-style-type: none"> <li>changing speed</li> <li>starting</li> <li>stopping</li> <li>changing direction</li> </ul>	<p><b>Skills:</b> Describe where forces may exist in everyday situations.</p> <p><b>Skill:</b> Conduct investigations to demonstrate the effects of forces on the movement of objects.</p> <p><b>Skill:</b> Predict how an object will be affected by different strengths and directions of force.</p> <p><b>Skill:</b> Describe the strength and direction of forces applied to objects.</p> <p><b>Skill:</b> Compare the strength of forces applied to objects.</p> <p><b>Skill:</b> Conduct investigations to demonstrate how forces can change the shape or size of objects. (Not included in sample plan)</p> <p><b>Skills:</b> Conduct investigations to demonstrate the effects of forces on the movement of objects.</p>
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1. Conduct investigations to demonstrate the effects of forces (push or pull) on an object that is not moving will stay still until a contact force makes it move,
  - applied by a person or an object on another object
    - Describe the strength( strong, weak, large or small) and direction(upward, downward, from the left, from the right) of forces applied to objects.
    - Predict how an object will be affected (changing speed, starting, stopping and changing direction) by different strengths and directions of force.
    - Compare the strength of forces applied to objects

2. Conduct an investigation to demonstrate the effects of the contact force caused by objects, surfaces or substances sliding against each other (friction) affects movement or stops the object
  - Describe the strength( strong, weak, large or small) and direction(upward, downward, from the left, from the right) of forces applied to objects.
  - Compare the strength of forces applied to objects.
  - Predict how an object will be affected (changing speed, starting, stopping and changing direction) by different strengths and directions of force.

3. Conduct investigations to demonstrate the effects of contact forces applied by pulling on a string or rope connected to an object, on the movement of objects.
  - Describe the strength( strong, weak, large or small) and direction(upward, downward, from the left, from the right) of forces applied to objects.
  - Compare the strength of forces applied to objects.
  - Predict how an object will be affected (changing speed, starting, stopping and changing direction) by different strengths and directions of force.

4. Conduct investigations to demonstrate how contact force, applied by compression(stretching) or stretched or spring, can change the properties
  - shape or size of objects.

**Forces can affect the properties and movement of objects  
Combine skills /procedures with knowledge statements**

**Scientific Methods  
Investigation procedure steps  
Skills/procedures from KUSPS**

**1. Conduct investigations to demonstrate the effects of forces, applied by a person or an object on another object on an object that is not moving will stay still until a contact force makes it move,**

- Describe the strength( strong, weak, large or small) and direction(upward, downward, from the left, from the right) of forces applied to objects.
- Predict how an object will be affected (changing speed, starting, stopping and changing direction) by different strengths and directions of force.
- Compare the strength of forces applied to object

**Explore:** Playground Movement, Moving Block

**Explain:** Push and pull video, Force Video

**Steps:** Asking questions, making predictions, planning the investigation, observing and recording data, analyzing data, reaching conclusions, discussing observations and conclusions.

**Skills:** Collect data using techniques to improve the accuracy of data, Analyze data collected during investigations, Develop questions to further investigation.

**2. Conduct an investigation to demonstrate the effects of the contact force caused by objects, surfaces or substances sliding against each other (friction) affects movement or stops the object**

- Describe the strength( strong, weak, large or small) and direction(upward, downward, from the left, from the right) of forces applied to objects.
- Compare the strength of forces applied to objects.
- Predict how an object will be affected (changing speed, starting, stopping and changing direction) by different strengths and directions of force.

**Explore:** Different surfaces

**Explain:** Give it a Push Give it a Pull book & Friction video

**Steps:** Asking questions, making predictions, planning the investigation, observing and recording data, analyzing data, reaching conclusions, discussing observations and conclusions.

**Skills:** Collect data using techniques to improve the accuracy of data, Analyze data collected during investigations, Develop questions to further investigation.

**3. Conduct investigations to demonstrate the effects of contact forces applied by pulling on a string or rope connected to an object, on the movement of objects.**

- Describe the strength( strong, weak, large or small) and direction(upward, downward, from the left, from the right) of forces applied to objects.
- Compare the strength of forces applied to objects.
- Predict how an object will be affected (changing speed, starting, stopping and changing direction) by different strengths and directions of force.

**Explore:** Tug of War, bridge

**Explain:**

**Steps:** Asking questions, making predictions, planning the investigation, observing and recording data, analyzing data, reaching conclusions, discussing observations and conclusions.

**Skills:** Collect data using techniques to improve the accuracy of data, Analyze data collected during investigations, Develop questions to further investigation.

**4. Conduct investigations to demonstrate how contact force, applied by compression(stretching) or stretched or spring, can change the properties (shape and size) of objects**

**Explore:** Compress & Stretch

**Explain:** Give it a Push, Give it a Pull Book, Stretch & Tensile video

**Steps:** Asking questions, making predictions, planning the investigation, observing and recording data, analyzing data, reaching conclusions, discussing observations and conclusions.

**Skills:** Collect data using techniques to improve the accuracy of data, Analyze data collected during investigations, Develop questions to further investigation.

## 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.

### Start with Curriculum First



Grow	Met Criteria	Grow
	<p><b>Scientific Methods</b> Learning Outcome: Students relate investigation to knowledge building Computer Science Learning Outcome: Students investigate creativity and its relationship to computational thinking</p> <p><b>Organizing Idea: Energy</b> Learning Outcome: Students investigate and explain how forces affect the movement and properties of objects Understanding: Forces can affect the properties and movement of objects in different ways</p>	
Student Name:		Date:
	<p><b>Skill: Predict how an object will be affected by different strengths and directions of force.</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Uses data from previous investigations to support prediction when anticipating how the strength of a kick down a ramp will change the speed of the ball</li> <li><input type="checkbox"/> Uses data from previous investigations to support prediction when anticipating how the ball will change direction</li> <li><input type="checkbox"/> Uses data from previous investigations to support prediction when anticipating how the ball will be slowed or sped up on different surfaces</li> </ul> <p>Ex: I predict if we kick the ball from the left towards the wall it will move around the corner and into the goal because when we played wall ball and I kicked it from the left.</p>	
	<p><b>Skill: Describe the strength and direction of forces applied to objects.</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Uses words or arrows to describe the strength of force applied to the ball (strong, weak, large or small)</li> <li><input type="checkbox"/> Uses words (upward, downward, from the left, from the right, from both sides) when describing the direction of the force applied to the ball.</li> </ul>	
	<p><b>Skill: Compare the strength of forces applied to objects</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Uses words such as stronger, weaker, larger or smaller to compare the strength of forces applied to the ball in the different trials</li> </ul>	
	<p><b>DM Skill: Collect data using techniques to improve the accuracy of data by choosing an appropriate tool to correctly record the data</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Selects a ruler to assist with drawing lines and arrows to show movement of ball after force was applied</li> </ul>	
	<ul style="list-style-type: none"> <li><input type="checkbox"/> Correctly labels the forces applied (push/pull) the strength and direction of those applied forces using correct words and/or arrows.</li> </ul>	
	<p><b>DM Skill: Create a set of instructions that could be that could be followed by a human or machine to complete a task</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Correctly sequences the steps, in writing, for others to apply similar force</li> <li><input type="checkbox"/> Provides recorded diagram of the successful s</li> </ul>	

#### Guiding Questions:

- How will students (insert verb from LO) their understanding of (insert understanding statement from KUSPs)? ( Ex: How will students investigate how force affects the movement of an object?)

#### Scientific Methods

- How can I use the Understanding statements to develop summative assessment that assess what students know, understand? EX: How will students support or contradict existing knowledge through an investigation?



# Performance Task: Soccer Showdown

How can we use force direct a ball to move around opposing players to score a goal?

## Criteria:

1. Use force to get a motionless ball to start moving and direct the applied force so the ball moves around the opposing players to score a goal.
2. Students collaboratively plan, test, adjust their plan, and retest for scoring, leading to the selection of the best plan or solution
3. Independently students will be assessed on their diagrams and explanations of their final solutions using a single point rubric



# Performance Task: Soccer Showdown

How can we use force direct a ball to move around opposing players to score a goal?

## Criteria:

1. Students collaboratively plan, test, adjust their plan, and retest for scoring, leading to the selection of the best plan or solution

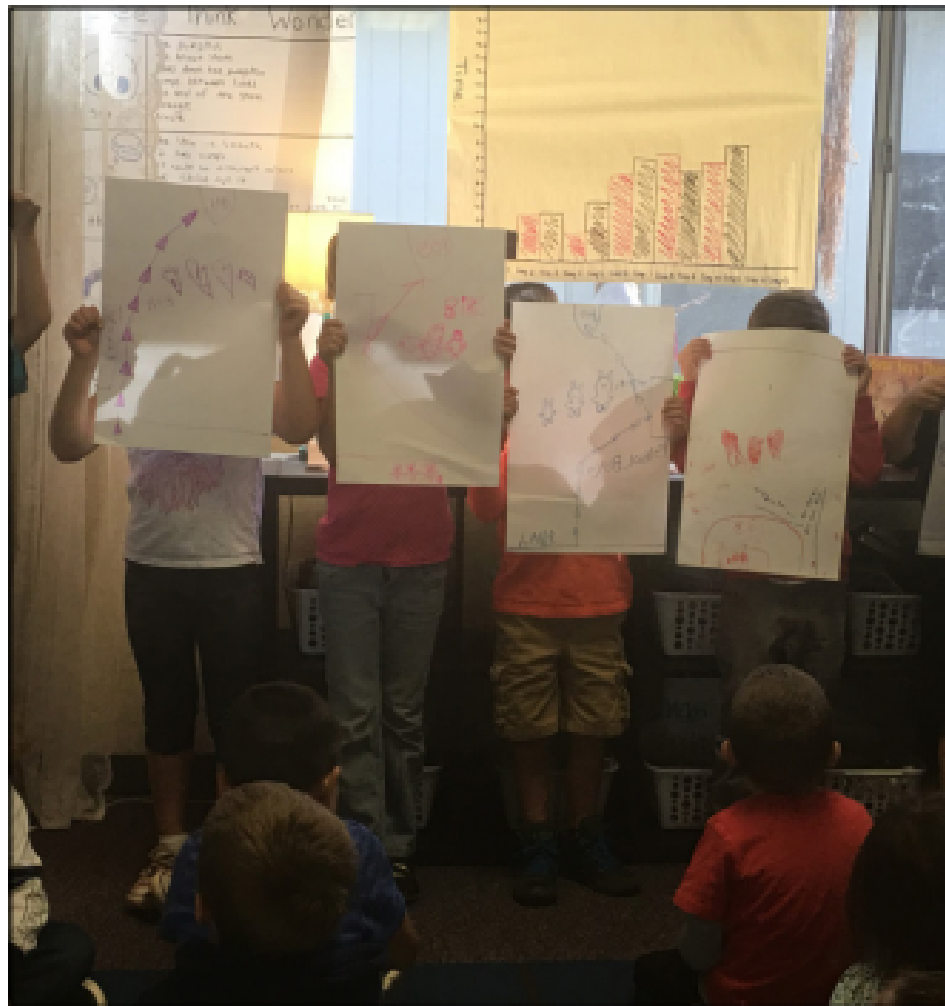


Image via Vista Unified School District  
[Used with Permission]



Image via Emerson/Bandini Elementary,  
San Diego Unified School District  
[Used with Permission]



Image via Lakeside USD  
[Used with Permission]

# Performance Task: Soccer Showdown

How can we use force direct a ball to move around opposing players to score a goal?

## Assessment:

1. Independently students draw a diagram and use words and arrows to describe the strength and direction of the applied forces.

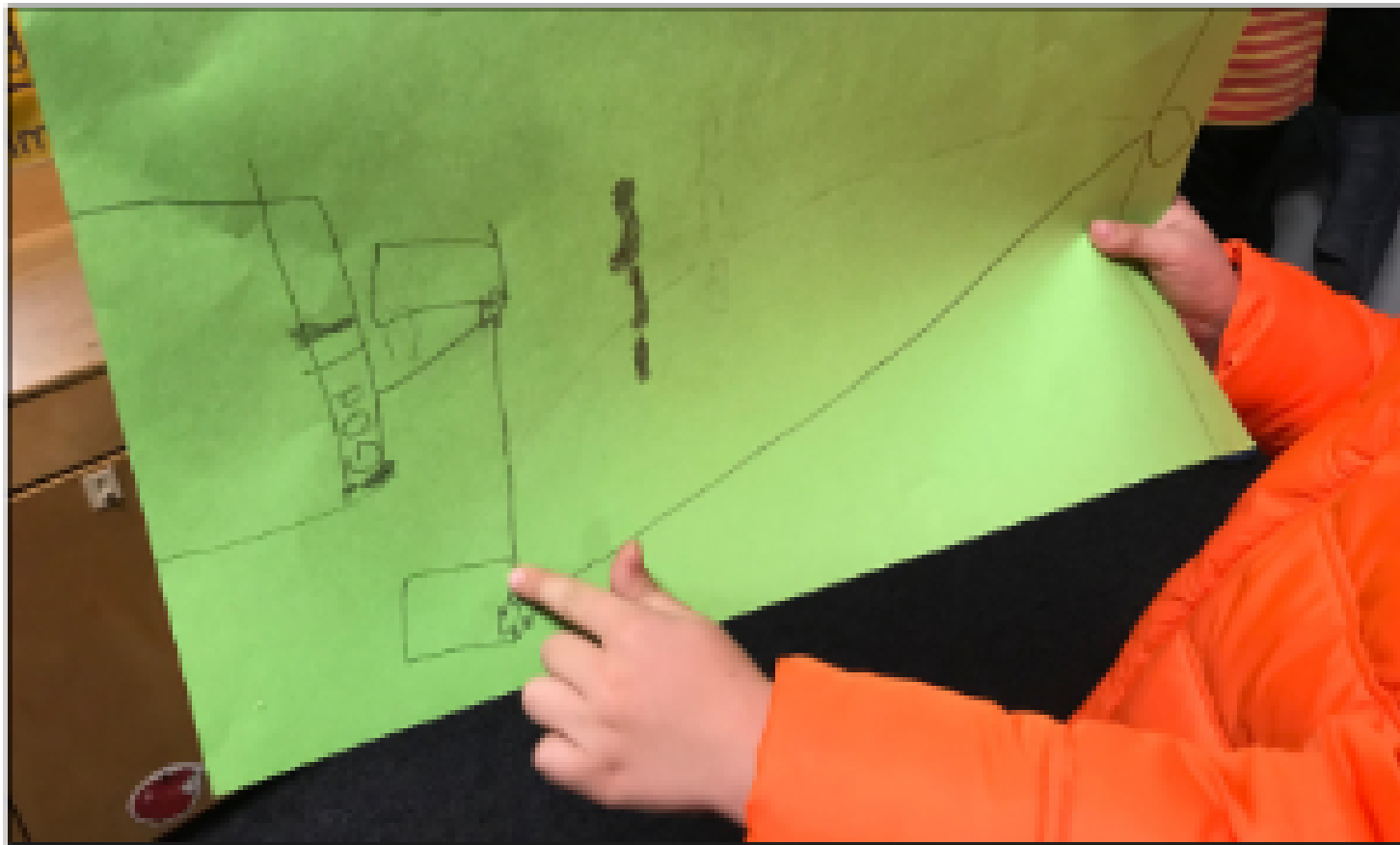


Image via Lakeside USD [Used with Permission]

## Collect data using techniques to improve the accuracy of data.

- Use words and arrows to describe the strength and direction of forces applied to ball
- Show the movement path the ball took (change in direction)

<u>Scientific Methods</u> Learning Outcome: Students relate investigation to knowledge building <u>Computer Science:</u> Learning Outcome: Students investigate creativity and its relationship to computational thinking	<u>Organizing Idea: Energy</u> Learning Outcome: Students investigate and <b>explain how forces affect the movement</b> and properties of objects Understanding: Forces can affect the properties and <b>movement of objects in different ways</b>
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Student Name:	Date:
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Grow	Met Criteria	Glow
	<b>Skill: Predict how an object will be affected by different strengths and directions of force.</b> <input type="checkbox"/> Uses data from previous investigations to support prediction when anticipating how the strength of a kick down a ramp will change the speed of the ball <input type="checkbox"/> Uses data from previous investigations to support prediction when anticipating how the ball will change direction <input type="checkbox"/> Uses data from previous investigations to support prediction when anticipating how the ball will be slowed or sped up on different surfaces Ex: I predict if we kick the ball from the left towards the wall it will move around the bears and into the goal <b>because</b> when we played wall ball and I kicked it from the left	
	<b>Skill: Describe the strength and direction of forces applied to objects.</b> <input type="checkbox"/> Uses words or arrows to describe the strength of force <b>applied to the ball</b> (strong, weak, large or small) <input type="checkbox"/> Uses words (upward, downward, from the left, from the right, from both sides) when describing the direction of the force <b>applied to the ball</b> .	
	<b>Skill: Compare the strength of forces applied to objects</b> <input type="checkbox"/> Uses words such as stronger, weaker, larger or weaker to compare the strength of forces applied to the ball in the different trials	
	<b>SM Skill: Collect data using techniques to improve the accuracy of data by choosing an appropriate tool to correctly record the data</b> <input type="checkbox"/> Selects a ruler to assist with drawing lines and arrows to show movement of ball after force was applied	

	<input type="checkbox"/> Correctly labels the forces applied (push/pull) the strength and direction of those applied forces using correct words and/or arrows.	
	<b>CM Skill: Create a set of instructions that could be that could be followed by a human or machine to complete a task</b> <input type="checkbox"/> Correctly sequences the steps, in writing, for others to apply similar force <input type="checkbox"/> Provides recorded diagram of the successful s	



**Understanding:** Behaviours of light affect its path.

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 **Develop Learning Sequence & Align Scientific Methods**
- Step 5 **Determine Evidence of Success**
- Step 6 **Plan for Instruction**

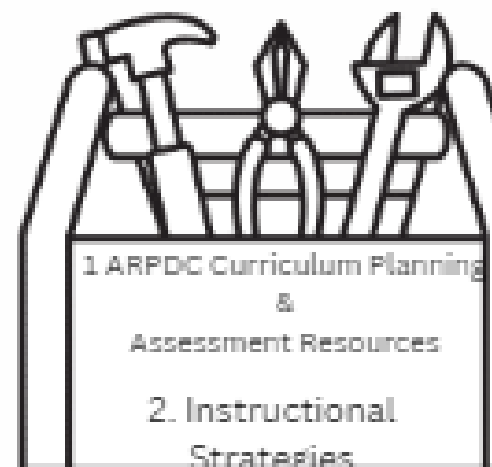
1. Plan for instruction that is cohesive from the students' perspective.
2. Be strategic in sequencing lessons that builds on prior knowledge and learning, as well as having the potential to extend student thinking.

	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 (Pre-assessment)?
- How can I minimize potential misconceptions with the science ideas?
- How can students use “explore before explain” to integrate the science methods?
- Where can I integrate cross curricular connections for students? For example KUSPs from ELAL (Ex: talking, 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?



Scientific Methods


Integrating

1. Bridge/Review Lesson - Movement
2. How do objects start moving?

## Sample Lesson Plans



# Lesson plan template

<b>Lesson 1 Focus/Question:</b> How do we know if something moves?		<b>Estimated Time:</b>
 <b>Formative Assessment: "Assessment Look Fors"</b> What do I want to <u>see or hear</u> that shows me they have met the skills/procedures?		
Energy combined skills and knowledge: Review/ bridge lesson on movement		
<b>Assessment "Look Fors":</b> Can the students..		
Day 1:		
<input type="checkbox"/> Define movement as both a change in location and position? <input type="checkbox"/> Describe where movement		
Day 2:		
<b>Science Methods Assessment Steps: Observations</b>		
<b>Assessment "Look Fors":</b> Can the students		
<input type="checkbox"/> Sense of sight to describe movement or motion of objects		
<b>What will they do? Why Are they doing this? &amp; How will they do it?</b> <b>Where can ELAL be integrated (vocabulary, oral language, comprehension)?</b> <i>Teachers modify &amp; adapt to own context</i> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Activate Prior Learning (engage and/or review previous learning)</li> <li><input type="checkbox"/> Think/pair/share</li> <li><input type="checkbox"/> <a href="#">Thinking routines</a></li> <li><input type="checkbox"/> Model (draw/write to show thinking)</li> </ul>	<b>How will all learners be reached?</b> <i>Teachers modify &amp; adapt to own context</i> <ul style="list-style-type: none"> <li><input type="checkbox"/> Sentence Stems</li> <li><input type="checkbox"/> Vocabulary Terms</li> <li><input type="checkbox"/> Anchor charts/Visuals</li> <li><input type="checkbox"/> Scribe for Children</li> <li><input type="checkbox"/> Provide word/picture cards</li> </ul>	<b>Resources &amp; Materials Required</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Videos</li> <li><input checked="" type="checkbox"/> Images</li> <li><input type="checkbox"/> Books</li> <li><input type="checkbox"/> Anchor Charts</li> <li><input type="checkbox"/> Graphic Organizers</li> <li><input type="checkbox"/> Student Journals</li> <li><input type="checkbox"/> Materials to investigate</li> </ul>
<b>What:</b> Review/bridge lesson - Through observations, and reading students will define the term "movement" and identify movement of everyday objects  <b>Why:</b> Movement is introduced in Kindergarten (change of location and position) for energy and is an important concept for students to have a solid foundation in the Energy organizing idea. This lesson provides a review or bridge to start with.  Note: movement (noun) is the "act of" changing position or location. Physical act of changing position or location. <i>Motion (noun) refers to a change in position or location.</i>	<b>Vocabulary:</b> <b>Everyday Tier 1 words</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Move - to change positions or location</li> <li><input type="checkbox"/> Location - spot or place</li> <li><input type="checkbox"/> Motion - anything that is in the act of changing position or location (movement) is in motion</li> </ul> <b>Across science OI's Tier 2 words:</b>	



**It really isn't about you explaining to your students what the science idea is. It's about you creating a learning environment in which they can construct the explanation.**

—Carla Zembal-Saul, professor of science education, Penn State University<sup>13</sup>

# Bridge/Review Lesson: What is Movement

**Lesson 1 Focus/Question:** How do we know if something moves?

**Estimated Time:**



## Formative Assessment: "Assessment Look Fors"

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

Energy combined skills and knowledge: Review/ bridge lesson on movement

Assessment "Look Fors": Can the students..

Day 1:

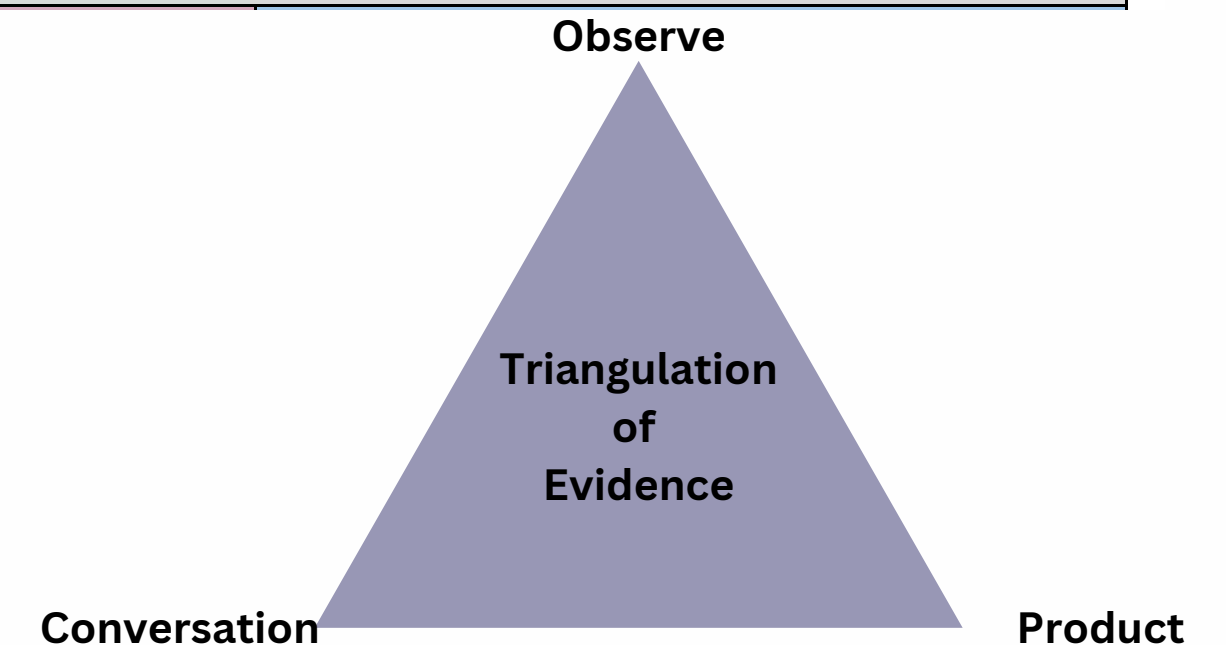
- Define movement as both a change in location and position?
- Describe where movement

Day 2:

**Science Methods Assessment Steps: Observations**

Assessment "Look Fors": Can the students

- Sense of sight to describe movement or motion of objects



# Day 1Explore

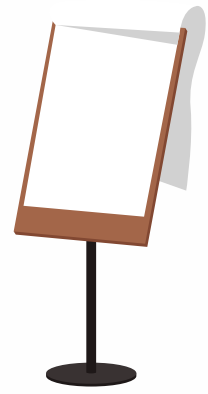
## Movement & Location

### Concept Attainment



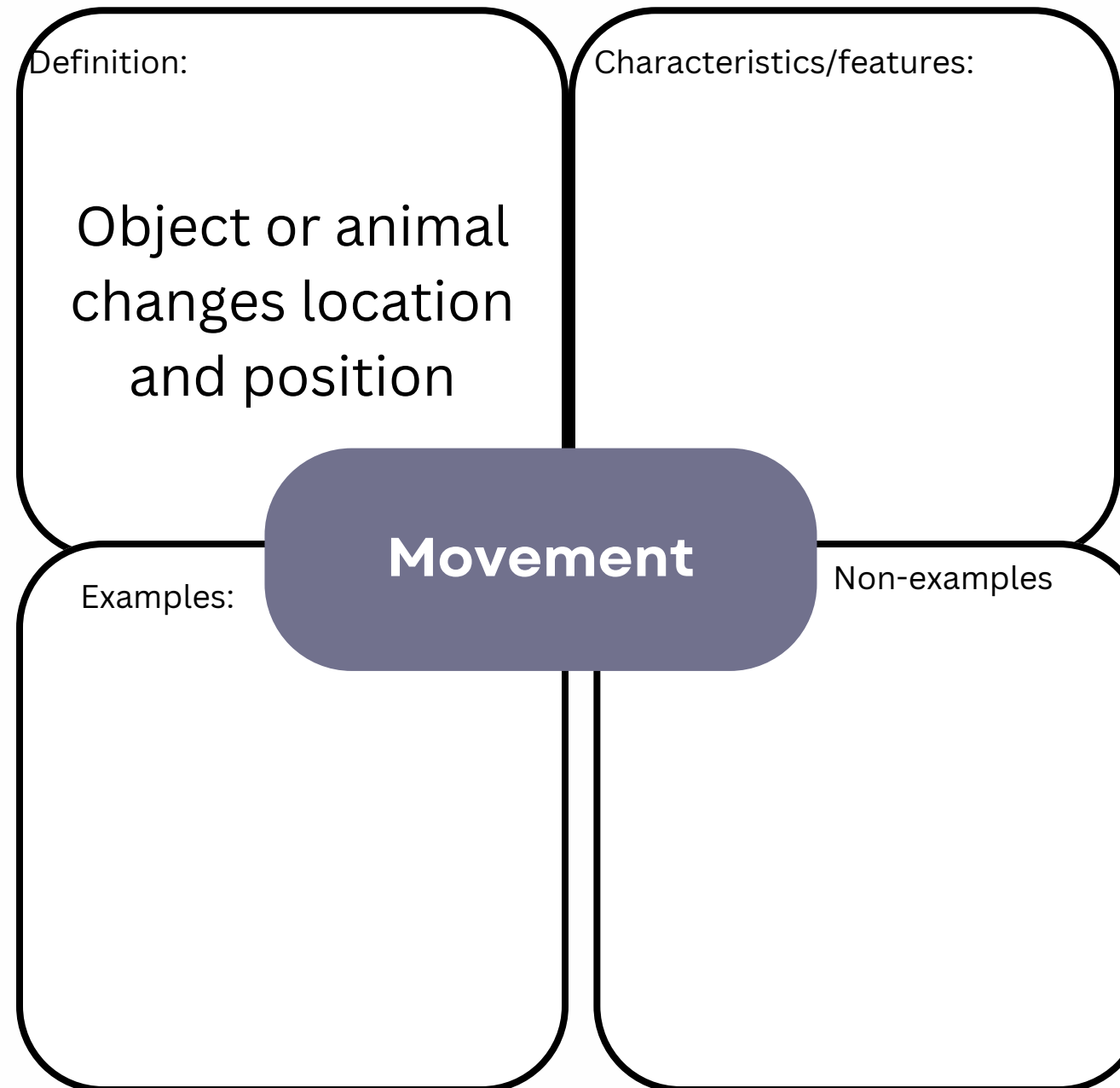
This work is licensed under a [Creative Commons  
Attribution-NonCommercial-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).



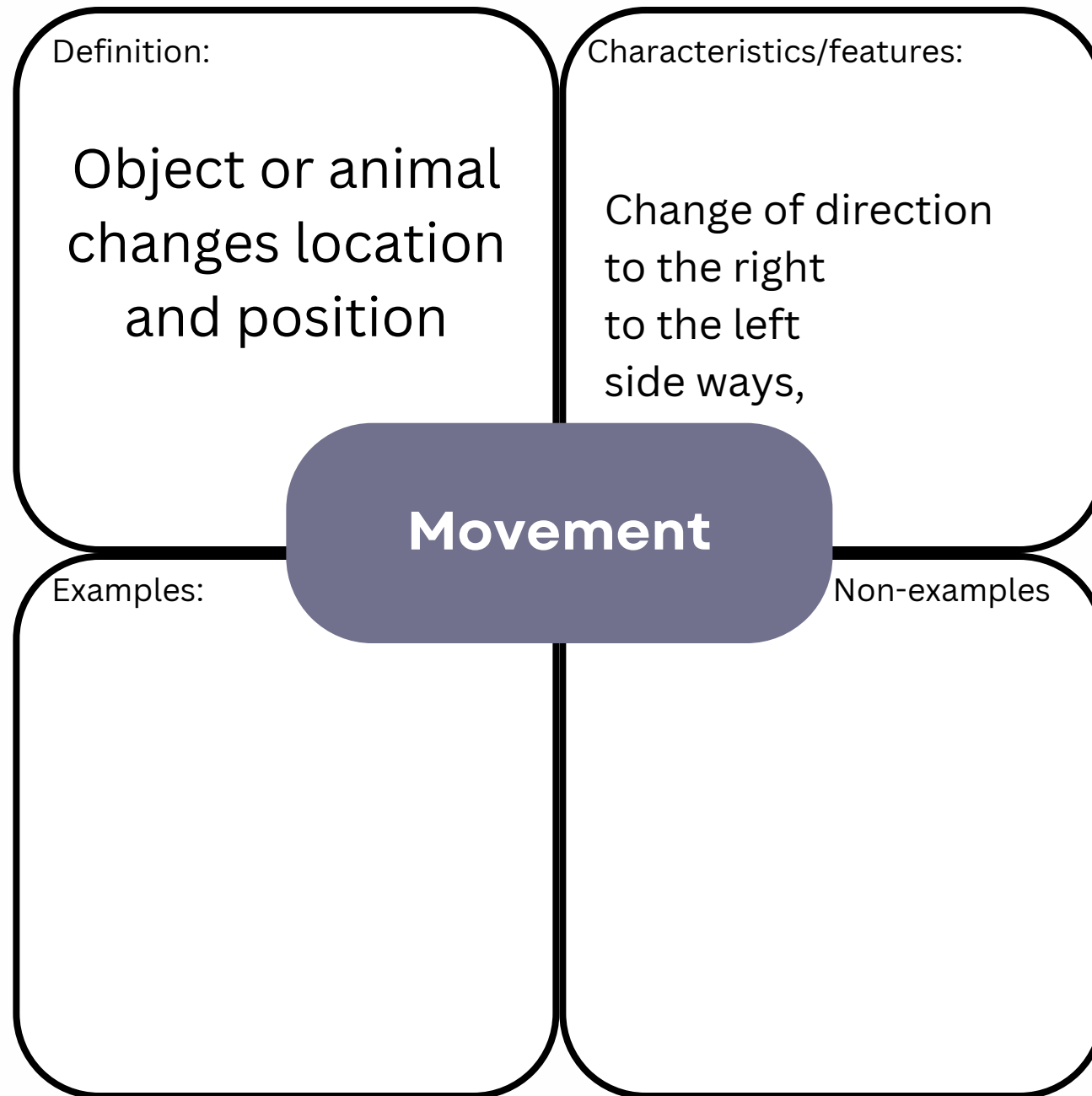


Whole class anchor chart

# Frayer Model



# Frayer Model



## Explain



Describe Movement p.7-13

# Frayer Model

Definition:

Object or animal changes location and position

Characteristics/features:  
Speed - fast, slow

Change of direction  
to the right  
to the left  
side ways,

**Movement**

Examples:



Non-examples





## Day 2 Explore: Predict

I predict I will see the swings move back and forth because...

# Day 2 Explore: Observe



Movement On The Playground

Object: Name:	Before Moving: Quick sketch	Moving: direction speed	What started the movement? (caused)

# Explain:

## Cause of Movement on playground

- Johnny pushed the swing
- Tina kicked the ball

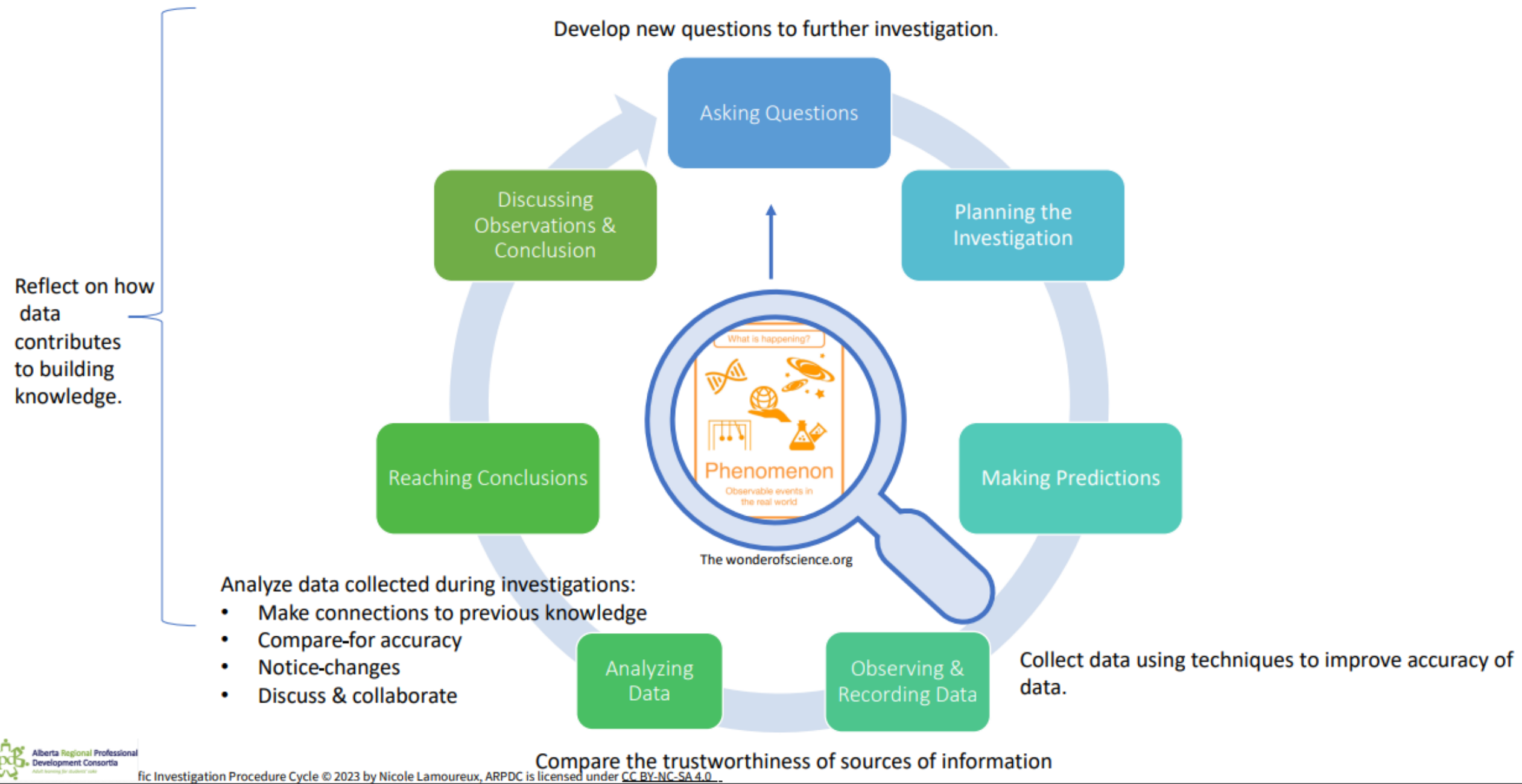
- Sally caught the ball

# I wonder questions...



# Launch into Investigation: Lesson 1

## Investigation Procedures Cycle: Grade 3 Scientific Methods Skills & Procedures



# Learning Summary Tables

## Synthesize Learning

Activity	Observed	Learned	Help us answer Driving Question	Vocabulary
Model Landfill Systems	Food materials changed but paper + plastic stayed the same	Things people make plastic and paper don't decompose early	Some materials decompose faster because of microbes and some people made materials that don't decompose	Open and closed systems Materials Properties Weight Matter
Crushed Material	Weight stayed the same. Properties stayed the same	Materials stay the same when crushed	The materials are still in the landfill. They just change shape	Properties Amount
Food Materials in Model Landfill Bottles	<ul style="list-style-type: none"> <li>Turning Brown</li> <li>Green with white edged blobs that are growing</li> <li>Yellow oozy liquid</li> <li>streaking and curdling</li> </ul>	Decomposers call microbes break down the food and put nutrients in soil	The food material in our garbage bins breaks down through decomposition and sends nutrients to soil	Decomposer Microbes

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

## Scientific Method Step: Reaching Conclusions

Last lesson you observed  
the objects on the playground  
that were not moving and how  
they were moving.

Johnny was wondering what makes  
things move or change direction?

Let's think about that. What could get this ball moving?



## Day 1 Launch

# Present Phenomenon (observable event)



## Movement In Soccer

Think about the motion of the ball.

1. What caused the ball to start moving?
  2. How was the player able to move the ball around the other team to score a goal?
- Sketch what you observed.



1. What caused the ball to start moving?

---

---

2. How was the player able to move the ball around the other team to score a goal?

---

---

**Scientific Method Step:** Making Observations, develop questions

# Day 2

what will make the chair  
or grocery cart start  
moving?  
Will it start moving on  
its own?



- Start investigation
- Just in time vocabulary of push and pull
- NOT introduce force yet



# Day 2

what will make the chair  
or grocery cart start  
moving?  
Will it start moving on  
its own?

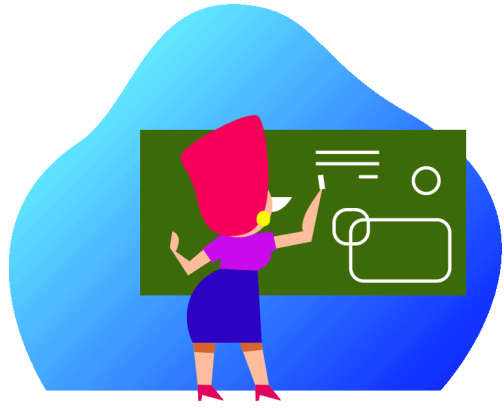


The wheels move it

I could move it  
back wards



# Day 2



Push - moving something away



Pull - bring something close



## Student glossary

**Explain:**

Cause of Movement on playground

- Johnny pushed the swing
- Tina kicked the ball

- Sally caught the ball

2)

4)

5)

# Making Objects Move

- Directions:
1. With your partner use objects in your bag to make a block move.
  2. In each box record the object

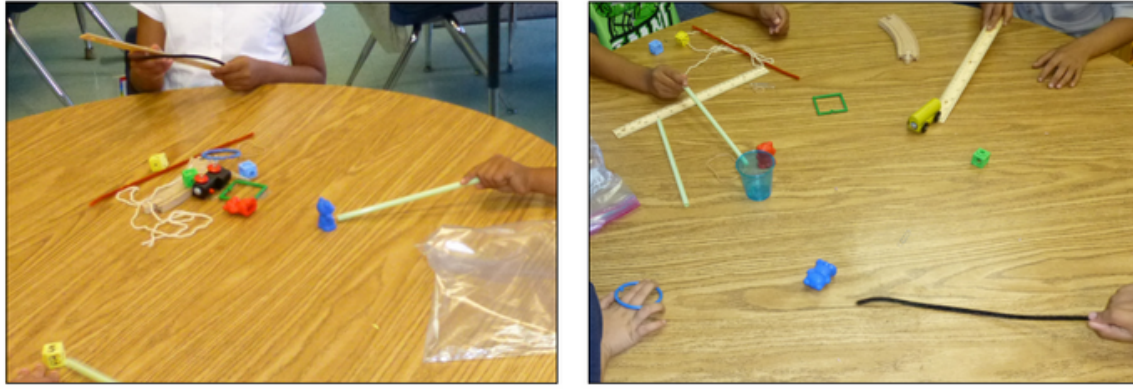
We used  We observed:   What action caused the motion?	We used  We observed:   What action caused the motion?
We used  We observed:   What action caused the motion?	We used  We observed:   What action caused the motion?



## Predict before moving Observe and record starting movement of objects

- Encourage accuracy of recording of data by labeling

Image via Vista Unified School District [Used with Permission]  
An Example of an Exploration Box



Images via Emerson/Bandini Elementary, San Diego Unified School District [Used with Permission]



**Scientific Methods Skills:** Collect data using techniques to improve the accuracy of data.



Think/pair/share

## Step: Reaching conclusions

From students will jump to conclusions.

Driving Question: How do players get the ball moving and change direction and speed of the ball?				
How do players get the ball moving? And change the direction of the ball?	Record student observations			
Question Activity (Small investigation)	Observation What did we observe? <i>Get a sampling from students but push them to describe</i>	Conclusion What did we learn from our data? reading <sup>4)</sup>	How does knowing this help us with how to start moving, change direction and speed of a soccer ball?	Questions I wonder.. Record as students ask or can be put on a sticky
Day 1: investigate Bucket of Objects	I pushed the ball with my hand and it rolled away from me  The string pulled the block towards me	Objects need people or other objects to push or pull to start a movement. Objects do not move on their own  <sup>5)</sup>	To start moving the ball it needs to be kicked (push)	

2)

### Skills/procedures:

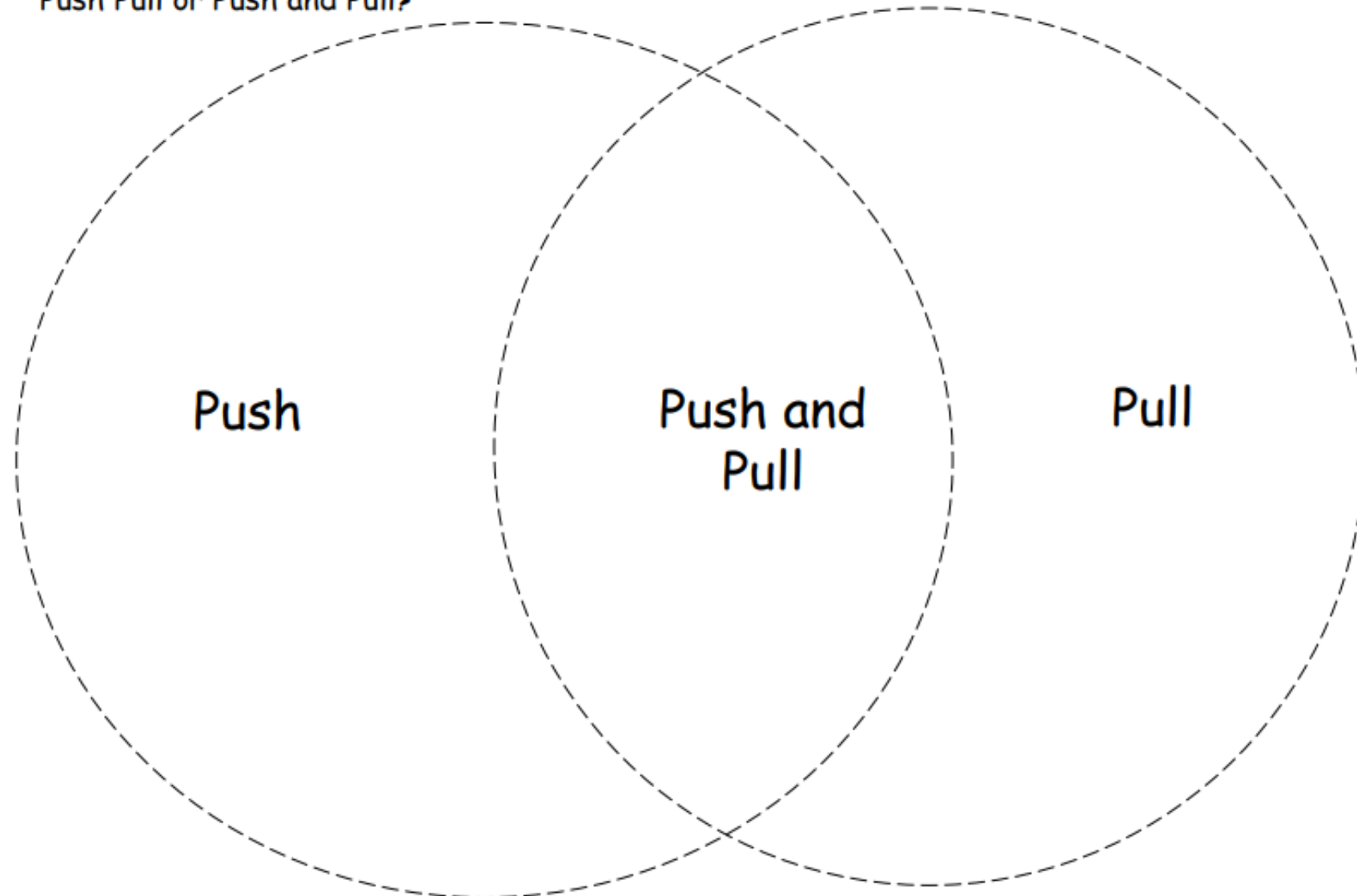
Analyze data collected during investigations. Data can be analyzed by

- making connections to previous knowledge, comparing for accuracy, asking questions, noticing changes, discussing, collaborating

Develop new questions for further investigations

# Do students need more practice correctly identifying push and pull?

Push Pull or Push and Pull?



<http://www.collaborativelearning.org/pushorpull.pdf>

<u>throw</u> a ball to your friend	<u>click</u> the mouse on the computer
<u>scrunch</u> up a piece of paper	<u>hop</u> three times
<u>open</u> the classroom door	<u>write</u> your name with a pencil

 <u>Scrub</u> your back	 <u>Pick</u> an apple	 <u>Write</u> on the whiteboard	 <u>Row</u> a boat.
 <u>Ride</u> a bike.	 <u>Squeeze</u> a sponge.	 <u>Climb</u> a tree.	 <u>Play</u> on the seesaw.
 <u>Thread</u> a needle.	 <u>Switch on</u> a light.	 <u>Cut</u> a slice o	


# 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



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**Thank you,  
Question & Answer**

