The Consortium
Alberta Professional Learning Consortium

SCIENCE Summer Symposium

Session 1
August 19 2024

Presenter: Ted Zarowny

Land Acknowledgement

Photo by Ricardo Gomez Angel on Unsplash

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.

Goal

This session will examine provide an overview of the content of the new Science curriculum, and examine its architecture to demonstrate how the knowledge, understandings, and skills and procedures (KUSPs) work together to create deep learning opportunities for students through the lens of the three phases of learning: surface, deep and transfer.

A quick tour of available resources on the ARPDC website and New LearnAlberta site will wrap up the session.

Agenda

1. “Old” vs. “New”
2. A Closer Look At Organizing Ideas | Guiding Questions | Learner Outcomes
3. A Closer Look At KUSPs - Knowledge
4. A Closer Look At KUSPs - Skills & Procedures
5. A Closer Look At KUSPs - Understandings
6. Phases of Learning
7. Resources
8. Q & A

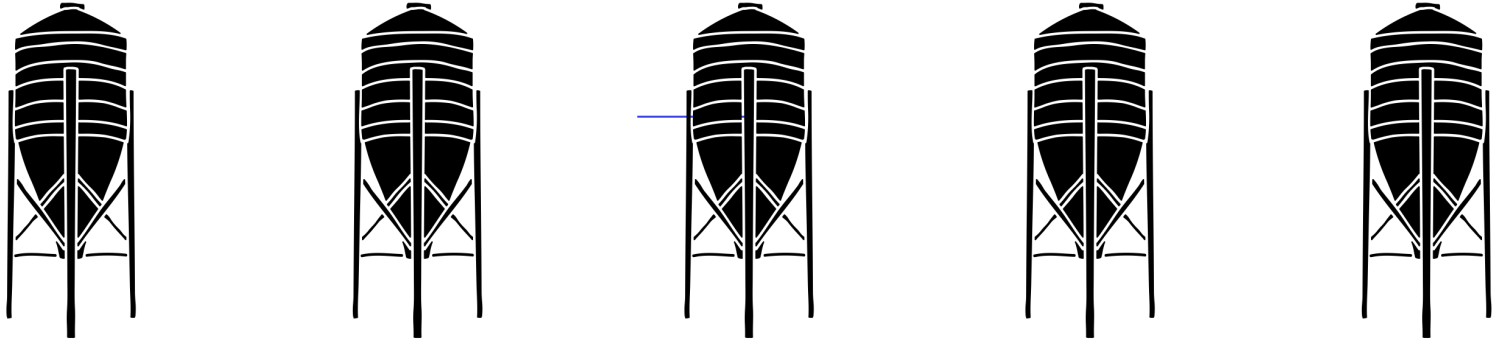
Old vs New

How is the old curriculum different from the new curriculum?

Photo by Glenn Carstens-Peters on Unsplash

Previous Science Curriculum: Topics

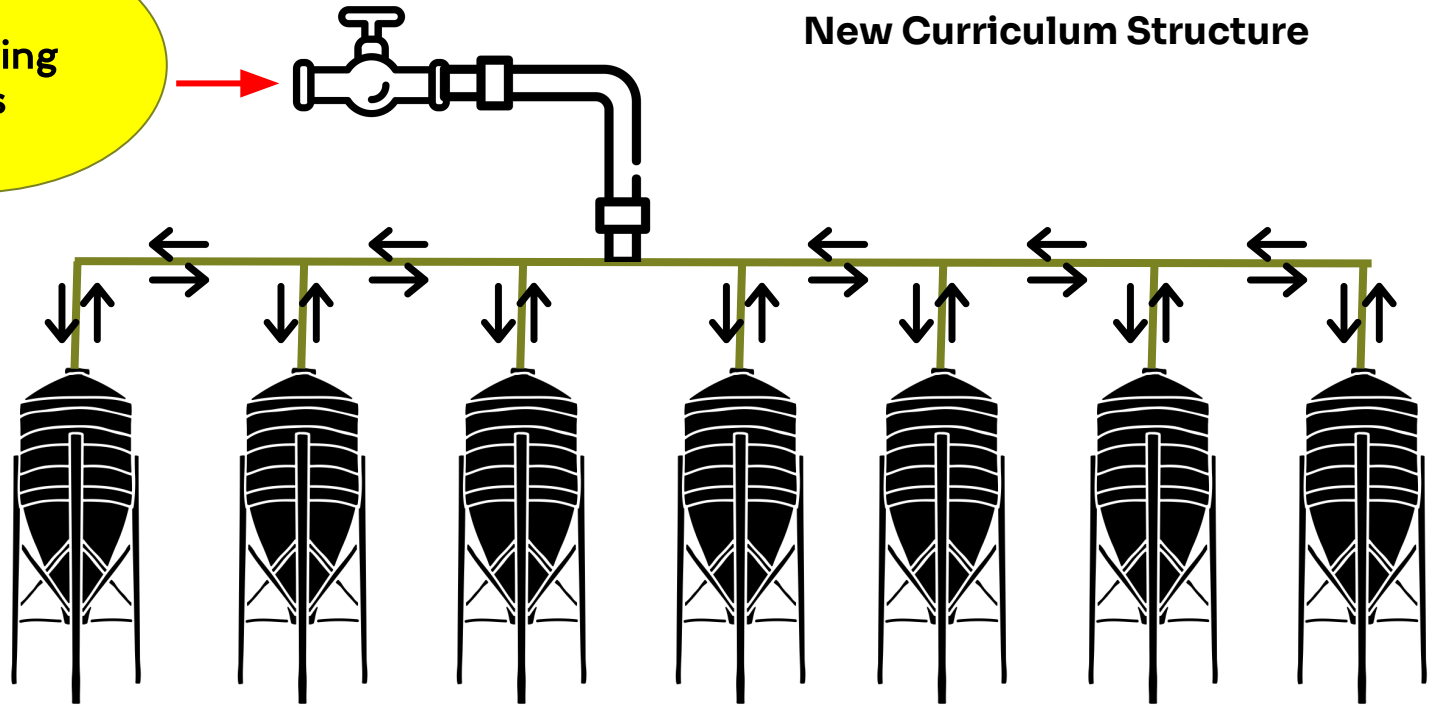
Silos



GR. 1	Seasonal Changes	Needs of Animals and Plants	Creating Colour	Building Things	Senses
GR. 2	Small Crawling and Flying Animals	Buoyancy and Boats	Magnetism	Exploring Liquids	Hot and Cold Temperature
GR. 3	Building with a Variety of Materials	Testing Materials and Designs	Rocks and Minerals	Hearing and Sound	Animal Life Cycles
GR. 4	Building Devices and Vehicles	Light and Shadows	Plant Growth and Changes	Waste and Our World	Wheels and Levers
GR. 5	Electricity and Magnetism	Mechanisms using Electricity	Classroom Chemistry	Weather Watch	Wetlands Ecosystems
GR. 6	Air and Aerodynamics	Flight	Sky Science	Evidence and Investigation	Trees and Forests

New Curriculum Structure

Organizing Ideas



Matter

Energy

Earth Systems

Living Systems

Computer Science

Space (Gr. 4-6)

Scientific Methods (Gr. 1-6)

Curriculum Architecture

Organizing Idea

- statement of the learning
- spans all or most grades
- main concepts

Science Kindergarten to Grade 6 Curriculum

	Grade 5			Grade 6		
Organizing Idea	Matter: Understandings of the physical world are deepened by investigating matter and energy.					
Guiding Question	How can states of matter and other physical properties be explained using the particle model of matter?			How can the particles of matter be influenced by heating or cooling?		
Learning Outcome	Students investigate the particle model of matter in relation to the physical properties of solids, liquids, and gases.			Students investigate how particles of matter behave when heated or cooled and analyze effects on solids, liquids, and gases.		
	Knowledge	Understanding	Skills & Procedures	Knowledge	Understanding	Skills & Procedures
	Ideas represented by the particle model of matter include that: • all matter is made up of small particles • particles of matter are always moving • particles of matter have spaces between them In solids, the particles are close together and vibrate in place. In liquids, the particles are separated by spaces and can slide past each other. In gases, the particles are separated by large spaces and are constantly moving in all directions. Attractive forces between particles are strongest in solids and weakest in gases.	The particle model of matter explains the behaviour of particles in matter.	Represent solids, liquids, and gases using the particle model of matter. Relate the movement and arrangement of particles to the state of matter. Describe the impact that attractive forces have on the movement and arrangement of particles in solids, liquids, and gases.	The particle model of matter states that heating matter causes particles to move faster. As particles move faster, the attractive forces between them weaken and the space between them increases. The particle model of matter states that cooling matter causes particles to move slower. As particles slow down, the attractive forces between them increase and the space between them decreases. A phase change is a change from one state of matter to another. During a phase change, the volume of the matter may change but the mass remains constant.	Particles change speed and distance from each other when heated or cooled.	Discuss the connection between movement of particles and temperature in degrees Celsius. Explain phase changes of matter when heated or cooled using the particle model of matter. Conduct a controlled experiment to prove the mass of a substance is the same after a phase change.

What's In The New Curriculum?

K-6 Organizing Ideas

Science Curriculum Summaries.pdf

Curriculum Architecture

Guiding Question

- informed by the organizing idea and frames the learning outcome
- intended to spark curiosity and wonder about the LO
- identifies more specific concepts

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Curriculum Architecture

Learning Outcome

- describes what students are required to know, understand, and be able to do by the end of a grade.
- must be assessed and reported.
- discipline (subject) specific
- key concepts to be learned and assessed are identified.

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Curriculum Architecture

KUSPs

Science Kinderg[illegible]en to Grade 6 Curriculum

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"Begin with the end in mind."
- Stephen Covey
Photo by Heidi Fin on Unsplash

Photo by Sam Balye on Unsplash

Learning For Transfer

"When we organize our curriculum through fundamental and powerful concepts, our students are able to transfer their understanding to new situations and apply it in unique ways."

- Julie Stern

"Transfer is the ultimate aim of teaching; we do not teach to help students do well in school, but to help them do well in life."
— Grant Wiggins and Jay McTighe, *Understanding by Design*

"We must prepare students not only for how things are, but for how things might be, by equipping them with the skills to transfer their learning to new situations."
— John Bransford, *How People Learn*

"The most useful knowledge is that which can be applied to novel and diverse situations."
— Robert Sternberg and Wendy Williams, *Educational Psychology*

"If we teach students to memorize factual information without a conceptual framework, we set them up to more readily accept disinformation … Teaching through concepts and intentional transfer is the antidote to disinformation campaigns."
— Julie Stern

Instructional Strategy: Spectrum Sort

1. Spectrum Sort has student put examples of items on a scale or spectrum such as the one below.

2. Students can place objects, words, images or anything that can be ranked to use on the spectrum.

3. Students justify their choices.

4. Ideas can be recorded and a discussion can ensue.

Place Each Quote on the Spectrum Based on What **Resonates** with You

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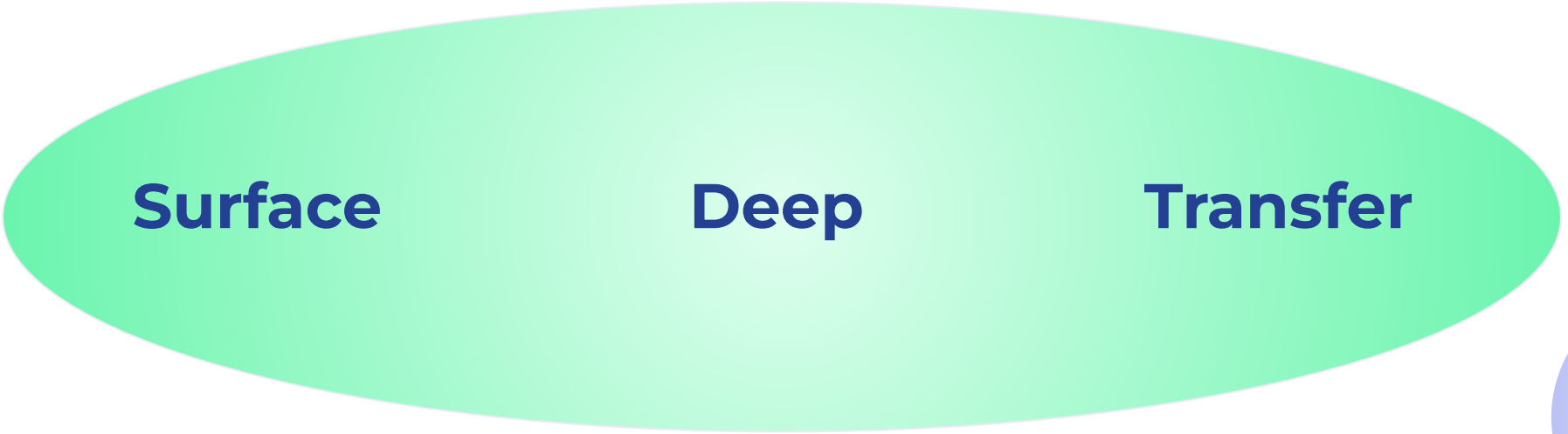
Spectrum Sort

Resonates Least

Resonates Most

Phases of Learning



Hattie, Fisher & Frey: *Visible Learning for Literacy* (2016)

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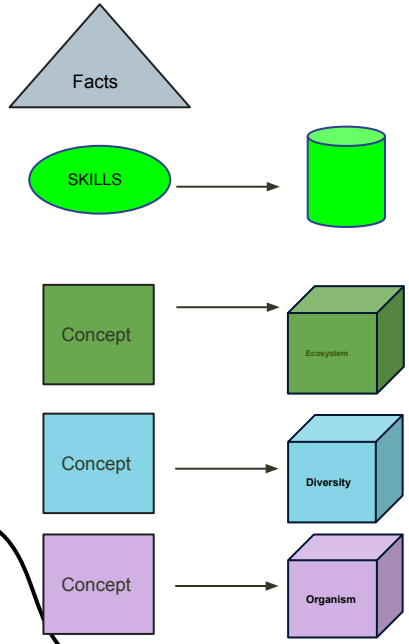
Phases of **Learning**

Surface



The Earth rotates.

What are the steps in an investigation ?
How do I compare and contrast ?
How do I notice and wonder?

What is an ecosystem ?

What is diversity ?

What is an organism ?

"Surface level learning occurs when students gain intellectual understanding of the **concepts,** terms, **skills, facts,** and vocabulary of a topic"

Hattie, Stern, Fisher, Frey (2020). *Visible Learning for Social Studies*

Curriculum Architecture

Knowledge - Concepts

"Knowledge includes the facts, symbols, rules, principles, and **concepts.** "

Science Kindergarten to Grade 6 Curriculum

	Grade 5			Grade 6		
Organizing Idea	Earth Systems: Understandings of the living world, Earth, and space are deepened by investigating natural systems and their interactions.					
Guiding Question	How can climate and its effects be understood?			What relationships exist between climate and changes on Earth?		
Learning Outcome	Students analyze climate and connect it to weather conditions and agricultural practices.			Students investigate climate, changes in climate, and the impact of climate change on Earth.		
	Knowledge	Understanding	Skills & Procedures	Knowledge	Understanding	Skills & Procedures
	Weather is the short-term conditions experienced in a region, including • temperature • wind speed and direction • amount of sunlight • precipitation • humidity • cloud cover	The study of climates across regions helps identify historical patterns and make predictions.	Distinguish climate from weather. Discuss the characteristics of local, national, and global weather conditions to determine climate. Compare key characteristics of climate zones. Interpret data about climate. Relate factors that contribute to Alberta's climate. Compare Alberta's climate to the climates of other Canadian provinces or territories.	Earth's systems interact with the Sun and each other to impact climate in various ways, including • clouds reflecting sunlight into space • greenhouse gases trapping heat from the Sun • ice reflecting light from the Sun Humans rely on the Sun and Earth's systems for a habitable climate.	Complex interactions between humans, Earth's systems, and the Sun can impact climate and climate change.	Describe possible impacts on climate due to interactions between the Sun and Earth's systems. Relate impacts of natural processes and human activities on climate change. Identify personal actions that may affect global climate change.
	Climate is the long-term weather patterns of a region over a period of at least 30 years.			Geographical location factors that affect climate include • latitude • proximity to a large body of water • elevation • urban or rural setting		
	Data in maps, tables, or graphs can be used to represent key characteristics of climate, including • temperature • precipitation • humidity • wind			Changes in climate can be caused by natural processes, including • volcanic eruptions • meteors • changes in the Sun's output • changes in orbits		
	Climates are dependent on factors that include • geographical location • landforms • altitude • proximity to bodies of water			Changes in climate can be caused by human activities, including industrialization and pollution.		
	Climate zones are defined areas with distinct climates and include • tropical • dry • temperate • polar • continental			The release of greenhouse gases into the atmosphere contributes to the warming of Earth. Clean energy production has the potential to reduce net greenhouse		

Weather

Climate

Dependence (Grade 1)

Geographical Location

Change (Kindergarten)

Human Activity (Grade 1)

ACTIVITY:

1. **Download the printable curriculum: https://curriculum.learnalberta.ca/printable-curriculum/en/home**

2. **Examine the Earth Systems organizing idea. What do you Notice and Wonder? Highlight what appear to be the important concepts.**

	Grade 3			Grade 4		
Organizing Idea	Living Systems: Understandings of the living world, Earth, and space are deepened by investigating natural systems and their interactions.					
Guiding Question	How do plants and animals interact?			In what ways do the structures of organisms support survival?		
Learning Outcome	Students analyze and describe how plants and animals interact with each other and within environments.			Students analyze organisms and relate external structures to functions.		
	Knowledge	Understanding	Skills & Procedures	Knowledge	Understanding	Skills & Procedures
	A food chain shows the order in which plants and animals depend on each other for food. A food chain can be represented in many ways, such as • illustrations • diagrams • stories • words A food chain represents one possible way that plants and animals interact. Plants and animals are part of many different food chains.	Plants and animals interact with each other in various environments in ways that can be represented with food chains.	Represent various food chains in local and other Canadian environments.	Organisms are living things that respond to stimuli and include plants, humans, and other animals. Organisms can be classified in various ways, including by • appearance • habitat • structures Structures, including body parts, are features of organisms that serve a purpose or function. Organisms have external structures that can vary; e.g., • plants may have roots, stems, leaves, flowers, fruit, or other structures • animals may have claws, teeth, legs, shells, skins, or other structures Functions of external structures in an organism include • eating • moving • protecting • sensing • reproducing	A variety of organisms live on Earth and have external structures that support various functions.	Find and classify examples of local plants and animals based on appearance, habitat, and structures. Demonstrate respect when interacting with plants and animals in local environments. Relate the external structures of plants to their functions. Relate the external structures of animals to their functions, excluding reproduction. Compare external structures of various plants and animals in relation to function.

Earth Systems Grade 4-6 Concepts

1	Abiotic	20	Interaction
2	Air	21	Landforms
3	Animals	22	Life
4	Atmosphere	23	Lithosphere
5	Biological System	24	Musculoskeletal System
6	Biosphere	25	Natural Object
7	Biotic	26	Object
8	Bodies of Water	27	Plants
9	Change	28	Respiratory System
10	Circulatory System	29	Seasons
11	Climate	30	Sense
12	Components	31	Slow Change
13	Constructed Object	32	Solar System
14	Digestive System	33	Sudden Change
15	Earth	34	Surface Components
16	Earth System	35	System
17	Ecosystem	36	Time
18	Environment	37	Weather
19	Hydrosphere		

Surface Level: Some Instructional Strategies (Concepts)

Spectrum Sort (Example: Creativity)
This strategy involves having students organize concepts, ideas, or objects along a continuum or spectrum based on certain criteria. Students are tasked with arranging items from one end of the spectrum to the other. They then justify their arrangement.

Frayer Model (Template)
The Frayer Model is a graphical organizer used to help students understand and define concepts. It consists of a four-square template with section to define, identify attributes, provide examples, and provide non-examples of the concept.

SEE-IT Model (Template)
In the SEE-IT Model, students elaborate their understanding by, stating the concept meaning, elaborating in their own words, exemplifying the concept, illustrating the concept, and talking with a partner about their ideas.

Concept Attainment (Example: Interaction)
In a concept attainment instructional approach includes giving students examples and non-examples of a concept. Students use the examples and non-examples to inductively determine the attributes (definition) of a concept.

Direct (Explicit) Instruction
Direct teaching is when the teacher explicitly gives the students the definition and examples of the concept.

Sample Surface Level Activities to Introduce Concepts

- Change (Introduction)
  - Change and Time
  - Criteria
  - Significant Change
  - Positive/Negative Statements
- Cycle & Repeating Pattern
- Divergent Thinking
- Diversity
- Environment
- Exploration
- Food Chain
- Growth and Development
- Human Activity

- Investigation (From Grade 2 Scientific Methods)
  - Asking Questions (Notice and Wonder)
  - Observing (Using senses)
  - Analyzing
  - Prediction and Predicting
  - Conclusion
  - Sample Introduction to Research as an Investigation
- Landforms
  - Landform Images
- Materials
- Originality
- Relationship
  - Concept Map
  - Cause and Effect
  - Dependence
  - Affect/Effect
  - Interaction
- Representation

Earth Systems Grade 4-6

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We can teach by treating **knowledge** as discrete bits of information ...

or we can teach by

*"... **understanding it in a way that permits many other things to be related to it meaningfully.** To learn the structure in short, is to learn **how things are related."***

-Jerome Bruner

Earth Systems Grade 4-6

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Are **landforms** and **time** related? If so, provide examples?

Landforms** change over **time.

Is it possible that all of these concepts are related?

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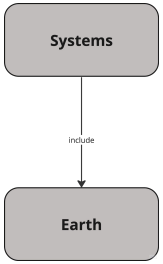
Earth Systems



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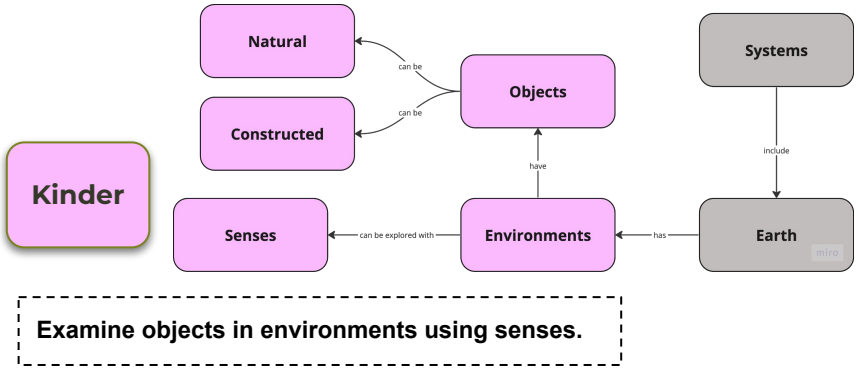

Examine objects in environments using senses.

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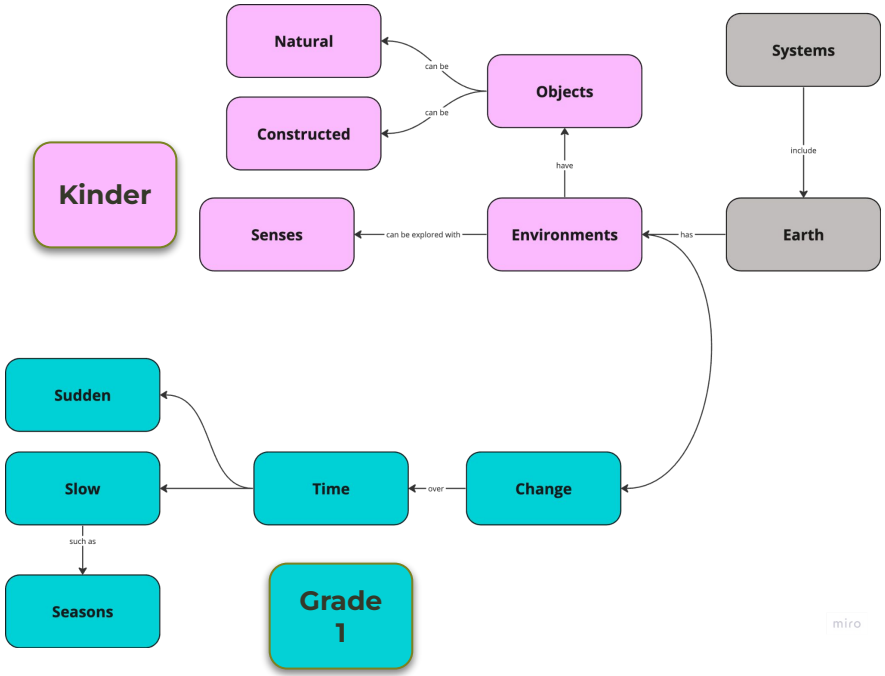

Analyze seasonal changes and their effects on plants and animals

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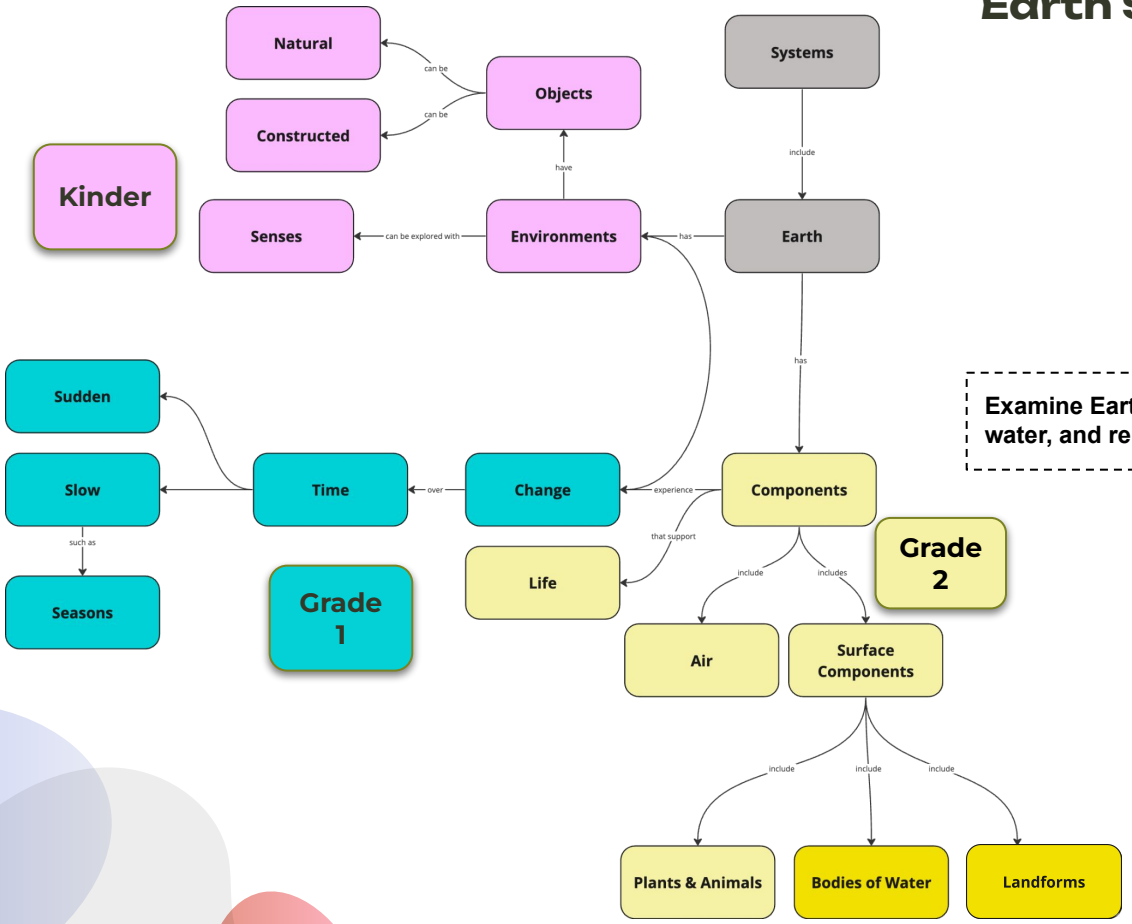

Examine Earth's landforms, bodies of water, and relationship to the Sun.

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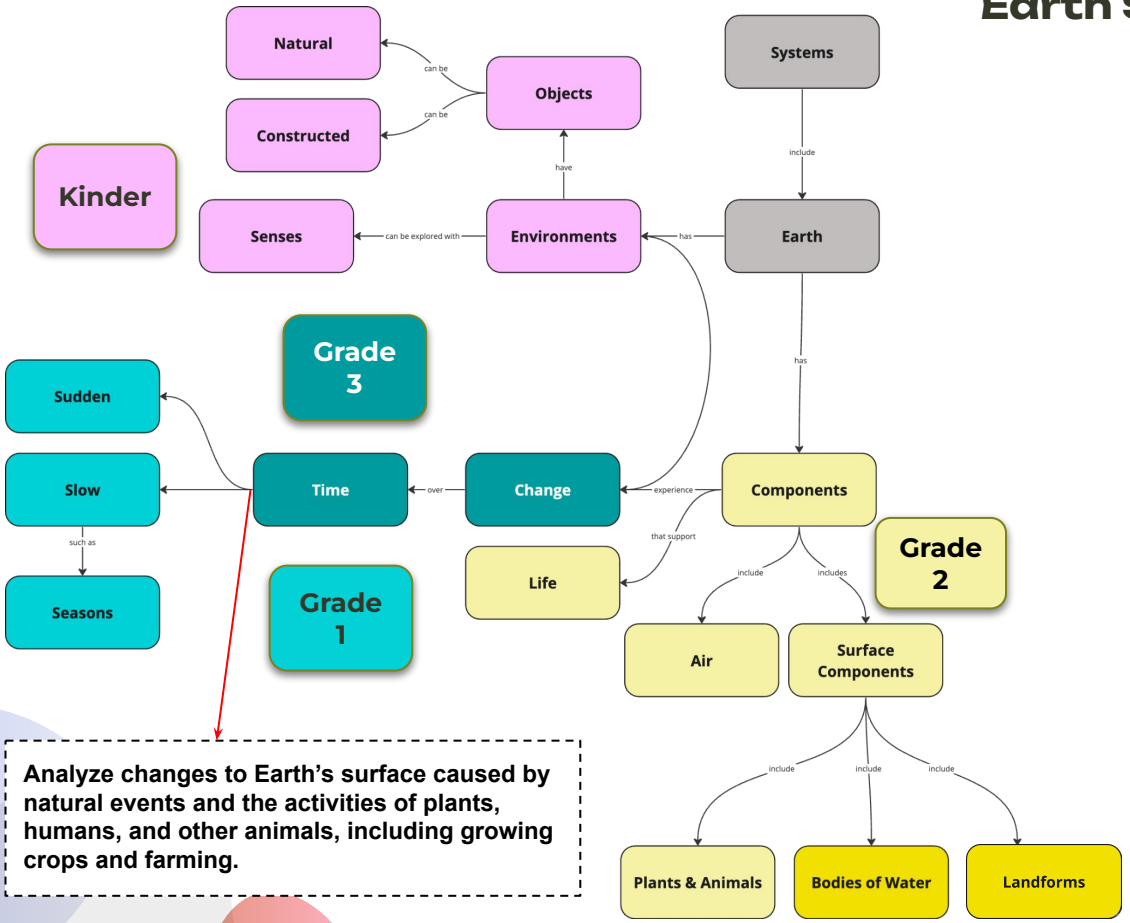

Analyze changes to Earth's surface caused by natural events and the activities of plants, humans, and other animals, including growing crops and farming.

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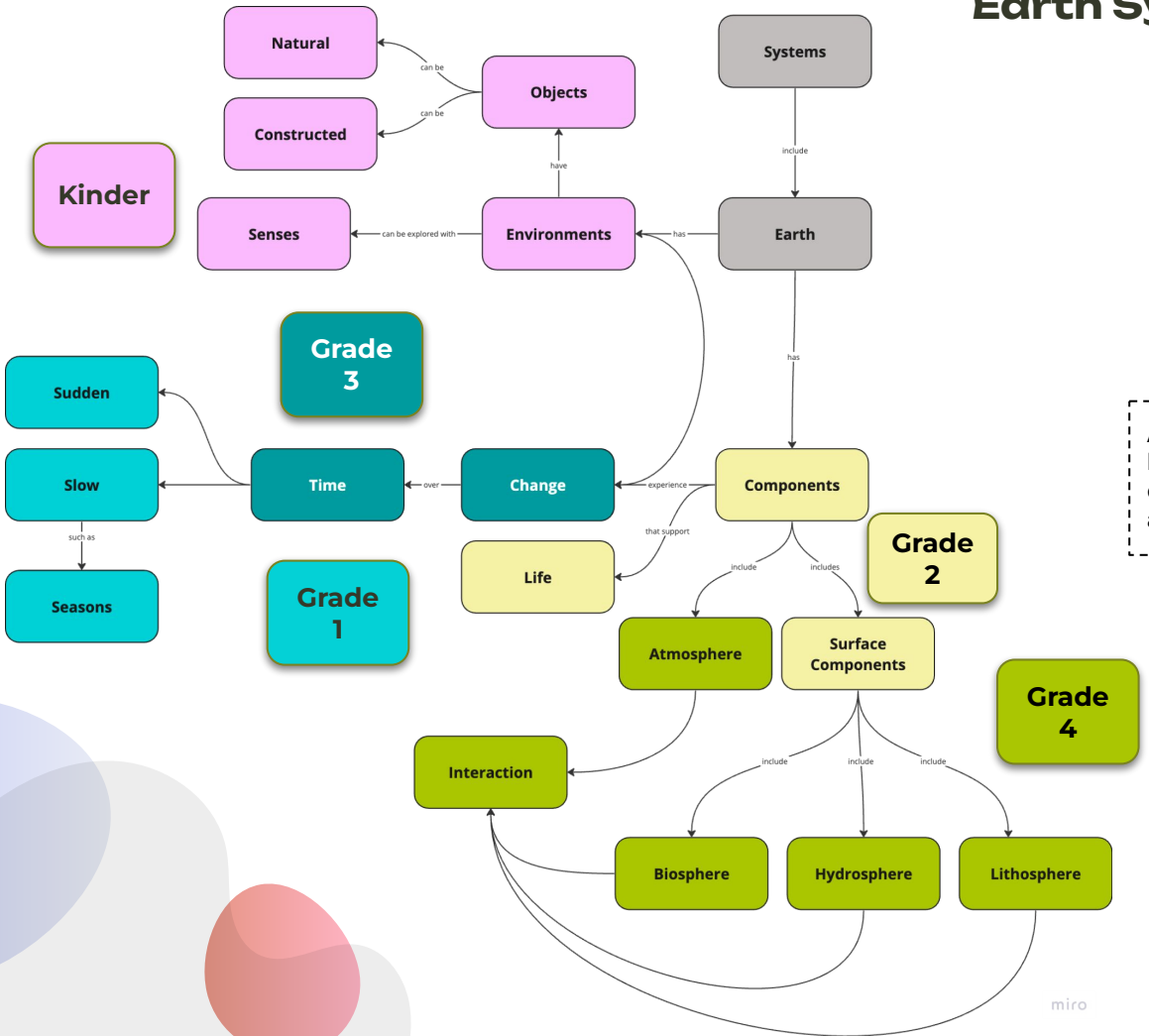

Analyze the interconnections between Earth's systems (land, air, water, and organisms) and explore conservation activities.

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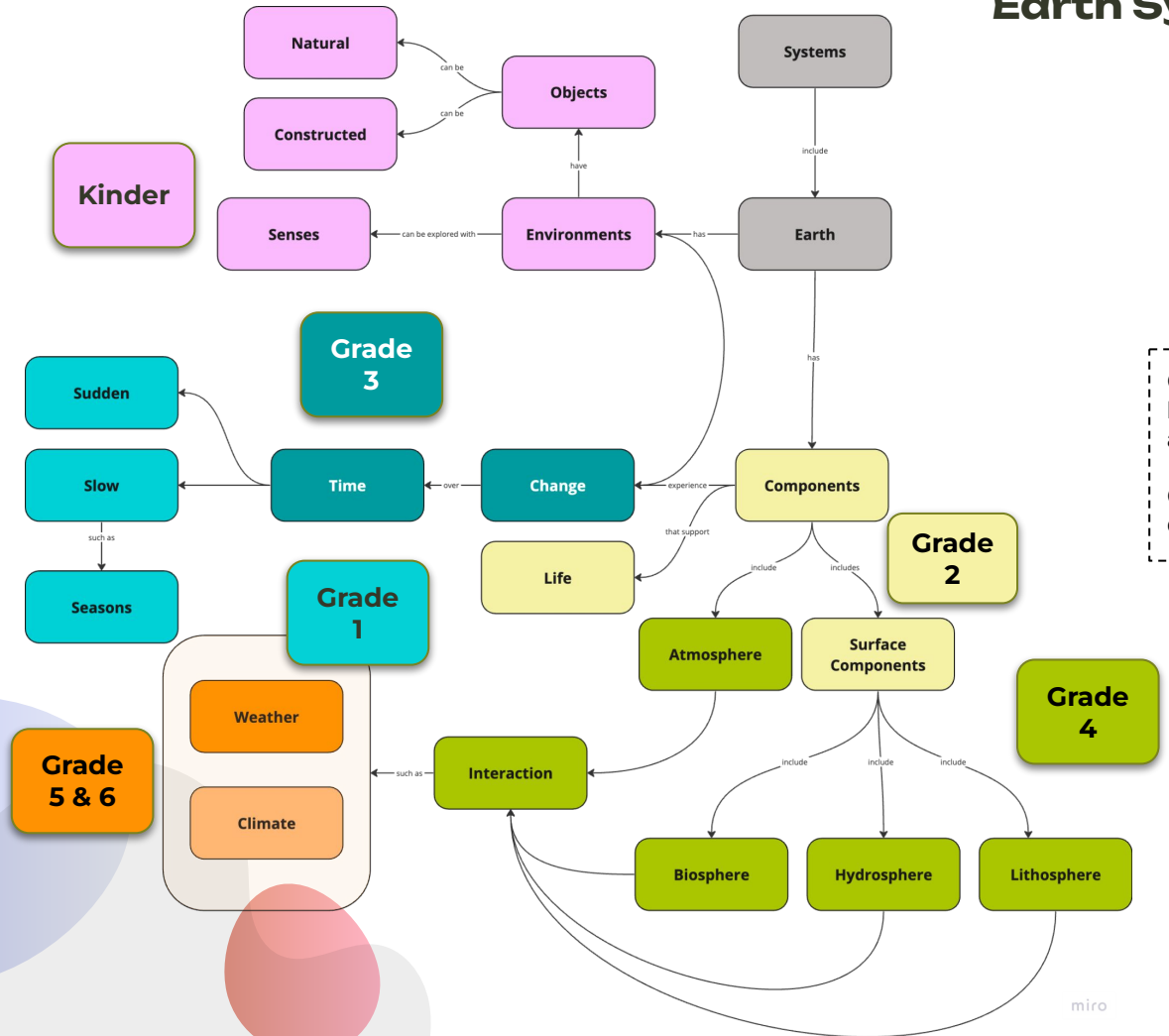

Gr. 5) Analyze the interconnections between Earth's systems (land, air, water, and organisms) and explore conservation activities.

Gr. 6) Investigate factors affecting climate and climate change, including personal actions

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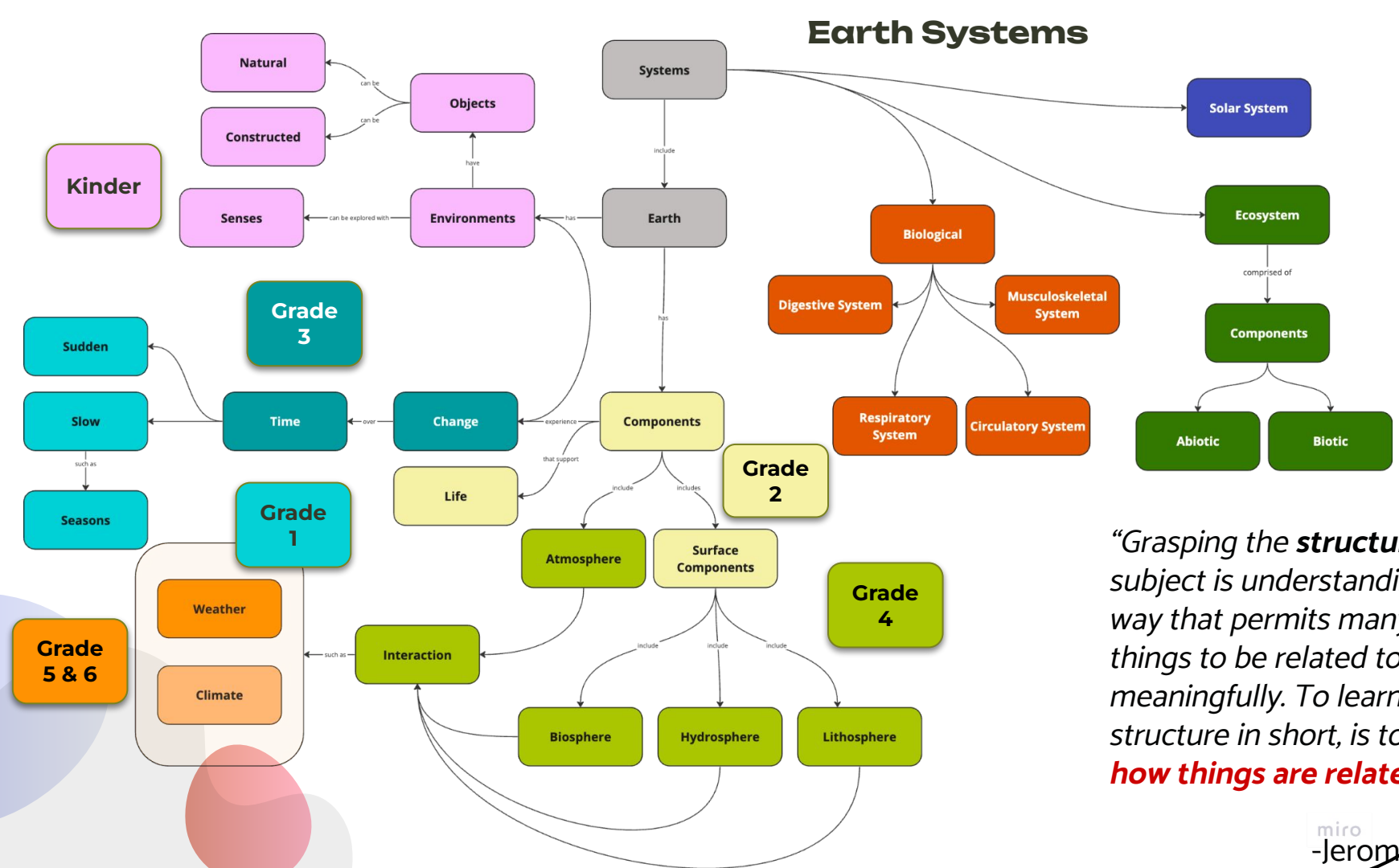
-Jerome Bruner

Earth Systems



*"Grasping the **structure** of a subject is understanding it in a way that permits many other things to be related to it meaningfully. To learn the structure in short, is to learn **how things are related.**"*

-Jerome Bruner

Concept Maps

Concept faps For the following are available for each of the following organizing ideas:

- Matter (K-6)
- Energy (K-6)
- Earth Systems (K-6)
- Living Systems (1-6)
- Space (4-6)

Concept Maps: Follow This Link to the ARPDC Website

Concept Progressions

Concept Progressions: Follow This Link to the ARPDC Website

Phases of **Learning**

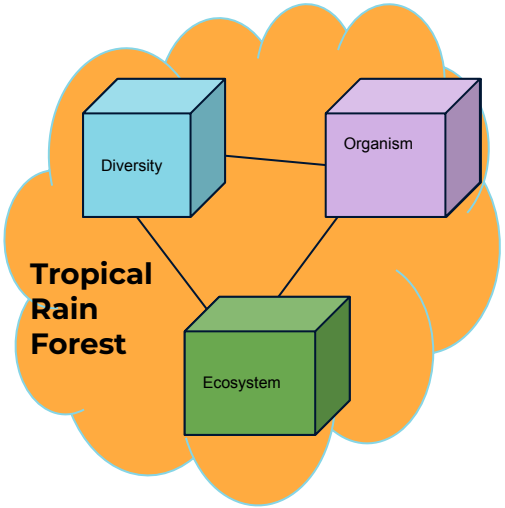
Deep ⟸ **Concepts & Understandings**

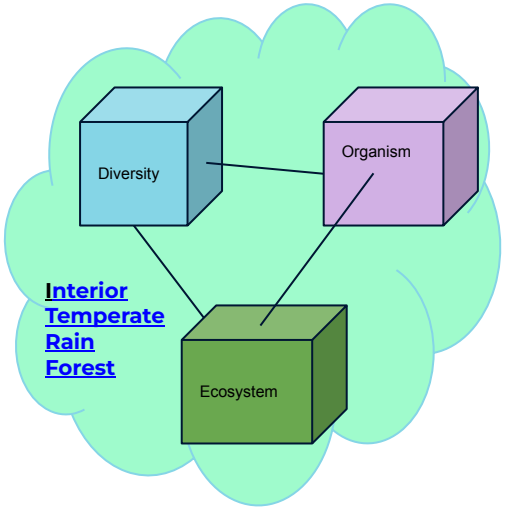
Deep learning occurs when students

- build larger schemas of organized understanding **[relate ideas]**;
- **apply** understanding to many contexts that are similar, but new.
- build increased self-regulation and self-talk;

*How are **diversity, organism,** and **ecosystem** related?*

***Ecosystems** have a **diversity** of **organisms**.*





Phases of **Learning**

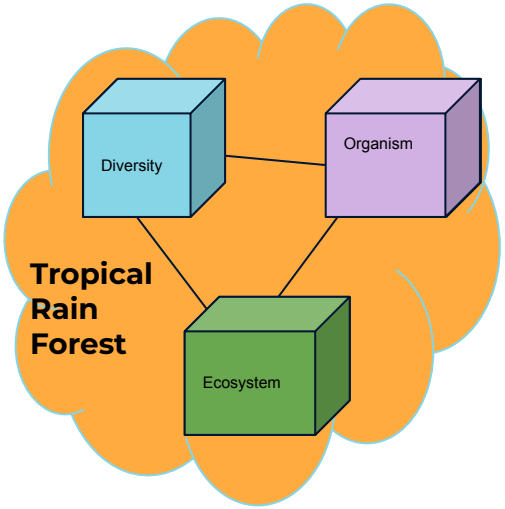
Deep ⟸ **Concepts & Understandings**

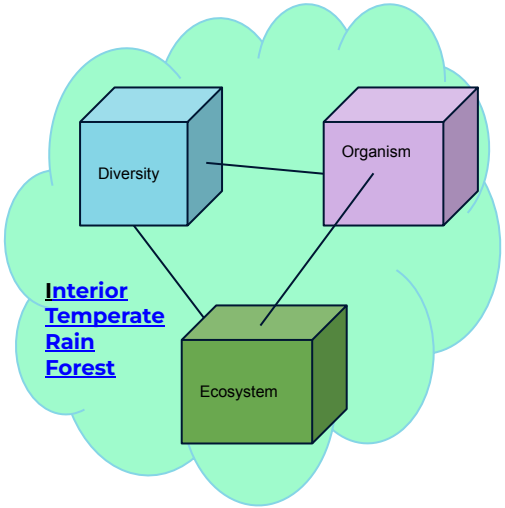
*How are **diversity, organism,** and **ecosystem** related?*

***Ecosystems** have a **diversity** of **organisms**.*

NOTE that in the deep phase, students are already transferring.

However, the contexts are familiar or not overly complex, and there is much teacher feedback and guidance.





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*How are **diversity, organism,** and **ecosystem** related?*

***Ecosystems** have a **diversity** of **organisms**.*

Add other concepts into the mix:

- **Human Activity**
- **Non-Native Organism**
- **Species Reintroduction**

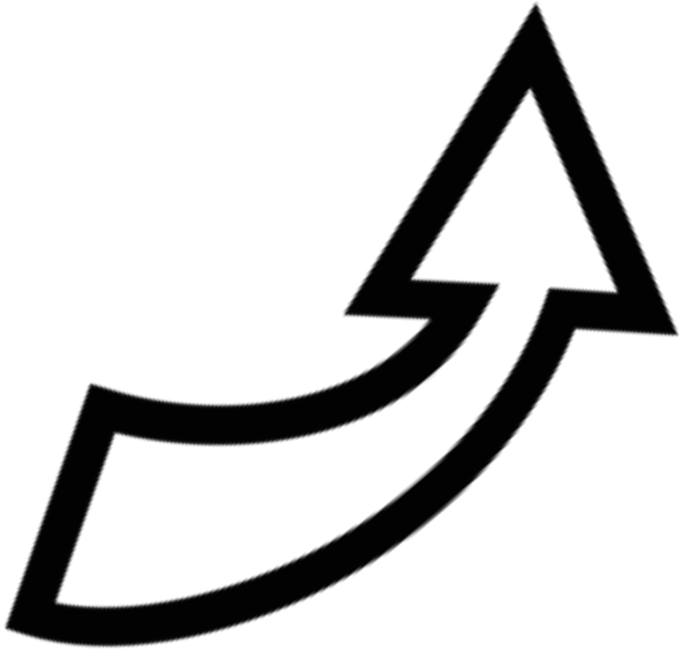
Example: Grade 5 Space

Understanding

"Understanding is about putting pieces of knowledge into **logical and meaningful order** with other knowledge." (Alberta Education. *The Guiding Framework*. 2020)

Knowledge (Individual Concepts)

- Interpretation
- Observation
- Daily Living
- Astronomical Phenomena



Example: Grade 5 Space

Understanding

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Knowledge (Individual Concepts)

- Interpretation
- Observation
- Daily Living
- Astronomical Phenomena

Understanding

Daily living can affect the observation and interpretation of astronomical phenomena.

Observation and interpretation of astronomical phenomena can inform daily living.

Example: Grade 5 Space

Understanding

Guiding Question	How are astronomical phenomena observed and interpreted?	
Learning Outcome	**5S1.1: Students investigate and interpret astronomical phenomena.**	
Knowledge	Understanding	Skills & Procedures
Astronomical phenomena are observable events that happen among objects in space. Astronomical phenomena include ● seasons ● Moon phases ● lunar and solar eclipse ● equinoxes and solstices ● length of day and night ● auroras	**Observations** and **interpretations** of **astronomical phenomena** can inform **daily living.**	

ACTIVITY:

1. **Download the printable curriculum: https://curriculum.learnalberta.ca/printable-curriculum/en/home**

2. **Examine the learner outcomes and understandings in your grade's curriculum. Take a moment to identify the concepts and them and examine the relationship that they are in.**

Deep Level: Some Instructional Strategies (Understandings)

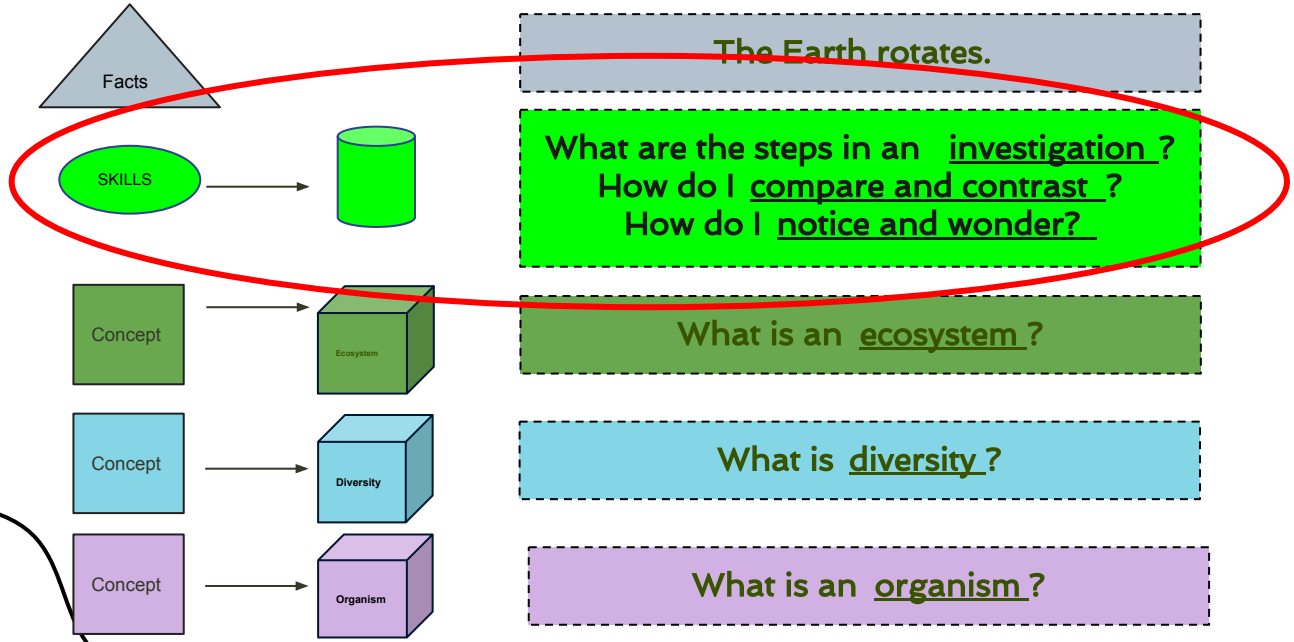
Concept Maps	A concept map is a visual or graphic way to represent knowledge or ideas and the relationships and connections between various concepts. **What is a Relationship?** | **What is a Concept Map?** | **Example**
Hexagonal Thinking	Hexagonal has students make connections between concepts, ideas, or themes using hexagon-shaped tiles. **(Example)**
Concept Graph	Students sort or create examples across two concept axes on a graph. They justify their arrangement. **(Example)**
Discussion	Discussion is one of the most frequently appearing verbs in the K-6 Science Curriculum Skills and Procedures. **What is a Discussion? - Surface Level)** **(Div. II Discussion Checklist)** Decision Formats: **Think - Pair - Share** | **Claim - Support - Question** |Many Others!
Guided Inquiry/Guided Investigations/Project Based Learning	Guided inquiry, investigations, and project based learning is when the teacher provides a structured framework for learning, while students actively explore and investigate a topic or problem. Each step of the inquiry/investigation is pre-planned by the teacher, or developed with teacher guidance. Students typically inquire or investigate authentic scenarios. These experience can last for one to several class periods.
Case Studies	Case studies are the use of that real-world or simulated scenarios (cases) to have students apply their understandings and skills.

Deep Level: Some Instructional Strategies (Understandings)

I Used To Think … Now I Think	This strategy helps students to reflect on their thinking about a topic or issue and explore how and why their thinking has changed. It helps consolidate new learning. (Link: I Used To Think … Now I Think)
What I Know, What I Want to Know, What I Learned (KWL)	KWL Charts

Phases of Learning

Surface



"Surface level learning occurs when students gain intellectual understanding of the **concepts,** terms, **skills, facts,** and vocabulary of a topic"

Hattie, Stern, Fisher, Frey (2020). *Visible Learning for Social Studies*

"Skills and procedures are what **students do** to **demonstrate their knowledge and understanding.** They are specific skills, methods, tools, strategies, and processes that students will develop as they achieve the learning outcome." (Alberta Education. *The Guiding Framework*. 2020)

Curriculum Architecture

Skills & Procedures

Science Kindergarten to Grade 6 Curriculum

"Skills and procedures are what **students do** to **demonstrate their knowledge and understanding.** They are **specific** skills, methods, tools, strategies, and processes that students will develop as they achieve the learning outcome." (Alberta Education. *The Guiding Framework*. 2020)

	Grade 3			Grade 4		
Organizing Idea	Matter: Understandings of the physical world are deepened by investigating matter and energy.					
Guiding Question	How can materials change?			How can materials be managed safely?		
Learning Outcome	Students investigate and analyze how materials have the potential to be changed.			Students investigate the management of waste and dangerous materials and describe environmental impacts.		
	Knowledge	Understanding	Skills & Procedures	Knowledge	Understanding	Skills & Procedures
	Processed materials are modified from natural materials and do not occur in nature. Processed materials are designed and manufactured for a specific purpose. First Nations, Métis, and Inuit communities respectfully interact with natural materials, such as • trees • rocks • ice • shells • plants • animals First Nations, Métis, and Inuit communities interact with natural materials for specific purposes, such as • teepees • igloos • medicines • clothing • transportation • ceremonies	Materials can be used in their natural form or processed to create new materials. Interaction with natural materials by First Nations, Métis, and Inuit is guided through living in harmony and balance with the land. Relate Discuss	Relate a processed material to the natural material from which it originated. Discuss how interaction with natural materials is guided by relationships with the land for First Nations, Métis, and Inuit communities.	Methods of waste management that can negatively impact the environment include using landfills and burning. Methods of waste management that can reduce negative environmental impacts include • reducing • reusing • recycling • repurposing • repairing • composting Increased production and consumption of materials leads to increased production of waste materials. Waste materials may be solids, liquids, or gases.	Responsible methods of waste management can reduce negative environmental impacts. Compare Design Discuss Represent	Compare the different methods of waste management and discuss their environmental impacts. Develop a personal plan to reduce waste. Discuss local waste management programs. Represent a recycling process using diagrams.

ACTIVITY:

1. **Download the printable curriculum:**
   https://curriculum.learnalberta.ca/printable-curriculum/en/home

2. **Examine the learner outcomes and skills and procedures statements in your grade's curriculum. Take a moment to identify some of the the specific skills and procedures.**

Skills & Procedures

What Students Do to Demonstrate their Knowledge and Understanding

Grade 4-6 Skills and Procedure Verbs			
Skill/Procedure	**Frequency**	**Skill/Procedure**	**Frequency**
Discuss	30	Observe	3
Relate	22	Safety	3
Compare	20	Analyze	2
Investigation/Experiment	17	Collect Data	2
Examine	13	Record Observations	2
Explain	12	Measure	2
Identify	12	Test	2
Describe	11	Conclude	1
Represent	9	Decide	1
Create	6	Magnetize	1
Demonstrate	5	Test	1
Interpret	5	Construct Weather map	1
Design	5	Defend	1
Collaborate	4	Translate	1
Evaluate	4	Divergent Thinking	1
Explore	4	Hypothesize	1
Apply	3	Order	1
Classify	3	Predict	1
Plan	3	Research	1
Observe	3	Use tools	1

Grade 4-6 Skills and Procedure Verbs

Skill/Procedure	Frequency	Skill/Procedure	Frequency
Discuss	30	Observe	3
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Apply	3	Order	1
Classify	3	Predict	1
Plan	3	Research	1
Observe	3	Use tools	1

Skills & Process Verbs

	Grade			
	K	1	2	3
Ask Questions				
Classify (Sort)				
Compare & Contrast				
Conclude				
Create				
Demonstrate Safety				
Describe				
Design				
Discuss				
Examine				
Explain				
Explore				
Investigate				
Observe				
Predict				
Record Data				
Relate				
Represent				

Skills From Scientific Methods

Investigation Progression

- The steps of an investigation are introduced in **Grade 2 Scientific Methods.**
- **Grades 3, 4, 5 and 6 build on those steps.**

Nicole Lamoureux: Aug, 20 (8:30 -10:00)

Photo by National Cancer Institute on Unsplash

Investigations 1-6 Progression

The information presented here is not intended to be a detailed summary of the Scientific Methods Organizing Idea. The intent is to highlight how the **steps of an investigation** grow in **complexity** and **depth** from Grade 1 to Grade 6

[Investigation Steps Grades 2 - 6 (Link)]

Grade 1

Steps followed during an investigation include:

1) Asking **Questions**
2) Making **Predictions**
3) Gathering **Data**
4) Forming **Conclusions**

Grade 2

Procedures scientists use to guide investigations include:

1) Asking **Questions**
2) Making **Predictions**
3) **Planning** the Investigation
4) **Observing** and **Recording Data**
5) **Analyzing** Data
6) Reaching **Conclusions**
7) **Discussing** Observations and Conclusions

Grade 3

Data
- Accuracy
- Objectivity
- Sources (Accurate & Trustworthy)

Analyzing
- Techniques

Grade 4

Data
- Descriptive (qualitative)
- Numbers (quantitative)
- Relevance

Evidence
- Data that supports the conclusion becomes evidence
- Reliability
- Validity

Système international d'unités
- international system of units

Grade 5

Phenomena
- facts or events that can be observed

Bias

Variables
- Manipulated (independent)
- Responding (dependent)
- Controlled

Experiment
- Controlled Experiment

Evidence Communication
- Representation
- Clarity & Accuracy

Scientific Ethics

GRADE 6

Explanations
- Hypothesis
- Testable (falsifiable)
- Use of reliable objective data and evidence
- Describe natural phenomena
- Use of variety of texts and representations

Transferable Skills From Computer Science

Angela Dearing: Aug, 20 (10:30 -12:00)

Grade	Skills
K-1	Following/ Creating Instructions (algorithmic thinking)
2	Creativity - Originality
3	• Creativity - Divergent Thinking • Computational Thinking - Introduction
4	Design Thinking
5	Design Thinking - Creating Artifacts
6	Computational Thinking - Abstraction

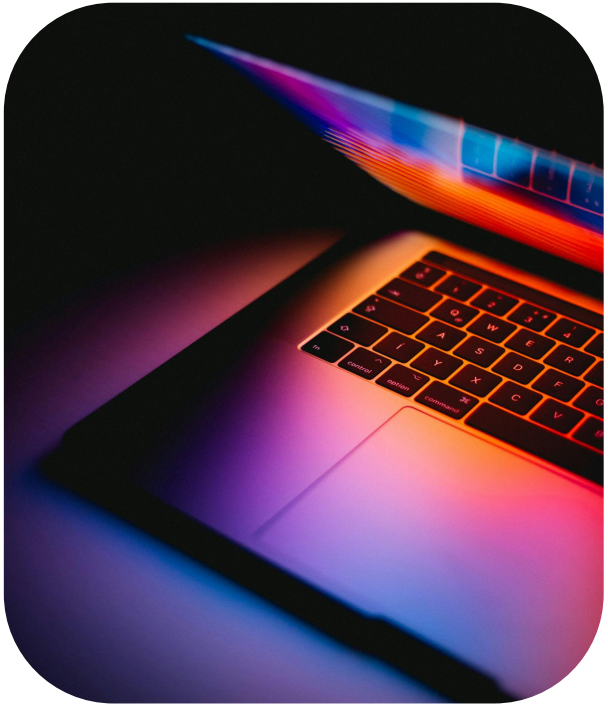


Photo by Andras Vas on Unsplash

Computational Thinking Skills

Sub-Skills
Break a task into smaller chunks. **(Decomposition)**
Identify the important details when reading or solving a problem. **(Abstraction)**
Find patterns and similarities in tasks. **(Pattern Recognition)**
Design instructions. **(Algorithmic Thinking)**
Working backward if a mistake is made. **(Debugging)**

Sub-Skills
Understand the Problem
Form Ideas *(Divergent Thinking)*
Plan
Create
Analyze
Test
Troubleshoot

Design Thinking

A Problem-Solving Approach

Surface Level: Some Instructional Strategies (Skills & Procedures)

Concept Attainment	**Skills have an associated concepts:** ● Represent & Representation ● Relate : Relationship ● Discuss and Discussion ● Predict and Prediction ● Conclude and Conclusion ● Analyze and Analysis
Direct Instruction	Direct instruction explicit and structured instruction *(eg. "This is how you compare and contrast two or more things.")*.It breaks down the learning process into small, manageable steps and provides opportunities for students to practice those steps with feedback. Examples ● Compare & Contrast ● Investigating (Steps provided in Curriculum - Computer Science Grade 2) ● Design Thinking (Steps Provided in Curriculum - Computer Science Grade 4)

Phases of Learning

Deep ⟸ Skills & Procedures

Deep learning of skills and procedures occurs when students when students

- **apply** understanding to many contexts that are similar, but new.
- receive effective feedback
- build increased self-regulation and self-talk;

Investigate

Notice & Wonder

What do you notice and wonder about the image of this ecosystem?

Investigate which material makes the best sound barrier.

What did you notice and wonder about the the time-lapse movie?

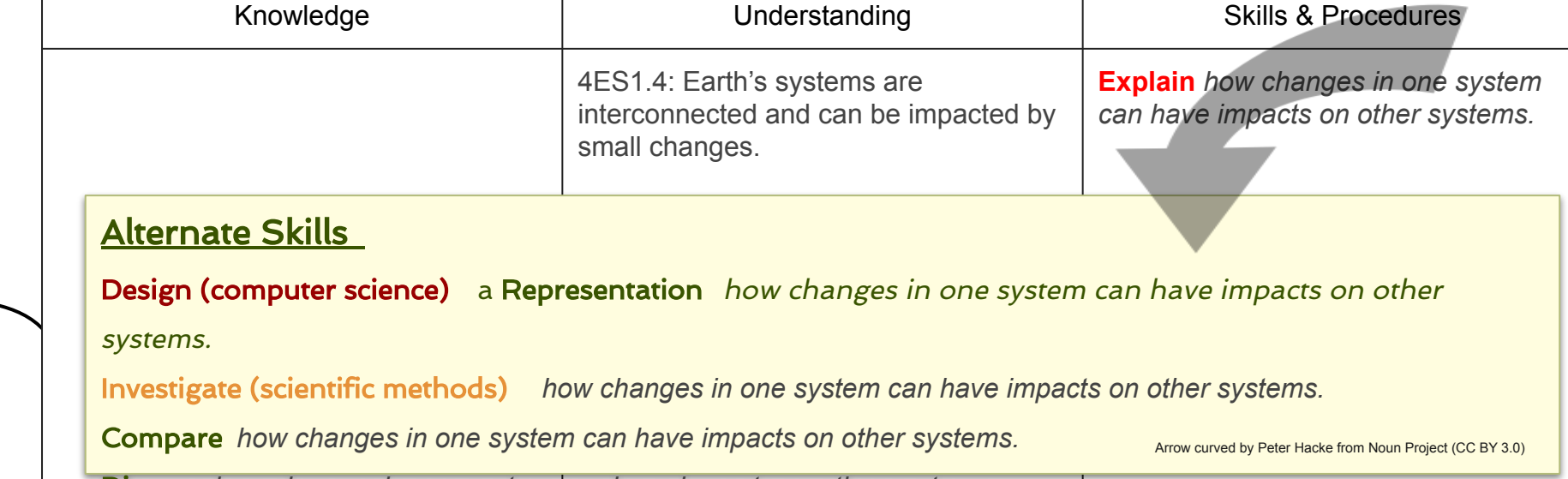
Investigate which material makes the best tin-can telephone.

Skills & Procedures

Using Alternate Skills to DEEPEN Learning

Example: Grade 4

Guiding Question	**How does Earth sustain life?**	
Learning Outcome	**4ES1: Students investigate the systems of Earth and reflect on how their interconnections sustain life.**	
Knowledge	Understanding	Skills & Procedures
	4ES1.4: Earth's systems are interconnected and can be impacted by small changes.	**Explain** *how changes in one system can have impacts on other systems.*



Alternate Skills

Design (computer science) a **Representation** *how changes in one system can have impacts on other systems.*

Investigate (scientific methods) *how changes in one system can have impacts on other systems.*

Compare *how changes in one system can have impacts on other systems.*

Discuss *how changes in one system can have impacts on other systems*

Phases of Learning

Surface

- Initial learning of **concepts,** terms, **skills, facts,** and vocabulary of a topic

Deep

- Relating concepts
- Applying to different contexts
- Teacher feedback and guidance
- Reflecting

Transfer

- Apply concepts, understandings and skills to a variety of novel and **unfamiliar contexts with independence**

Hattie, Fisher & Frey: *Visible Learning for Literacy* (2016)

Transfer

4ES1.5: Conservation can impact land, natural resources, and organisms.

Context 4
Historical

Example: From Deep to Transfer

Deep

4ES1.5: Conservation can impact land, natural resources, and organisms.

Context 1
Local Park

Context 2
Arctic

Context 3
?

Example: From Deep to Transfer

What surface and deep learning was needed to complete the inquiry you are about to view?		
SURFACE	**DEEP**	**TRANSFER**
Concepts ?	Understandings ?	Project/Problem Based Learning (Inquiry) Do you recommend to your friends who are coming in from out of town that they go tubing in Boulder Creek?
Skills ?	Practice/Typing Skills ?	

Transfer Activity:
Inquiry / Problem Based Learning

As you watch the video, try to determine what concepts and skills were likely taught at the surface level, and what what deepened before the inquiry project occurred.

Video: Inquiry-Based Learning in the Science Classroom

Cheryl Babin: PBL 10:30 - 12:00

What surface and deep learning was needed to complete this inquiry?		
SURFACE	**DEEP**	**TRANSFER**
Concepts ● Parameter ● Sample ● Turbidity ● Data ● Conclusion ● Organism ● Physical Survey	What is the relationship between turbidity and temperature? What is the relationship between turbidity and organisms? What is the relationship between turbidity, organisms, and safety?	Project/Problem Based Learning (Inquiry) Do you recommend to your friends who are coming in from out of town that they go tubing in Boulder Creek?
Skills ● Representing (Infographic) ● Sampling ● Asking Questions ● Collaborating ● Recording Daya ● Making Conclusions	Practice opportunities ● Experimenting / Investigating ● Sampling ● Observing & Recording Data ● etc.	

Helpful Sites & Resources

New LearnAlberta https://curriculum.learnalberta.ca/home/en		
Alberta Regional Learning Consortium (ARPDC) **Alberta Professional Learning Consortium (APLC)** https://arpdc.ab.ca/		
Grade 4	**Grade 5**	**Grade 6**
Living Systems	Living Systems	Living Systems
Matter	Matter	Matter
Earth Systems	Earth Systems	Earth Systems
Energy	Energy	Energy
Space	Space	Space
Look for upcoming learning activities to support implementation from APLC!		

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Energy	Energy	Energy
Space	Space	Space
Look for upcoming learning activities to support implementation from APLC!		

Questions?

The Consortium
Alberta Professional Learning Consortium

Presenter: Ted Zarowny

Email: ted.zarowny@arpdc.ab.ca

ARPDC Post Session Survey

Thank you for attending this session!

To help us enhance the delivery of future sessions, we ask that you complete this short survey. Your feedback is important and appreciated!

Note: Your survey will be submitted anonymously.

APLC Summer Science Symposium

Session 1

August 19 2024