



# CONCEPT-BASED TEACHING FOR DEEP LEARNING

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# 1. INTRODUCTIONS



ME



# IB Learner Profile



Source: Griffin, R. (2014, January 17). IB learner profile poster. Retrieved April 15, 2019, from <https://nccportfolio.weebly.com/blog/ib-learner-profile-poster>.

# Portrait of a Learner

The graphic features a central image of a young boy in a blue checkered shirt holding a tablet. Three other tablets are positioned around him, each displaying text. The background is a light blue gradient with faint images of people. The text is presented in a clean, modern font with red and black colors.

**Learner Agency**  
The *belief* and *capacity* required to take action in making life better for oneself and others.

**Capable Learners are:**

- literate,
- globally competent, and
- have disciplinary competence.

**Self-Determined Learners feel:**

- autonomous,
- competent, and
- related to others.

Belief

Capacity

Portrait of a Learner

5

Source: Government of New Brunswick. (n.d.). Portrait of a Learner. Retrieved April 25, 2022, from <https://www2.gnb.ca/content/dam/gnb/Departments/ed/pdf/K12/curric/General/PortraitofaLearner.pdf>

# LEARNING OBJECTIVES

1. Recognize the value of concept-based teaching and learning.
2. Use the knowledge structure and essential elements of concept-based curriculum to design learning experiences
3. Understand the difference between facts, topics, concepts, generalizations in STEM subjects.
4. Gain insight of the development of conceptual understanding in learners through interdisciplinary activities.
5. Learn to enhance conceptual understanding by crafting quality guiding questions when planning units.

# IT STARTS WITH A MISSION

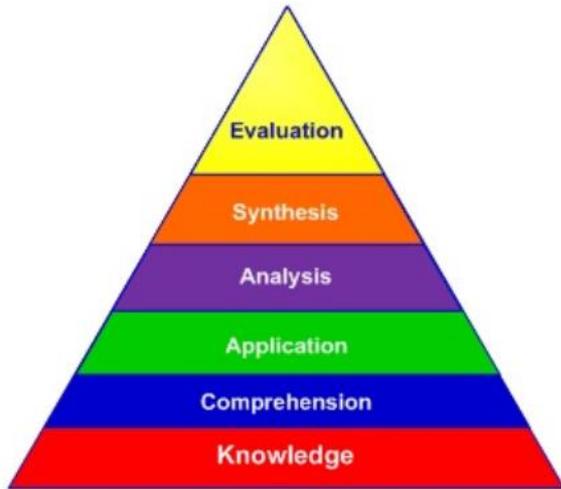
- Provide **equitable, inclusive** and **quality** education and **lifelong learning** opportunities to all children and harness their **full potential** to become **productive** citizens.
- Equip all children with appropriate **knowledge, skills** and **values** to *cope* with the challenges of the 21st century.

# AND A COMPETENCY

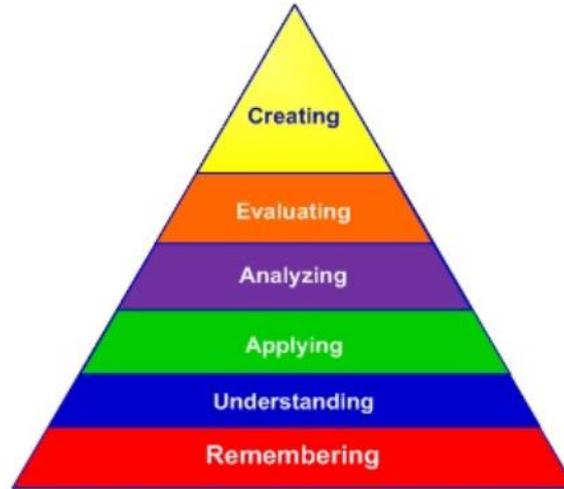
- capability of the learner to **apply** or **use** a set of related knowledge, skills, and abilities required to successfully perform "critical work functions" or tasks in a defined work setting.
- ability to **analyse** and **synthesize** information and experiences to create "working knowledge" that can be **used in a real-world setting**, or **transfer learning** from one subject to another.
- ability to reach **higher order thinking**

Source: Royal Government of Bhutan. (2021). Vision & Mission. Ministry of Education. Retrieved April 25, 2022, from <http://www.education.gov.bt/?p=7024>, p.5.

Blooms Taxonomy

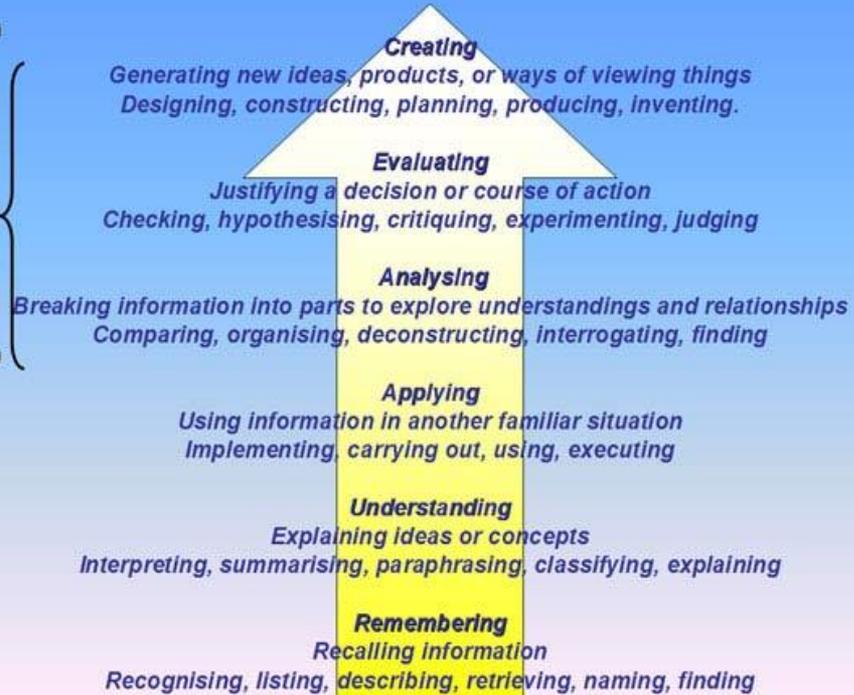


Blooms Taxonomy - Revised



### BLOOM'S REVISED TAXONOMY

Higher-order thinking



# ATTRIBUTES OF AN EXCELLENT LESSON

- Objectives and Goals
- Engagement and Motivation
- Connections and Relevance
- Questioning and Inquiry
- Feedback and Reinforcement
- Monitoring and Assessment
- Application



# ACTIVITY CORNER : BRAINSTORM

- 1) Choose 1 lesson attributes.
- 2) Think of 2 teaching strategies that you would use to achieve these in your classroom.

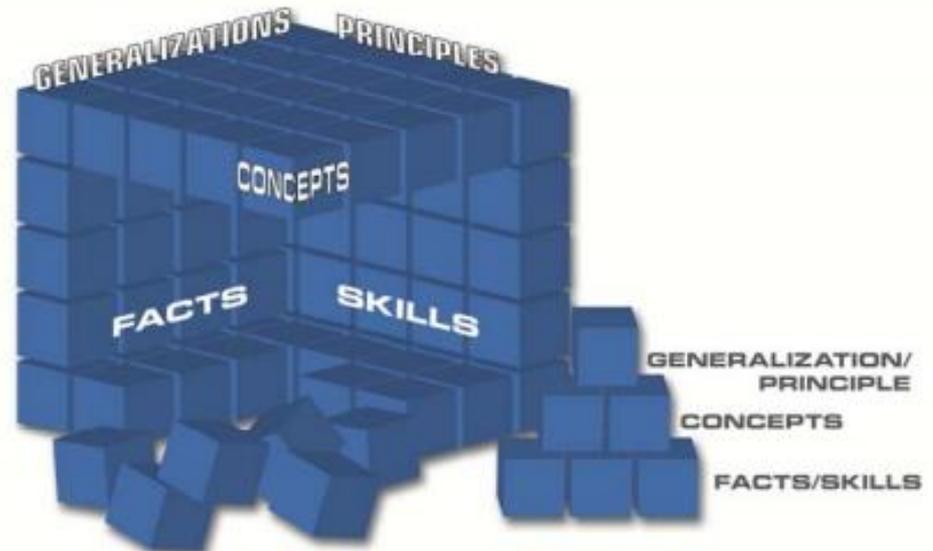


## 2. DEFINING CONCEPT-BASED CURRICULUM DESIGN : ESSENTIAL ELEMENTS

**2D CURRICULUM/INSTRUCTION  
TOPIC/SKILL-BASED MODEL**

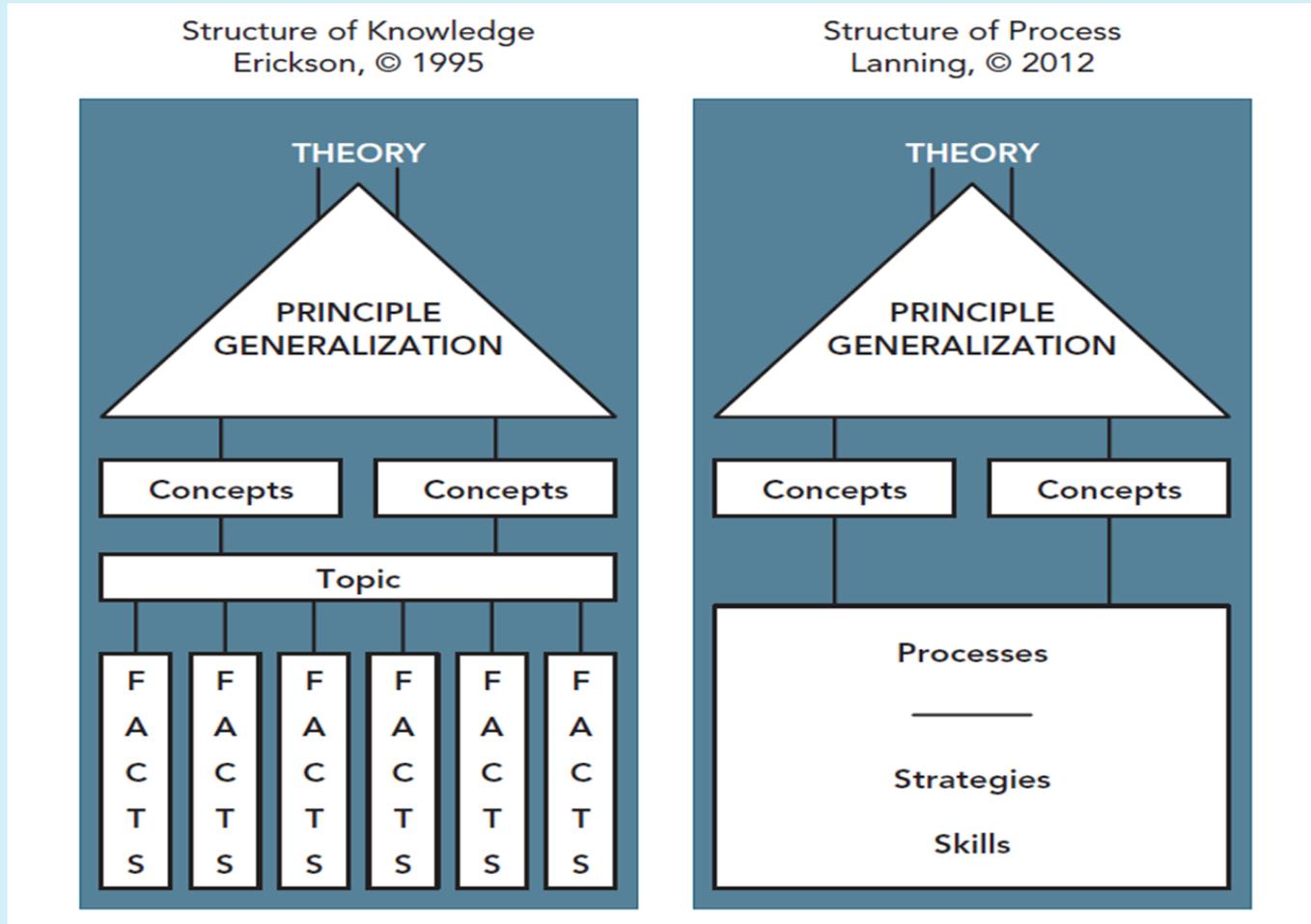


**3D CURRICULUM/INSTRUCTION  
CONCEPT-BASED MODEL**



Source: Stern, . H., Mohnkern, J., & Ferraro, K. F. (2017). *Tools for teaching conceptual understanding: Designing lessons and assessments for deep learning; Secondary*. Thousand Oaks, CA: Corwin, a SAGE Publishing Company.

# STRUCTURE OF KNOWLEDGE



Source: Stern, J. H., Mohnkern, J., & Ferraro, K. F. (2017). *Tools for teaching conceptual understanding: Designing lessons and assessments for deep learning; Secondary*. Thousand Oaks, CA: Corwin, a SAGE Publishing Company.

# EXAMINING THE STRUCTURE OF KNOWLEDGE

**Generalization** = Connection/relatedness of two or more concepts stated in a sentence of relationship that transfers through time across cultures and across situations. Supported by facts. (also called enduring understandings by Wiggins)

**Concept** = an organizing idea, represented by one or two words, examples have common attributes OR mental constructs that are abstract, timeless and universal (transferable) (Erickson & Lanning, 2013).

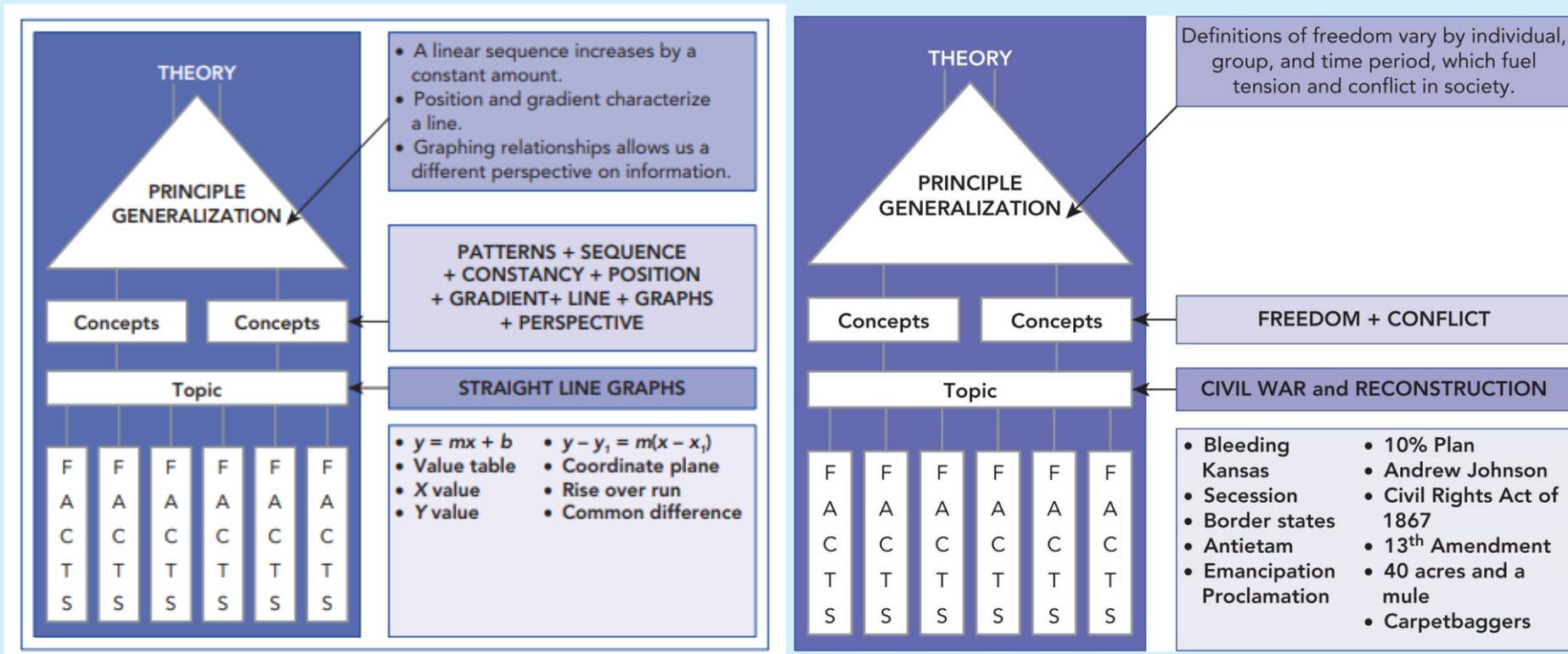
- Concepts that are broad such as change, pattern, and system which can be applied across disciplines = **macro-concepts**.
- Concepts that are discipline specific = **micro-concepts**

**Topic** = a category of study with a body of related facts to be learned (specific, not transferable)

**Fact** = a statement of truth or knowledge unique to a topic, time and place (not transferable)

Concept-based curriculum develops the use of topics, facts and skills to investigate relationship among concepts.

# EXAMPLES: MATHS & SOCIAL STUDIES



Source: Stern, J. H., Mohnkern, J., & Ferraro, K. F. (2017). *Tools for teaching conceptual understanding: Designing lessons and assessments for deep learning; Secondary*. Thousand Oaks, CA: Corwin, a SAGE Publishing Company.

# ANOTHER EXAMPLE — ECOSYSTEM (CONCEPT)



Source: Bishop's College School – Sherbrooke, Canada

# FOCUS ON CONCEPTS

❖ **Concepts** = understanding (this is transferable), key concepts are broad, organizing and powerful ideas that have relevance within the subject group but also transcend it, having relevance in other subject groups.

Course	Topic	Facts/Examples	Concepts
Chemistry	Acids and bases	pH scale Equilibrium Constants ( $K_a$ , $K_b$ ) Strong acid/base Weak acid/base	Systems Equilibrium Disassociation Neutralization
Physics	Newtonian Mechanics	Balanced and unbalanced forces $F=ma$ (acceleration) $p=mv$ (momentum)	Force Energy Movement Equilibrium

# INTRADISCIPLINARITY

## Integrated, *Intra* disciplinary

### Bond Energy

- potential energy
- bond strength
- exothermic and endothermic bonds

### Modern Materials

- liquid crystals
- polymers
- ceramics

### Compounds & Properties

- amorphous solid
- crystalline solid
  - molecular, ionic, atomic
- liquids
  - molecules with strong intermolecular forces
- gases
  - molecules with weak intermolecular forces

### *System/Interaction*

(Conceptual Lens)

Unit Theme

## *Chemical Bonding*

### Intermolecular Forces

- London dispersion
- dipole-dipole
- hydrogen bonding

### Electronegativity

- periodic table trend
- ionic/covalent continuum

### Bond Types

- covalent, ionic, metallic
- polar covalent
- orbital hybridization
- sigma and pi bonds

### Molecular Shape

- VSEPR Theory
- Valence-bond theory
- polarity

### Atomic Structures

- valence electrons
- formation of ions
- electronegativity

Figure 5.11. Chemistry Unit  
Source: Jean Lummis, Washington Township High School  
Washington Township School District, Sewell, New Jersey; used with permission

(Concepts italicized)

# INTERDISCIPLINARITY

## Integrated, Interdisciplinary

Conceptual Lens: **System**

### Health

*Wellness*  
*Nutrition*  
*Eating Disorders*  
*Weight Management*  
*Substance Abuse*  
*Diseases*

### Science

*Circulatory System*  
*Respiratory System*  
*Digestive System, etc.*  
*Function & structure*  
*Interdependence*

### Math

*Calculations: heart rate, body mass,*  
*Statistics*  
*Measurements: height, weight*  
*Ratios*  
*Charts; graphs*



### Literature

The Human Body  
(Science concepts)  
The Scarlet Ibis (J. Hurst)  
(limits of the human body)  
To the Top: Annapurna (Blum)  
(endurance, respiratory system)

### Physical Education

*Body Control*  
*Movement*  
*Coordination*  
*Musculatory System*  
*Fitness*  
*Endurance*

### Art

*Draw a body:*  
*symmetry, line, shape*  
*Human forms - art*  
*realism, abstract,*  
*cubist*

# KEY CONCEPTS IN IB MYP

## Key concepts

The MYP identifies 16 key concepts to be explored across the curriculum. These key concepts, shown in Table 2, represent understandings that reach beyond the eight MYP subject groups from which they are drawn.

Aesthetics	Change	Communication	Communities
Connections	Creativity	Culture	Development
Form	Global interactions	Identity	Logic
Perspective	Relationships	Systems	Time, place and space

**Table 2**  
*MYP key concepts*

Source: Inquiry: Establishing the purpose of the unit. (n.d.). Retrieved April 16, 2019, from [https://ibpublishing.ibo.org/server2/rest/app/tsm.xql?doc=m\\_0\\_mypxx\\_guu\\_1409\\_1\\_e&part=6&chapter=2](https://ibpublishing.ibo.org/server2/rest/app/tsm.xql?doc=m_0_mypxx_guu_1409_1_e&part=6&chapter=2)

# ACTIVITY CORNER: IMAGES OF CONCEPTS

- 1) Identify as many concepts as possible in the images below.



# EXAMPLES OF CONCEPTUAL LENS

Conflict  
Complexity  
Beliefs  
Paradox  
Interdependence  
Interactions  
Freedom  
Transformations  
Force  
Identity  
Patterns  
Relationships  
Origins  
Change

Revolution  
Perspective  
Reform  
Heroes  
Power  
Influence  
System  
Balance  
Structure  
Innovation  
Design  
Aesthetics  
Creativity

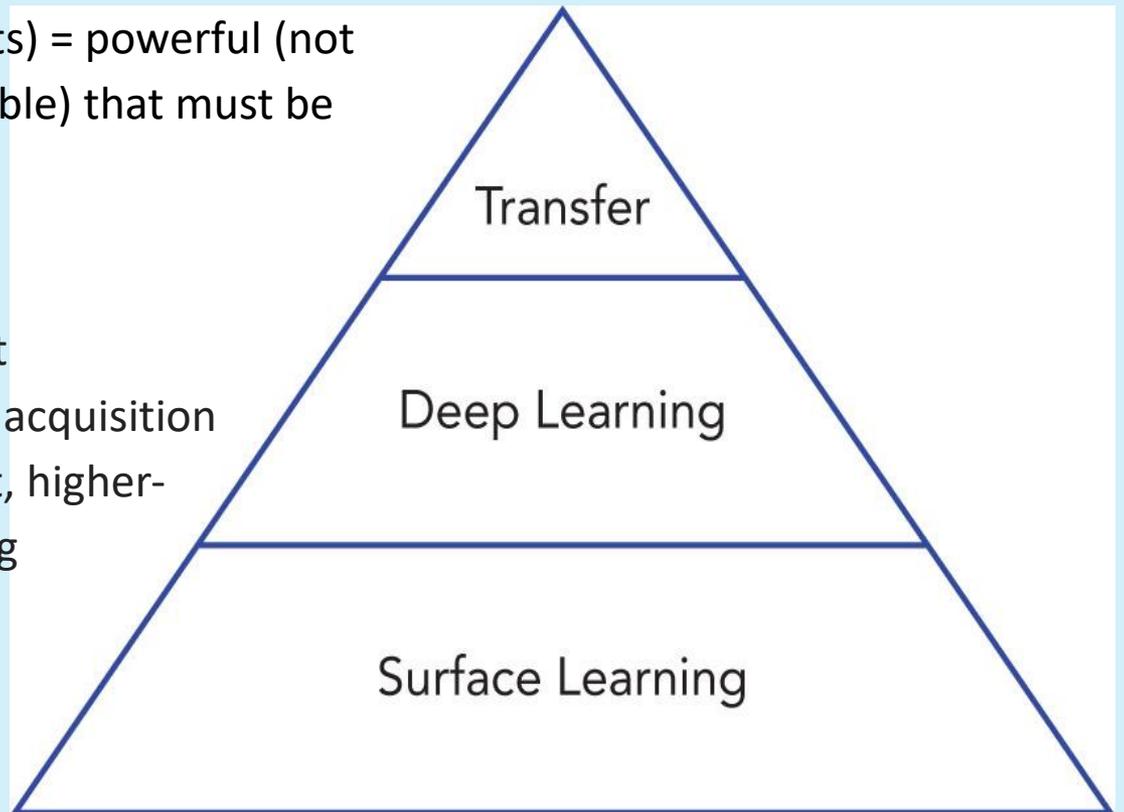


Source: Laurel, V. (2021, December 26). *Conceptual lenses: What are they?* Educaideas.com. Retrieved April 25, 2022, from <https://educaideas.com/en/conceptual-lenses/>

# BIG IDEAS AND DEEP LEARNING

- **Big Ideas** (Aha! moments) = powerful (not large) themes (transferable) that must be uncovered.

- **Deeper learning** = set of student educational outcomes including acquisition of robust core academic content, higher-order thinking skills, and learning dispositions.



**A thought:** Interestingly, the types of assessments seem to be varied (see below) (and follow the revised Bloom's taxonomy), but how does the curriculum lends itself to support these?

- Formative Assessment will consist of 3 activities of 10 marks each: (Final Weightage: 10 marks)
- Individual Activity (Making chart, model, project etc)
- Group Activity (Skit, Model making, project presentations etc)
- Pen and paper exam

## Structure of Knowledge Across the Core Content Areas

TEKS	SS 8.24 (a-e)	SS 8.6 (Biology 12)	ELA 8.12
<b>Principle/ Generalization</b>	<ul style="list-style-type: none"> <li>• Similarities and differences between and among people influence relationships.</li> <li>• Differences between and among people can create conflict.</li> </ul>	<ul style="list-style-type: none"> <li>• There is a relationship of mutual influence between organisms and their environment.</li> <li>• Interdependence occurs among living systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Forms of written texts have distinguishing characteristics.</li> <li>• Different types of texts serve different purposes.</li> </ul>
<b>Concepts</b>	Influence Relationships Conflict Patterns	Influence Relationships Systems Interdependence	Conflict Relationships Change
<b>Topics</b>	Conflict in American Society	Ecosystems in the Northern Hemisphere	American Literature During the Civil War
<b>Facts</b>	<ul style="list-style-type: none"> <li>• Conflict between white settlers and Native Americans led to forced migration of the American natives.</li> </ul>	<ul style="list-style-type: none"> <li>• Organisms are organized into species.</li> <li>• Organisms depend on unique resources to survive.</li> <li>• Species vary from ecosystem to ecosystem.</li> </ul>	<ul style="list-style-type: none"> <li>• Uncle Tom's Cabin by Harriet Beecher Stowe was a novel written to influence public opinion concerning slavery.</li> <li>• Proponents of states' rights and abolitionists both used written texts to explain their views and influence public opinion.</li> </ul>

# REASONS FOR A CONCEPT-BASED LESSON

- Enhance transfer of knowledge and skills to different situations
- The world is interdisciplinary
- Interaction of factual knowledge and concepts.
- Deeper level of mental processing and increases understanding
- Helps students develop strategies for learning
- Depth of knowledge and understanding is needed for innovation
- Facts alone are not enough
- Helps make connections
- Empowers students
- Fosters their love for learning
- Synergistic thinking
- Thinking involved for students
- Intercultural understanding
- Motivation for learning
- Fluency with language
- Engages emotions

# CONTENT OF A GOOD UNIT

- Unit title
- Conceptual lens, concepts and sub-concepts
- Unit web
- Generalizations that put the concepts into relationships with one another
- Guiding questions
- Critical content and key skills that students will need to master
- Learning experiences and lessons
- Assessments: performance tasks and corresponding scoring guides

Conclusion: In a concept-based unit, all the parts work together to form a cohesive whole: Students tackle the *guiding questions* by investigating the critical content using key skills.

# EXAMPLE : SCIENCE

- “What happens when an ecosystem is disturbed?”
- Topics: ecosystems
- Skill: testing hypotheses
- Conceptual lens of: interdependence, change and adaptation
- Sub-concepts (of Biology): ecological succession and cyclical disturbance
- Ultimate understanding: When an ecosystem experiences disturbance, new conditions enable the success of some species while disadvantaging others, which they use to predict the impact of an underwater earthquake on an ocean ecosystem.

# UNIT PLANNING

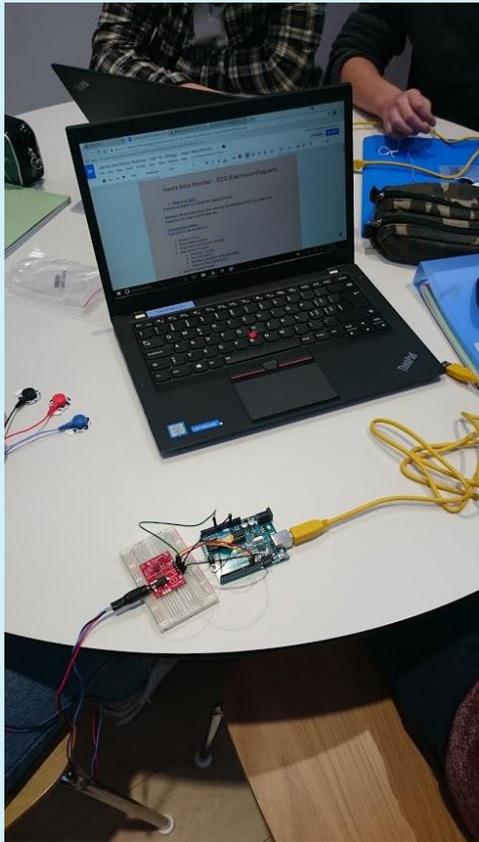


FIGURE 1.10 UNIT PLANNING STEPS

**Step 1: Create a unit title.**

The unit title can be engaging for students but needs to clearly indicate the content focus.

**Step 2: Identify the conceptual lens.**

The conceptual lens is a concept that provides focus and depth to the study and ensures synergistic thinking.

**Step 3: Identify the unit strands.**

Strands will be subject areas for inter-disciplinary units. The strands will be major headings, which break the unit title into manageable parts for intra-disciplinary units. In a process discipline, the strands are defined: understanding, responding, critiquing, and producing. Strands are placed in a web around the unit title.

**Step 4: Web out the unit's topics and concepts under the strands.**

After brainstorming, underline the concepts under each strand so they can be easily accessed in the next step.

**Step 5: Write the generalizations you expect students to derive from the unit study.**

Craft one or two generalizations using the conceptual lens, and one or two generalizations for each of the strands. Sometimes a generalization will address one or more strands (especially in a process discipline). A unit of study may have 5–9 generalizations depending on the grade level and length.

**Step 6: Brainstorm the guiding questions.**

Guiding questions facilitate student thinking toward the generalizations. Guiding questions should be coded as to type (factual, conceptual, debatable). Each generalization needs a mixed set of 3–5 factual and conceptual questions developed during the planning process, and 2 or 3 provocative questions for the unit as a whole.

**Step 7: Identify the critical content.**

The critical content is the factual knowledge required for grounding the generalizations, deepening knowledge of the unit topic, and defining what students may need to know about processes/skills.

**Step 8: Identify the key skills.**

The key skills may be drawn verbatim from academic standards or national curricula. Key skills transfer across applications and are not tied to specific topics until they appear in the learning experiences.

**Step 9: Write the common, culminating assessment and scoring guide/rubric.**

The culminating assessment reveals student understanding of an important generalization (or two), their knowledge of critical content, and key skills. Develop a scoring guide, or rubric, with specific criteria for evaluating student work on the task.

**Step 10: Design suggested learning experiences.**

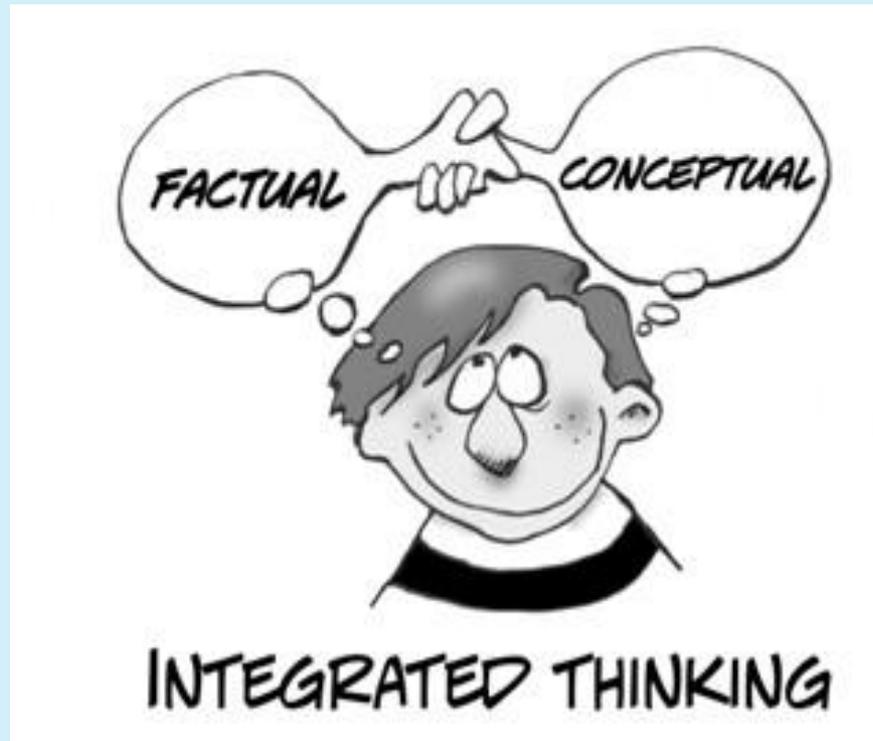
Learning experiences ensure students are prepared for the expectations of the culminating assessment and reflect what students should understand, know, and be able to do by the end of the unit. Learning experiences are meaningful and authentic. Included in this section are suggestions for pacing, other assessments, differentiation strategies, and unit resources.

**Step 11: Write the unit overview.**

The unit overview is written to read to the students to hook or grab their interest and attention and to introduce them to the study.

**WRITING GOOD**

**GUIDING/INQUIRY/CONCEPTUAL QUESTIONS**



# GOOD QUESTIONS ARE FACTUAL, CONCEPTUAL, & DEBATABLE

**Factual questions** are content specific, and generally, are answered either right or wrong; for example:

“What are some of the push factors for the migrations of the Bantu peoples between the 13th and 15th centuries?”

“How does the construction of hydroelectric plants (dams) differentially impact populations in India and Egypt?”

**Conceptual questions** are broader and may be answered across time and contexts, for example:

“In what ways does the uneven distribution of resources limit economic and political opportunities?”

“Why might a country restrict the migration of its people both within and outside of the country?”

“What is the relationship between formulas and unknown quantities?”

“What is the relationship between the parts of a system and change?”

# MORE CONCEPTUAL QUESTIONS

- **Mathematics:** When is the “correct” answer not the best solution?  
What are the limits of mathematical representation and modelling?
- **Science:** To what extent are science and common sense related?  
How are “form” and “function” related in biology?
- **Technology:** In what ways can technology enhance expression and communication?  
In what ways might technology hinder it?  
What are the pros and cons of technological progress?
- **MYP Maths**

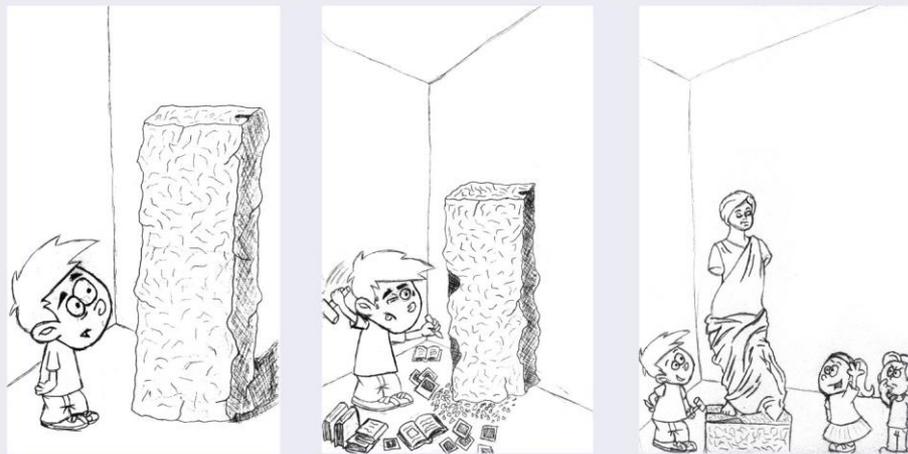
Factual questions: Remembering facts and topics	Conceptual questions: Analysing big ideas	Debatable questions: Evaluating perspectives and developing theories
<ul style="list-style-type: none"><li>• How do the gradients of perpendicular lines compare?</li><li>• How does the volume of a quantity differ from its area?</li><li>• What determines whether two events are independent?</li></ul>	<ul style="list-style-type: none"><li>• What does it mean to have a “solution” of a function?</li><li>• Why can estimation be useful?</li><li>• How could we map the neural network of a human brain?</li></ul>	<ul style="list-style-type: none"><li>• What is more natural: order or chaos?</li><li>• Are all events in the universe determined by probability?</li><li>• How big is infinity?</li></ul>

# 3. STRATEGIES FOR CONCEPT-BASED TEACHING & LEARNING

Panel 1: Traditional Learning



Panel 2: Concept-Based Learning



Source: Stern, J. H., Mohnkern, J., & Ferraro, K. F. (2017). *Tools for teaching conceptual understanding: Designing lessons and assessments for deep learning; Secondary*. Thousand Oaks, CA: Corwin, a SAGE Publishing Company.

# PROJECT-BASED TEACHING AND LEARNING - SDG PROJECT

Key knowledge, understanding, and success skills

Challenging problem or question

Sustained Inquiry

Authenticity

Student voice and choice

Reflection

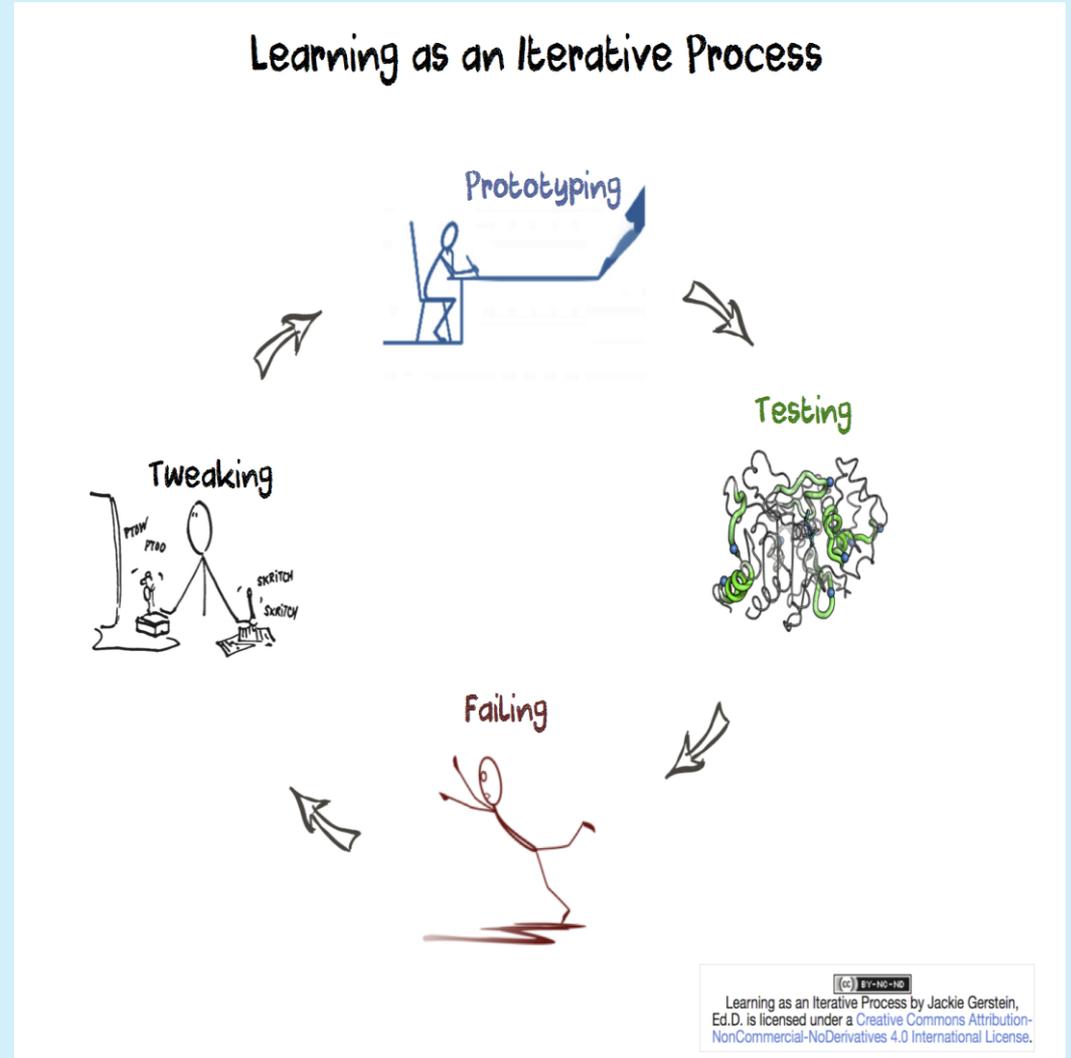
Critique and Revision

Public product or action



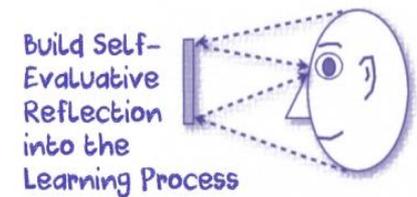
# FOR THE TEACHER

- Adopt a growth mindset
- Keep an intellectual journal = you and your students can keep a notebook or scrapbook of your thinking.
- Teach students to learn conceptually
- Build a common concept-based language - start with what makes someone an expert?
- Use iterative learning (conceptual relationship)
- Move students through the inquiry cycle



- Use sophisticated and dynamic ideas
- Uncover to transfer ideas
- Use a variety of assessments
- Use technology to connect and collaborate and to foster conceptual understanding
- Use concepts against curriculum standards

## Educator as a Model Learner



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# BUILDING BLOCKS OF CONCEPT-BASED INSTRUCTION: STRATEGIES FOR STUDENTS

## ACTIVITY EXAMPLE : FOUR CORNERS

Pose a conceptual question and ask them to think about the answer, move to the corner of the room and as a group explain why they chose that definition.

Ex: Which of the following best matches your understanding of atoms?

- A. Smallest component of an element having the chemical properties of the element
- B. Energy or source of nuclear energy
- C. Anything extremely small; a minute quantity
- D. Element that consists of a nucleus with combinations of neutrons and protons and electrons

AND:

- Individual Journaling
- Take a stand then divide and slide
- Gallery Walk with Chalk Talk
- Uncover and Transfer
- Transfer and Limitations



Conclusion:

- ❖ Pre-instructional understanding: students respond with initial thoughts to conceptual questions about the relationship between the concepts of
- ❖ Deep understanding of each concept by itself: students explore one or more specific contexts that illustrate the nature of the relationship and give them the fact base needed for deep thinking.
- ❖ Students uncover conceptual relationship: students explain (write, draw, tell, etc..) a statement of conceptual relationship with evidence from the context to help support and explain the relationship
- ❖ Transfer of understanding to a new situation

## 4. CLOSING REMARKS

### ACTIVITY CORNER : CONNECT, EXTEND, CHALLENGE

**CONNECT:** How are the ideas and information presented **CONNECTED** to what you already knew?

**EXTEND:** What new ideas did you get that **EXTENDED** or pushed your thinking in new directions?

**CHALLENGE:** What is still **CHALLENGING** or confusing for you to get your mind around? What questions, wonderings or puzzles do you now have?

To make continuous progress in improving education, we must maintain a dynamic balance between challenge and comfort as we strive to inspire young people,

to think deeply  
to question openly  
to risk personally  
to care for others  
to act globally and  
to value humanity & the environment.

- Lynn Erikson (2011)

# OTHER USEFUL RESOURCES

<https://www.thinkib.net/leadership/page/21002/ib-approaches-to-teaching>

<https://www.youtube.com/watch?v=3xvY20jtjr0>

[http://www.ibmidadlantic.org/Concept Based Teaching Learning.pdf](http://www.ibmidadlantic.org/Concept%20Based%20Teaching%20Learning.pdf)

<http://semiscoalition.org/wp-content/uploads/Getting-the-Big-Idea-Handout.pdf>

-Most pictures are courtesy of Pexels.

THANK YOU!

