MODULE 1
CONCEPT-BASED CURRICULUM

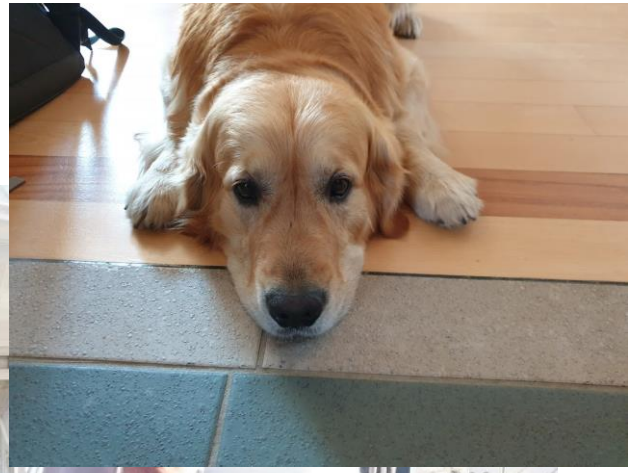
Trainer
Marie-France
Labelle

1. INTRODUCTIONS

ACTIVITY CORNER : I AM…

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

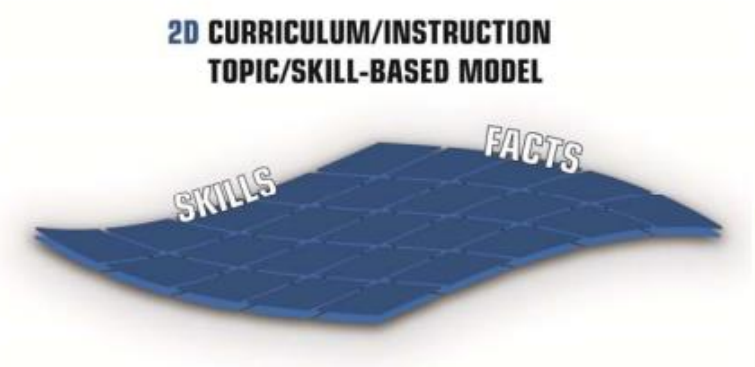
The new STEM Centre at La Grande Boissière

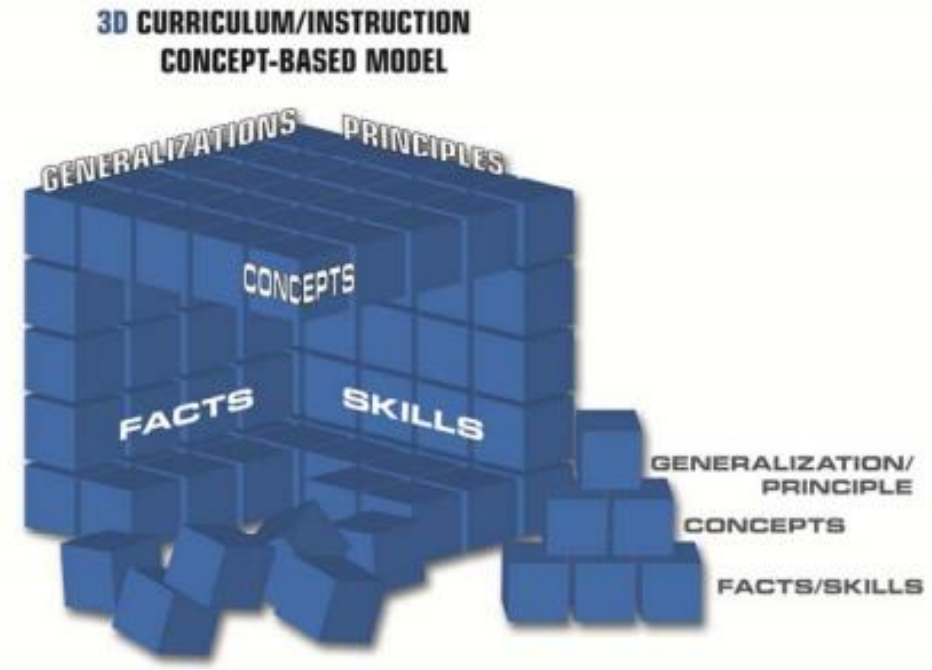


LEARNING OBJECTIVES

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.

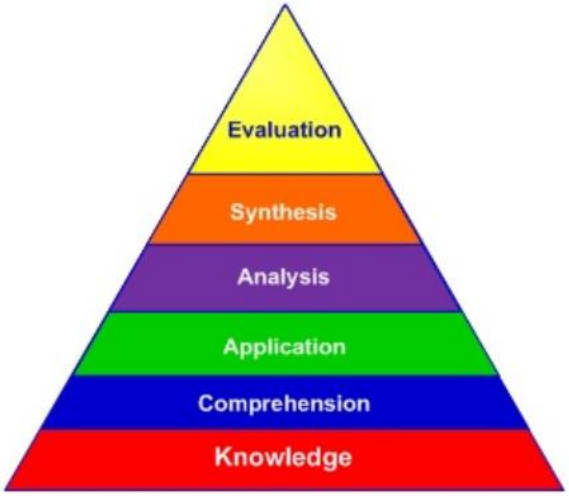
2. DEFINING CONCEPT-BASED CURRICULUM DESIGN : ESSENTIAL ELEMENTS



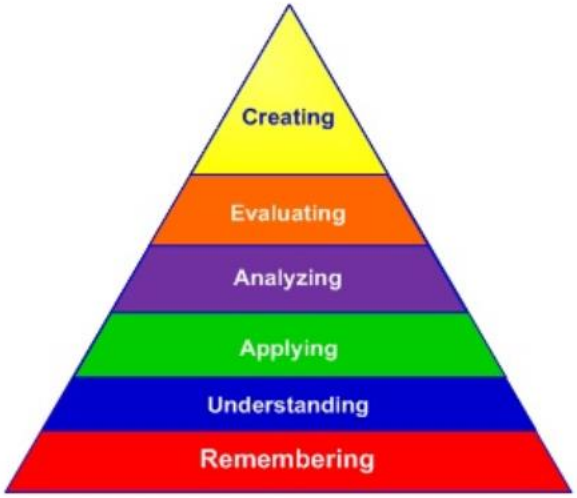


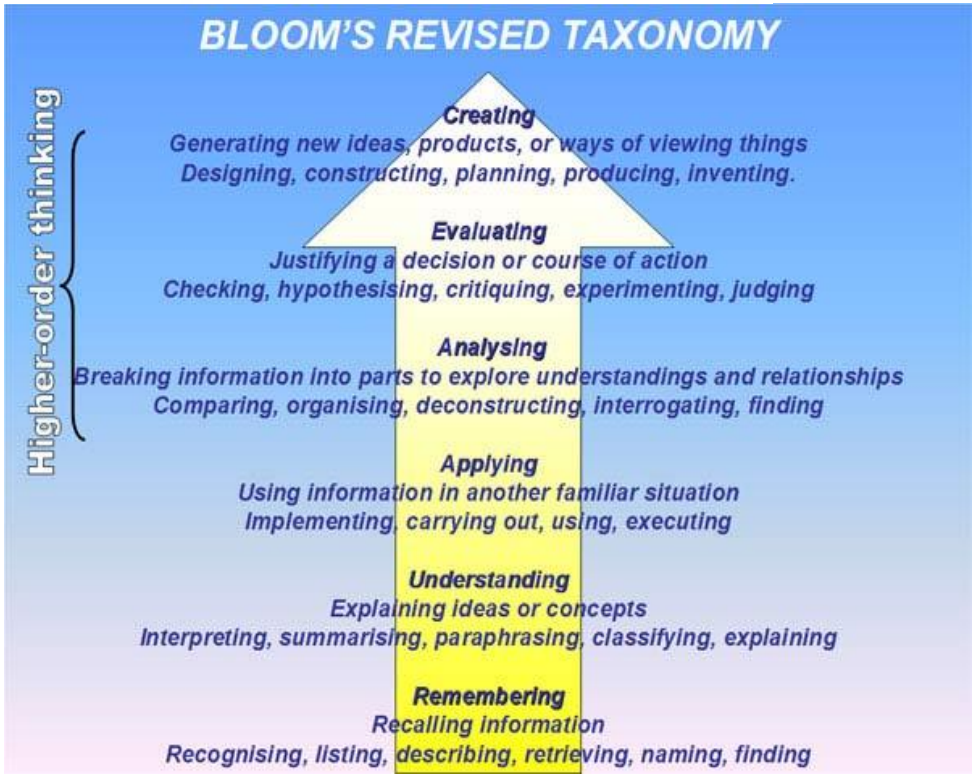
Source: Stern, . H., Mohnkern, J., & Ferraro, K. F. (2017). *Tools for teaching conceptual understanding: Designing lessons and assessments for deep learning; Secondary*. Thousand Oaks, CA: Corwin, a SAGE Publishing Company.

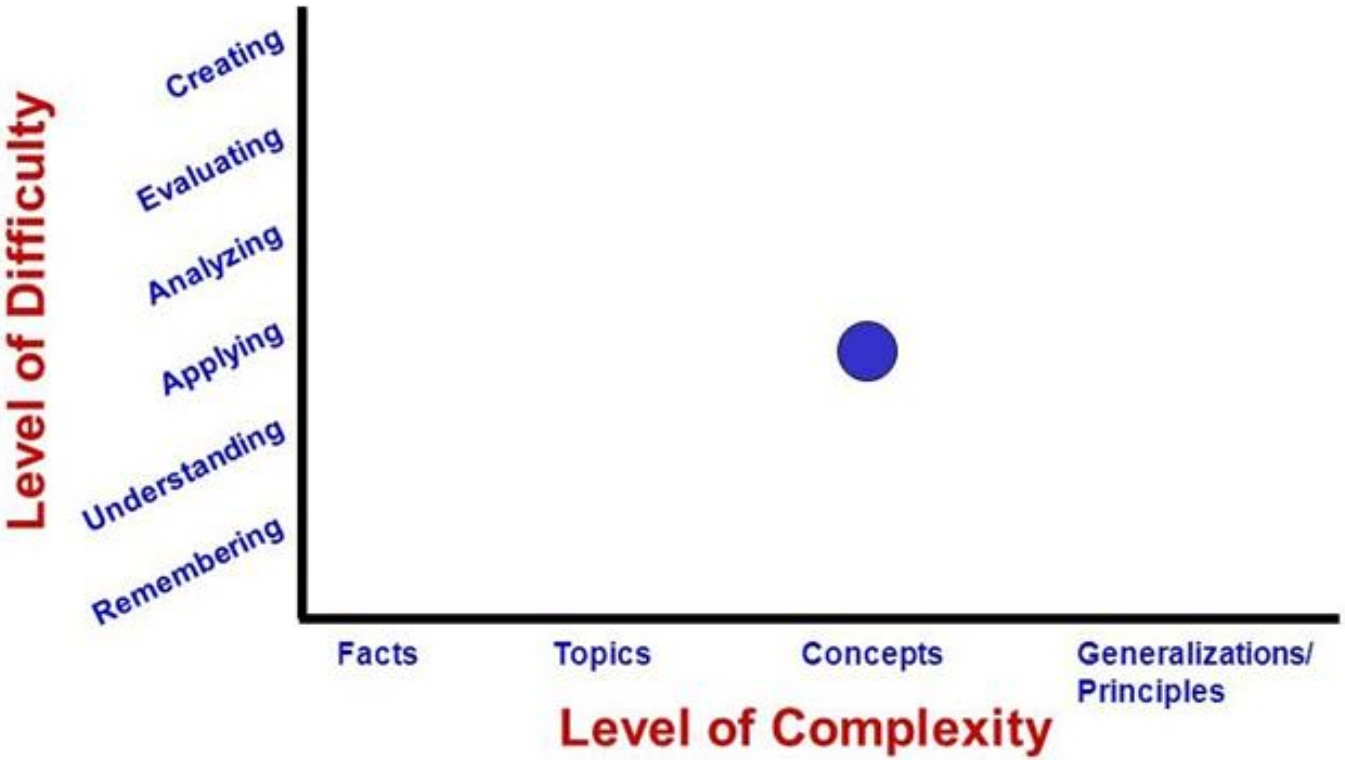
Blooms Taxonomy



Blooms Taxonomy - Revised






Level of Difficulty
Creating
Evaluating
Analyzing
Applying
Understanding
Remembering
Facts
Topics
Concepts
Generalizations/
Principles
Level of Complexity

ACTIVITY CORNER : 3-2-1 STRATEGY

1) Recall your 'special student'.
2) Select 3 practices that you feel had or would positively impact your student.
3) Discuss 2 of the practices with a partner.
4) Highlight the 1 practice that you feel would have the potential for the most positive impact on your student (post-it).

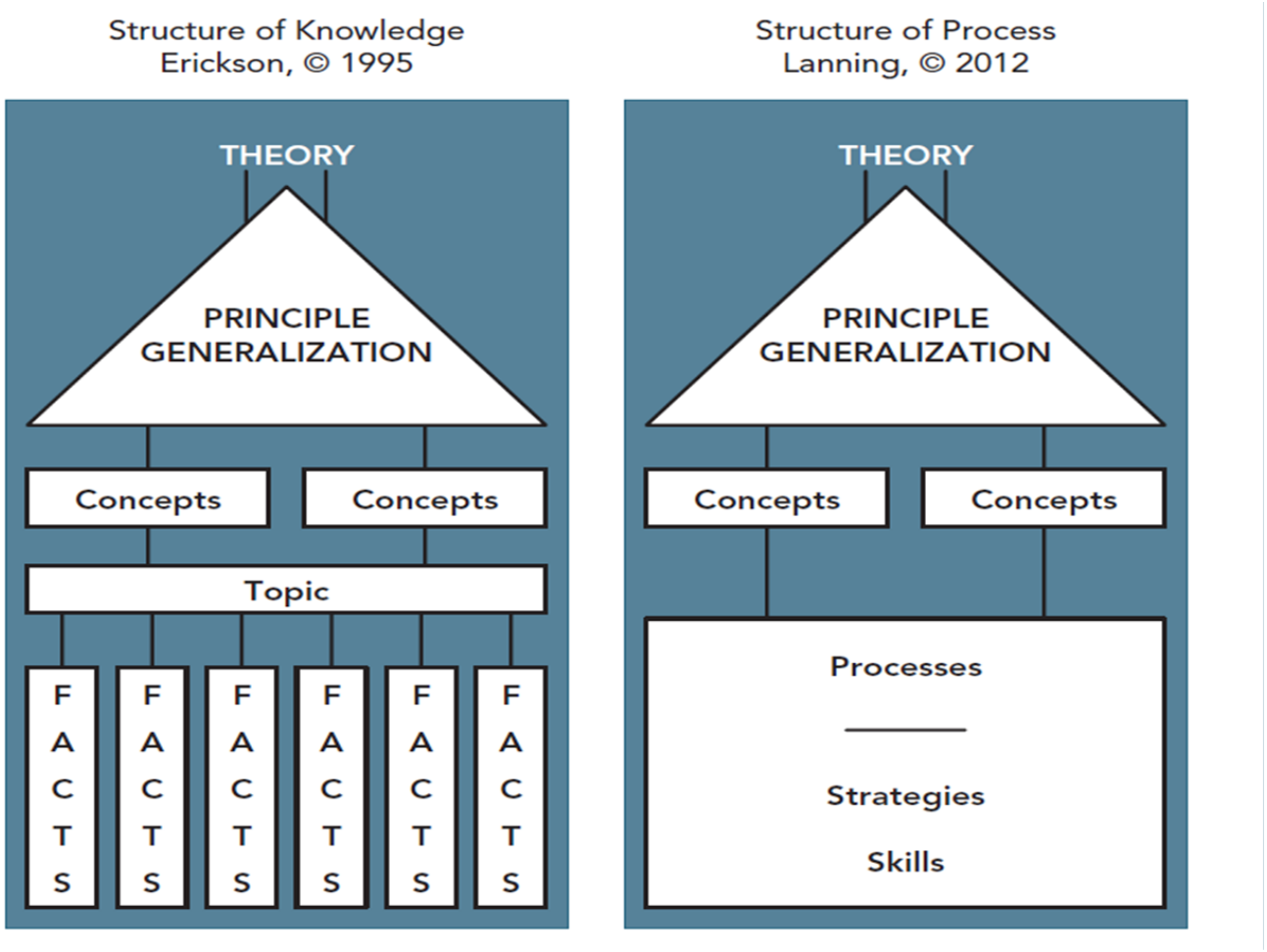
LESSON ATTRIBUTES

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

ACTIVITY CORNER : BRAINSTORM

1) Choose 2 lesson attributes.
2) In a group of 2 people, suggest 2 teaching strategies (on flipchart paper) for each that you would use to achieve these in your classroom.

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

Theory = is a conceptual idea that is yet to be proven

Principle = a form of generalization, but is a truth that holds consistently through time

Generalization = Connection/relatedness of two or more concepts

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

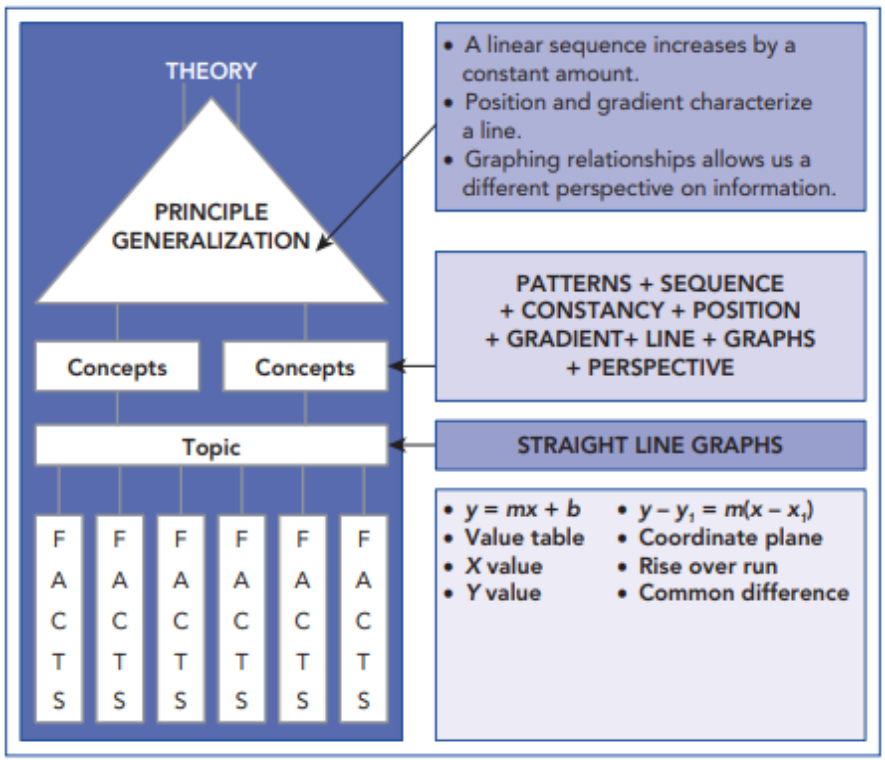
- Concepts that are broad such as change, pattern, and system which can be applied across disciplines = ***macro-concepts***.
- Concepts that are discipline specific = ***micro-concepts***

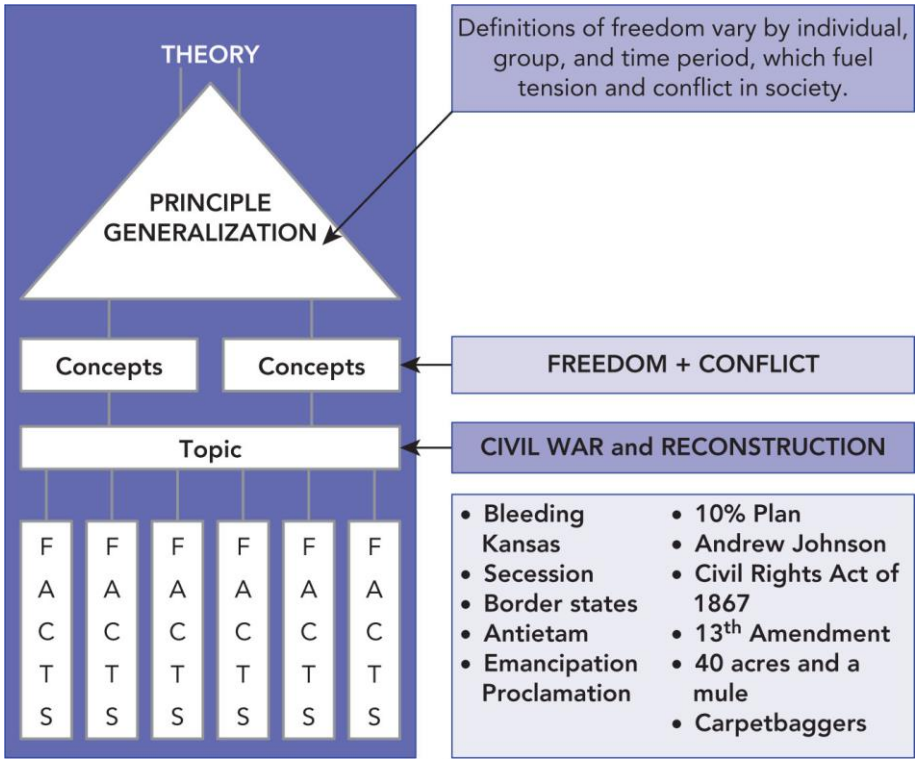
Topic = a category of study with a body of related facts to be learned

Fact = a statement of truth or knowledge (not transferable)

Conclusion: 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.

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 (Ka, Kb) Strong acid/base Weak acid/base	Systems Equilibrium Disassociation Neutralization
Heath and Physical Fitness	Basketball	Dribbling Layup Jump shot	Offensive versus defensive Movement Systems

KEY CONCEPTS IN 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

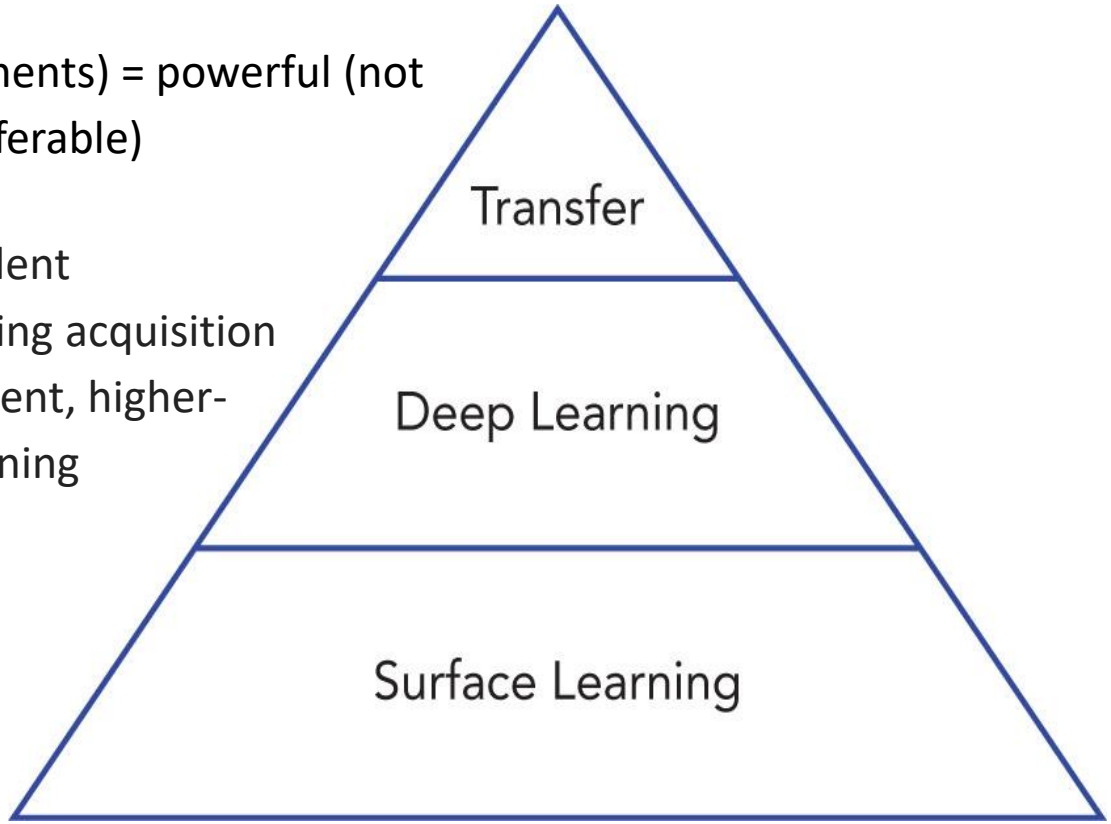
ACTIVITY CORNER: IMAGES OF CONCEPTS

1) In a group, identify as many concepts as possible in the images given to you
2) You may use the IB MYP list.

BIG IDEAS AND DEEP LEARNING

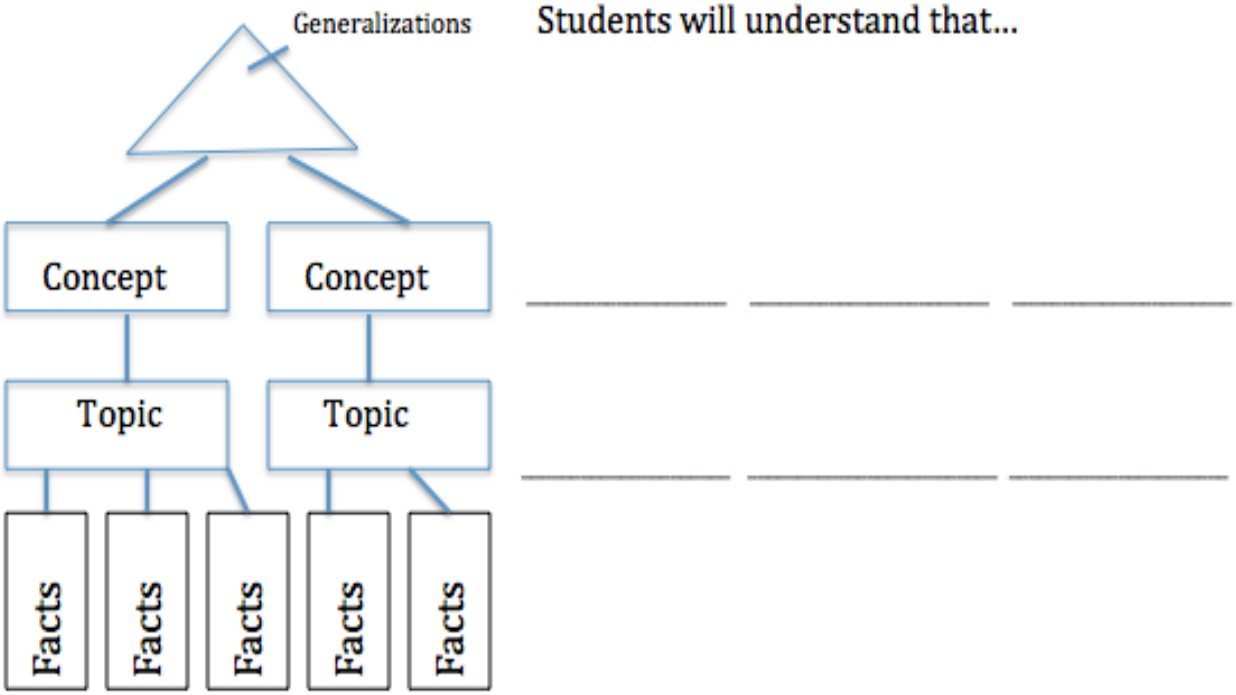
- ***Big Ideas*** (Aha! moments) = powerful (not large) themes (transferable)

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



ACTIVITY CORNER: STRUCTURE OF KNOWLEDGE FOR STEM

1) Using the CBSE subject curriculum given to your group, determine the facts, topics, concepts and generalizations by 'Chapter' or 'Standard'.



2) **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?

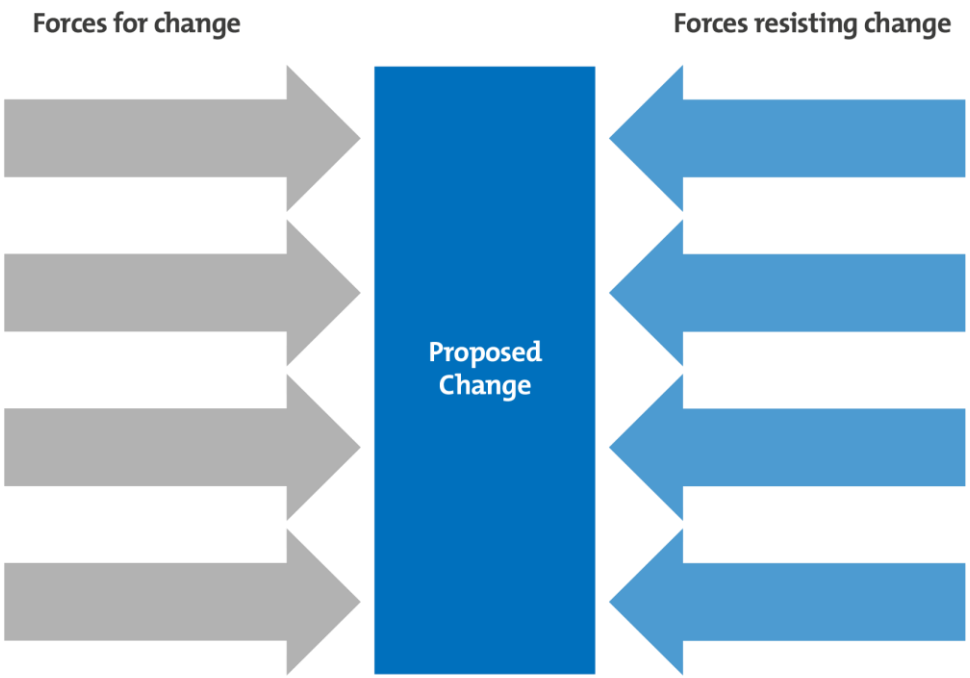
- Formative Assessment will consist of 3 activities of 10 marks each: (Final Weightage: 10 marks)
- Individual Activity (Making chart, model, project etc)
- Group Activity (Skit, Model making, project presentations etc)
- Pen and paper exam

Structure of Knowledge Across the Core Content Areas

TEKS	SS 8.24 (a-e)	SS 8.6 (Biology 12)	ELA 8.12
Principle/ Generalization	• Similarities and differences between and among people influence relationships. • Differences between and among people can create conflict.	• There is a relationship of mutual influence between organisms and their environment. • Interdependence occurs among living systems.	• Forms of written texts have distinguishing characteristics. • Different types of texts serve different purposes.
Concepts	Influence Relationships Conflict Patterns	Influence Relationships Systems Interdependence	Conflict Relationships Change
Topics	Conflict in American Society	Ecosystems in the Northern Hemisphere	American Literature During the Civil War
Facts	• Conflict between white settlers and Native Americans led to forced migration of the American natives.	• Organisms are organized into species. • Organisms depend on unique resources to survive. • Species vary from ecosystem to ecosystem.	• Uncle Tom's Cabin by Harriet Beecher Stowe was a novel written to influence public opinion concerning slavery. • Proponents of states' rights and abolitionists both used written texts to explain their views and influence public opinion.

ACTIVITY CORNER: REASONS FOR CONCEPT-BASED CURRICULUM

1) Using a force field analysis worksheet decide if a concept-based curriculum is worth trying.



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

ACTIVITY CORNER : THINK PAIR SHARE

1) List on your own all of what you would include in a good unit (you can choose a specific topic).
2) Share with a partner to add to your list.
3) Share with the group.

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

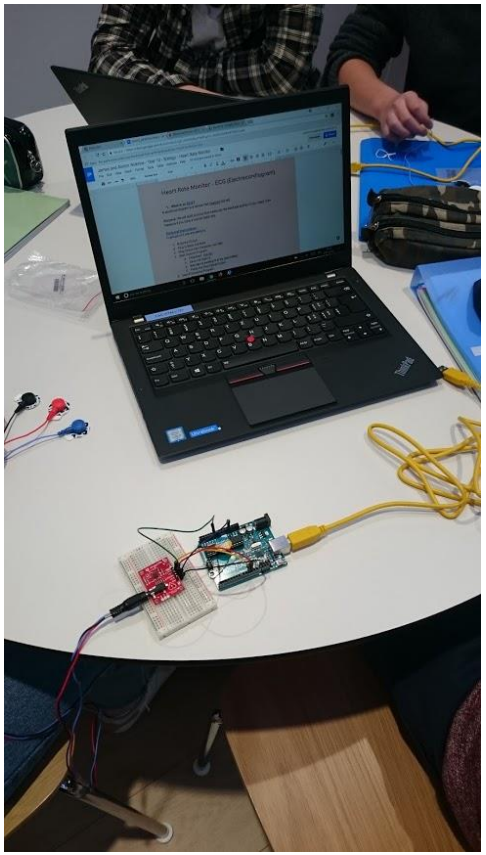


FIGURE 1.10 UNIT PLANNING STEPS

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.

SOURCE: Erickson, Lanning, & French. (2017). *Concept-Based curriculum and instruction for the thinking classroom* (2nd ed.). Thousand Oaks, CA: Corwin.

WRITING GOOD GUIDING/INQUIRY/CONCEPTUAL QUESTIONS

INTEGRATED THINKING

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
• How do the gradients of perpendicular lines compare? • How does the volume of a quantity differ from its area? • What determines whether two events are independent?	• What does it mean to have a "solution" of a function? • Why can estimation be useful? • How could we map the neural network of a human brain?	• What is more natural: order or chaos? • Are all events in the universe determined by probability? • How big is infinity?

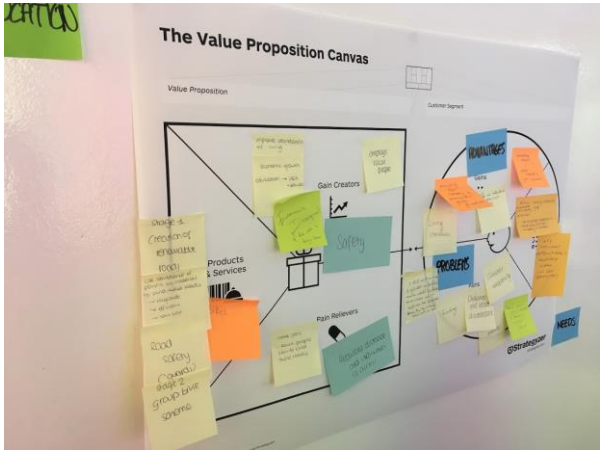
ACTIVITY CORNER : WRITING QUESTIONS

Conceptual questions should ask about the nature of the relationship between concepts (blank spaces should be filled in with concepts, not facts or topics).

- What is the relationship between _____ and _____?
- How does _____ impact _____?
- What effect do _____ and _____ have on _____?
- How do the forces of _____ and _____ interact?

1) Select a lesson or unit that you teach.
2) What changes could be made to a lesson or the unit so that it focuses more on conceptual learning?
3) Write a conceptual and a factual question to guide that learning (through a conceptual lens)?

CONCEPTUAL LENS



Sample Conceptual Lenses		
Conflict	Identity	Power
Complexity	Patterns	Influence
Beliefs/Values	Relationships	System
Paradox	Origins	Balance
Interdependence	Change	Structure/function
Interactions	Revolution	Innovation
Freedom	Perspective	Design
Transformations	Reform	Genius
Force	Heroes	Aesthetics
		Creativity

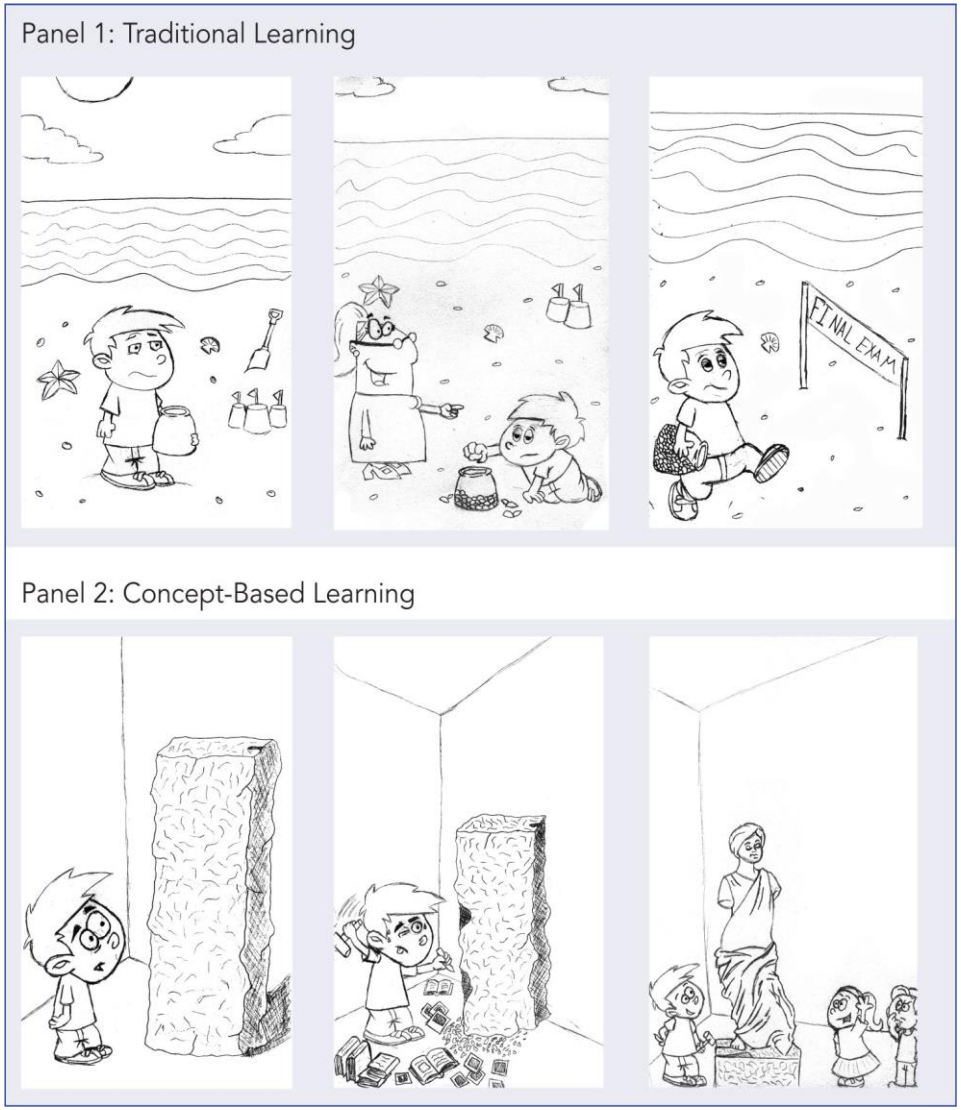
ACTIVITY CORNER : SDG PROJECT PROJECT-BASED TEACHING & LEARNING

1) In groups of 2-4 start to devise the skeleton for the development of an SDG Project (targeting 1 SDG goal) that will help students with conceptual understanding. Your project must have some if not all of the following elements:

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

2) Refer to example (p.80-82 printed)

3. STRATEGIES FOR CONCEPT-BASED TEACHING & LEARNING



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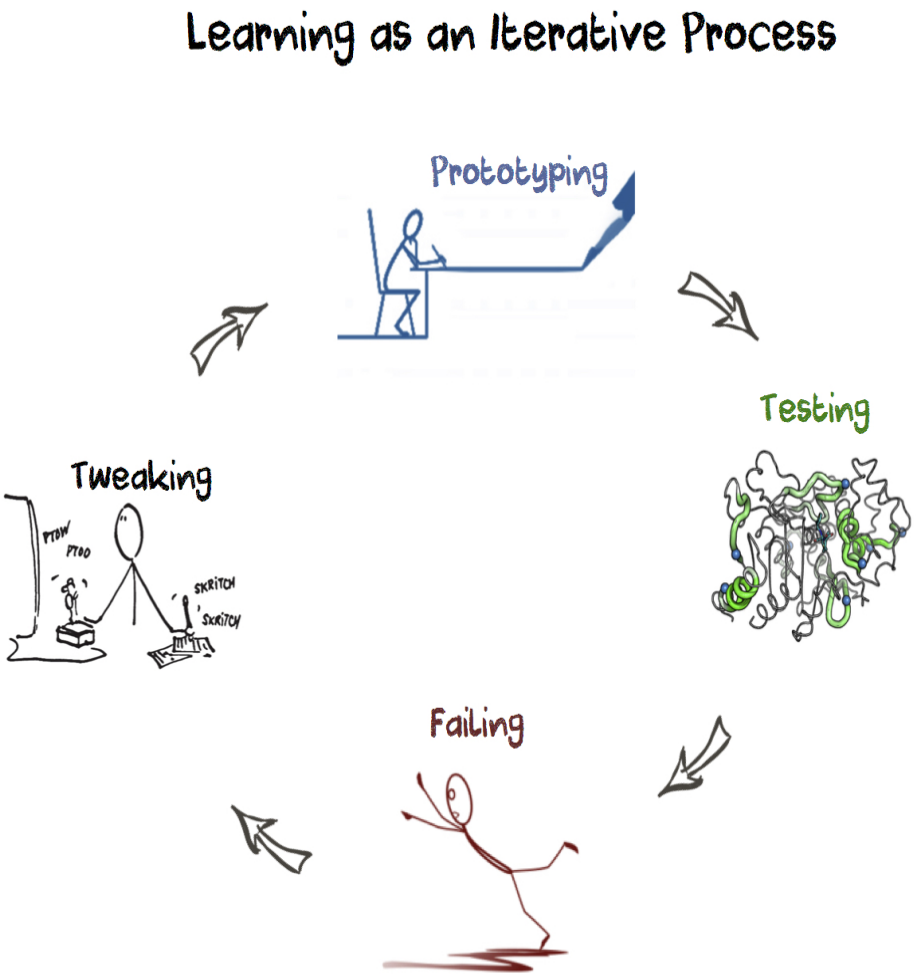
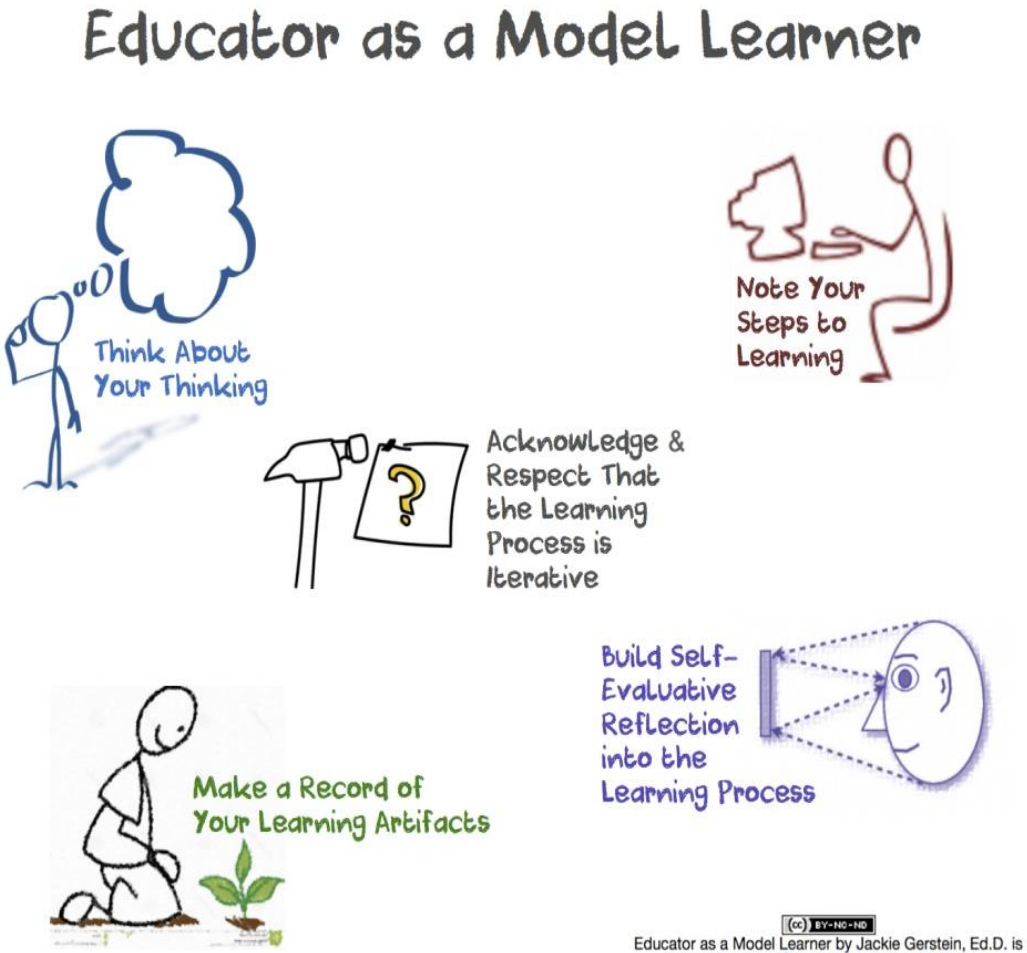
FOR THE TEACHER

- ➔ 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 of ideas
- ➔ Use a variety of assessments
- ➔ Use technology to connect and collaborate and to foster conceptual understanding
- ➔ Use concepts against curriculum standards



BUILDING BLOCKS OF CONCEPT-BASED INSTRUCTION: STRATEGIES FOR STUDENTS

ACTIVITY CORNER : 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
- 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.ibmidatlantic.org/Concept_Based_Teaching_Learning.pdf
http://semiscoalition.org/wp-content/uploads/Getting-the-Big-Idea-Handout.pdf