Dep't Earth, Ocean & Atmospheric Sciences
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THE UNIVERSITY OF BRITISH COLUMBIA

EOAS Science Education Initiatives

"How Learning Works"

Some fundamentals that can improve all learning, research, teaching & professional communications.

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Intro

- Learning happens in all professional and academic interactions.
- *Facilitating* learning is a distinct form of expertise.

- Objectives: we hope you can …
  - Apply *4 fundamental characteristics* of learning to enhance professional or academic communication and teaching.
  - Recognize how *facilitating learning* ('teaching') involves expert knowledge and skills that can be learned.
  - Be inspired to look into the precedent & literature about learning – teaching – novices & experts – etc.

Who benefits

- In what professional or academic settings does "learning" of ANY kind happen?
- Think – pair – share

- Examples:
  - Determine scope of a project with a client
  - Presenting a seminar
  - Discuss a research challenge with peers

Why fundamentals?

- We all refer to fundamentals when puzzled.
- Fundamentals & theory are needed to react in new situations.
- **Examples:**
  - In a statistical analysis … … results NOT as anticipated … ☹
  - → *Revert to fundamentals*
    - **Assumptions**: N big enough? Populations have a "normal distributions"? Etc.
    - **Methods**: algorithm was correct? Choice of T or ANOVA was appropriate?

- **Learning examples:**
  - Students all do poorly on test … ☹
  - Or, colleagues respond as if you never spoke …
  - → …. What fundamentals to consider?

Fundamentals of learning?

- Suggest examples of "universal" (as you see it) fundamental notions about learning?
- Think … share
  - Eg: learning involves practice …
  - ..
  - ..
  - ..

Primary inspiration for most of this hour:
How Learning Works: 7 research-based principles for smart teaching. *Referenced later.*

Fundamentals we'll explore

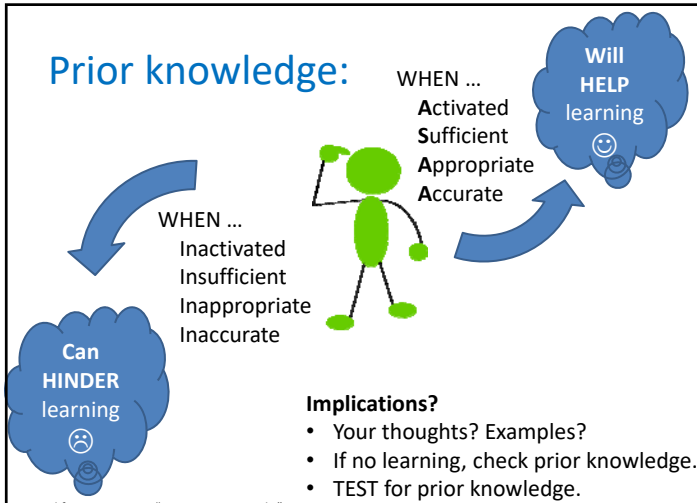
1. Prior knowledge
2. Motivation
3. Experts vs novices
   - Knowledge: how its organized, accessed, applied ...
   - Developing "mastery" (and some implications).
4. Practice & feedback
   - Briefly

1. Prior knowledge

Preconditions for changing the brain (i.e. *learning*):

- **Activated:** Is **prior knowledge** *accessible*?
  - Eg. "transfer" from one setting to another
- **Sufficient:** Is there *enough* to proceed?
- **Appropriate:** Is it *aligned* with particular needs?
  - Eg. "common usage" of terms in "technical" settings
  - Eg. Writing skills based on "creative writing" courses.
- **Accurate:** No *misconceptions* or gaps?

Prior knowledge:



Derived from Figure 1.1, "How Learning Works".

Implications?

- Your thoughts? Examples?
- If no learning, check prior knowledge.
- TEST for prior knowledge.
- Foster access to, & assessment of, P. K.

2. Motivation

Three dimensions:

In order to be "well motivated", a student (or other learner) must …

- Value what is to be learned
- Have sufficient self confidence (self efficacy)
- Be in a supporting environment

2. Motivation

Three dimensions of motivation:

	UNsupportive environment		Supportive environment	
	Not valued	Valued	*Not valued*	Valued
Low self efficacy	*Rejecting*	Hopeless	*Rejecting*	Fragile
High self efficacy	***Evading***	**Defiant**	***Evading***	**Motivated**

Derived from Figure 3.2, "How Learning Works".

2. Motivation

- Value what's being learned
- Self efficacy
- Supporting environment

Implications?

- May need to actively foster "value" (eg in Calc101!)
- Assess & support self efficacy (diversity issues, etc.)
- Other implications?

3. Novices vs. experts

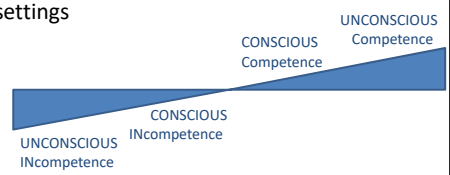
- Most fundamentals boil down to distinctions between ***expert*** and ***novice*** behavior.

3. Novices vs. experts

- What behaviors distinguish experts & novices?
  - think – pair – share
- Examples
  - Complex work is 'effortless' & 'automatic'.
  - Path forward is "obvious" or has distinction options.
  - "Unconscious" competence.
  - Can "*transfer*" skills/knowledge to new settings.

Attaining "mastery"

- Are experts unconscious of their competence?
- Are novices conscious of their incompetence?
- Elements of mastery
  - Acquire *component* skills
  - Practice *integrating* components
  - Know *which/when* to apply skills
  - *Transfer* to new settings
- Which is emphasize at school?



Effortless? Automatic?

- Experts use complex combinations of skills, assumptions, cognitive "leaps" etc.
- Driving is one example
  - Talking while driving in the city …?
- Expert cook's instructions are another
  - *"sauté until done… "*

Novice/experts … implications

- Expert blindness = loosing awareness of your own expertise.
- Do experts = best teachers?
  - Not without *pedagogic expertise*.
- Expert task deconstruction
  - Conscious, careful deconstruction of steps.
  - Often very helpful for teachers, consultants, etc.
- Frameworks for knowledge
  - A key for courses, lessons or professional communications.
  - How do you (experts) "hook" your skills / knowledge together?

What is our framework for "how learning works" …. ???

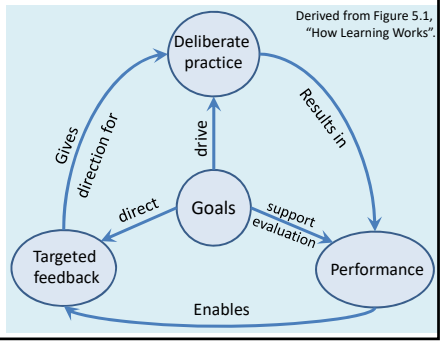
Other examples of expertise?

- Your example of effortless expertise compared to struggling novices.
- Can you recognize issues related to
  - Unconscious competence of an expert?
  - Unconscious incompetence of a novice?
  - Expert's assumptions?
  - The framework experts use that novices need?

4. Practice and feedback;
Moving towards expertise …

- Practice does make perfect … but learning takes time.
- How to "work smarter", not just "more"?

- Goal-directed practice *coupled with* targeted feedback.
- ***Obvious?*** Maybe, but many *research-based* strategies can be used.
- Hence: *"Discipline-based pedagogic expertise"*



Fundamentals we've explored

1. Prior knowledge:
2. Motivation:
3. Experts vs novices
   - Knowledge organization, access and application
   - Developing "mastery" (and some implications)
4. Practice & feedback
5. Other aspects can be related to these.

Time & knowledge frameworks

- More novice / expert distinctions;
  - Expert knowledge chunking
  - Novices struggle to attach "pieces" to purposes
  - Hence lectures can resemble a "fire hose …"

- Frameworks help "coordinate" new ideas.

Inter-related concepts

✓Prior knowledge …

✓Motivation …

✓Experts vs novices …

✓Practice & feedback …

… are all in play when communicating, teaching or learning.

End with a professional communication example

Meet with UBC **Legal Counsel** regarding a project proposal involving contractual relationship with a Central Asian institution.

- What was relevant?
- What slowed the pace of communication?

- Prior knowledge & assumptions
  - His assumptions about our intentions and needs as geoscience professionals and educators
  - My prior assumptions and understanding - including misconceptions
- Motivation
  - If the project was not an exciting opportunity I would not be going within a mile of this conversation. ALSO, salient points would NOT remain as useful concepts in my knowledge.
- Novice-expert issues
  - His legal expertise and my novice perspective.
  - **Framework:** Their document containing 1) project requirements, 2) potential risks to workers and institutions, 3) potential mitigations, 4) options or alternatives.
- Practice? Feedback? To gain more "expertise"?
  - Would require *deliberate practice* and *attention*, with conscious check points, self-assessments, feedback from experts and a spiral notion of moving forwards. BUT - perhaps I won't go there …

Thanks all … ☺

Resources and references handed out.

Questions?

Suggestions?

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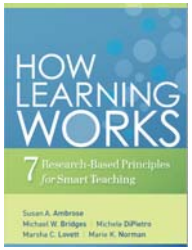
Always available to "consult"; EOS-South, rm361.

How learning works



Components in each of 7 chapters

- Contexts; two short scenarios
- What's going on in each?
- What principles of learning are at work?
- What does research say about these principles?
  - Subsections …
- Implications of that research
- What strategies does research suggest?
  - Subsections …
- Summary

Also 8 specific appendices with concrete recommendations