"How Learning Works"
Some fundamentals that can improve all learning, research, teaching & professional communications.

Francis Jones
https://www.eoas.ubc.ca/people/francisjones

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.

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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?

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

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![Diagram showing the three dimensions of motivation.

2. Motivation

Three dimensions of motivation:

<table>
<thead>
<tr>
<th>Low self efficacy</th>
<th>Unsupportive environment</th>
<th>Supportive environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not valued</td>
<td>Rejecting</td>
<td>Rejcting</td>
</tr>
<tr>
<td>Valued</td>
<td>Hopeless</td>
<td>Fragile</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High self efficacy</th>
<th>Unsupportive environment</th>
<th>Supportive environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not valued</td>
<td>Evading</td>
<td>Motivated</td>
</tr>
<tr>
<td>Valued</td>
<td>Defiant</td>
<td></td>
</tr>
</tbody>
</table>

Derived from Figure 3.2, “How Learning Works”.

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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?

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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.

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... “

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?

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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fjones@eoas.ubc.ca
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
How Learning Works: Some fundamentals that can improve all communication, learning, research and teaching practices.

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Virtually any communication involves someone learning something from someone else; maybe even everyone learning something! What fundamentals about how people learn are well established? And - how can we leverage those concepts to improve research, teaching and professional communication? We will discuss some fundamental concepts, including:

- Distinguishing novices vs. experts;
- Influence of prior knowledge (or lack of it) on learning;
- Motivation: can learning happen without it?
- Practice and Feedback; a crucial, iterative cycle, but how best to do it?

WORKSHEET

1. In what professional or academic settings does “learning” of ANY kind happen?

2. Suggest examples of “universal” (as you see it) fundamental notions about learning?

3. What behaviors distinguishing experts & novices?

4. Examples in your field illustrating effortless expertise compared to struggling novices. Can you recognize issues related to...

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"How Learning Works" - A Few Recommended Resources

If I had to give only one formal and one informal reference:

- [http://cwsei.ubc.ca/](http://cwsei.ubc.ca/) - references, student/instructor guidelines etc from two major science ed. initiatives at UBC & CU.

Short guidelines (most are 1-3 pages)

1. Targeting instructors: [http://www.cwsei.ubc.ca/resources/instructor_guidance.htm](http://www.cwsei.ubc.ca/resources/instructor_guidance.htm)
2. Targeting students: [http://www.cwsei.ubc.ca/resources/student_guidance.htm](http://www.cwsei.ubc.ca/resources/student_guidance.htm)
3. From EOAS: [https://www.eoas.ubc.ca/research/cwsei/eossei-times.html](https://www.eoas.ubc.ca/research/cwsei/eossei-times.html)
4. Most “teaching and learning support groups” in Departments, Faculties, Institutions.

Websites

5. [http://cwsei.ubc.ca/resources/index.html](http://cwsei.ubc.ca/resources/index.html): at the *Carl Wieman Science Education Initiative*. This site basically has it all - hundreds of pointers to all types of resources from articles, books and general publications to video interviews, public domain guidelines and on and on and on. Includes sections on Instructor Guidance; Student Guidance; Clickers; Video; Learning Goals; Tools; Course Transformation Resources; Papers; Other Resources (books, TA training, Talks, etc.) .
7. **SERC - the Science Education Resource Center at Carleton College**, developed with NSF funding at [http://serc.carleton.edu/index.html](http://serc.carleton.edu/index.html). Many workshop outcomes, teaching and/or learning materials, guidelines and resources, many tested and/or peer reviewed. FOUR AREAS: Higher Ed Portal; *Geoscience Educators*; K12 Portal; Resources Shortcuts.

Papers (just a few)

8. List of 49 recommended papers at CWSEI: [http://www.cwsei.ubc.ca/resources/papers.htm](http://www.cwsei.ubc.ca/resources/papers.htm)
11. **How to Succeed in College: Learn How to Learn.** Robert Bjork, American Psychological Society, 14 (3), March 2001. See also [https://bjorklab.psych.ucla.edu/research/](https://bjorklab.psych.ucla.edu/research/)

Books or reports