Insights on Teaching from the Research on Student Learning

Cassandra Volpe Horii
cvhorii@post.harvard.edu

1. Novice/Expert Differences

2. Cognitive Development

3. Learning Styles

Research on Student Learning

“Here’s a nightmare you might know:”
- Eric LeMay

course evaluation comments

- The final exam/essay/project was so unfair...
- The professor never showed us how to...
- I probably won’t remember anything after the final exam...
1. Novice/Expert Differences

Example:

Novice:
Oh, a problem about inclined planes. Blocks and planes are in chapter 3.

Expert:
This problem is about conservation of energy. I’d think about it the same way I would a mass on a spring. 

meaningful pattern
deeper structure

1. Novice/Expert Differences

Example:
Propose a multi-step synthesis of estrone from the starting material indicated

Expertise changes the way you see things

1. Novice/Expert Differences

- Novices organize information by superficial, not deep, characteristics.
- Novices do not use automated processes (e.g., problem solving, reading).
- Novices work harder and are less efficient at learning and applying new knowledge.*

* Cognitive Load & Chunking
What can you do?

Reveal the Deep Structure/Process

1. Novice/Expert Differences

1. Novice/Expert Differences

First overhead: A passage from the reading

“The Jewish apocalyptic genre emerged from the earlier prophetic tradition, but is distinct from it. The Jewish prophets of the eighth to the sixth centuries B.C.—Amos, Joel, Isaiah, Jeremiah, Ezekiel, and the others—functioned primarily as preachers, focusing on the people’s transgressions and foretelling the Lord’s renewed favor if they repented and further woes if they did not. The prophets were present minded and specific as they addressed a people beset by enemies and continually straying from the path of righteousness.”

Second overhead: The same paragraph with the importance of difference sections emphasized:

“The Jewish apocalyptic genre emerged from the earlier prophetic tradition, but is distinct from it. The Jewish prophets of the eighth to the sixth centuries B.C.—Amos, Joel, Isaiah, Jeremiah, Ezekiel, and the others—functioned primarily as preachers, focusing on the people’s transgressions and foretelling the Lord’s renewed favor if they repented and further woes if they did not. The prophets were present minded and specific as they addressed a people beset by enemies and continually straying from the path of righteousness.”

Reveal the Deep Structure/Process

e.g., Concept Maps in VUE

vue.tufts.edu
Additional Ideas:

- Draw analogies between examples/cases/problems with common deep concepts but different superficial features.
- Ask questions that require deep organization (how, why).
- Make processes explicit; include and highlight all steps.
- Use memory aids to help learners remember processes.
- Provide opportunities for practice, with feedback.

1. Novice/Expert Differences

What can you do?

Here’s a dream you might realize:

- The final exam/essay/project looked unfamiliar, but I knew it used the same underlying concepts...
- Now I really understand how chemists/historians/artists think and work...
- I’ll always remember...

Have you heard these before?

- You know the answer, so why don’t you just tell me?
- It’s all subjective anyway and I like my way best.
- This case isn’t like the ones we’ve seen in class, but if I stick to the process, maybe it’ll work out.
- The best solution depends on a lot of factors; I’ll consider the context and uncertainties to find a reasonable course of action.
2. Cognitive Development

Helps explain puzzling students
but

how can you encourage
cognitive development?

Safety + Dissonance

Intellectual change happens in a **safe environment:**

- Understand and acknowledge the utility of each phase.
- Model the next step, rather than jumping to the end point:
  - Teach procedures and processes.
  - Use both separate (doubting) and connected (believing) modes.
Intellectual change requires **cognitive dissonance:**

- Create situations that challenge the limitations of students’ ways of knowing.
- Model questioning of evidence & data.
- Give and guide assignments that encourage complexity:
  - Knowledge, comprehension, application.
  - And analysis, synthesis, evaluation.

1. Novice/Expert Differences

- Later stage qualities are not always superior: the “bottom line” answer may be useful.
- Development may be context specific: thinking like a novice or dualist in a subject.
- Later stages and expertise share qualities of metacognition, self-authorship.
- Role of desirable difficulties, feedback, praise in both models.
What's your “learning style”?  How about your students?

Many taxonomies

3. Learning Styles

Styles or preferences?  Fixed or changing?

Making use of learning styles

Deep Learning

Students’ preferred modes

Teacher’s preferred modes

3. Learning Styles
3. Learning Styles

**Making use of learning styles**

**Motivation**

- What will the end product be?
- Why is this important?
- Concrete Experience
- Reflective Observation
- Active Experimentation
- Abstract Conceptualization

**Questions adapted from Laura L. B. Border's work with the Kolb Learning Styles Inventory**

**...as a way to reach students**

- Ask students how they're approaching their work.
- Recognize when problems come from style contrasts.
- Use multiple styles of presenting, explaining, & working:
  - Ask & answer a variety of motivating questions.
  - Pay particular attention to styles you prefer less.

**...as a way to enhance learning**

- Encourage students to employ alternative strategies for deeper, more flexible learning.
- When appropriate to your goals, give students a choice in how they fulfill course requirements.
2. Cognitive Development

- Focus on the learner and his/her process.
- Understand one's own teaching & learning process.
- Expand one's repertoire beyond individual intuition.

1. Novice/Expert Differences

3. Learning Styles
Selected Bibliography

General:

Novice-Expert Differences
* Analogical Encoding: Gentner, D., Lowenstein, J., & Thompson, L. (2003). Learning and transfer: A general role for analogical encoding. J. of Ed. Psych. 95(2), 393-408.

Cognitive Development

Learning Styles
* Kolb's Learning Styles Inventory: available online at http://www.hayresourcesdirect.haygroup.com/.

Other
* Decoding the Disciplines: Pace, D. & Middendorf, J. Eds. (Summer 2004). Decoding the Disciplines: Helping Students Learn Disciplinary Ways of Thinking. New Directions for Teaching and Learning 98, 1-110.