Evidence-Based Teaching
Strategies that Promote Student Learning

Eric Main
Faculty Center for Teaching & Learning

Caveats
• No single best teaching method
• Lecture is not “bad”; it is over-used
• Most learning techniques result in positive learning gains, but some are more effective than others.
• We can only touch on a few ideas today. Follow up with readings, department discussions, and programming by FCTL and other support units.

The case for evidence-based teaching
• Many studies have demonstrated how quickly students lose memory of course content.
• Primarily lecturing and covering content results in students primarily adopting surface-level approaches to learning which do not result in long-term retention or transformation.
• Classroom practice at the post-secondary level is generally not informed by what is known about learning.
• Until practice becomes evidence-based, teaching at the post-secondary level will not gain the status it deserves as a profession.

Maryellen Weimer (2010)
Let’s test our clickers:
What is your academic rank this semester?

A. Full or Associate Professor
B. Assistant Professor
C. Instructor/Lecturer
D. Visiting Instructor/Lecturer
E. Librarian, Clinical, or other

I know my teaching has been effective when students have ...

A. successfully passed exams covering the subject matter I presented.
B. demonstrated responsibility for their future role in society or their chosen profession.
C. shown a qualitative change in how they think about the subject, not just what they know.
D. demonstrated a strong self-concept and self-efficacy.
E. convincingly analyzed and challenged social norms

Five Perspectives on Teaching in Adult and Higher Education

1. Transmission Perspective: delivering content
2. Apprenticeship Perspective: modeling ways of being
3. Conceptual Development Perspective: cultivating ways of thinking
4. Nurturing Perspective: facilitating personal agency
5. Social Reform Perspective: seeking a better society

Pratt (1998)
From your experience, which is the biggest obstacle to student learning?

A. They are too passive; they want education to be done unto them.
B. They lack confidence as learners; they want you to spell out everything.
C. They lack basic study skills to succeed.
D. They are too often motivated by grades or points; they rarely demonstrate intellectual curiosity.

Maryellen Weimer (2010)

Practices of Convenience

• It is more convenient for administration to permit large numbers of students to be efficiently processed through the system—whether or not deep learning occurs.
• It is more convenient for teachers to adopt a transmission (coverage) model of lecturing with few assessments.
• It is more convenient for students to adopt a “surface-level” approach to learning.
Christensen and Mighty (2010)
• It is more convenient to evaluate teaching by student perception rather than by direct measures of learning.

Student approaches to learning

• Surface-level: intend reproduction, to cope with course requirements by studying without reflection, seeing only unconnected bits of knowledge, routine memorization, with high level of worry.
• Strategic: intend organization and highest grades by consistent study, time and effort management, gearing deliverables to instructor preference.
• Deep-level: intend transformation, understand for self, seek patterns and underlying principles, relate evidence to conclusions, examine logic and argument, be actively interested in content.

Marton and Säljö (1976)
• Learning outcomes are relative to interactions among student approaches to learning and instructor approaches to teaching.
• For example, we see positive outcomes when a surface approach to learning matches a transmission approach to teaching.
• Adopting a conceptual change approach to teaching will lead to higher quality learning because it demands that students adopt a deep-level approach to learning. (Trigwell and Prosser 2004)

To encourage a deep-level approach, design for “deliberate practice”

1. Deliberate practice is designed specifically to improve performance.
2. It requires high repetition of properly demanding activity.
3. Feedback on results is continuously available.
4. It requires demanding effort of focus and concentration.
5. It is difficult and painful.
7. It requires the skill of self-observation or metacognition to reflect and critically self-evaluate after the practice. Colvin (2008)

How many hours per week do you plan for students to study for your course?

A. 4+ to 1 (12+ hours for a 3 credit hour course)
B. 3 to 1 (9 hours)
C. 2 to 1 (6 hours)
D. 1 to 1 (3 hours)
E. 0 to 1
Time-on-task is a necessary but insufficient requirement for effective learning

- Find that 35% of students spend five or fewer hours each week studying on their own (those who spend additional time in group study had worse learning outcomes).
- Students report on average spending 7% of their time each week studying and 51% socializing.
- 45% of 3000 students showed no significant learning gains over 2 years and 36% showed little change over 4 years in critical thinking, analytical reasoning, problem solving, and writing.

Arum and Roksa (2011)
How many practice assessments do you typically assign to your students?

A. 0  
B. 1-2  
C. 3-5  
D. 6-10  
E. More than 10

<table>
<thead>
<tr>
<th>Technique</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Elaborative interrogation</td>
<td>Generating an explanation for why an explicitly stated fact or concept is true</td>
</tr>
<tr>
<td>2 Self-explanation</td>
<td>Explaining how new information is related to known information, or explaining steps taken during problem solving</td>
</tr>
<tr>
<td>3 Summarization</td>
<td>Writing summaries (of various lengths) of to-be-learned texts</td>
</tr>
<tr>
<td>4 Highlighting or underlining</td>
<td>Marking potentially important portions of to-be-learned materials while reading</td>
</tr>
<tr>
<td>5 Keyword mnemonic</td>
<td>Using keywords and mental imagery to associate verbal materials</td>
</tr>
<tr>
<td>6 Imagery for text</td>
<td>Attempting to form mental images of text materials while reading or listening</td>
</tr>
<tr>
<td>7 Rereading</td>
<td>Restudying text material again after an initial reading</td>
</tr>
<tr>
<td>8 Practice testing</td>
<td>Self-testing or taking practice tests over to-be-learned material</td>
</tr>
<tr>
<td>9 Distributed practice</td>
<td>Implementing a schedule of practice that spreads out study activities over time</td>
</tr>
<tr>
<td>10 Interleaved practice</td>
<td>Implementing a schedule of practice that mixes different kinds of problems, or a schedule of study that mixes different kinds of material, within a single study session</td>
</tr>
</tbody>
</table>

The Testing Effect

<table>
<thead>
<tr>
<th>Technique</th>
<th>Utility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Elaborative interrogation</td>
<td>Moderate</td>
</tr>
<tr>
<td>2 Self-explanation</td>
<td>Moderate</td>
</tr>
<tr>
<td>3 Summarization</td>
<td>Low</td>
</tr>
<tr>
<td>4 Highlighting/underlining</td>
<td>Low</td>
</tr>
<tr>
<td>5 Keyword mnemonic</td>
<td>Low</td>
</tr>
<tr>
<td>6 Imagery for text</td>
<td>Low</td>
</tr>
<tr>
<td>7 Rereading</td>
<td>Low</td>
</tr>
<tr>
<td>8 Practice or self-testing</td>
<td>High</td>
</tr>
<tr>
<td>9 Distributed practice</td>
<td>High</td>
</tr>
<tr>
<td>10 Interleaved practice</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Dunlosky, et al. (2013)
Testing Effect

Frequent classroom testing can both directly aid students’ learning and give teachers continuous assessments of how well students are learning, so that they can review material that many students did not understand and change teaching strategies appropriately.

Roediger and Karpicke (2006)

Effective learning requires multiple practice opportunities

1. Be more explicit about your goals in your course materials. Share the curriculum map, course map, and unit-level learning outcome statements.
2. Build scaffolding into assignments. Give students multiple supports for the learning early in practice and gradually remove them as students gain mastery.
3. Set expectations about practice. Students will underestimate the time needed to master complex material or tasks.
4. Use rubrics to specify and communicate performance criteria.

Ambrose et al. (2010)

Students’ prior knowledge can help or hinder learning.

• Administer a diagnostic assessments like a quiz or concept inventory (UCF Financial Aid Req.)
• Have students assess their own prior knowledge with a knowledge survey.
• Use exercises to generate students’ prior knowledge. Begin a lesson by asking students what they already know about a topic or create a concept map.
• Explicitly link new material to prior knowledge

(Ambrose, et al. 2010)
The Distributed Practice Effect (encompasses both spacing effect and lag effect)

- Discuss the benefits of DL with students and encourage them to space their study rather than doing mass cramming.
- Repeat some questions (or similar problems) in subsequent assessments over the semester.

Consider flipping your classroom

- Some or all direct instruction happens outside of class (video lectures, readings, etc.)
- Class time is spent on practice activities (may include micro-lectures, Q&A, etc.)
- See FCTL web site
- See Waldrop & Bowdon (2016)
- See Eric Mazur’s Peer Instruction (1997)

Student-Centered Active Learning Environment for Undergraduate Programs (SCALE-UP) video
UCF Studio Physics
No lectures, no exams

Have you ever developed proficiency or even excellence at something you had previously believed you were bad at?

A. Yes
B. No

Effective learning requires sustained motivation

Ambrose, et al. (2010)
Expectancy and Mindsets

- **Fixed mindsets:** students believe that intelligence is a fixed trait and that their intelligence is reflected in their performance. They believe learning comes easily to intelligent students. They would rather appear lazy than un-intelligent.
- **Growth mindset:** students value hard work and challenges, believe failure is something to learn from, are willing to practice. They believe brain is malleable and intelligence and abilities can be enhanced through hard work and practice. Time will tell how smart they can become.

Carol Dweck (2006)

Building value

- Learn about your students. What do they find motivating? What do they believe about learning?
- Manage the learning context, not the learners. Establish conditions that are likely to foster intrinsic commitments to quality rather than seeking to control students; students will seek to do what needs to be done.
- Establish a safe, supportive, and positive classroom
- Make the work they do be of value to them
- Provide evidence of student’s success
- Make learning active, authentic, challenging, and meaningful

Rogers and Renard (1999)

Motivation

- Excessive reliance on extrinsic motivators squelches the intrinsic motivation students need to excel. (Kohn, 1993)
- Intrinsic motivation requires
  - autonomy, the ability to choose what and how tasks are completed;
  - mastery, the process of becoming adept at an activity; and
  - purpose, the desire to improve the world.
- Pink (2009)
The role of metacognition

• To become self-directed learners, students must learn to monitor and adjust their approaches to learning.
• Teach students to develop procedural knowledge regarding academic tasks.
• Make planning a central goal of the assignment
• Provide opportunities and guidance for self-assessment (e.g. exam wrappers).

Metacognition and stages in the development of mastery

(Ambrose, et al. 2010)

How students organize knowledge influences how they learn and apply what they know.
1. Graduates of the B.A. program in Anthropology will understand the scientific evidence for the evolution of humans.
2. By the end of this course, students will be able to use genetic and evolutionary theory to explain patterns of modern human genotypic and phenotypic variation and relate them to ecological variables.
3. By the end of this unit, students will be able to describe the characteristics of four hominid groups (Australopithecines, Homo erectus, Homo sapiens neanderlensis, and early modern Homo sapiens sapiens like Cro-magnon), map their major migration pathways, and chart their approximate timelines.

(Ambrose, et al. 2010)
To be continued...

- Teaching, like any complex cognitive skill, must be practiced to be improved.
- Improvement requires more than experience; it also requires conscious effort and feedback.
- We encourage you to engage in the many conversations at UCF to improve teaching and learning.