The Evidence About Teaching

Over the past 15 to 20 years, well-controlled studies of teaching practices, as well as advancements in cognitive science, have significantly changed our understanding of how students (and really, all people) learn. Here is a short list of findings about learning for which the evidence is the strongest, along with selected references for each, listed below.

1. Students who work with/use/apply the information they are learning, especially during class time, learn more (1,2,3,16,18,24,25,27). This is the single best-supported piece of knowledge we have about learning.

2. Students who are given frequent feedback on their understanding, either through more frequent exams or quizzes, or other methods (examples: “clicker” questions, asking conceptual questions in class for students or student teams to answer, the Minute Paper) can learn more during a semester (9,21,26,35).

3. When students work together in teams to answer questions or solve problems given to them in class or outside of class (4,6,10,22,23,28,29,34,36), they learn more. (This seems be to be because students have to “try out” their explanations and understanding in a group, allowing them to get valuable feedback about their learning; additionally, our “expert blind spot” often prevents us from giving non-experts the best explanations of concepts we understand well but they do not, and peers can help bridge this gap).

4. Students who are given specific learning goals, written in terms what they should “Be Able to Do,” can learn both more and (if goals are complex) more deeply than otherwise. Goals that a) emphasize conceptual understanding over pure memorization and b) include some higher-level skills like application, each increase the length of time students can remember and use concepts (11,12,13,15,20,30,31,32). Student learning of goals is dependent upon the exam being based on them.

5. When students are expected to come to class having already learned some basic information (6,7,16,17,39,40,41), enforced by a short quiz or homework assignment, they learn more, partly because they are forced to study earlier and more often, and partly because class time can now be spent on more complex and difficult questions or topics.

6. When students are asked to explain concepts on exams (in part), in writing or orally, instead of answering only multiple choice questions, they study using more big-picture, deep methods, learn more, and retain the information for a longer time (5,14,19).

7. Students perform better on exams if they are explicitly taught to study more deeply (8,33,37,38).
To Learn More:

**Visit these websites:**

Carl Weimann's Science Education Initiative: [http://www.cwsei.ubc.ca](http://www.cwsei.ubc.ca)


Jim Sibley’s Team-Based Learning site: [http://learntbl.ca](http://learntbl.ca)

Cognitive Psychologist Stephen Chew's videos that can help students study more deeply: [https://www.youtube.com/watch?v=RH95h36NChI&t=1s](https://www.youtube.com/watch?v=RH95h36NChI&t=1s)

**Read These Books:**

*What Is the Evidence About Teaching University Science?*
Teaching Undergraduate Science by Linda C. Hodges
Teaching and Learning STEM: A Practical Guide by R. Felder and R. Brent
How Learning Works: Seven Research-Based Principles for Teaching by S. Ambrose

*Designing Your Class:*
Understanding By Design by G. Wiggins and J.McTighe
Creating Significant Learning Experiences by D. Fink

*Assessing Student Understanding During Class Time:*
Classroom Assessment Techniques by T. Angelo and K.P. Cross
Collaborative Learning Techniques by E. Barkley and C. Major
Student Engagement Techniques by E. Barkley

*Motivating Students:*
Creating Self-Regulated Learners by L. Nilson
Learner-Centered Teaching by M. Weimer

*Watch these videos of teaching workshops:*
[https://www.youtube.com/watch?v=1wxRqyoeKuA](https://www.youtube.com/watch?v=1wxRqyoeKuA) (Evidence-Based Teaching)
[https://www.youtube.com/watch?v=1YgvD4iEvqI](https://www.youtube.com/watch?v=1YgvD4iEvqI) (Motivating Students)
[https://www.youtube.com/watch?v=NOIQ-L-8300U](https://www.youtube.com/watch?v=NOIQ-L-8300U) (But What about the Content?)
[https://www.youtube.com/watch?v=dEvbntzfAoM](https://www.youtube.com/watch?v=dEvbntzfAoM) (Outcomes-Based Course Design)
[http://www.medicalmedia.eu/cs/Detail/1459](http://www.medicalmedia.eu/cs/Detail/1459) (Team-Based Learning)

*Contact me:* leupen@umbc.edu
References
18. Van Sickle Discrepancies between Student Perception and Achievement of Learning Outcomes in a Flipped Classroom. *Journal of the Scholarship of Teaching and Learning*, 16(2)29-38 (2016).