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Improving Student Learning by Addressing Student and Teacher

Misconceptions about Learning

Xavier University

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# Beliefs about Learning that Make You Stupid

## Learning is fast

## Being good at a subject is a matter of inborn talent rather than hard work,

## Knowledge is composed of isolated facts

## I’m really good at multi-tasking, especially during class or studying

# Metacognition

## A student’s awareness of their level of understanding of a topic

## Metacognition distinguishes between stronger and weaker students

## One of the major tasks for a freshman is developing good metacognition

### In high school, they spent years developing a metacognitive sense that is likely inadequate or even counterproductive for college.

Which of the following is the MOST important ingredient for successful learning?

1. The intention and desire to learn
2. Paying close attention to the material as you study
3. Learning in a way that matches your personal Learning Style?
4. The time you spend studying
5. What you think about while studying

# Achieving Deeper Processing

## As you study, follow these principles:

## **Elaboration**: How does this concept relate to other concepts? Is it a story?

## **Distinctiveness**: How is this concept different from other concepts?

## **Personal**: How can I relate this to my own personal experience?

## **Appropriate to Retrieval and Application**: How am I expected to use or apply this?

Cognitive Load Theory (e.g. van Merrienboer & Sweller, 2005)

* Mental effort is the amount of concentration that a person has available to devote to tasks
* Mental effort is always a limited resource
* Cognitive Load is the total amount of mental effort a task requires to complete it
  + A person can do multiple tasks at once as long as the total cognitive load does not exceed available mental effort
* If cognitive load exceeds available mental effort, then performance suffers

Implications of Cognitive Load Theory

* If the cognitive load demanded of students exceeds their available mental effort, then learning will not occur
* If the cognitive load demanded of students takes up most or all of available cognitive effort, then there will not be enough mental effort available for learning or schema formation
* Teachers must monitor, manage and minimize cognitive load to allow schema development as well as design activities to promote schema development

The Cognitive Challenges of Teaching

1. Student Mental Mindset
2. Metacognition and Self-regulation
3. Student Fear and Mistrust
4. Prior knowledge
5. Misconceptions
6. Ineffective Learning Strategies
7. Transfer of Learning
8. Constraints of Selective Attention
9. Constraints of Mental Effort and Working Memory

All factors interact with each other

10 Principles of Successful Learning for Students

* Principle 1: Your level of understanding is a direct result of how hard you prepare.
* Principle 2: There are effective and ineffective ways to prepare.
* Principle 3: You have to master the basics before moving on to more complex skills.
* Principle 4: Overconfidence should be avoided at all costs
* Principle 5. Effective preparation requires your total focus; no distractions
* Principle 6. Successful learning requires planning ahead
* Principle 7. Feedback helps you get better
* Principle 8. Recognize and take advantage of prime learning opportunities
* Principle 9. Improvement involves dealing with challenges, difficulty, and uncertainty
* Principle 10. Find the pleasure or value in what you are studying in order to do your best

Productive Persistence Mindset

1. I belong in this academic community
2. My ability and competence grow with my effort
3. I can succeed at this
4. This work has value for me

Goals of Formative Assessments

* Improve metacognition for students and teachers
* Address tenacious student misconceptions
* Illustrate desired level of understanding of knowledge for students
* Promote student learning and understanding
* Model thinking for understanding
* Promote rapport and trust

Properties of Conceptests (Mazur, 1997)

A multiple choice question that…

* Focuses on a single concept
* Requires conceptual understanding to solve
* Has adequate response alternatives
  + Ideally the incorrect alternatives should reflect the most common misconceptions
* Be unambiguously worded
* Be neither too easy nor too difficult

The ConcepTest General Format

1. Present ConcepTest to class – 1 minute
2. Students given time to think – 1 minute
3. On a given signal, students indicate their answer by number of fingers.
4. Have the students pick someone around them, preferably with a different answer, to discuss their choices – 1- 2 minutes
5. Repeat step three to see how choices have changed
6. Explain and discuss the answer as a class – 2+ minutes

Concept Maps

A concept map is a graphical, node-link network representation of knowledge structures.

* Nodes represent concepts
* Links represent relationships such as category membership, relatedness, or distinctiveness.

Question Generation

Provide us with three (3) questions that you would like answered concerning the topics covered in your textbook readings or in lecture. These can be any questions you might have, as long as the questions are about the material or are stimulated by the material. They can be questions about concepts you are still unclear about, further information you would like to have, or questions about how some issue applies to your own life or to other courses.

* Why, How, and What if questions

Think Pair Share

* Create a question that requires conceptual understanding or application of a concept, preferably one which also encompasses a common misconception.
* Think: Present the question and have students think of their answer
* Pair: Have students pair up and discuss their answers and reasoning
* Share: Discuss as a class

Exit Problems

* Toward the end of class, assign a problem to be solved before leaving class.

Exam Wrappers

* Exam Wrappers are an After Exam Review or Exam Debriefing activity completed by students after exams have been returned to them which makes them reflect on their level of preparation and understanding.

Formative Assessment Worksheet

You can do this activity individually or in collaboration with departmental colleagues.

1. List a concept or concepts that students find difficult to understand. The concept can be difficult because is conceptually abstract or complex (dependent on understanding other newly learned course concepts), counterintuitive or contrary to popular beliefs, or subject to confusions and misconceptions. It is helpful to think about why the concept is difficult.
2. If you are working collaboratively, see if you agree on the difficult concepts you have listed.
3. Select an appropriate method of formative assessment, such as a think-pair-share, conceptest (“clicker questions”), exit problem, concept map, or minute paper. It should be brief and provide useful feedback to both you and the students.
4. Create a formative assessment to try in your classes. Even if you already use formative assessments, try a new method, or design one to achieve a different purpose, or create one where you did not have one before.

Video Series: How to Get the Most Out of Studying

[www.samford.edu/how-to-study](http://www.samford.edu/how-to-study)

**Introductory Video: Developing a Mindset for Successful Learning *(NEW)***

This video gives an overview of the information presented in the video series, organized into 10 Principles of Effective Studying. The video can serve as an introduction to the series or as a reminder for students who have already viewed the series.

**Video 1: Beliefs That Make You Fail…Or Succeed**

**Video 2: What Students Should Understand About How People Learn**

**Video 3: Cognitive Principles for Optimizing Learning**

**Video 4: Putting the Principles for Optimizing Learning into Practice**

**Video 5: I Blew the Exam, Now What?**

New Video Series: The Cognitive Principles of Effective Teaching

Playlist: <http://bit.ly/1EGm7fW>

This is a series of five brief videos on the cognitive basis of effective teaching

**Video 1: Beliefs about Teaching**

This first video is about how the beliefs teachers hold about teaching and learning influence teaching effectiveness. I discuss teacher beliefs that can help or undermine teaching

**Video 2: The Cognitive Challenges of Teaching: Mindset, Metacognition, and Trust**

This video introduces the nine factors identified by cognitive research that teachers must understand in order to help students learn. Three of those factors, mental mindset, metacognition and self-regulated learning, and trust, are discussed, including how feedback can promote these factors.

**Video 3: The Cognitive Challenges of Teaching: Prior Knowledge, Misconceptions, Ineffective Learning Strategies, and Transfer**

Students come to us not as blank slates, but with a mix of both accurate knowledge and misconceptions. This video discusses how both of these factors influence learning. Finally, the video explores the importance of students developing and utilizing effective learning strategies.

**Video 4: The Cognitive Challenges of Teaching: Constraints of Selective Attention, Mental Effort, and Working Memory**

Selective attention, mental effort, and working memory are major constraints on learning. The video discusses of deliberate practice, automaticity and chunking as ways of addressing these constraints.

**Video 5: Teachable Moments, Formative Assessment, and Conceptual Change**

This video discusses how all nine cognitive factors interact with each other and how teachers must manage that interaction to bring about learning. The concept of teachable moments is introduced. Finally, the video discusses how formative assessments can help create a constructive learning context in which learning becomes long lasting, regardless of which pedagogy teachers use.

Dropbox Public Folder Guide

1. Videos on How to Get the Most out of Studying: [www.samford.edu/how-to-study](http://www.samford.edu/how-to-study)
2. Think-Pair-Share items for the How to Study Videos: <https://dl.dropboxusercontent.com/u/22761776/TPS%20Activities%20for%20study%20videos.docx> or <http://bit.ly/LM2kaw>
3. Exam Debriefing Activity (“Exam Wrapper”) using the Study Videos: <https://dl.dropboxusercontent.com/u/22761776/Exam%20Debrief%20Activity.docx> or <http://bit.ly/LM2sXn>
4. Guide to the levels of processing demonstration I do, including response sheets: <https://dl.dropboxusercontent.com/u/22761776/Orienting%20Task%20Demonstration%20with%20Instructions%20and%20Guide.pdf> or <http://bit.ly/1aKaWuc>
5. Multitasking in-class activity showing the cost of multitasking: <https://dl.dropboxusercontent.com/u/22761776/Multitasking%20in-class%20activity.docx> or <http://bit.ly/1o73MDS>
6. Brief article describing the use and design of ConcepTests from the Psychology Teacher Network: <https://dl.dropboxusercontent.com/u/22761776/Intro%20to%20Conceptests.ptn.doc> or <http://bit.ly/1dzKtKK>

For Further Reading

Books on cognitive research applied to teaching:

A free e-book written by some of the best researchers in learning sciences:

*Applying Science of Learning in Education: Infusing Psychological Science into the Curriculum (*2014): <http://teachpsych.org/ebooks/asle2014/index.php> or <http://bit.ly/KbYLtG>

Ambrose, S. A.., Bridges, M. W., DiPietro, M., Lovett, M. C., Norman M. K. (2010). How Learning Works: Seven Research-Based Principles for Smart Teaching. San Francisco, CA: Jossey-Bass

Brown, Roediger, & McDaniel (2014). *Make It Stick: The Science of Successful Learning*. Belknap Press.

Cox R. D. (2011). *The College Fear Factor: How Students and Professors Misunderstand One Another*. Harvard University Press.

Miscommunication and conflicting expectations between teacher and student can undermine instruction even when both the student and teacher are motivated to succeed. Cox makes this point in her book:

Elena Silva and Taylor White (2013).  *Pathways to improvement: Using psychological strategies to help college students master developmental math*. Carnegie Foundation for the Advancement of Teaching. <http://www.carnegiefoundation.org/sites/default/files/pathways_to_improvement.pdf>

The Carnegie Foundation for the Advancement of Teaching has an excellent summary of mental mindset as it applies to productive persistence, especially as it relates to developmental math. Although focused on math, the general principles discussed apply to all areas.

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Perceptual Judgment Task

Instructions: You will hear a list of 24 words. For each word, check the “YES” box or the “NO” box depending on your instructions. You may not write down any of the words. The words will be spoken at a fairly fast rate, just check the appropriate box.

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| **Word #** | **YES** | **NO** |  | **Word #** | **YES** | **NO** |
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Critical Thinking Demonstration

Draw your answer here

Word Generation Activity

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