



## Let's Start by Thinking About the Lives of Our Students Present and Future

- What do they need to know in a world where knowledge is accumulating an unprecedented rate?
- Where our students will work at jobs that do not exist today.
- Where a college degree is a requirement for 90% of the fastest growing jobs.
- Where pollution is a major problem, along with racism, poverty, and terrorist attacks

## Information, information, information...

- "A weekday edition of *The New York Times* contains more information than the average person was likely to come across in a lifetime in 17th. century England."

*Information Anxiety*, R.S.Wurman

## Rethinking the Purpose

### of Education

The first and only goal:  
Teach for long-term retention  
and transfer

## Transfer of Learning

- Transfer of learning is the **very foundation** of learning, thinking, and problems solving. (Haskell, 2001)
- Throughout history, educators have attempted to equip students with cognitive tools that they can apply beyond the initial learning context. At present, transfer of learned knowledge and skills is still considered a **fundamental goal** of education. (De Corte, 2003)
- The *sine qua non* of training is the successful transfer of trained skills to the job. (Richman-Hirsch, 2001)

## The Problem with Transfer

- If there is a general conclusion to be drawn from the research on transfer, it is that the **lack of general transfer is pervasive and surprisingly consistent**. (Detterman, 1993)
- Transfer of learning is universally accepted as the ultimate aim of teaching. However, achieving this goal is one of teaching's more formidable problems. Researchers have been **more successful in showing how people fail to transfer learning than they have been in producing it**, and teachers and employers alike bemoan students' inability to use what they have learned. (McKeough, Lupart, and Marini, 1995)

## More of the Problem

- For some years now, many students who have arrived in my classes with A and B averages from high school college-preparatory programs are unable to read a college introductory psychology text written on a high school level or lower. **When asked to write an analytical paper, they say they have never been asked to think**. When given different forms of the same question on an exam, they fail to transfer their answers to virtually identical questions, even after having been constantly reinforced throughout the entire course with multiple examples. (Haskell, 2001)

## Principles of Transfer

### To Get Transfer, Teach for Transfer

1. Practice with Effortful Retrieval
2. Space practice
3. Vary Learning Conditions
4. Use Multiple Representations
5. Alter Mental Models
6. Use Feedback as Information
7. Understand the Learners' Epistemology

## Start Here:

1. Be clear about the outcomes you want to promote. If you don't know where you want to be, you will never know if you've arrived.

Here are the outcomes I want for you from this morning's session:

## I want you to remember that

- There are powerful learning strategies that can promote long-term retention and transfer
- It's what the learners do that determines what and how much is learned
- You need to look for evidence when evaluating claims about what works in education
- This is important

## Principles in Cognitive Psychology that should be guiding the design of learning activities

- Acquisition (learning) and Retrieval (remembering) Have Different Operating Principles—Don't Confuse What Looks Like Good Learning with Good Remembering
- A Corollary—Don't confuse What Looks Like Good Teaching With Good Learning

## The Goal: Durable Learning

- How can we apply and extend new knowledge of how people learn, think, and remember?
- How can we promote engagement in learning?
- How can we foster effective academic performance and learning that lasts?

## Principles in Cognitive Psychology that should be guiding the design of learning activities

- Practice at retrieval strengthens memory traces (generation effect)



## Practice at Retrieval

- Generate responses, with minimal cues, repeatedly, over time, with varied applications.
- Recall becomes more fluent, more likely to occur across contexts and knowledge domains.

## The single most important variable in promoting long-term retention and transfer is practice at retrieval.

- Have students make frequent summaries as a check on comprehension
- Present a brief problem to solve
- Use reciprocal peer-teaching
- Have students find relevant information and rate it for degree of relevancy
- Use different perspectives
- Post questions on list serves, etc.
- Use Weekly Quizzes (Do not need to grade them)

## Ok. Let's Practice Retrieval

- Explanations are a good way to enhance long-term learning and transfer, so
- Find someone near you, and explain to your new friend what I want you to remember. New friend—check the accuracy of the recall.

Are you moaning?? Learning is not a passive activity. Our students moan too when we expect them to be active participants in their own learning

## Disturbing the Educational Universe President of MIT, Charles Vest

- ~~“We are at the proverbial fork in the road and where we should and will take both paths.”~~
- MIT has made primary course materials for 2000 courses available on the web.
- “A ‘personal tutor’ monitors the student's path through the material and his or her performance on problems in order to make suggestions about areas to investigate or reinforce. Early indications are that the use of [these programs] does not lead to higher scores on basic tests, but appreciably improves conceptual understanding.”

□ Vest, C.M. (2005). Disturbing the Educational Universe: Universities in the Digital Age—Dinosaurs or Prometheans? Retrieved March 5, 2008 from <http://web.mit.edu/president/communications/rpt00-01.html>

## IES Grant that is incorporating what we know about the science of learning

- A program to teach critical thinking/ scientific reasoning skills using what we know about current students (play games on line, use teaching agents, and more.
- Grant is with Keith Millis at Northern Illinois University and Art Graesser at University of Memphis—(they are the brains behind this project)
- ARIES Acquiring Research Investigative and Evaluative Skills (a brief look early in the project)

## Principles in Cognitive Psychology that should be guiding the design of learning activities

- Spaced practice enhances long-term retention (cramming only works for short retrieval intervals)



## Recommendations from IES Practice Guide

“To help students remember key facts, concepts, and knowledge, we recommend that teachers arrange for students to be exposed to key course concepts on at least two occasions—separated by a period of several weeks to several months. Research has shown that delayed re-exposure to course material often markedly increases the amount of information that students remember. The delayed re-exposure to the material can be promoted through homework assignments, in-class reviews, quizzes, or other instructional exercises. In certain classes, important content is automatically reviewed as the learner progresses through the standard curriculum (e.g., students use single-digit addition nearly every day in second grade math), and this recommendation may be unnecessary in courses where this is the case.”

## Principles in Cognitive Psychology that should be guiding the design of learning activities

- Variability during learning can make learning more effortful, but it is beneficial to long-term retention and transfer



## Principles in Cognitive Psychology that should be guiding the design of learning activities

- Dual Coding of Information in Visuospatial and Verbal Formats Will Enhance Learning and Memory



## Re-Representing

- Learners take information presented in one format, e.g., words
- Translate it to another format, e.g., a schematic diagram (Duncker’s X-ray problem—the solution transferred when students drew the solution)

## Principles in Cognitive Psychology that should be guiding the design of learning activities

- We use our mental models about the world to make sense out of experience. We may be more likely to change our memory for an event than to change a belief system that cannot account for the event.



## Think about our knowledge of the physical world

- The elevator problem (or walk light problem)
- How dishwashers work (i.e., not like a washing machine)
- The thermostat (or oven) problem

## Principles in Cognitive Psychology that should be guiding the design of learning activities

- Feedback as Knowledge of Results
- How does the learner make sense from the feedback?



## Learning from Feedback

Kluger & DeNisi's (1996) meta-analysis

- Experimental vs. control, studies back to 1917
- Feedback yields poorer performance in 1/3 of cases
- What is the purpose of the feedback? What are the consequences of poor performance? Does it mean you are dumb or tell you how to improve?

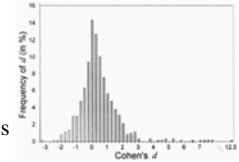


Figure 1. Distribution (histogram) of 607 effects (ds) of feedback interventions on performance.

Focus on the task to be learned and motivation to perform it.

## Principles in Cognitive Psychology that should be guiding the design of learning activities

- Learning is influenced by our students' and our own epistemologies. Academic motivation is related to beliefs about learning.



## Past Learning

- What and how much gets learned in any situation depends heavily on prior knowledge and experience.

“What the teacher says in the classroom is not unimportant, but what the students think is a thousand times more important. The ideas should be born in the students' mind and the teacher should act only as midwife.”

George Polya (1982, p. 104)

## How will you transfer these principles of learning to your teaching practice?

- ◇ State clear learning objectives
- ◇ Actively engage students in learning
- ◇ Challenge student and teacher epistemologies
- ◇ Use effortful learning—create desirable difficulties
- ◇ Challenge existing cognitive models
- ◇ Teach for transfer—frequent uncued review with real-life examples
- ◇ Make careful choices because less can be more
- ◇ Check for long-term retention
- ◇ Use rerepresenting—visuospatial and verbal formats

## Wrapping Up

- ❑ Focus on durable learning
- ❑ Figure out what's in it for students
- ❑ Write measurable learning outcomes
- ❑ Identify measures and data
- ❑ Collect data, and analyze and interpret it
- ❑ Do something based on the findings!
- ❑ Document what you're doing!!

## *Today's Challenge Revisited:*

How will you transfer these principles of learning to your own *learning* and *teaching*?

## *Contact Information*

Dr. Diane F. Halpern  
Claremont McKenna College  
850 Columbia Ave.  
Claremont, CA 91711

diane.halpern@cmc.edu

