

Active Learning for Lectures

# CHOOSING THE RIGHT LEVEL



# Response Ware

- IF you have an account and want to participate in polling...
- [responseware.com](https://responseware.com)
- App Store
- Session ID 634018



# Which of the following might be described as active learning?

1. Having students sit quietly for 2 minutes
2. Asking students questions
3. Having students ask questions
4. Putting students in groups
5. “Flipping” the classroom



*Stay tuned for the answers...*



# Overview

- ⦿ Background, assumptions & preconceptions
- ⦿ Evidence for AL
- ⦿ Levels of AL in lectures
  - What they are
  - Why to use them
  - How to use them



# Background

- ◎ Associate Dean for Teaching and Learning
  - Dr. David and Lola Rognlie Monson Endowed Professor in Medical Education
- ◎ Education
  - BA in Psychology and English (UW-Milwaukee)
  - MA in English (UND)
  - PhD in Instructional Design and Technology (University of South Alabama)



# Background

- ◎ 21+ years teaching experience
  - 2 as GTA in English at UND
  - 3 as faculty in Media Arts and Communication at Cochise College
  - (5 years learning to be a better teacher at USA)
  - 5 years as IDT faculty at University of Memphis
  - 11 years as IDT faculty at UND



# What is IDT?

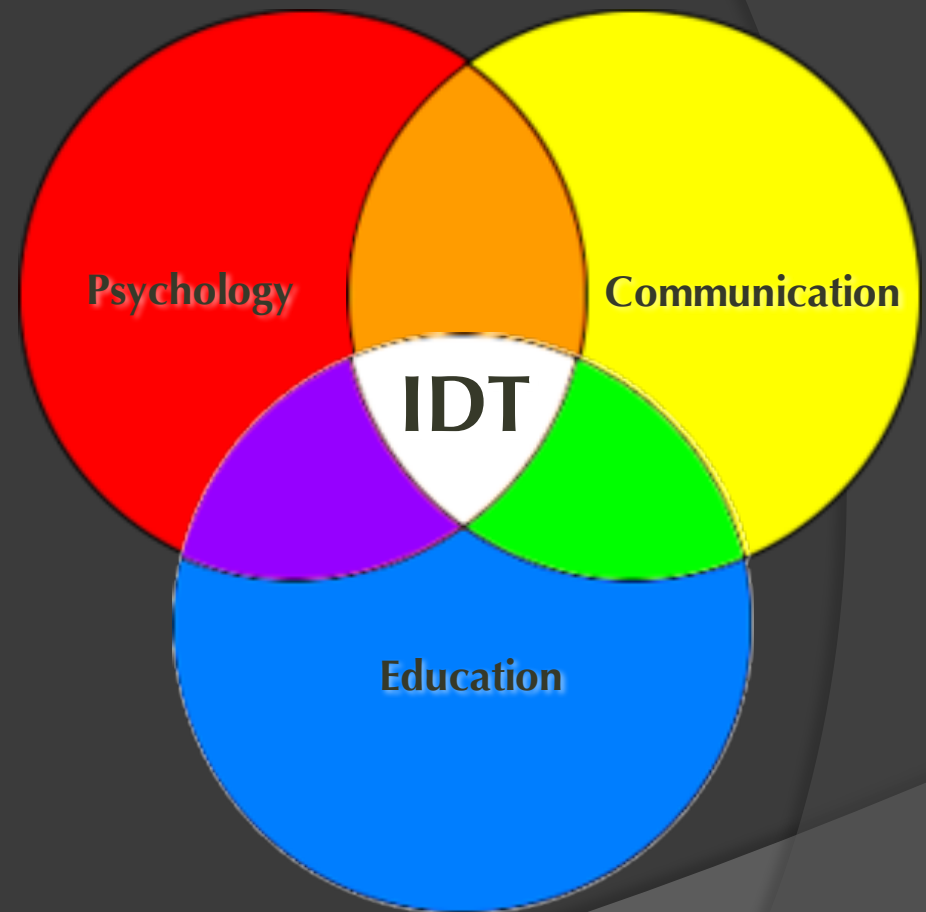
- Needed thousands of soldiers, fast
- How to train quickly...
- ...and accurately?
- Could technology help?





# Three fields

- Psychology
- Communication
- Education
- Science of learning



# What is the best teaching strategy?

1. Problem-based learning
2. Lecturing
3. Written instruction
4. None of the above



# Assumptions and preconceptions

- The best strategies are those that match intended learning outcomes
- Active learning is not always better than other strategies
- Even if it were, we couldn't do it all the time...

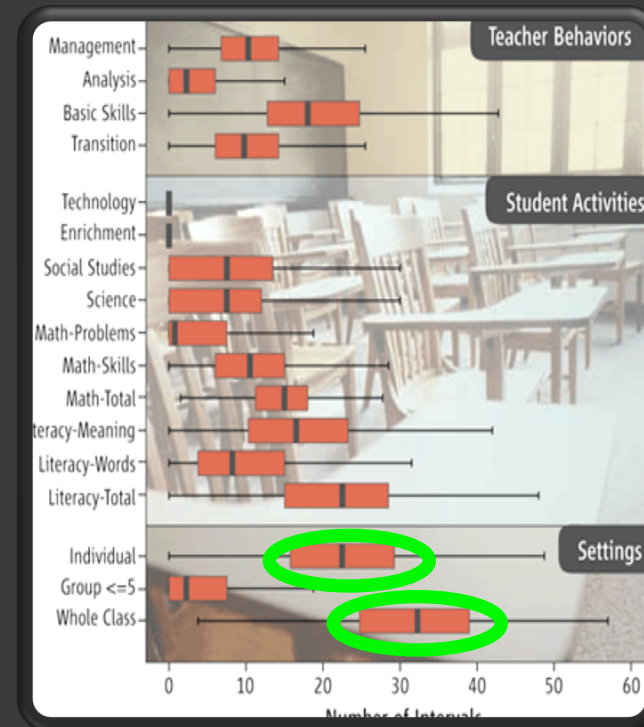


# Good Instruction Is Interactive



# What Does Most Instruction Look Like?

- Pianta et al., 2007
  - 1000 students
  - 2500 classrooms
  - 400 school districts
  - Direct observation grades 1, 3, and 5
- Lecture/Independent Work = 92%



# Evidence for AL

## ● NSF & DoE SCALE UP

- 16,000 students over 5 years
- Well-designed AL science courses vs. non-AL
- Rigorous, validated measures of learning
  - Nationally recognized, discipline-specific tests
  - Force Concept Inventory (physics)
  - Test of Understanding Graphs (Kinematics)

# Evidence for AL

## ⦿ AL produced

- Higher scores on national tests, end-of-course exams, and measures of conceptual knowledge
- 50% lower failure rates overall and for at-risk students
- higher class attendance (more than 90% in most cases)



# 15 years of evidence

- ⦿ Hundreds of studies have replicated findings
- ⦿ 383 in three meta-analyses
- ⦿ Moderate-to-large effect sizes across the board in:
  - achievement
  - persistence
  - application of knowledge
  - exam scores
  - concept inventories
- ⦿ Smallest effect size observed would move a student from the 50th percentile to the 70th (from failing to passing)





# Most recent evidence

- ⦿ Examined 225 studies:
  - Student exam and concept inventory scores increased by 0.47 SDs under active learning ( $n = 158$  studies)
  - Average exam scores 6% higher in active learning
  - Students in traditional lecturing 1.5 times more likely to fail

# Most recent evidence

- Results hold across all the STEM disciplines
- Results hold across all class sizes
- Results are not due to publication bias
  - Trim and fill analyses and fail-safe  $n$  calculations
- Results are robust to variation in the methodological rigor of the included studies
- Authors question the use of traditional lecture as a “control” in future studies

*“If the experiments analyzed here had been conducted as randomized controlled trials of medical interventions, they may have been stopped for benefit—meaning that enrolling patients in the control condition might be discontinued because the treatment being tested was clearly more beneficial.”*

*—Beichner et al., 2007*



# What is the average amount of time people can pay attention to learning stimuli?

- A. 9 minutes
- B. 17 minutes
- C. 26 minutes
- D. 50 minutes



*What is the average attention span of a learner?*

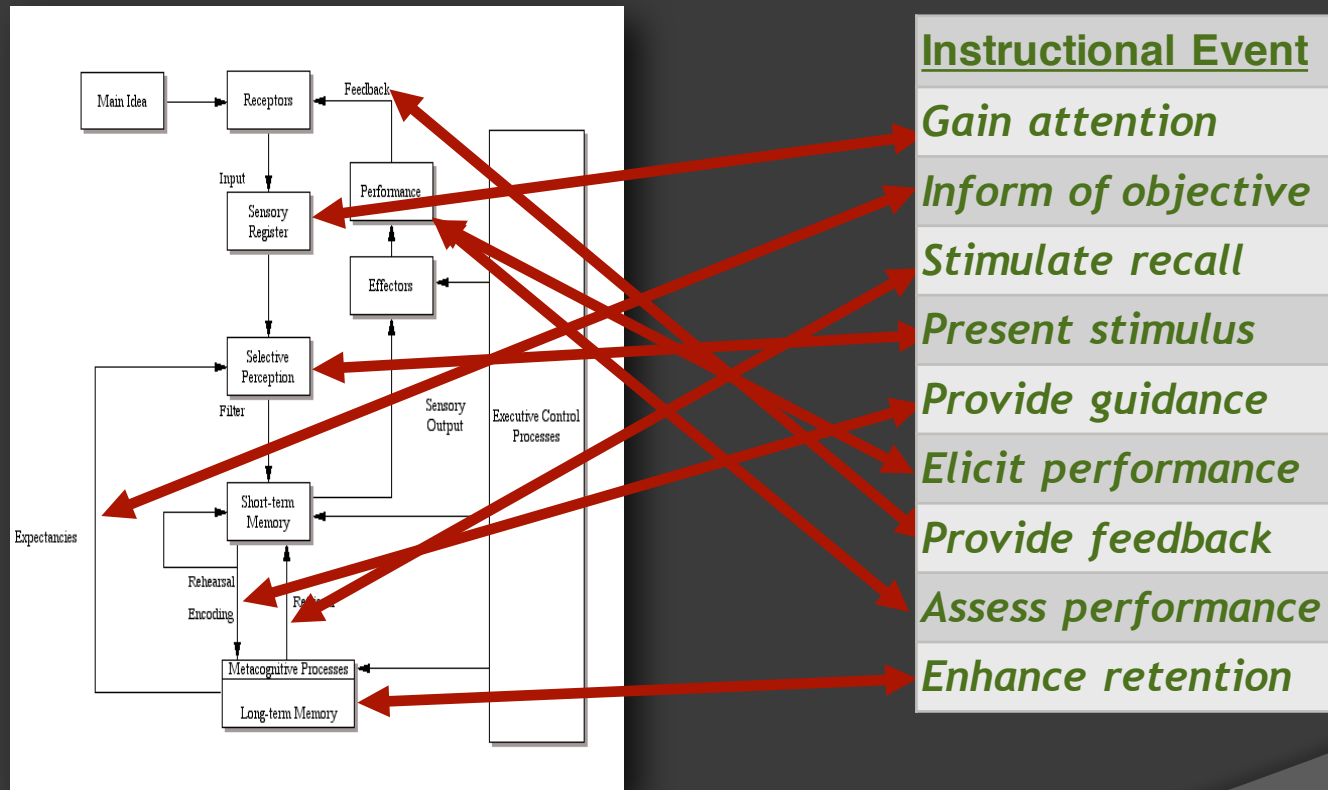


# Attention span

- ⦿ Depends...
- ⦿ Continuous Attention Span = 8 seconds
  - Minimal lapses are not significant disruptors
- ⦿ Intrinsically Motivating Attention Span = 20 minutes
  - But we can “reset” if we choose to



# Remember the Nine Events?



*What does this have to do with lectures?*





# Level 1: What, why, how

- ◉ It's 10-to-2: Do you know where your students are?
- ◉ What
  - ◉ Talk for 10 (or 13), rest for 2 (or 1)
- ◉ Why
  - ◉ Pauses allow for reset
  - ◉ Learners come to expect them and defer attention lapses
- ◉ How
  - ◉ Need a volunteer with good reading skills



*Once blood travels through the pulmonic valve, it enters your lungs. This is called the pulmonary circulation. From your pulmonic valve, blood travels to the pulmonary artery to tiny capillary vessels in the lungs. Here, oxygen travels from the tiny air sacs in the lungs, through the walls of the capillaries, into the blood. At the same time, carbon dioxide, a waste product of metabolism, passes from the blood into the air sacs. Carbon dioxide leaves the body when you exhale. Once the blood is purified and oxygenated, it travels back to the left atrium through the pulmonary veins.*



*I wonder what else I COULD do with those pauses?*



# Level 2: What was the question?

## ⦿ What

- Use questions to
  - Guide student learning
  - Adjust your teaching



# Which of the following are true?

- A. Students learn more in lecture when they ask good questions
- B. Questions during lecture distract other students from their learning
- C. Students rarely ask questions
- D. A & C
- E. All of the above



# Level 2: Why

- ⦿ Asking questions increases learning\*
- ⦿ How often do students ask questions?
  - Average one question per 10 hours of instruction\*\*
- ⦿ Why do you think that is?

# Why don't students ask questions?

- ◎ Opportunities
  - Have to create a space for questions
- ◎ Prior training
  - Remember Pianta et al. study?
  - Students need to know QA is “ok”
- ◎ Not paying attention/engaged
  - Remember the Nine Events?
- ◎ Where, when, and what to ask?



# When is the best time to use questions?

1. Before lecture begins
2. During lecture
3. At the end of lecture
4. All of the above





# Level 2: How

- Prior to lecture, use questions to:
  - Focus attention (cognitive load)
  - Activate prior knowledge (schema theory)
  - Provide structure (advance organizer)
- During lecture (with or without 10-2)
  - Ask questions about what you just covered
  - Ask students to provide examples
  - Ask students to pose questions
- After Lecture
  - Test what was learned, close the loop
  - Help them recognize what are key areas to study (metacognition)



*What if students WON'T ask questions?*



# If students don't ask questions in class, it's a good idea to ask the questions for them.

- A. True
- B. False



# I know what you're thinking...

- ◎ Presenting GOOD questions is nearly as effective\*
  - Scaffolds metacognition (how to ask, when to ask)
  - Vicarious learning (watching others learn is nearly as effective)
- ◎ But “nearly” as effective is not as good as “just” as effective...



# What about the chorus of crickets?

- ⦿ What if students won't RESPOND to our questions?
- ⦿ What if it's always the same one or two who respond?



# Level 3

- ◉ Safety in numbers
- ◉ What
  - Use clickers to anony-mize responses and remove social stigma of “looking dumb”
- ◉ Why
  - Maximize participation, gauge learning (formative evaluation)
    - Shows you where class is
  - Application of rules (rule—example—**practice**)
  - Win the confidence game
    - Top Gun Effect and the teachable moment



Which of the following is true about a question that would take a student 15 minutes to answer independently?

- A. It takes more effort on the part of students
- B. They might be good candidates for higher level AL
- C. There are practical ways to integrate them into lectures
- D. All of the above



*That's great as long as I only ask 5, 2-minute questions; What about big, complex questions?*





# Level 4

- ◎ It's your breakout moment
- ◎ What
  - Put people into groups for application/complex questions
  - Jigsaw, Fishbowl
- ◎ Why
  - Understand components of a system too big to “get” all at once
  - Build schemas to organize complex information
  - Vicarious learning



# Level 4: How (5 minutes)

- ◎ Pick a topic or topics you lecture on
- ◎ Share them and generate one question as follows:
  - **NE**
    - Generate a question YOU would pose (and then answer) to the class to get them “ready” to process a concept or idea
  - **NW**
    - Generate a question that requires students to apply a concept you just presented (e.g., “give me an example of ....)
  - **SE**
    - Generate a question that requires students to provide a real-world example of a concept you just presented
  - **SW**
    - Generate a question that requires students to relate prior knowledge to a concept you are about to present or which you have just presented



# Level 5

## ⦿ What

- Use live time to focus on outcomes students cannot achieve independently
- *Learning in Real Time* (Finkelstein)

## ⦿ Why

- Higher-order outcomes (e.g., problem solving)
- Privileges your expertise rather than your ability to disseminate facts

## ⦿ How



# Level 5: How

- ◎ Identify an appropriate problem(s)
  - Where do students struggle to see the big picture or real world applications?
  - Which content is so complex that they cannot learn it from their own study?
  - Which things are too complex to fit into a 50-minute lecture?



# Level 5: How

- Develop real-world case/application that requires them to apply what they have learned outside of class
- Generate/identify content outside of class
- Establish expectations, measurement (and penalties) for preparation for live class
- Establish group roles, guidelines, and grading



# Which of the following can be examples of active learning?

- A. Having students sit quietly for 2 minutes
- B. Using Clickers
- C. Incorporating questions during class
- D. Putting students in groups
- E. Flipped Classroom



*Bonus Level!*



# A new use for questions

*How much do end-of-unit test scores go up as a result of ungraded, five-question pretest–posttest quizzes?*

1. None
2. Half a letter grade
3. Three-quarters of a letter grade
4. One full letter grade





# No-stakes quizzing raises grades one full letter grade

## ◉ What

- Ungraded pre-post quizzes covering 30% of lecture material, given occasionally, produce test score gains of one full letter grade on end of unit exams
- Persisted when tested again 8 months later

## ◉ Why

- Retrieval practice (Elicit performance, provide feedback)
- The forgotten events...

## ◉ Which questions to test?

*How would you decide which questions to test?*



# Closing Remarks

- ⦿ Different levels of active learning support address different outcomes
  - AL is not “for all learners, all outcomes, all the time”
  - Neither is lecture!
- ⦿ Problems/outcomes determine the level
  - How important is the problem/outcome?
  - What are the resources you have available?
- ⦿ Questions and interactivity are key to good instruction

