Using Formative Assessments to Engages Students in Large STEM Classrooms

(And some cognitive psychology)

David Howard

Biology Department

UW-La Crosse

Acknowledgements

- Dr. Jennifer Miskowski – UW-L
- Dr. Scott Cooper – UW-L
- Dr. Bill Cerbin – UW-L
- UW Women & Science Program
- UW Office of Professional & Instructional Development (OPID) – Wisconsin Teaching Scholar Program

- Form a group of 4, four, IV, 4
- Get out 2 full, blank sheets of paper per group
- Introduce yourselves
- Write your names on BOTH sheets of paper.

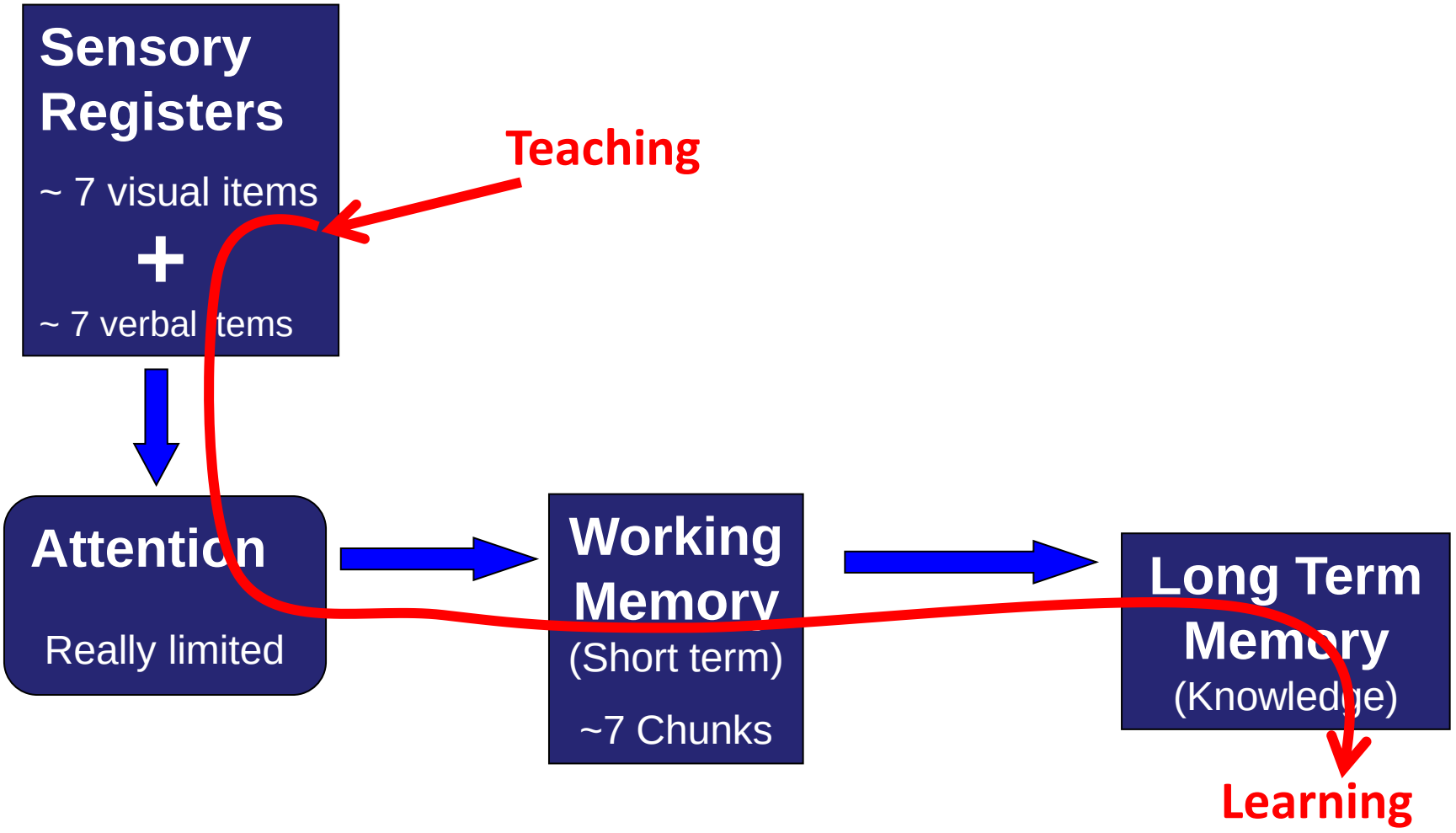
Draw a cell (5 min)

- Include as many different organelles and structures as you can remember. HEARTS ARE THE ARTIST.
- Label each organelle or structure with its name.
- Make a separate list of organelle names (one per line). DIAMONDS KEEP LIST.
- Spades and Clubs contribute ideas & check work.

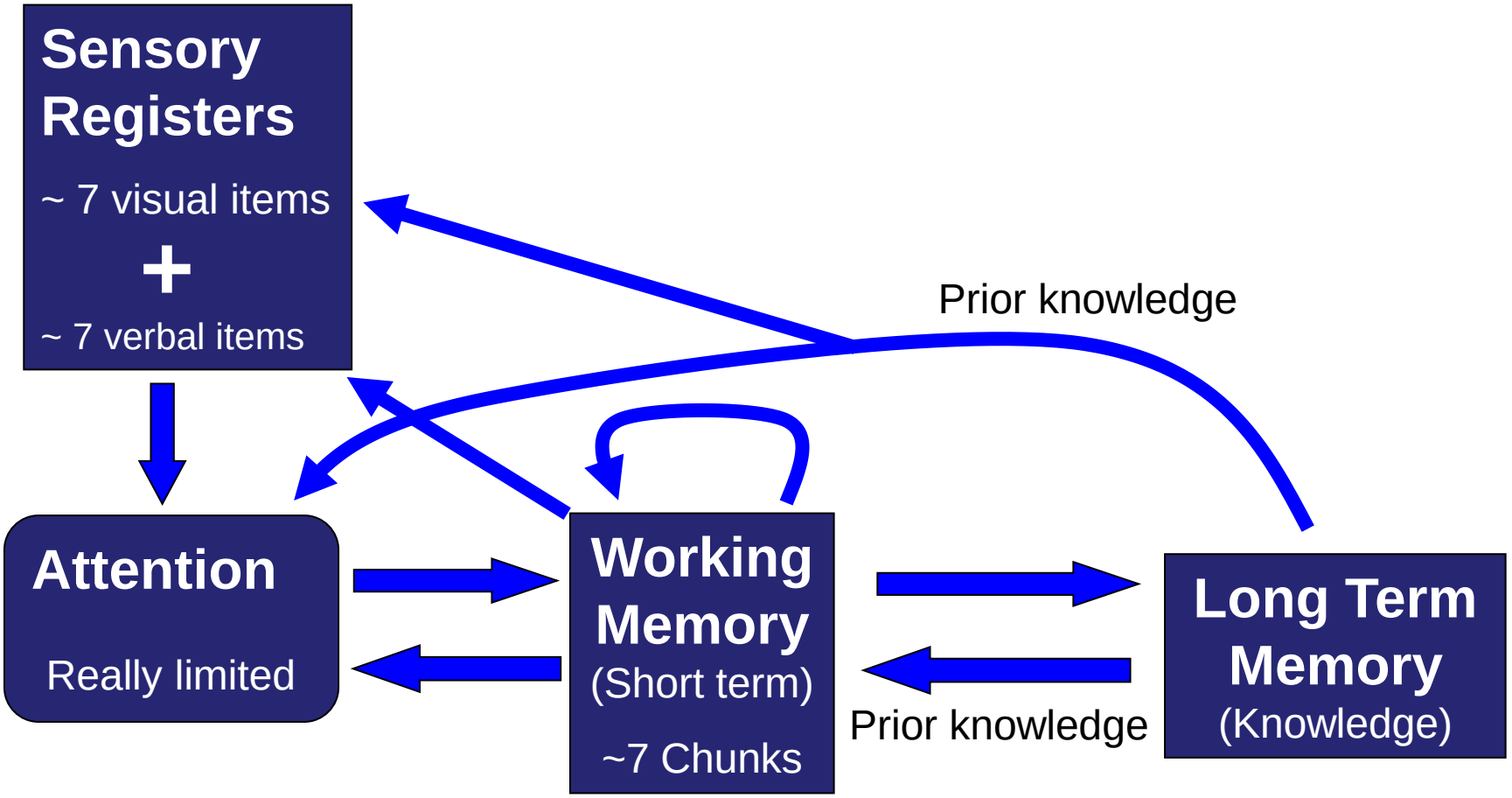
Change Roles

- SPADES ARE ARTISTS.
- CLUBS MAKE LIST.
- Add new organelles or make corrections.
- In **6 words or less** write the **function** (not definition) of each organelle on the list.
- If you finish your drawing and functions, check with another group to see what they have

Basic Model of Memory & Learning



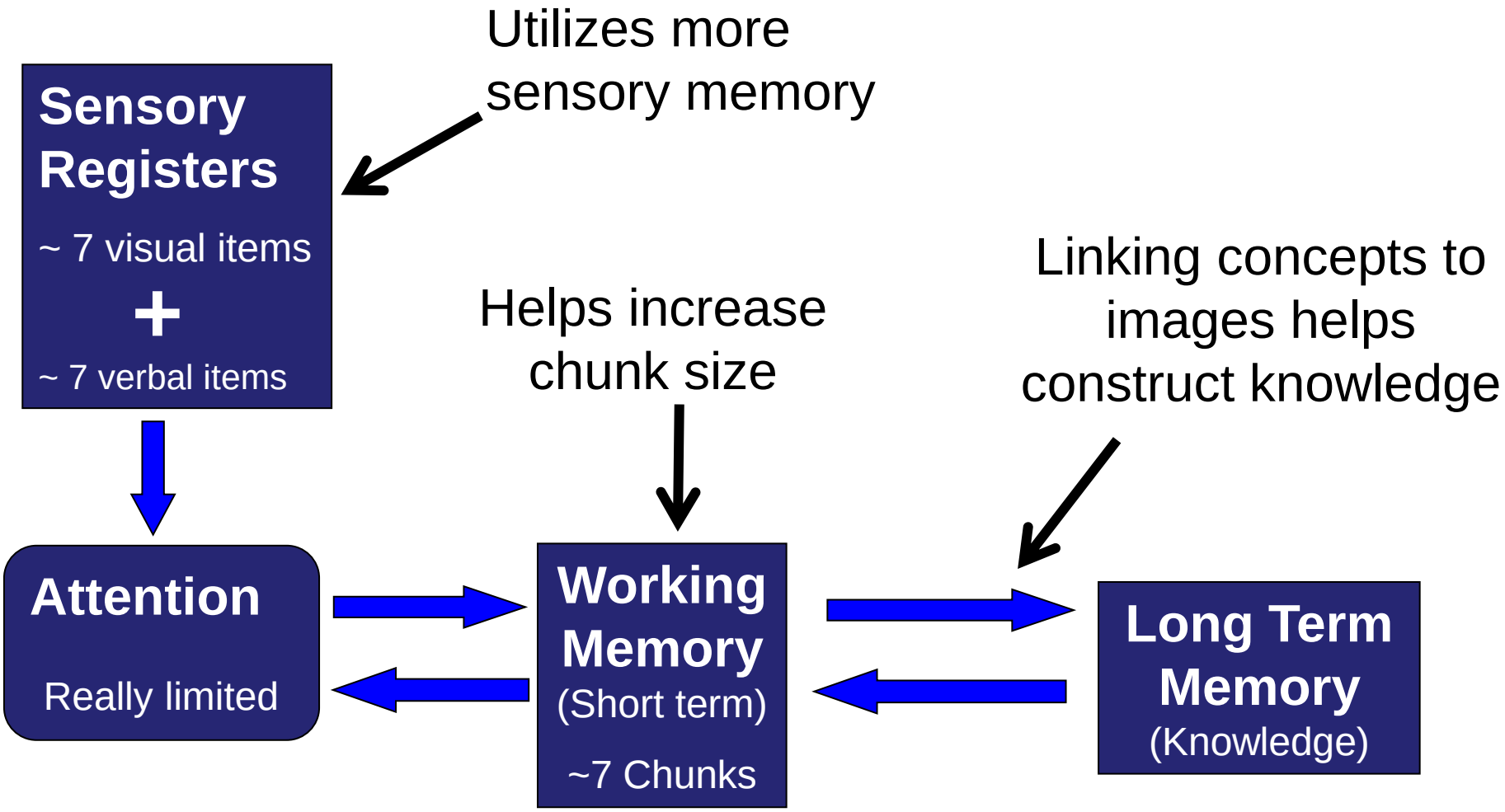
Better Basic Model of Memory & Learning



Dual Register In Class Problems (DRICPs)

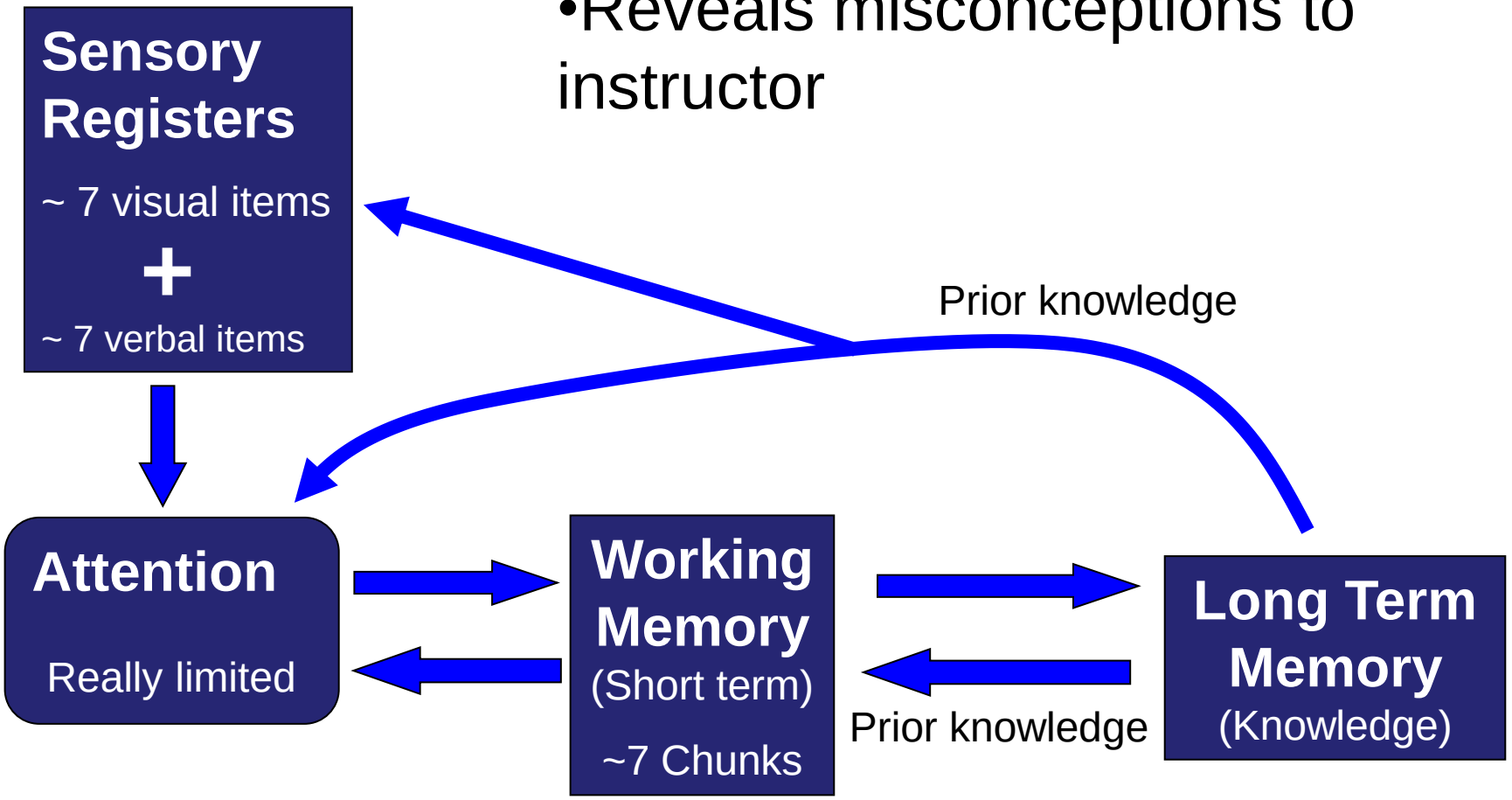
- Utilizes both words and images
- Activates prior knowledge &/or
- Requires synthesis of concepts

Application – Working with Images & Words

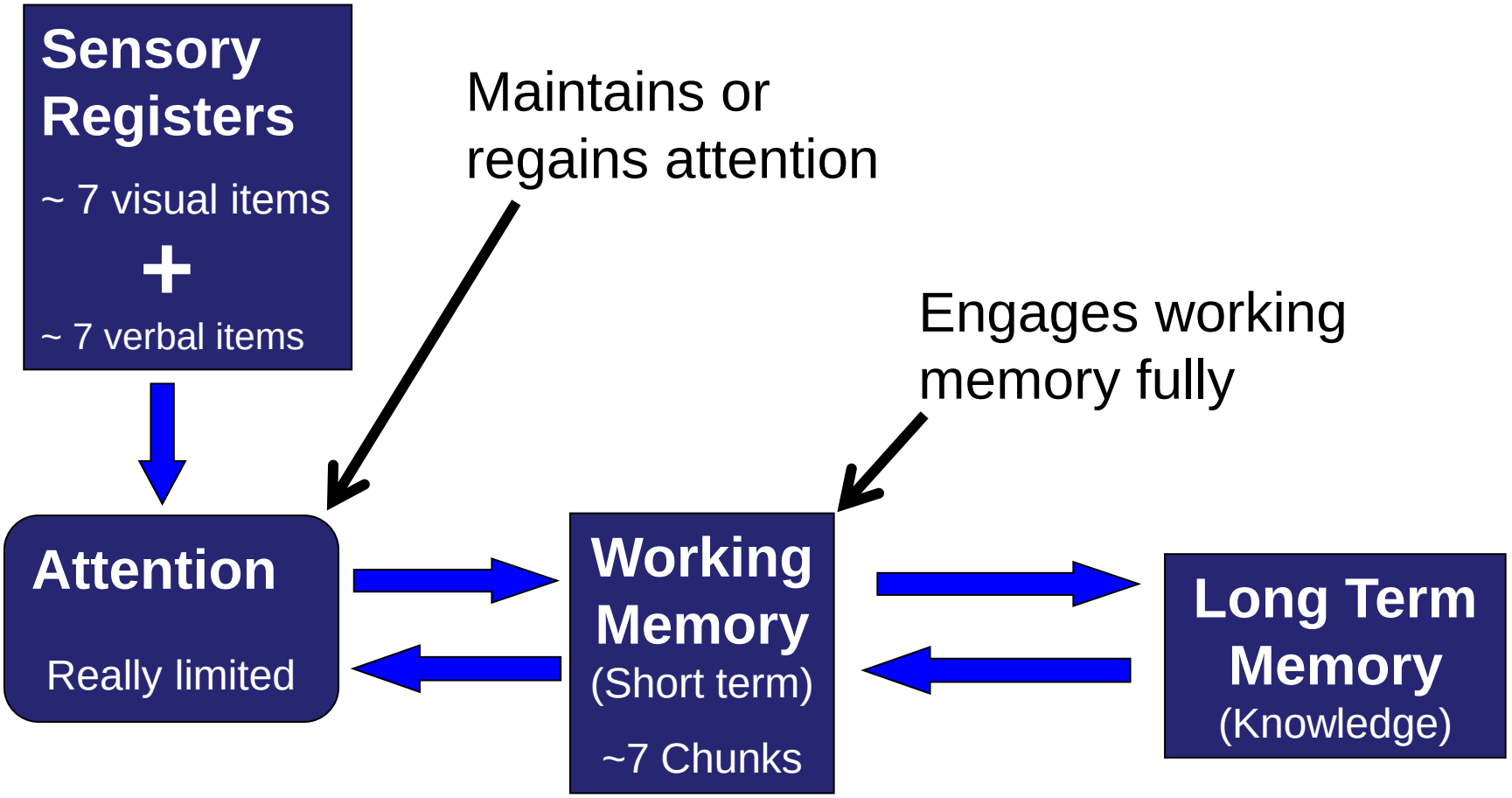


Application – Activating Prior Knowledge

- Primes mind for future learning
- Engages more of the mind
- Reveals misconceptions to instructor



Application – In class activity, generally



Other Mechanics of Example DRICP

- In Class Problem on 1st Day sets tone
  - In class work – not just lecture
- Card trick changes student roles
  - Lessens non-participation

Explicit instructions save time

- Form a group of 4, four, IV, 4
- Get out 2 full, blank sheets of paper per group
- Introduce yourselves
- Write your names on BOTH sheets of paper.

2 Component Question Makes it Manageable

1. Draw & label a cell
   – Should be able to do some = comfort

2. Describe function of structures
   – More difficult – the important part
   – Links the concepts to imagery

Working in teams helps students get through difficult or large problems

Create a DRICP where students

1. Produce a visual & written answer
2. And one or more of the following

- Draw on prior knowledge
- Apply a recently discussed concept
- Synthesize information &/or concepts
- Might reveal misconceptions

More Ideas for Writing ICPs

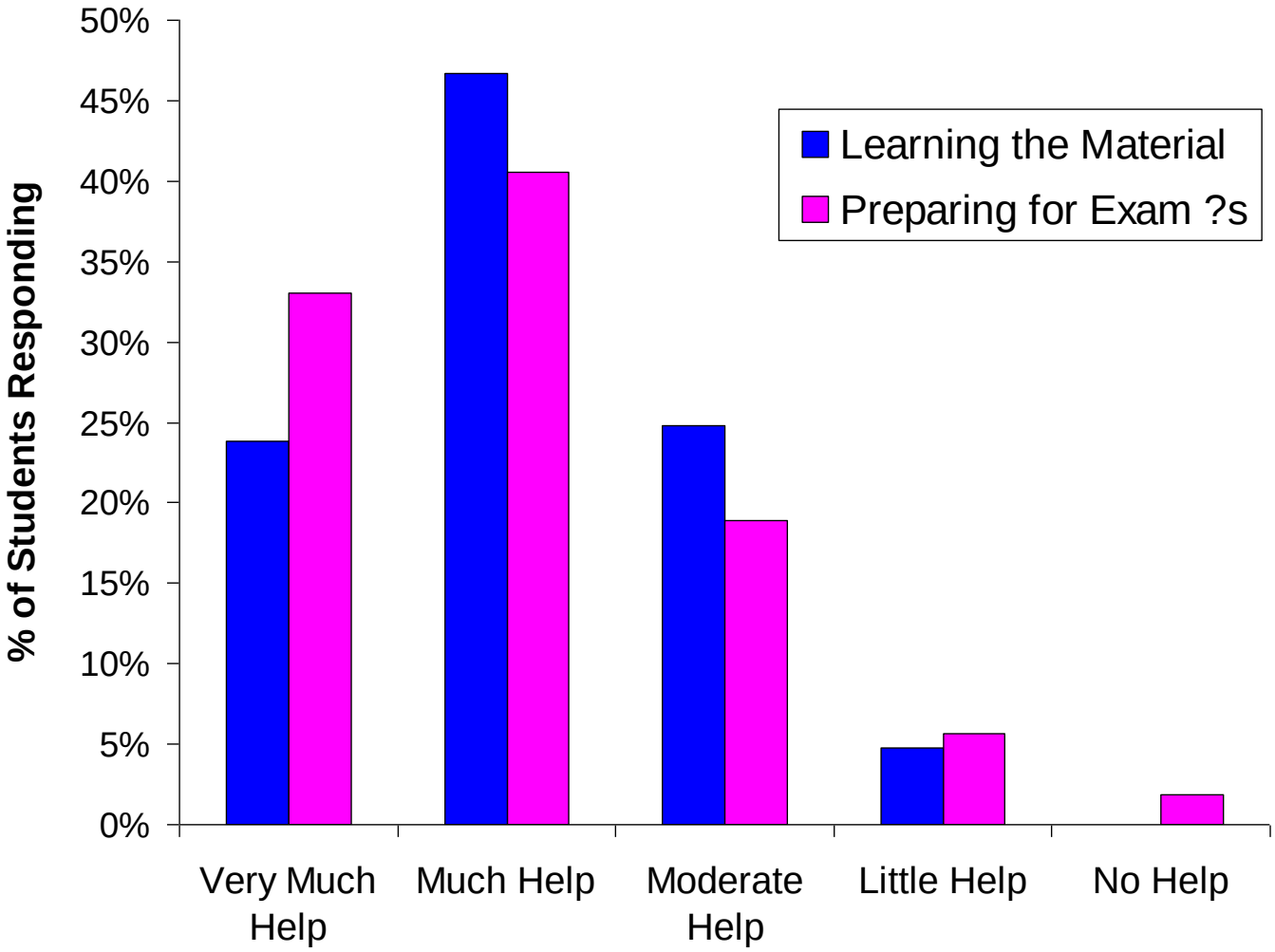
- Have students construct a “real-life” analogy
- Provide a little data & students hypothesize **creative** explanations
- Provide actual data & pose specific questions

In Class Problems

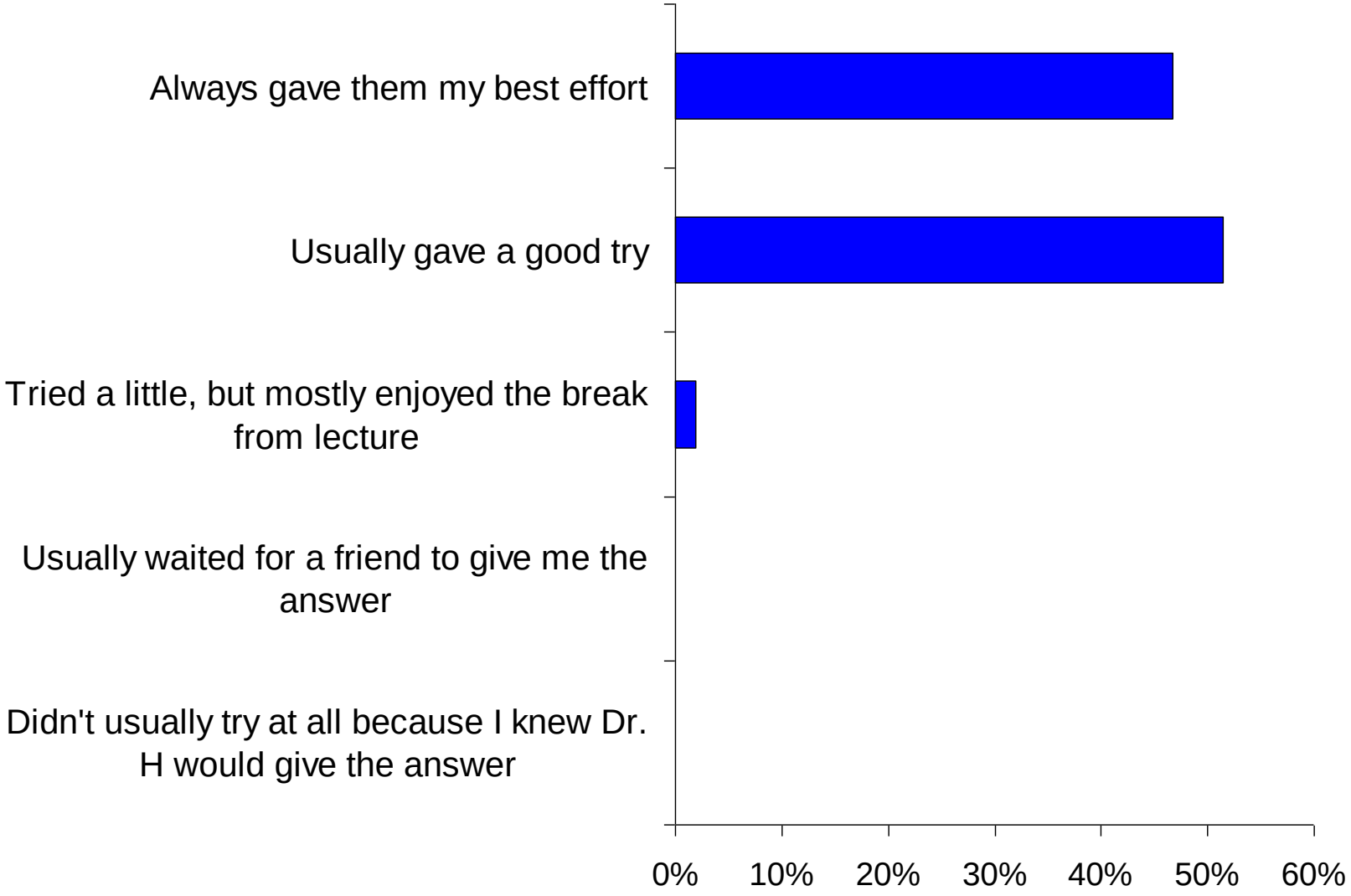
- Exam-like question (often)
- 5-15 minutes to answer
  - Individually or in groups
  - Instructor interactions & guidance
- Grading, discussion, assessment
- Correct answer is immediately provided
  - Instructor models problem solving
- Encourages attendance

How much did the ICPs help you in…

n = 105



How did you approach the ICPs?

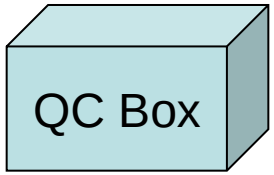


Other Ways to Engage & Do Formative Assessment

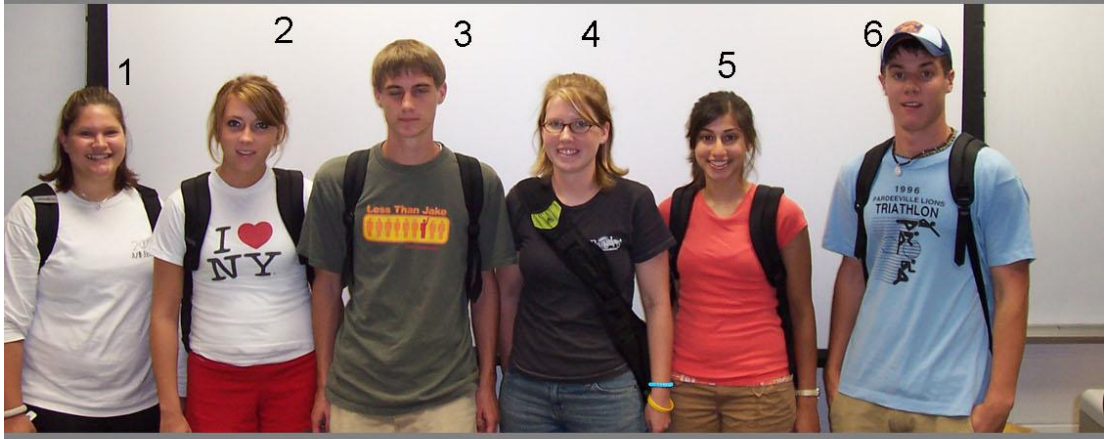
- Student Polling (clickers)
- Minute problems
  - Phrase or sentence answer – quick check
- Muddiest point
  - A sentence at end of day or topic
- Concept maps
- Think-pair-share
- Students create test questions
- Case studies

Create an Interactive Environment

- Welcome questions
  - Feel free to ask questions.
  - You may ask questions.
  - Please ask questions.
  - Questions are encouraged.
- Questions & Comments = Quality Control Box.
- Get to know students



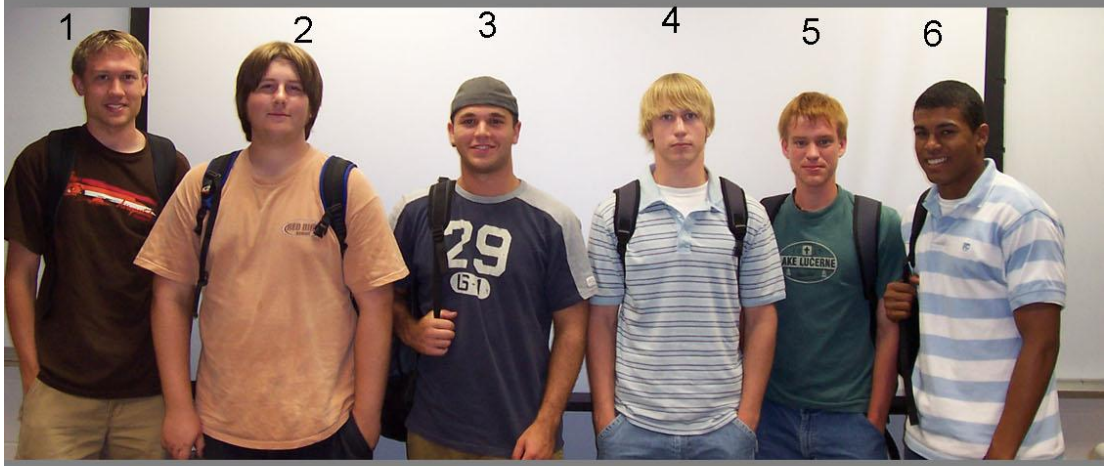
Learning 100+ student names can be fun.



1._____ 4._____

2._____ 5._____

3._____ 6._____



1._____ 4._____

2._____ 5._____

3._____ 6._____

A Few References

- Cooper S, D Hanmer, B Cerbin. 2006. Problem-Solving Modules in Large Introductory Biology Lectures. *Amer. Biol. Teacher* 68:578-583.
- Angelo TA, KP Cross. 1993. *Classroom assessment techniques: a handbook for college teachers*. Jossey-Bass Publishers. San Francisco.
- Bruning RH, GJ Schraw, MM Norby, RR Ronning. 2004. *Cognitive psychology and instruction*. 4th ed. Upper Saddle River, N.J. : Pearson/Merrill/Prentice Hall.
- Rekart JL. 2013. *The Cognitive Classroom: Using Brain and Cognitive Science to Optimize Student Success*. NY: Rowman and Littlefield Publishers.
- Dirks C, MP Wenderoth, M Withers. 2014. *Assessment in the College Science Classroom*. New York, NY : W. H. Freeman