

Introducing Challenging Coursework - Asking, and Reflecting On, What's Working

Dr. Janet Casagrand

Dept. of Integrative Physiology

May 7, 2009

Challenging Coursework

Neurophysiology

Challenging conceptual material

Lecture

Problem solving -
homework assignments,
clicker questions,
HELP room

Attitudes on
interventions, &
Measure of performance

Course

Challenge

Typical format:
teacher-centered

Interventions:
student-centered

Outcome
Measures

Critical Thinking: Neurobiology of Disease

Reading & interpreting
primary scientific literature

Teacher feedback

Partner work

Pre/post attitudes
& learning
(performance)

Challenging Coursework

Neurophysiology

Challenging conceptual material

Lecture

Problem solving -
homework assignments (F05),
clicker questions (F06),
HELP room (F08)

Attitudes on interventions,
&
Measure of performance

Course

Challenge

Typical format:
teacher-centered

Interventions:
student-centered

Outcome
Measures

Critical Thinking: Neurobiology of Disease

Reading & interpreting
primary scientific literature

Teacher feedback

Partner work

Pre/post attitudes
& learning
(performance)

What Do the Students Think of Interventions?

Attitude survey (F07) - 90% response rate (94/105)

- *students enjoyed*
- clickers (91%)
- homework assignments (50% enjoyed, 22% neutral)
 - & *felt helped their understanding*
- clickers (90% found helpful)
- homework assignments:
 - helped understanding of course material (100%)
 - helped with exam preparation (98%)
 - didn't have to study/cram as much for exams (80%)

Has level of understanding of material improved?

- How to answer? Outcome measures
 - Pre/post tests (gains before/after intervention)
 - No pre/post assessment data
 - Exam performance (F04 *versus* F08)
 - 83% of questions changed
 - Why?
 - 14 questions (17%) on both F04 & F08 exams
 - % *answering correctly* increased by 15%, on average
 - increased from 62% to 77%, on average
 - Other outcome measures?
 - Rate questions based on *Bloom's taxonomy of cognitive domain*

Bloom's Taxonomy of the Cognitive Domain (Levels of Learning)

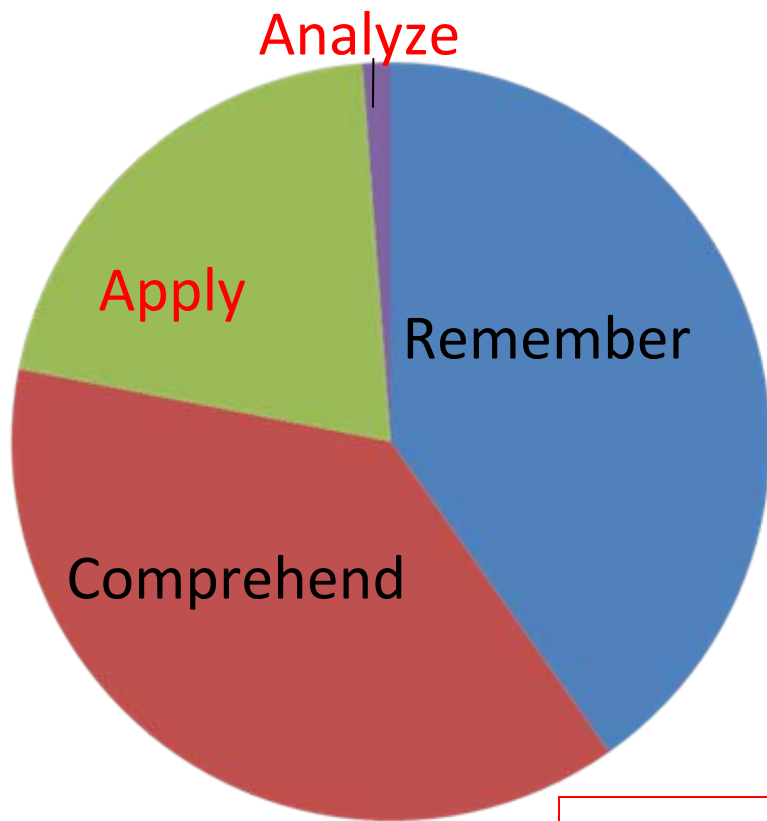
1. Factual Knowledge: remember and recall factual information
Define, List, State, Label, Name, Describe
2. Comprehension: demonstrate understanding of ideas, concepts
Describe, Explain, Summarize, Interpret, Illustrate
3. Application: apply comprehension to unfamiliar situations
Apply, Demonstrate, Use, Compute, Solve, Predict, Construct, Modify
4. Analysis: break down concepts into parts
Compare, Contrast, Categorize, Distinguish, Identify, Infer
5. Evaluation: think critically about and defend a position
Judge, Appraise, Recommend, Justify, Defend, Criticize, Evaluate
6. Synthesis: transform, combine ideas to create something new
Develop, Create, Propose, Formulate, Design, Invent

Higher levels: Require deeper
conceptual understanding

Has level of understanding of material improved?

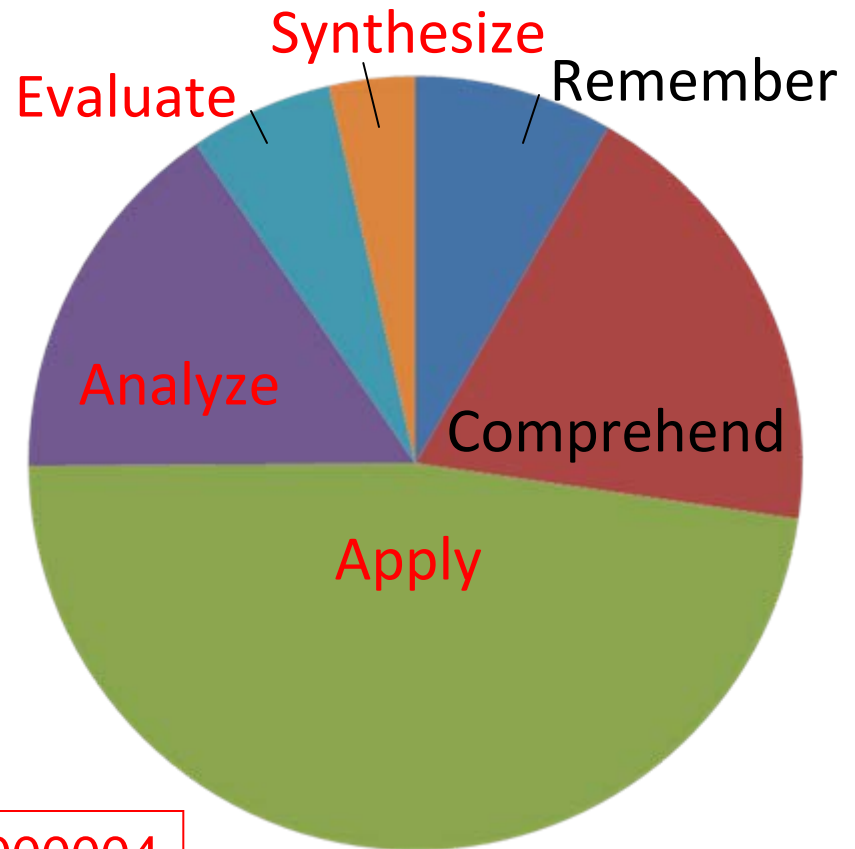
- Other outcome measures?
 - Rate questions based on *Bloom's taxonomy of cognitive domain*
 - refining & testing rubric
 - preliminary results

Bloom's Analysis of Exam Questions



Fall 2004

78% remember & comprehend
22% apply & analyze

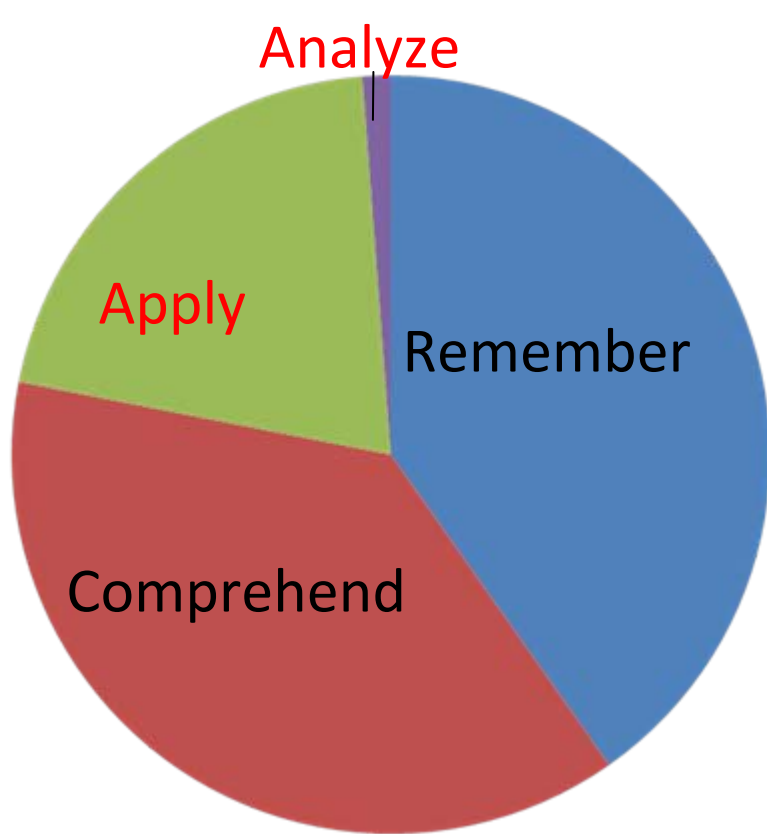


Fall 2008

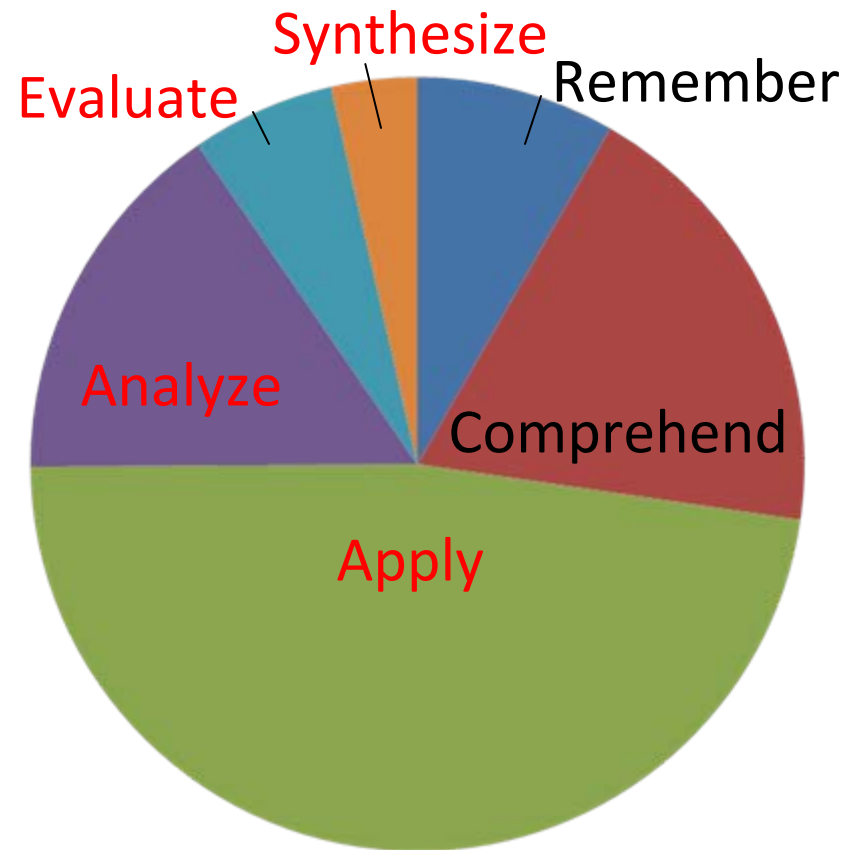
27% remember & comprehend
64% apply & analyze
9% evaluate & synthesize

$P=0.000000000000004$

Bloom's Analysis of Exam Questions



Fall 2004 exam ave (72.6%)



Fall 2008 exam ave (72%)

So following incorporation of problem-solving practice, students are performing at much higher cognitive level on exams.

What's Next?

- Neurophysiology
 - Finish testing rubric
 - Independent reviewers rate exam questions
 - Independent reviewers rate clicker & homework questions

Challenging Coursework

Neurophysiology

Challenging conceptual material

Lecture

Problem solving - homework assignments (F05), clicker questions (F06), HELP room (F08)

Attitudes on interventions & Measure of performance

Course

Challenge

**Typical format:
teacher-centered**

**Interventions:
student-centered**

**Outcome
Measures**

Critical Thinking: Neurobiology of Disease

Reading & interpreting primary scientific literature

Teacher feedback

Partner work

Pre/post attitudes & learning (performance)

Evolution of Critical Thinking Course

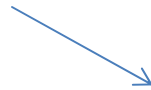
Read & interpret primary literature

need practice



2 practice assignments (write portions)
(teacher feedback)

need more practice



Small group discussion of articles
practice assignments
In-class critique of student writing
(in addition to instructor feedback)
need more practice,
but grading overload

Student Problem: understanding how to read primary literature & what it means to look at data

Instructor Problem: limit to feedback can provide

Calibrated Peer Review (CPR)

- What is CPR?
 - web-based tool (www.cpr.molsci.ucla.edu)
 - facilitates use of writing as a learning & assessment tool
 - enables frequent writing assignments without increasing instructor grading load
 - discipline & level independent
- How does it work?
 - students submit a writing assignment
 - typically about a paragraph
 - we did 1-2 pages
 - rate 3 calibration essays (calibrate as reviewers)
 - detailed grading rubric (both content & style questions)
 - review 3 peer papers (anonymous)
 - self-assessment
 - students get feedback

CPR Intervention

F07

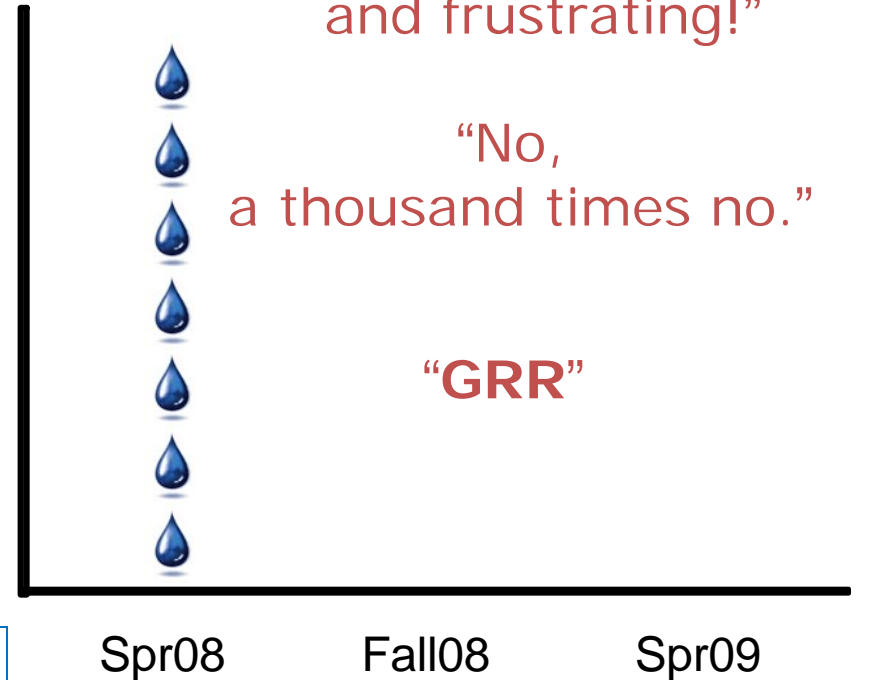
Sp08
CPR

- Assignments
-2 papers
- Small group discussion
- Final Papers
- Presentation

- Assignments
->Practice Intro
-2 papers
- Small group discussion
- Final Papers
- Presentation

Students: too challenging
Instructor: ready to give up

Tear Factor



CPR Intervention

F07

Sp08
CPR

F08

CU Learn - mimic CPR

<ul style="list-style-type: none">•Assignments -2 papers•Small group discussion•Final Papers•Presentation	<ul style="list-style-type: none">•Assignments -Practice Intro -2 papers•Small group discussion•Final Papers•Presentation	<ul style="list-style-type: none">•Assignments -Practice Intro ->Divide to 4 papers ->Work w/ partner for review•Small group discussion•Final Papers•Presentation
--	--	--

Changes for F08

- divide 2->4 assignments
- partner for CPR
- CU Learn

CPR Intervention

F07

Sp08
CPR

F08

CU Learn - mimic CPR

- Assignments

-2 papers

- Small group discussion

- Final Papers

- Presentation

- Assignments

-Practice Intro
-2 papers

- Small group discussion

- Final Papers

- Presentation

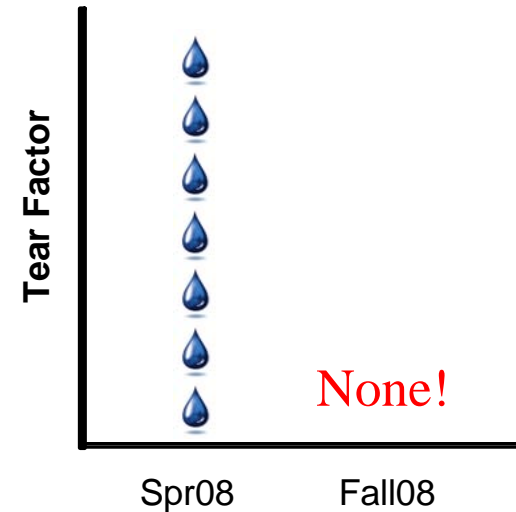
- Assignments

-Practice Intro
->Divide to 4 papers
->Work w/ partner for review

- Small group discussion

- Final Papers

- Presentation



Students: all about writing
Instructor: CU Learn too cumbersome

CPR Intervention

F07

Sp08

CPR

F08

CU Learn - mimic CPR

Sp09

CPR

•Assignments

-2 papers

•Small group discussion

•Final Papers

•Presentation

•Assignments

-Practice Intro

-2 papers

•Small group discussion

•Final Papers

•Presentation

•Assignments

-Practice Intro

-Divide to 4 papers

-Work w/ partner for review

•Small group discussion

•Final Papers

•Presentation

•Assignments

-Practice Intro

- 4 papers

-Work w/partner for review

->Work w/partner for writing

•Small group discussion

•Final Papers

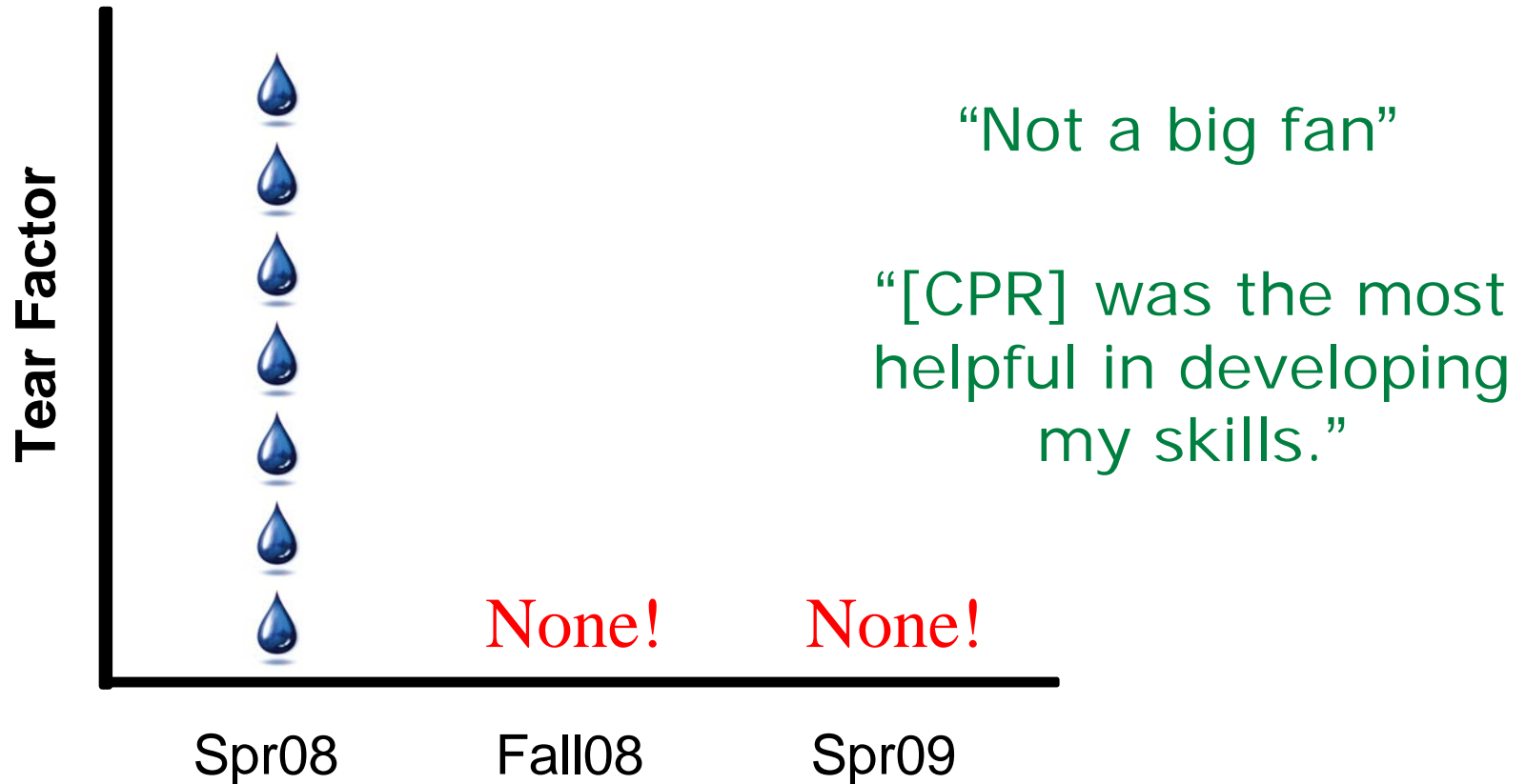
•Presentation

Changes for Sp09

-focus on content

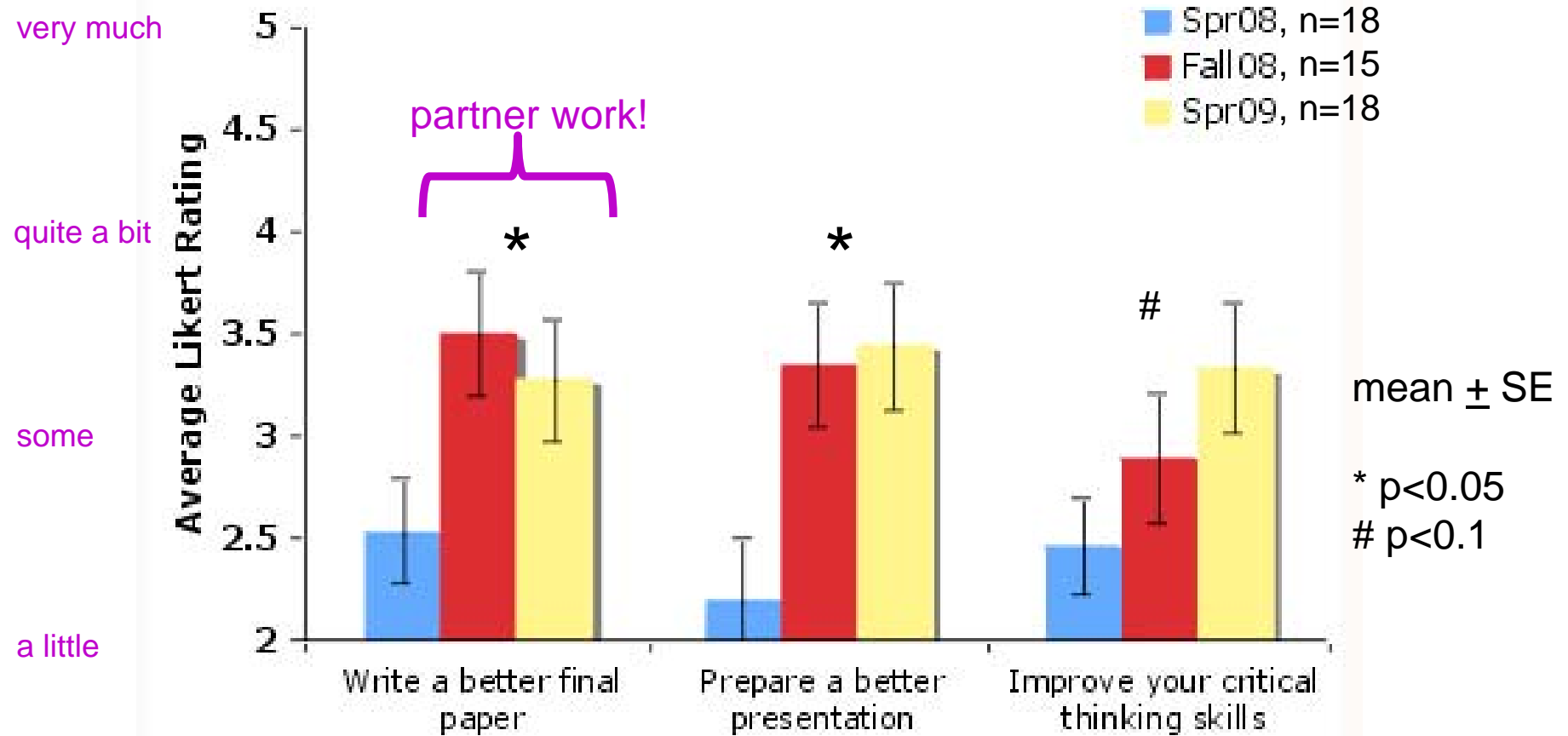
- de-emphasize style questions
- small group activities
- co-write (b/c of CPR)

CPR Intervention



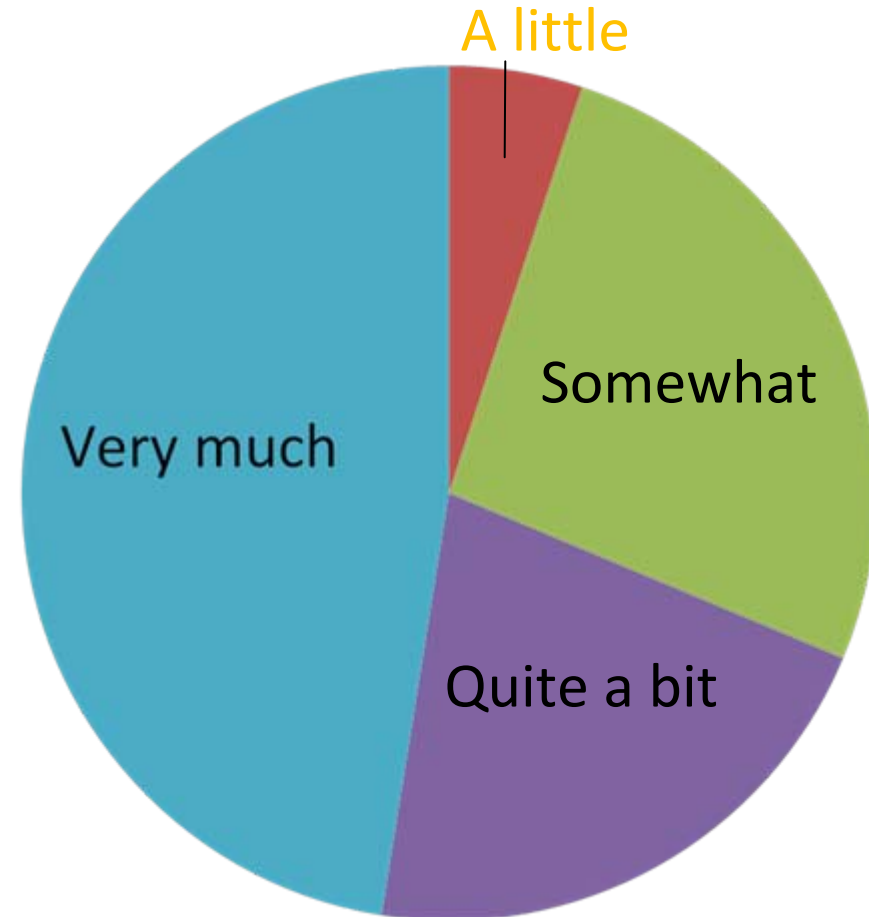
And, some students would even want to use CPR in another course!

Partner work increases extent to which students find CPR helpful



Partner work is viewed as beneficial

- 94% felt partner work was 'somewhat' helpful or greater
- When asked to explain their answer:
 - 75% felt led to improved quality
 - 42%: ***different opinions*** led to better / less biased / more standardized [evaluation]
 - 26%: one person could ***catch things the other missed***
 - 26% felt led to better understanding of assignment

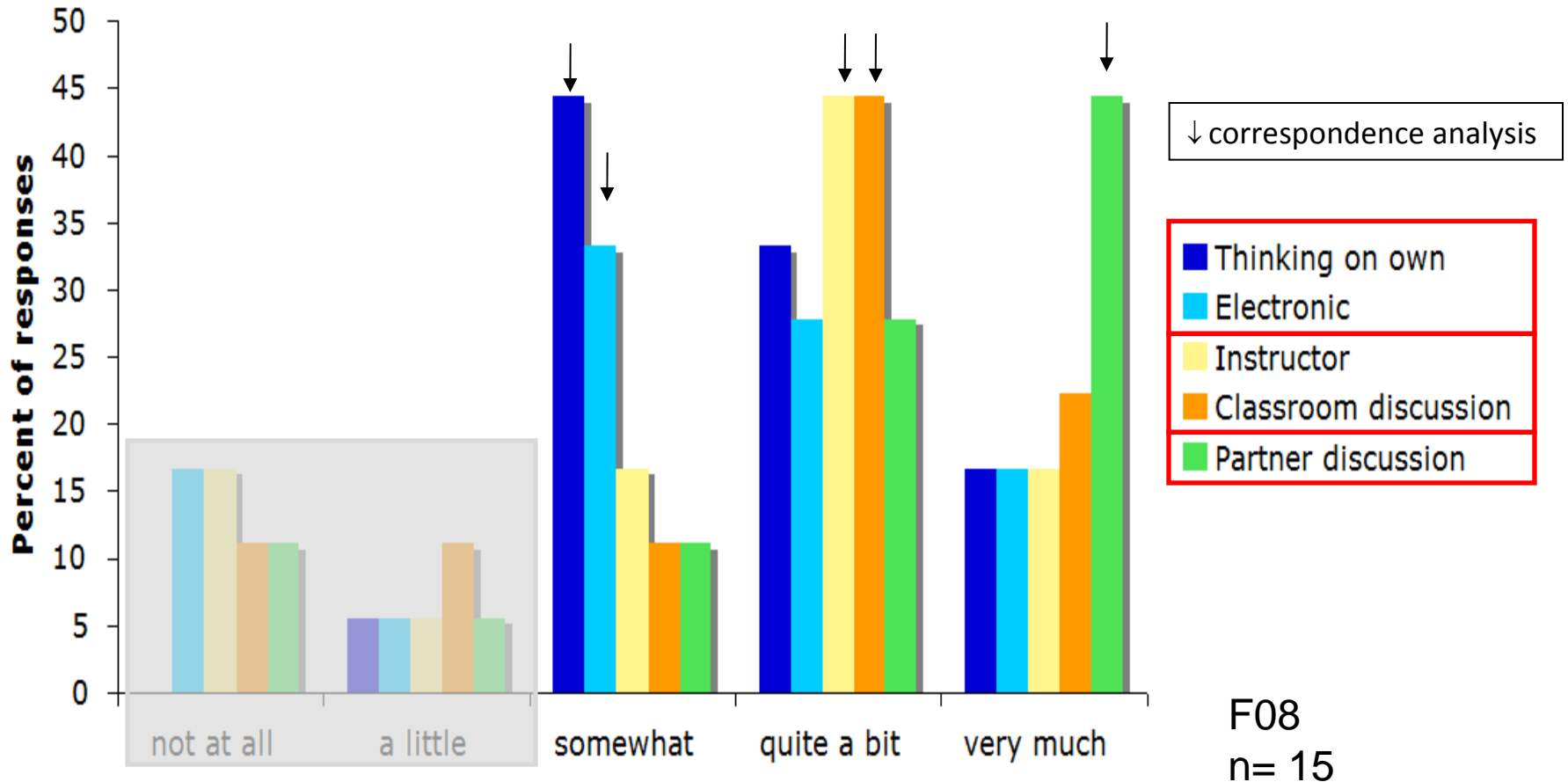


F08, n=19
mid-semester survey

Student quotes about partner work for CPR

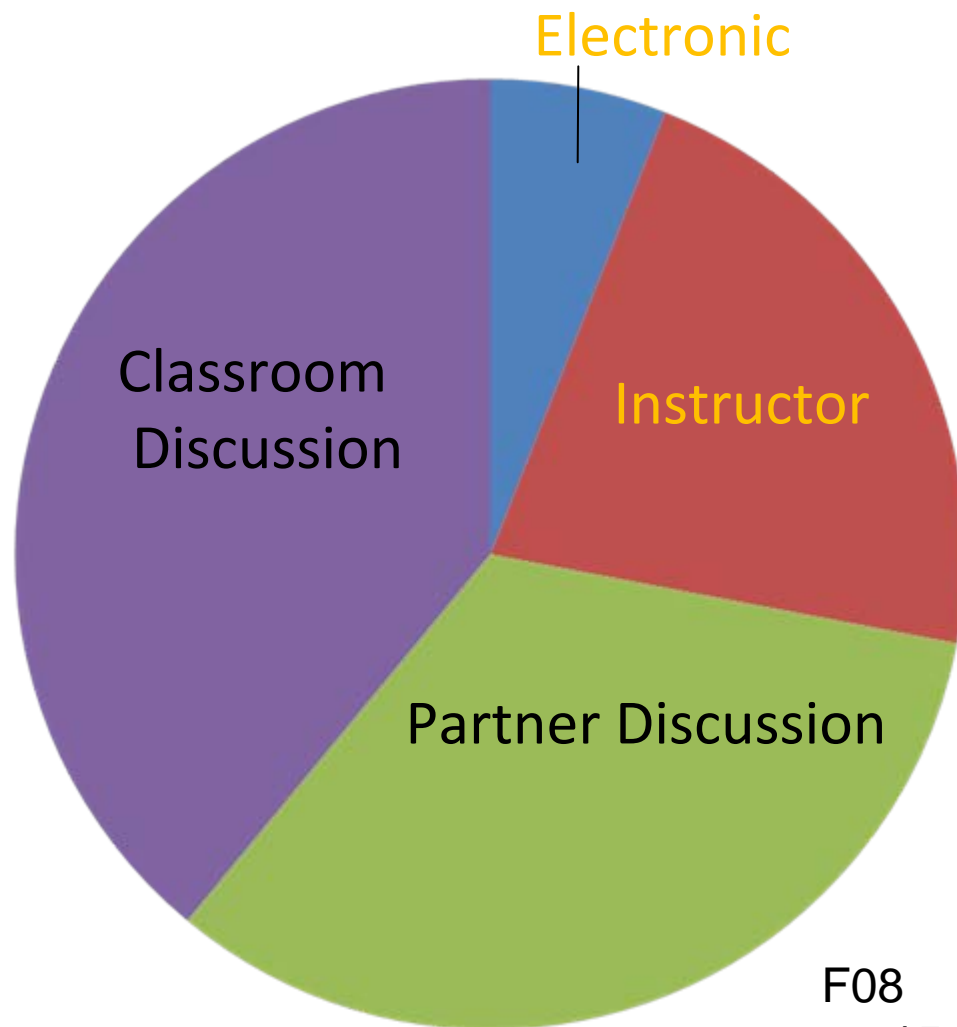
- ❖ “Working with someone is great b/c it makes **you feel like you’re understanding the material better if you agree with your partner.** It also allows for some help when you miss key points in papers, or read something wrong.”
- ❖ “Talking with a peer made it much easier to **see what we were thinking** and then trying to talk it through to explain why we thought it was A, B, or C. [You] notice much more.”
- ❖ “The other person might have a completely different view than yours on certain topics. Its **good to listen to their reasoning** and explain yours and **come up with an agreement on which reasoning is more valid** and makes sense”
- “Not everyone grades in the same way. While it can be beneficial to view other people's opinions, it can also be a tedious process”

Partner discussion rated highest in helpfulness



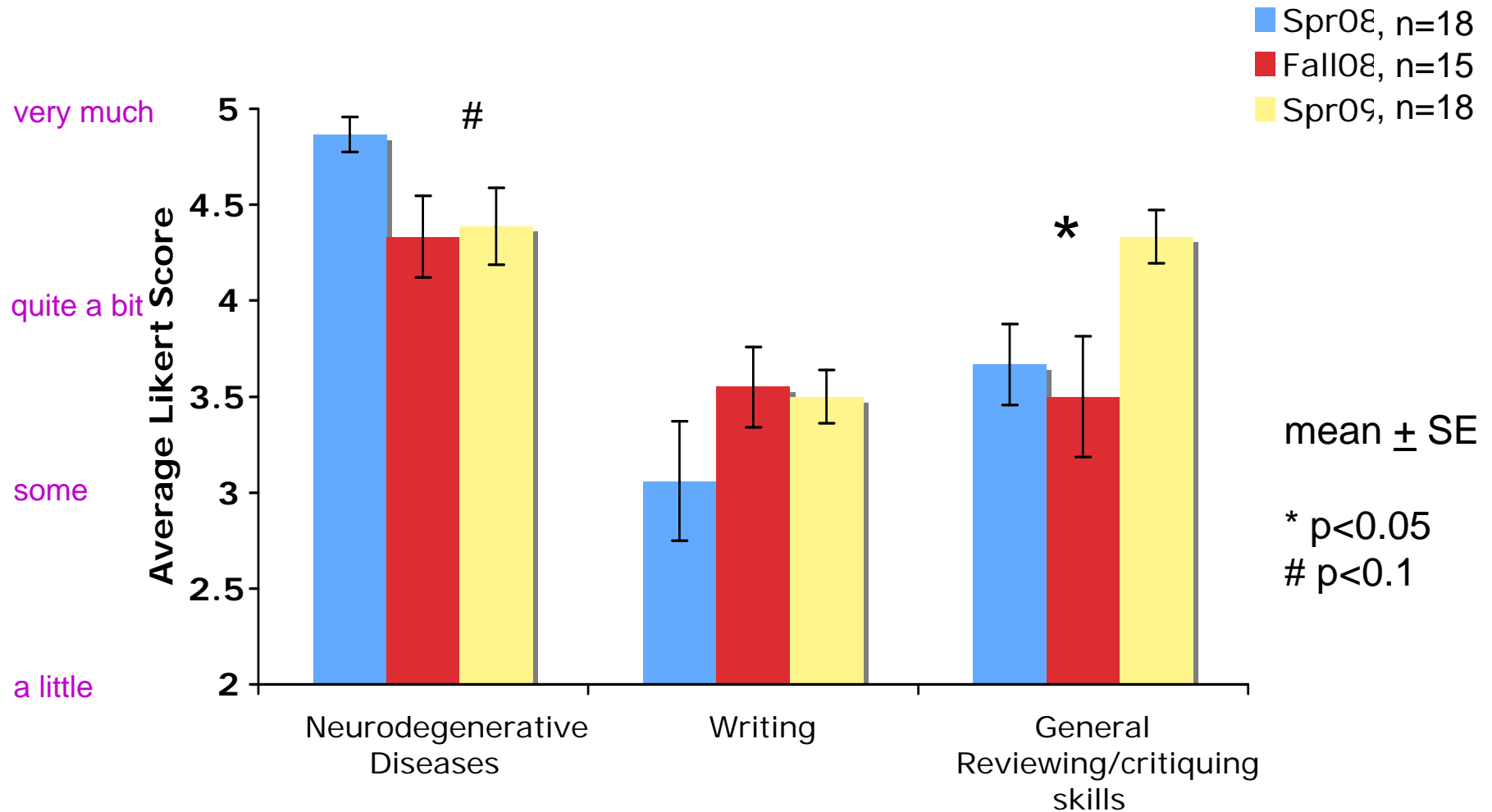
Which type of feedback is *most* helpful in passing calibrations?

- 72% chose some form of peer discussion:
 - *partner discussion* (33%)
 - or *classroom discussion* (small group discussion with some instructor feedback) (39%)

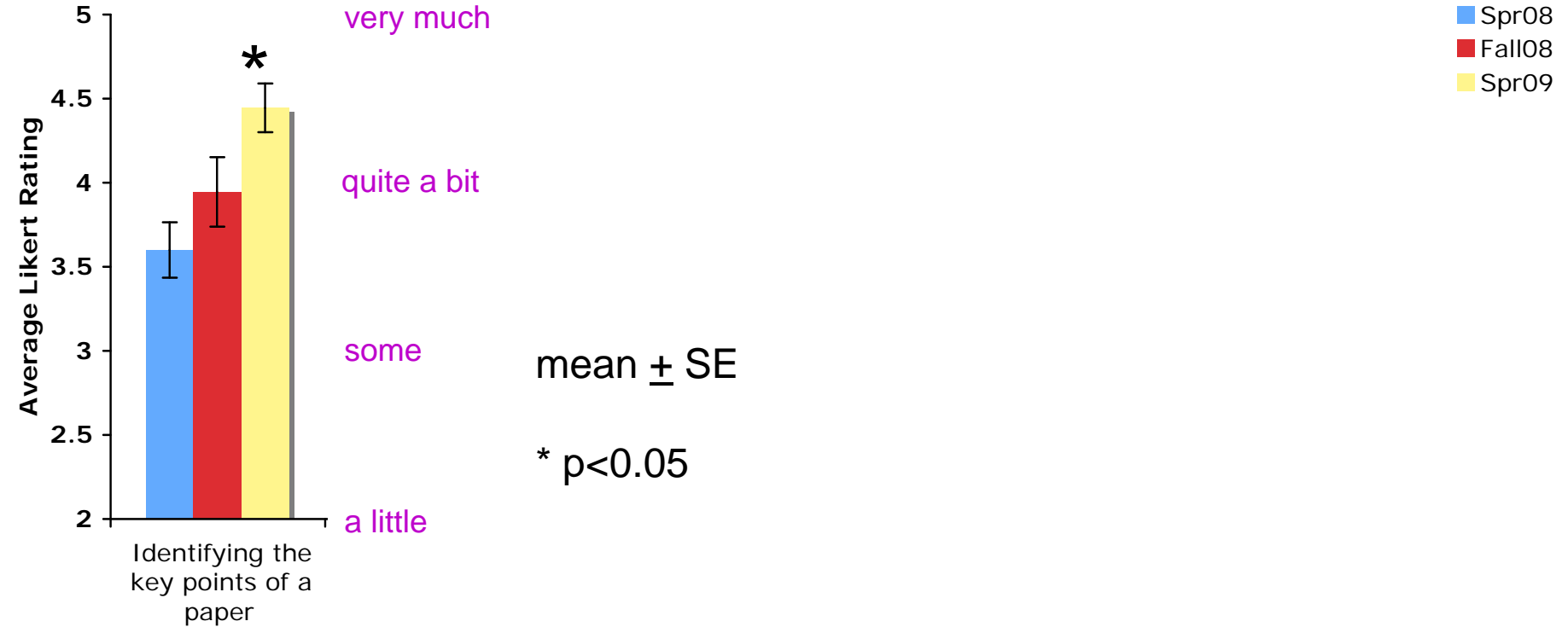


F08
n= 15

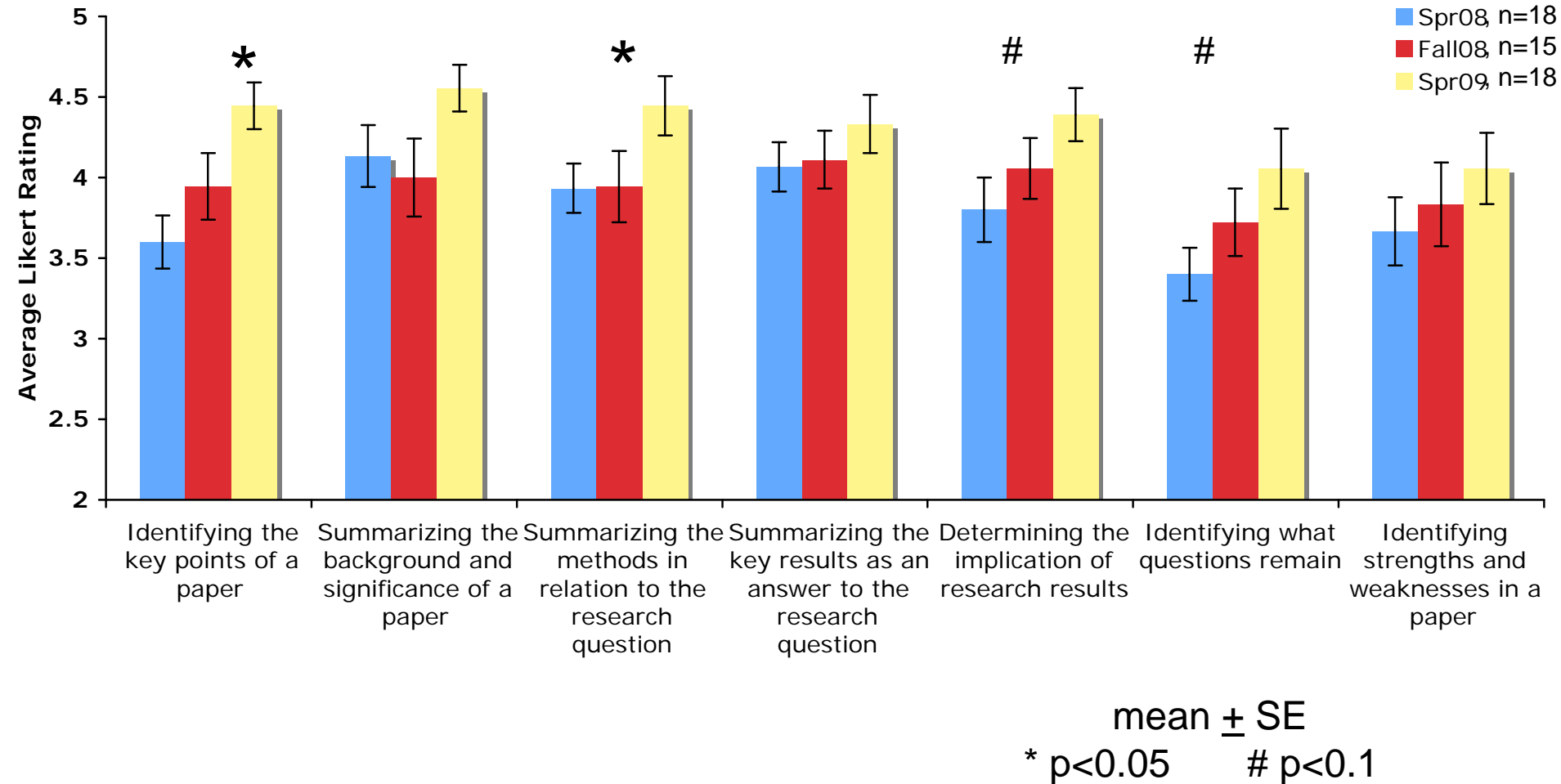
Focusing on content led students to feel they acquired more general reviewing/critiquing skills



Focusing on content helped students feel they learned more about how to read & interpret primary literature



Focusing on content helped students feel they learned more about how to read & interpret primary literature



Other observations...

- When students worked with partners:
 - there was a significant improvement in whether they felt CPR was worth their time
 - they performed better on the last 2 CPR calibrations (for results, & significance and implications)

What's Next?

- Critical Thinking
 - Independent reviewers rating answers to rubric summary questions & overall score for final papers in different semesters to assess performance
- Potential COLTT workshop on CPR in August

Conclusions

- Interventions leading to more ***student-centered learning*** improve student *attitudes & abilities*
 - **problem-solving practice** in Neurophysiology allows students to work at a higher cognitive level on exams (& they enjoy the practice!)
 - **partner work** on CPR in Critical Thinking leads to:
 - more positive attitudes
 - better performance on calibrations
 - quality of final papers?

Acknowledgements

Neurophysiology

– Attitude surveys

- Franny Benay, M.S., STF

– Bloom's rubric

- Dr. Kate Semsar, STF
- Franny Benay, M.S., STF
- Jeff Gould, B.S.
- Dr. Dale Mood
- Support from: CU
President's Teaching & Learning Collaborative

Critical Thinking

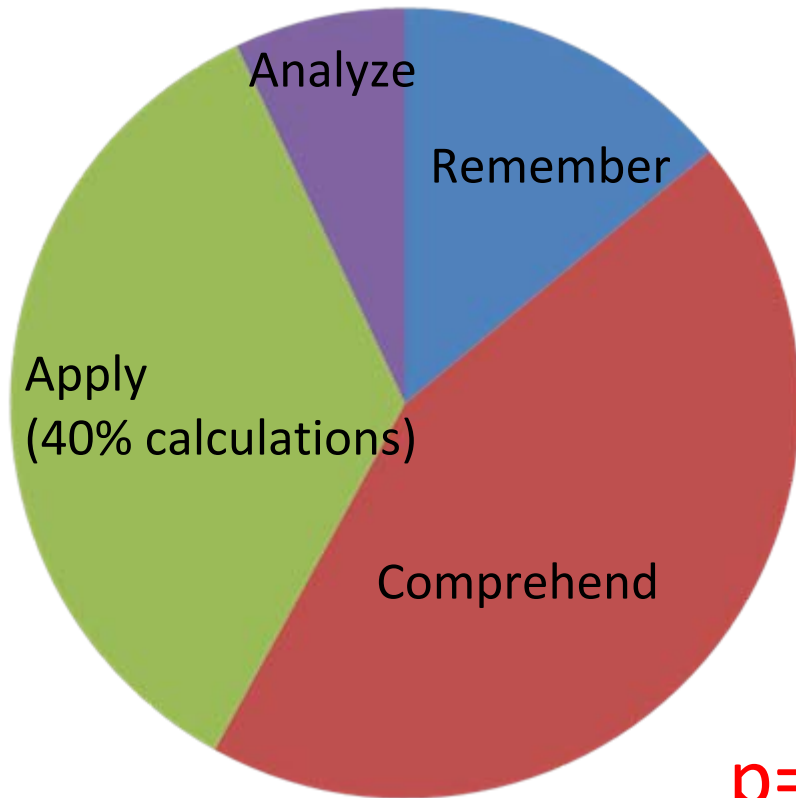
– Attitude surveys

- Dr. Kate Semsar, STF
- Franny Benay, M.S., STF

– Performance

- Dr. Teresa Foley, STF
- Dr. Kate Semsar, STF

Bloom's Analysis of Clicker Questions

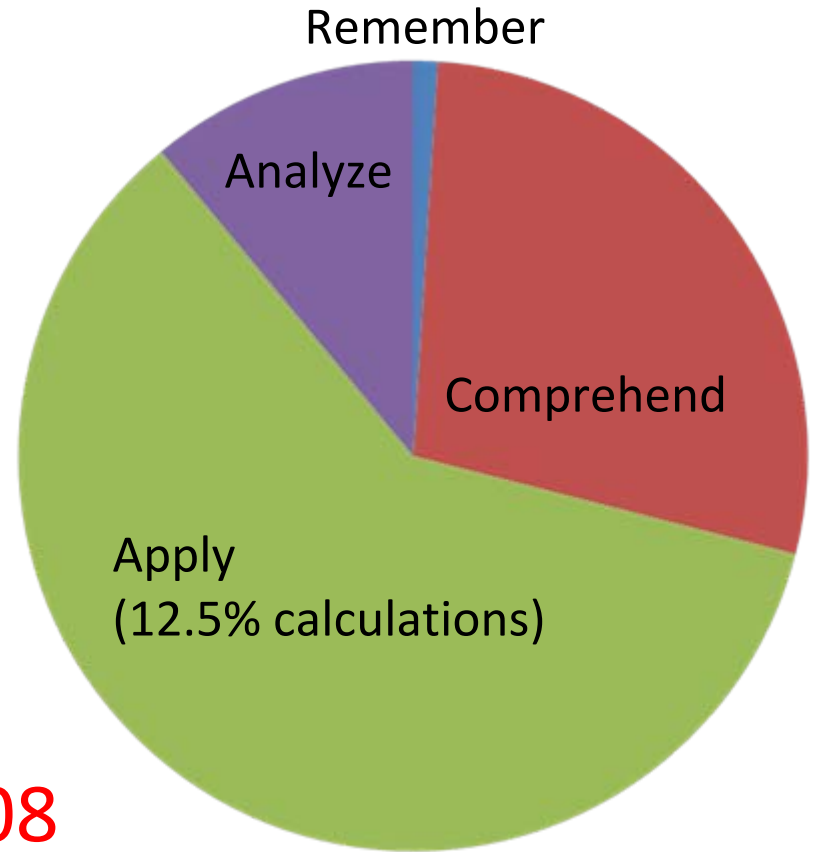


Fall 2006

58% remember & comprehend

42% apply & analyze

$p=0.008$

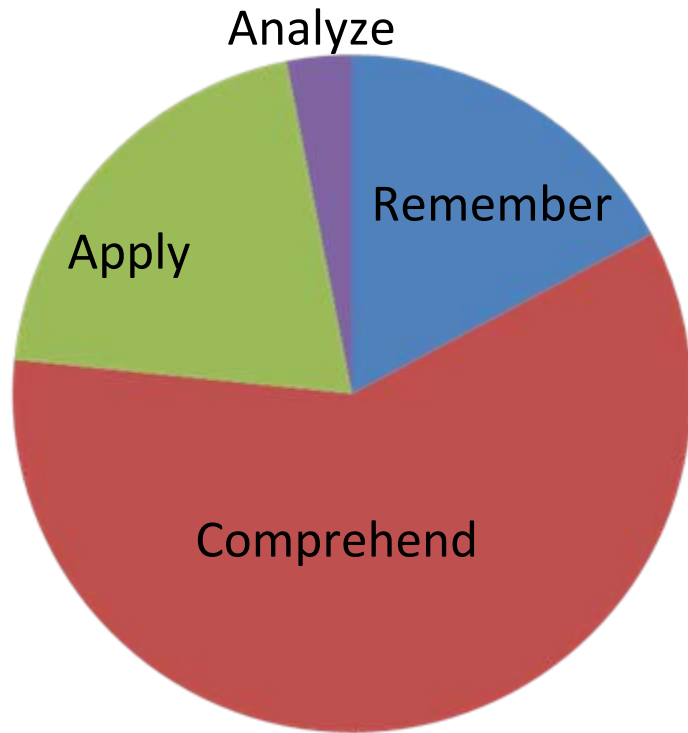


Fall 2008

29% remember & comprehend

71% apply & analyze

Bloom's Analysis of Homework Questions



Fall 2005

77% remember & comprehend

23% apply & analyze

Fall 2008

x% remember & comprehend

x% apply & analyze

x% evaluate & synthesize