

Preparing Undergrads to Teach (Well): The Colorado Learning Assistant Model

Steven Pollock

V. Otero,

& the STEM Colorado/PhysTEC Team

University of Colorado, Boulder



Acknowledgements

Physics faculty:

SJP

Noah Finkelstein

Carl Wieman

Kathy Perkins

Michael Dubson

Postdocs:

Sam McKagan

Laurel Mayhew

Stephanie Chasteen

Archie Paulson

Wendy Adams

Ph. D. students:

Noah Podolefsky

Chandra Turpen

Lauren Kost

Charles Baily

+recently graduated, 3
with PhD, 1 with
MSc.

School of Ed :

Valerie Otero,

Kara Gray

Bud Talbott



QuickTime™ and a TIFF (Uncompressed) decompressor are needed to see this picture.



QuickTime™ and a
(uncompressed) decc
needed to see this p



**COLORADO
LEARNING ASSISTANTS
MODEL**

Participants

Applied Math

Jim Curry (Chair)
Mary Nelson
Adam Norris
Ann Dougherty
Jim Weiss
Susan Hallowell

Geosciences

Alan Lester
David Budd
Andrea Bair
Jennifer Stempien

K-12 Teachers

Steve Iona
Mike Fuchs
Roberta Tanner
PhysTEC TAG

Astronomy

Dick McCray
Doug Duncan
Nick Schneider
John Stocke
Fran Bagenal

MCD Biology

Mike Klymkowsky
Bill Wood
Jennifer Knight
Sylvia Fromherz
Jia Shi
Michelle Smith

Graduate Students

Danielle Harlow
Bud Talbot
Heidi Iverson
Mariel Desroche

Chemistry

Veronica Bierbaum
Margaret Asirvatham
Linda Koch
Laurie Langdon
Robert Parson

Steve Pollock
Kathy Perkins
Carl Wieman
Carl Rogers
Murray Holland
Shijie Zhong

Education

Valerie Otero
Derek Briggs
Lorrie Shepard
Laura Moin
David Webb

Physics

Noah Finklestein
Mike Dubson
Ed Kinney
Jim Shepard
James Nagle
John Cumulat (Chair)

Mathematics

Eric Stade
Robb Tubbs

226 Learning Assistants

Supported by:

Provost Phil DiStefano, Dean Lorrie Shepard (Education), Dean Todd Gleeson (A&S)

Guiding Questions

How can we recruit more science students to careers in K-12 teaching?

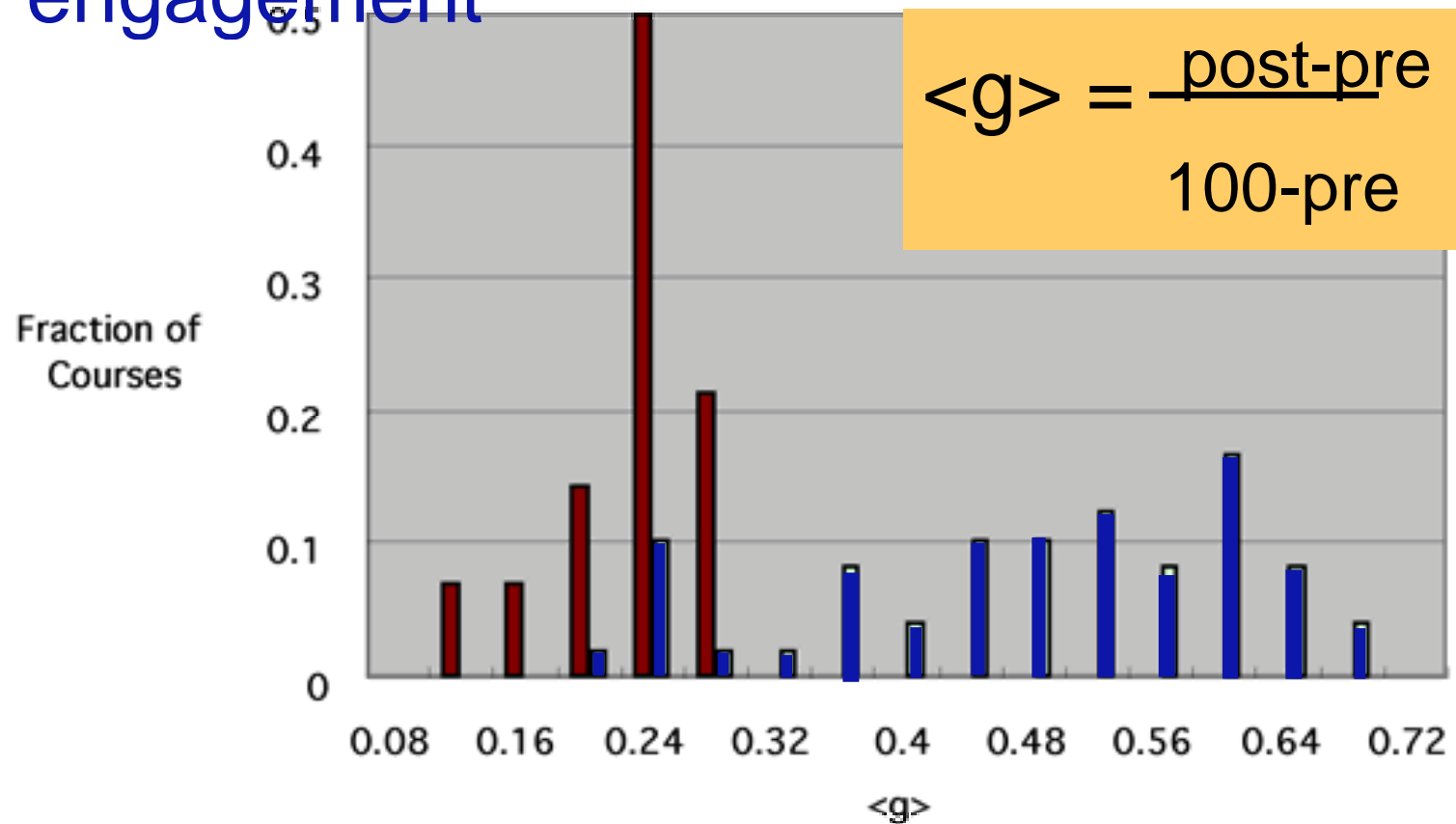
How can science research faculty be involved?

How do we create a reasonable experience for students who *might* become teachers?

How do we leverage the above with our desire to improve intro courses?

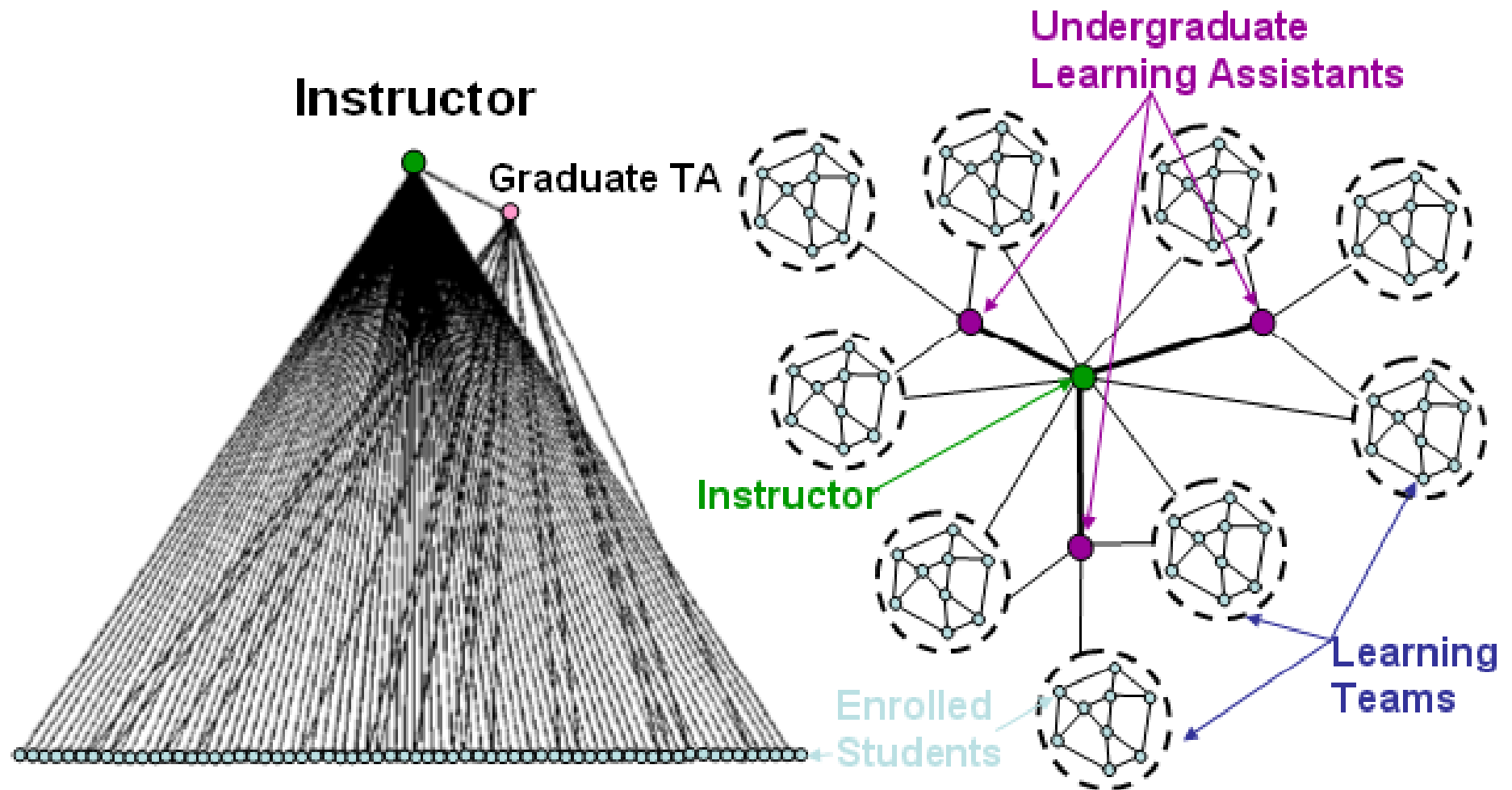
Force Concept Inventory

red = trad, blue = interactive
engagement



R. Hake, "...A six-thousand-student survey..." AJP 66, 64-74 ('98).

Transformation of Large-Enrollment Introductory Courses with Undergraduate Learning Assistants (LAs)



Traditional large enrollment lecture course: one instructor and a graduate TA to serve 200+ students

Course transformed using Learning Assistants to facilitate collaboration

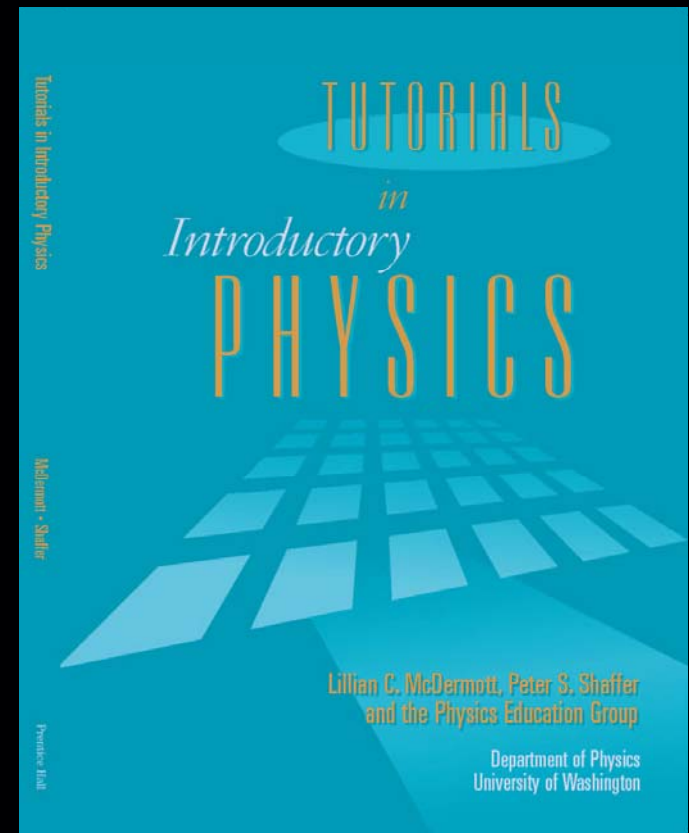
Tutorials in Introductory Physics

Reconceptualize Recitation

Elicit, Confront, Resolve

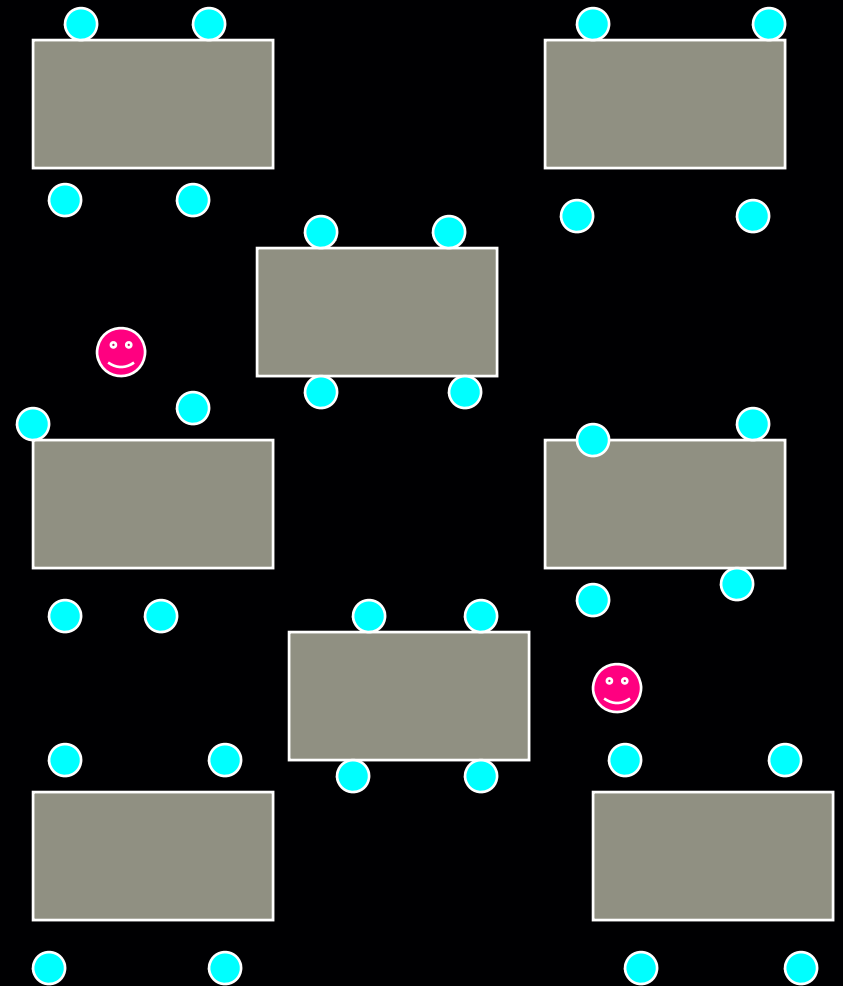
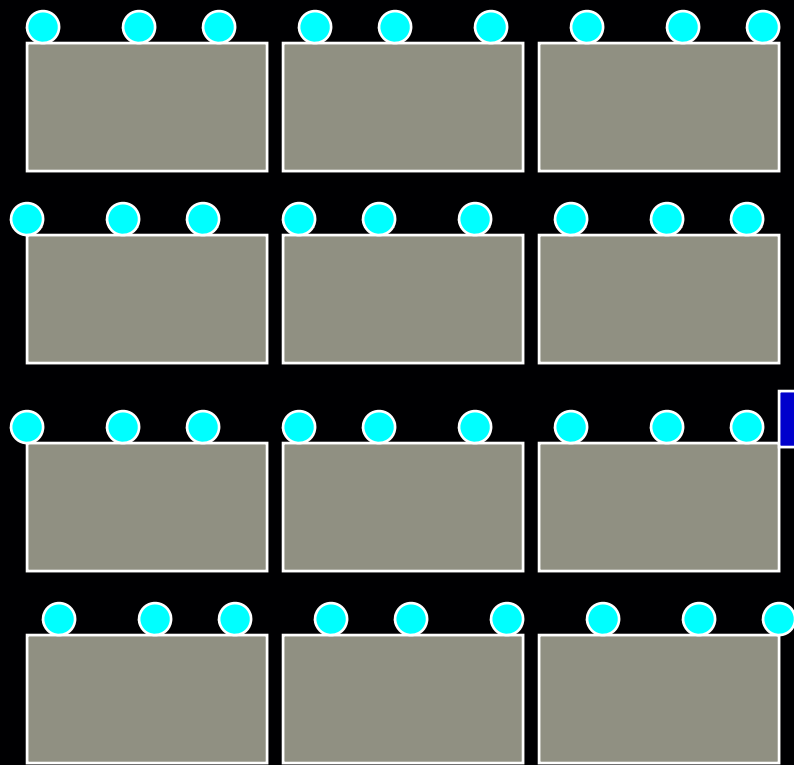
Socratic Method

(=> 1.5 hr/wk prep/training)



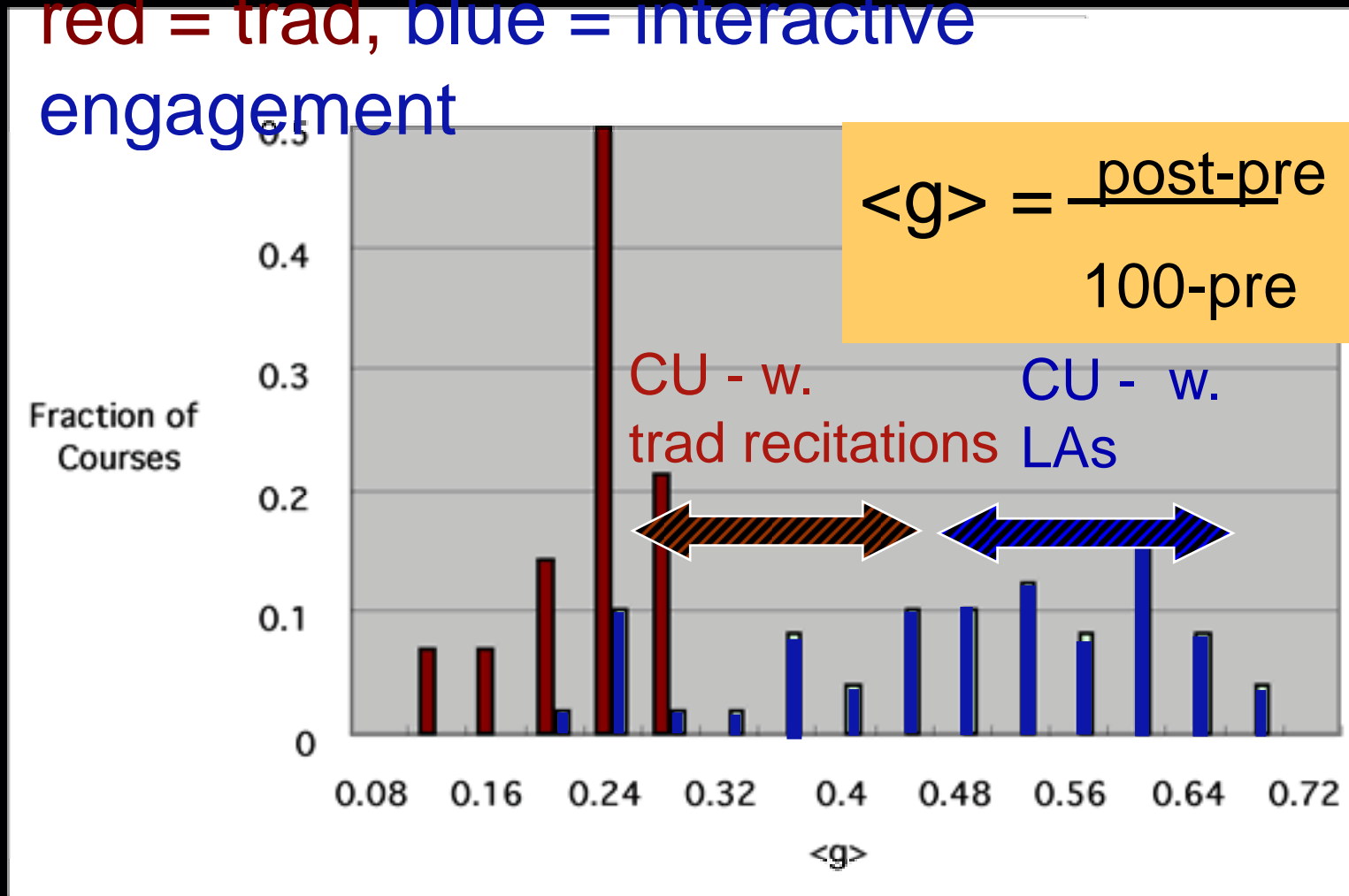
(From University of Washington's Physics Education Group)

Tutorial vs. Trad'l Recitation



Force Concept Inventory

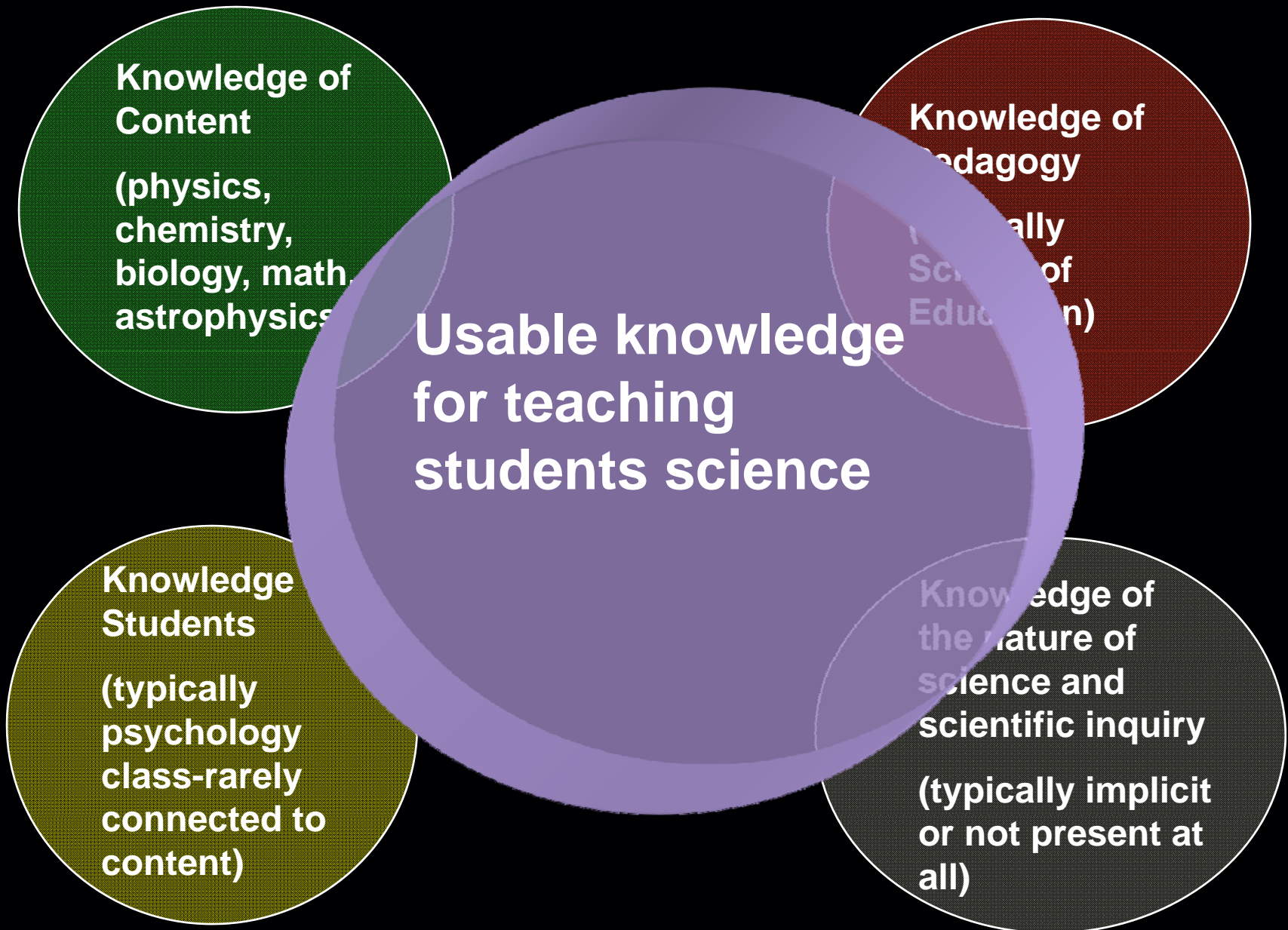
red = trad, blue = interactive
engagement



R. Hake, "...A six-thousand-student survey..." AJP 66, 64-74 ('98).

S. Pollock and N. Finkelstein, *Phys. Rev. ST Phys. Educ. Res.* 4, 010110 (2008)

What is a Qualified Teacher

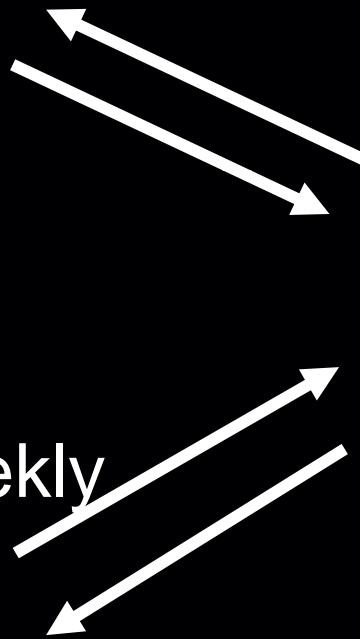


The Learning Assistant Experience

Content: Weekly planning sessions with science faculty member teaching the course

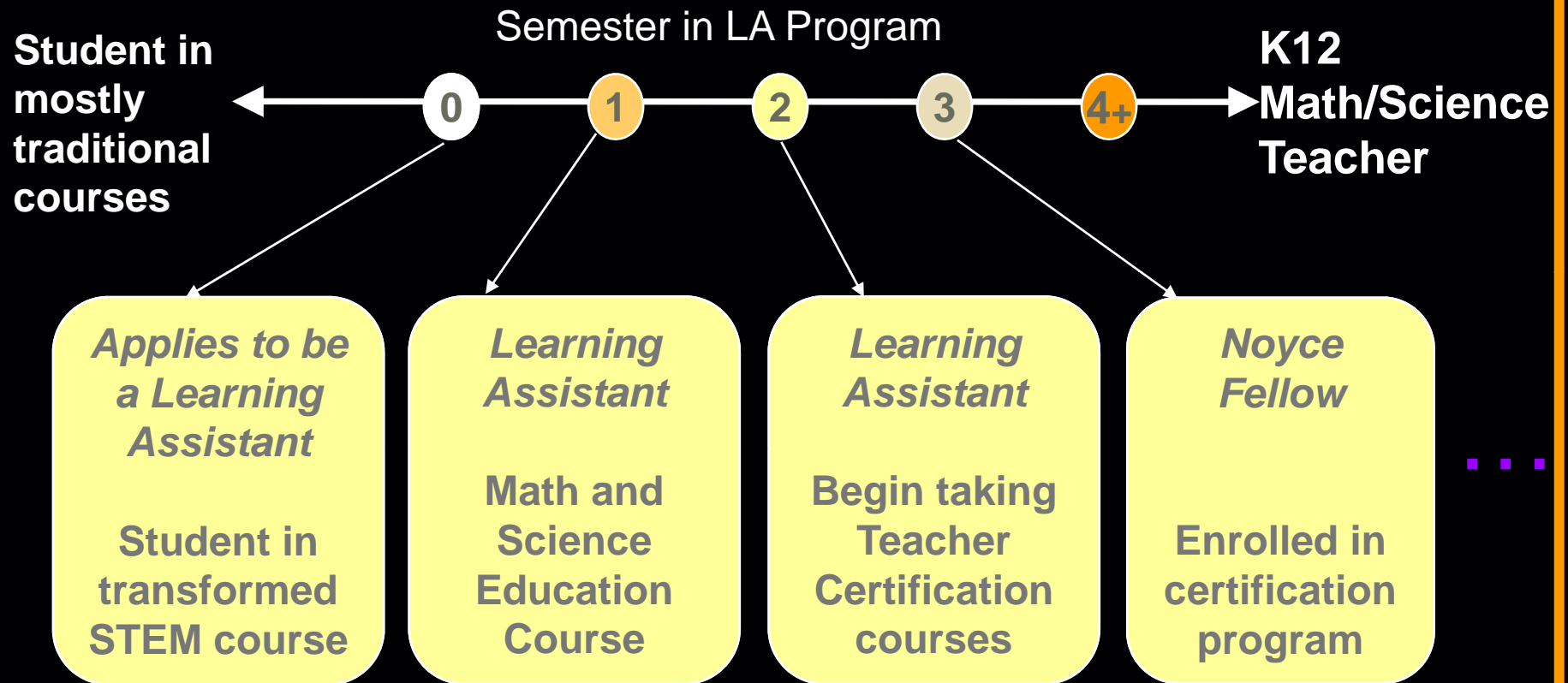


Practice: LAs lead weekly Learning Teams



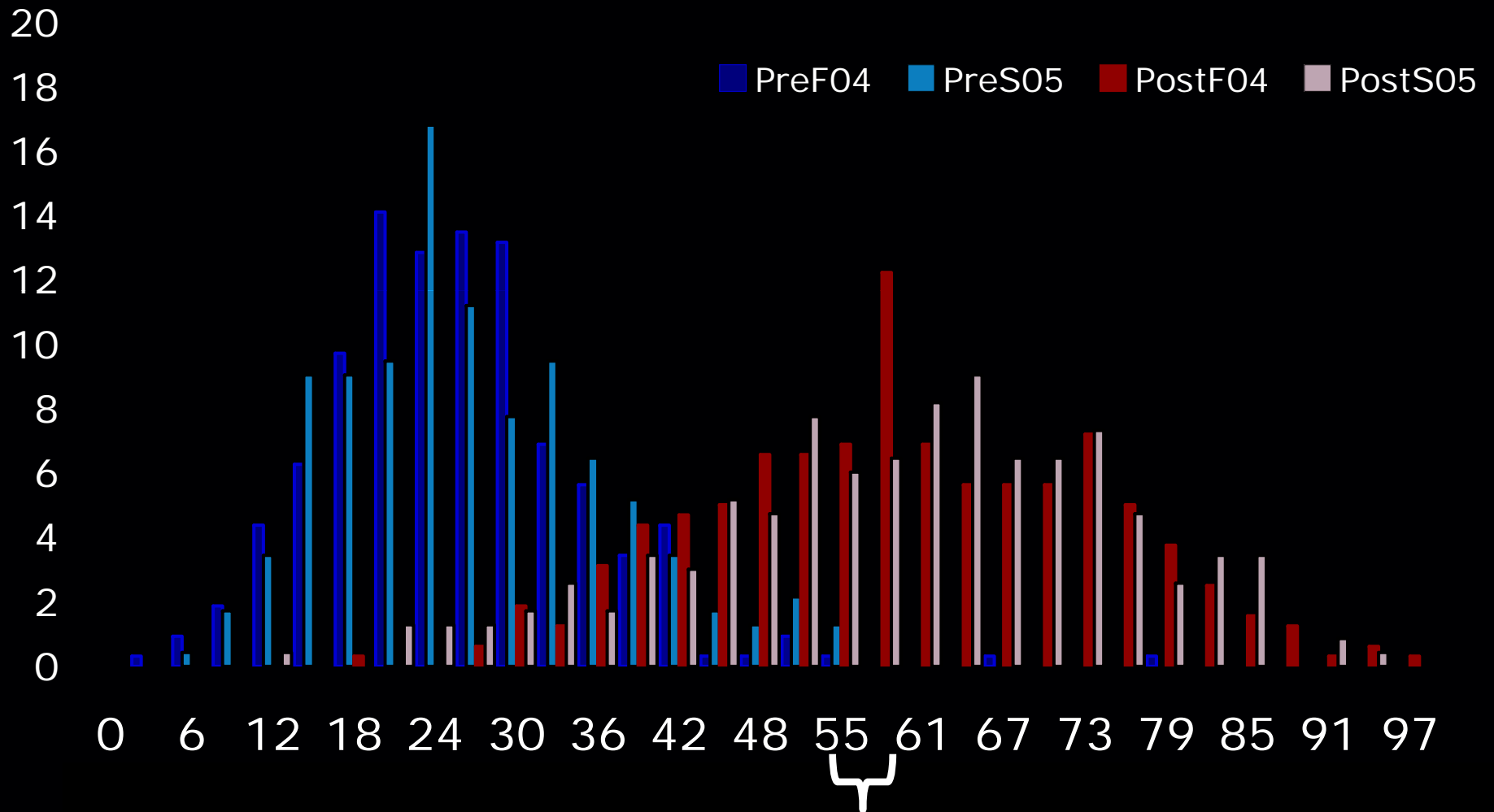
Pedagogy: LAs from all dep'ts take weekly course in science education theory and practice—led by Ed faculty and K12 Teacher

Formative feedback for instructor to use in lecture



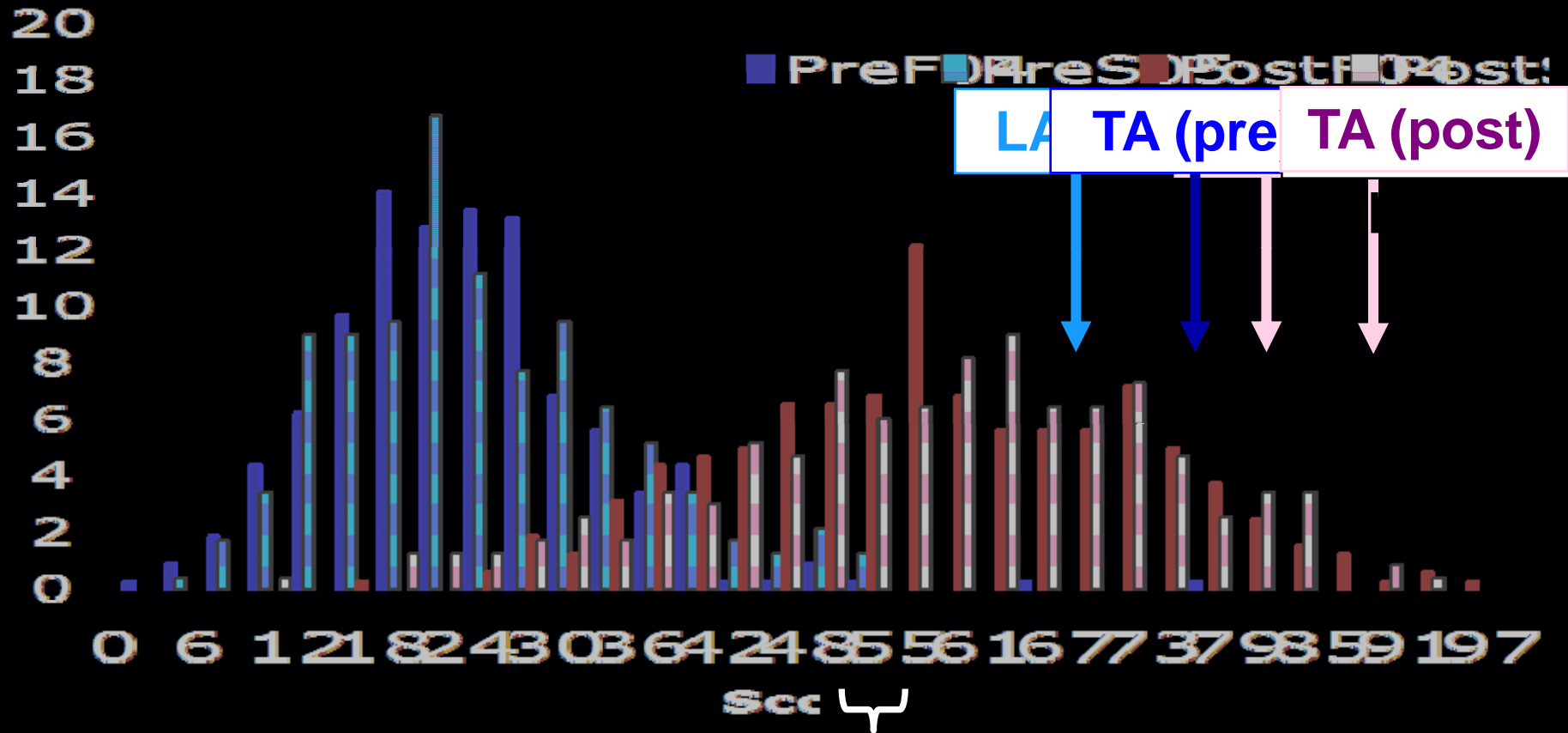
In the LA program, students learn about teaching *while* they are teaching and while they are learning science/math content.

1120 BEMA pre/post



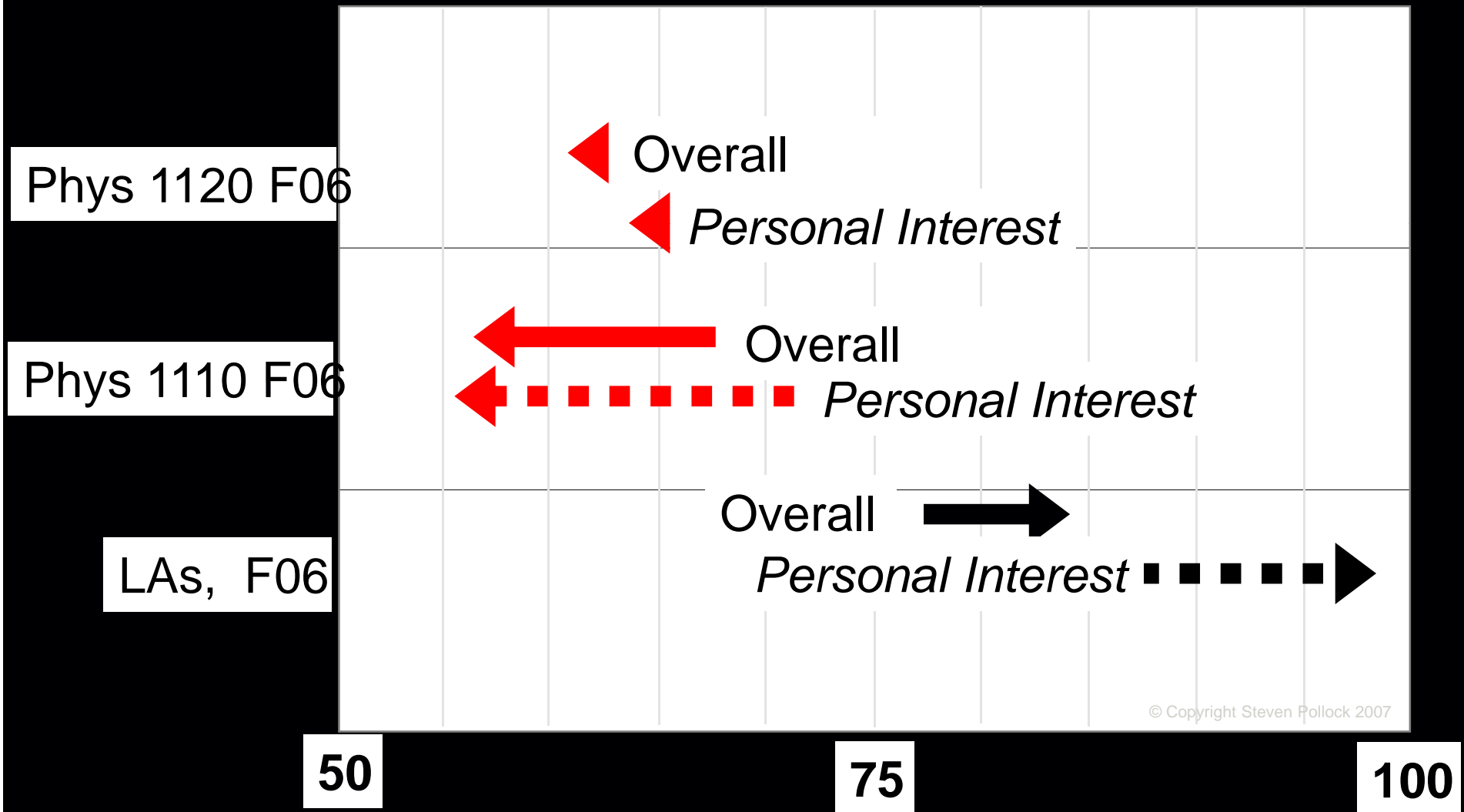
CU upper division (trad)

1120 BEMA



CU upper division (trad)

CLASS F06: Comparing students & LA's



Teaching is attractive to LAs

Total physics/astrophysics enrollment in certification programs in Colorado* 2004-2005	Phys/Astrophysics LAs enrolled in teacher certification programs from CU Boulder LA Program 2007-February 2008	Former Phys/Astro LAs teaching 2007-2008	Total number of physics/astrophysics LAs – teachers and future teachers
5	13	4	17

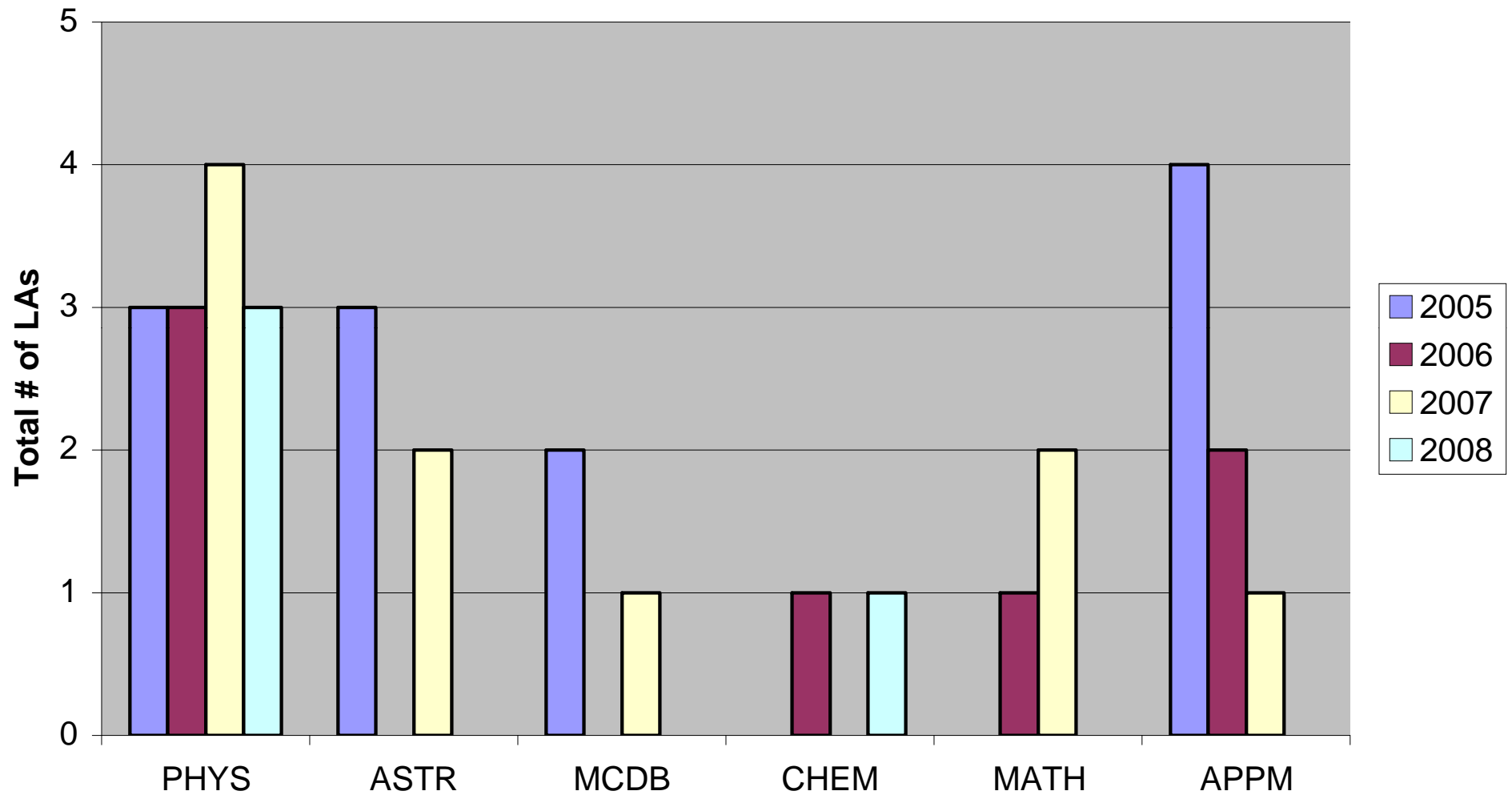
*At 18 colleges and universities with 10,869 candidates, 385 science majors¹

LAs report that they had not seriously considered becoming a teacher until participating as a Learning Assistant

Two most frequently stated reasons for making the decision:

- (1) Recognizing Teaching as a complex endeavor**
- (2) Encouragement and support by participating Faculty**

Recruitment of LAs to Teaching Careers 2005-2008



LAs are attractive to Faculty

226 # of LAs hired since Fall 2003

3.5 Average cumulative GPA (**3.7** in physics)

Fall 2003

Spring 2008

7 faculty (4 departments)

4 courses transformed

28 LAs/semester

Impacts: 400 stud/yr

48 faculty (7 departments)

30 courses transformed

>60 LAs/semester

>7000 students/year

Cost Per Year=\$274K Cost per Impacted Student: \$39

Growth of the LA Program Nationwide

Physics Teachers Education Coalition (PTEC) APS

104 Institutions

LA Program is a hallmark of PTEC activities



LA program support

University Commitment

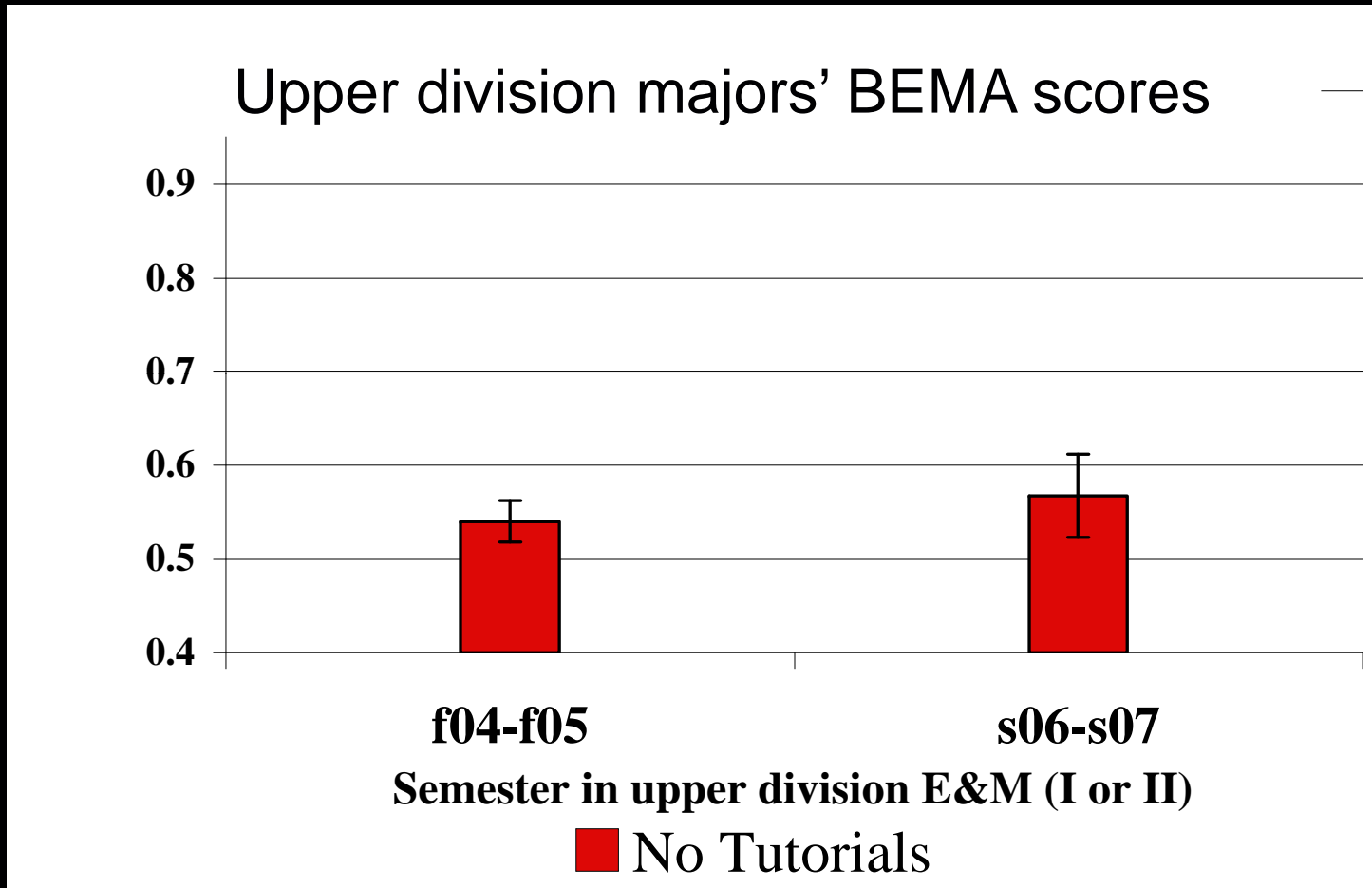
- \$100k private donor
- \$150k university commitment
- Raising \$1M for endowment

External \$\$

NSF, NMSI, and hopefully CU Foundation

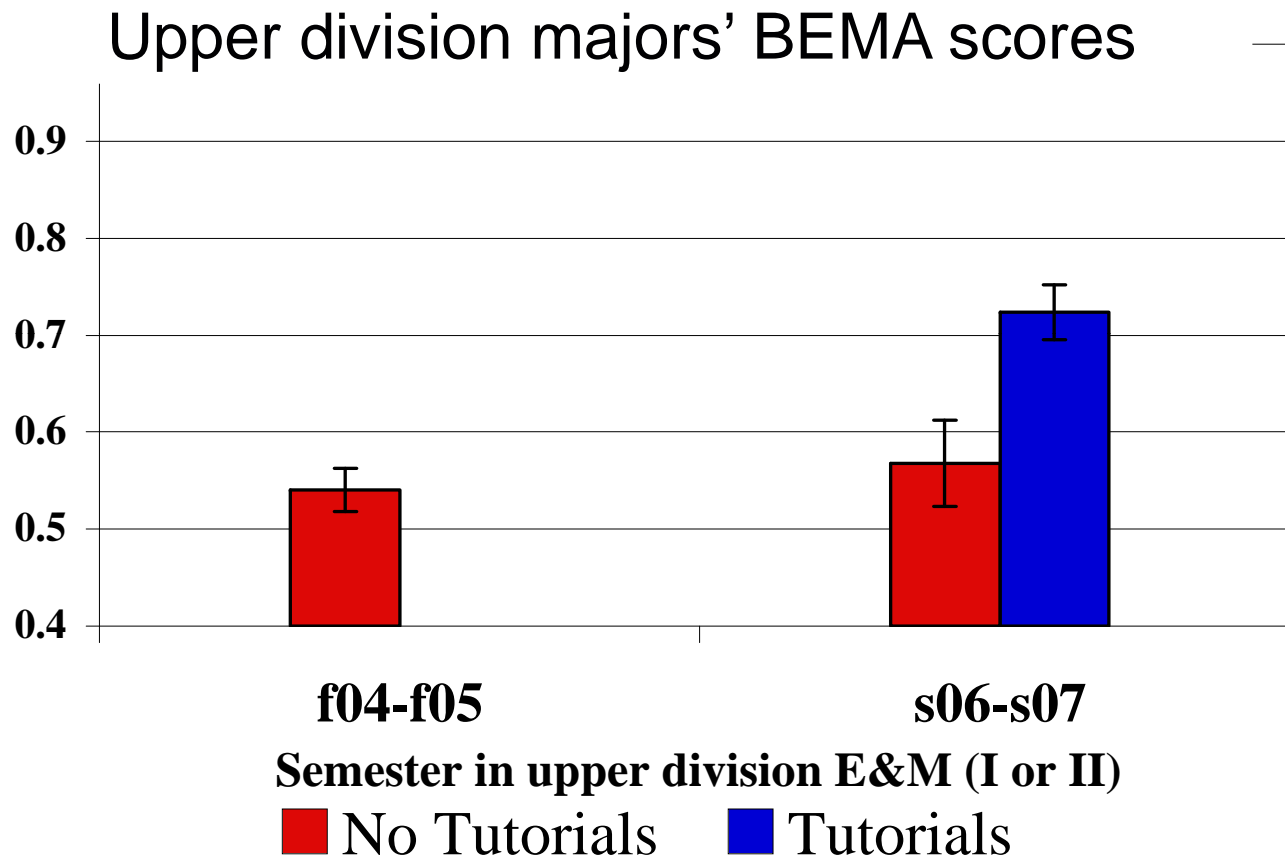
Longitudinal impacts in upper division physics

Longitudinal



After completing upper div. E&M I or II.
(Only students who took intro *without* Tutorials)

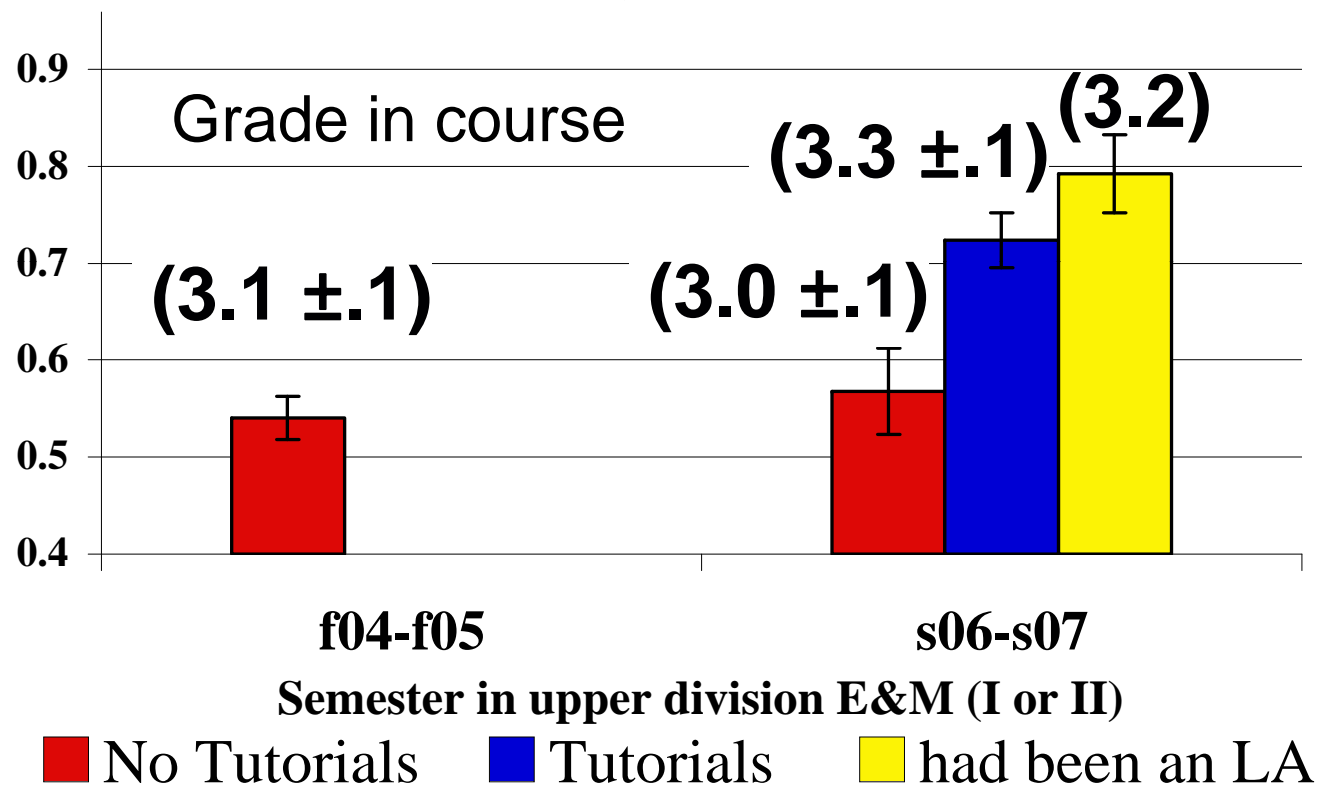
Longitudinal



BLUE: students who had taken their freshman E&M *with* Tutorials

Longitudinal

Upper division majors' BEMA scores



Yellow: students who had been E&M LAs

SUMMARY

Learning Assistant program is

- Addressing critical nat'l need
- Building on a research base
- Many impacts

K12, students, LAs, faculty, institution...

CHALLENGES:

- costs (time, \$\$, growth, training)

Questions?

per.colorado.edu

stem.colorado.edu