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Physics faculty:
- SJP
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- Kathy Perkins
- Michael Dubson

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- Noah Podolefsky
- Chandra Turpen
- Lauren Kost
- Charles Baily
  +recently graduated, 3 with PhD, 1 with MSc.

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- Sam McKagan
- Laurel Mayhew
- Stephanie Chasteen
- Archie Paulson
- Wendy Adams

School of Ed:
- Valerie Otero
- Kara Gray
- Bud Talbott
COLORADO LEARNING ASSISTANTS MODEL
## Participants

<table>
<thead>
<tr>
<th><strong>Applied Math</strong></th>
<th><strong>Astronomy</strong></th>
<th><strong>Chemistry</strong></th>
<th><strong>Education</strong></th>
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<tr>
<td>Jim Curry (Chair)</td>
<td>Dick McCray</td>
<td>Veronica Bierbaum</td>
<td>Valerie Otero</td>
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<tr>
<td>Mary Nelson</td>
<td>Doug Duncan</td>
<td>Margaret Asirvatham</td>
<td>Derek Briggs</td>
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<td>Adam Norris</td>
<td>Nick Schneider</td>
<td>Linda Koch</td>
<td>Lorrie Shepard</td>
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<td>Ann Dougherty</td>
<td>John Stocke</td>
<td>Laurie Langdon</td>
<td>Laura Moin</td>
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<td>Jim Weiss</td>
<td>Fran Bagental</td>
<td>Robert Parson</td>
<td>David Webb</td>
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<td>Susan Hallowell</td>
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<th><strong>Geosciences</strong></th>
<th><strong>Physics</strong></th>
<th><strong>MCD Biology</strong></th>
<th><strong>Mathematics</strong></th>
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<tr>
<td>Alan Lester</td>
<td>Steve Pollock</td>
<td>Mike Klymkowsky</td>
<td>226 Learning Assistants</td>
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<tr>
<td>David Budd</td>
<td>Kathy Perkins</td>
<td>Bill Wood</td>
<td>Eric Stade</td>
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<tr>
<td>Andrea Bair</td>
<td>Carl Wieman</td>
<td>Jennifer Knight</td>
<td>Robb Tubbs</td>
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<td>Jennifer Stempien</td>
<td>Carl Rogers</td>
<td>Sylvia Fromherz</td>
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<td>Murray Holland</td>
<td>Jia Shi</td>
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<td>Shijie Zhong</td>
<td>Michelle Smith</td>
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<th><strong>K-12 Teachers</strong></th>
<th><strong>Graduate Students</strong></th>
<th><strong>Ph TEC TAG</strong></th>
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<tr>
<td>Steve Iona</td>
<td>Danielle Harlow</td>
<td>Maria Cartas</td>
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<td>Mike Fuchs</td>
<td>Bud Talbot</td>
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<td>Roberta Tanner</td>
<td>Heidi Iverson</td>
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<td>PhysTEC TAG</td>
<td>Mariel Desroche</td>
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<td>Kim Geil</td>
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**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?
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
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

[Diagram showing the comparison between tutorial and traditional recitation methods]
Force Concept Inventory

**red = trad, blue = interactive engagement**

\[ \langle g \rangle = \frac{\text{post-pre}}{100\text{-pre}} \]

CU - w. trad recitations  
CU - w. LAs

R. Hake, ”…A six-thousand-student survey…” AJP 66, 64-74 (‘98).  
What is a Qualified Teacher

Knowledge of Content
(physics, chemistry, biology, math, astrophysics)

Knowledge of Pedagogy
(typically School of Education)

Knowledge of Students
(typically psychology class—rarely connected to content)

Knowledge of the nature of science and scientific inquiry
(typically implicit or not present at all)

Usable knowledge for teaching students science
The Learning Assistant Experience

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

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

**Practice**: LAs lead weekly Learning Teams

Formative feedback for instructor to use in lecture
Time Line of the LA Experience

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)
CLASS F06: Comparing students & LA’s

Phys 1120 F06

Phys 1110 F06

LAs, F06

Overall

Personal Interest

Overall

Personal Interest

Overall

Personal Interest

50 75 100

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## Teaching is attractive to LAs

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<tr>
<td>5</td>
<td>13</td>
<td>4</td>
<td>17</td>
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*At 18 colleges and universities with 10,869 candidates, 385 science majors

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
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<th>Fall 2003</th>
<th>Spring 2008</th>
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<tbody>
<tr>
<td><strong>LAs are attractive to Faculty</strong></td>
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<tr>
<td># of LAs hired since Fall 2003</td>
<td>226</td>
<td></td>
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<tr>
<td>Average cumulative GPA (3.7 in physics)</td>
<td>3.5</td>
<td></td>
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<tr>
<td><strong>Fall 2003</strong></td>
<td>7 faculty (4 departments)</td>
<td>48 faculty (7 departments)</td>
</tr>
<tr>
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<td>4 courses transformed</td>
<td>30 courses transformed</td>
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<td>28 LAs/semester</td>
<td>&gt;60 LAs/semester</td>
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<tr>
<td><strong>Impacts:</strong></td>
<td>400 stud/yr</td>
<td>&gt;7000 students/year</td>
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| 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

Upper division majors’ BEMA scores

0.9
0.8
0.7
0.6
0.5
0.4

f04-f05
s06-s07

Semester in upper division E&M (I or II)

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

Upper division majors’ BEMA scores

<table>
<thead>
<tr>
<th></th>
<th>f04-f05</th>
<th>s06-s07</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Tutorials</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Tutorials</td>
<td>0.5</td>
<td>0.8</td>
</tr>
</tbody>
</table>

**BLUE:** students who had taken their freshman E&M with Tutorials
Upper division majors’ BEMA scores

Grade in course

(3.3 ± 1) (3.2)

(3.1 ± 1) (3.0 ± 1)

Yellow: students who had been E&M LAs

S. Pollock, 2007 PERC Proc. 951, p.172
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