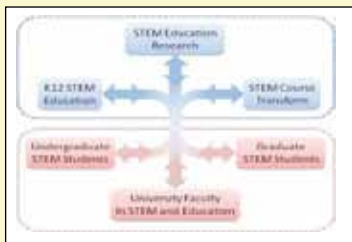


## ABOUT

### What is Integrating STEM Education?

Integrating STEM Education (iSTEM) is a 5-year initiative to establish the University of Colorado at Boulder as a national hub of STEM education research and reform.



Ultimately, iSTEM will evolve into a national center at CU that coordinates, centralizes, and leads:

- Efforts to transform STEM education,
- Landmark research on STEM education,
- STEM Teacher preparation (K20)

These initiatives directly address today's educational challenges: There are too few teachers trained in STEM, courses are not meeting students' needs, and fundamental research is needed to support education of the future.

iSTEM is committed to and strives for **Diversity, Access, and Inclusion** of all people in STEM disciplines.

iSTEM is addressing local, state and national calls for reform through **Policy Work**.

iSTEM is a signature program of the University of Colorado at Boulder and an NSF Innovation through Institutional Integration (I<sup>3</sup>) program.

### Sample STEM Programs:



## CONTACT



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**Principal Investigator:** Chancellor Phil DiStefano

**Co-PIs:** Dean Gleeson, Dean Shepard,  
Assoc. Dean Argrow, Professor Finkelstein

### With Support From:



## A Signature Program of The University of Colorado



*Committed to Excellence  
in STEM Education*

## The University of Colorado is a National Hub for:

- Transforming STEM Education
- Leading STEM Education Research
- Preparing STEM Teachers

To learn more, visit:  
[www.colorado.edu/istem](http://www.colorado.edu/istem)  
Or e-mail: [istem@colorado.edu](mailto:istem@colorado.edu)

Be Part of the Transformation--  
Your gifts make a difference!  
For more information on supporting excellence  
at CU, contact [Margot.Neufeld@cufund.org](mailto:Margot.Neufeld@cufund.org)

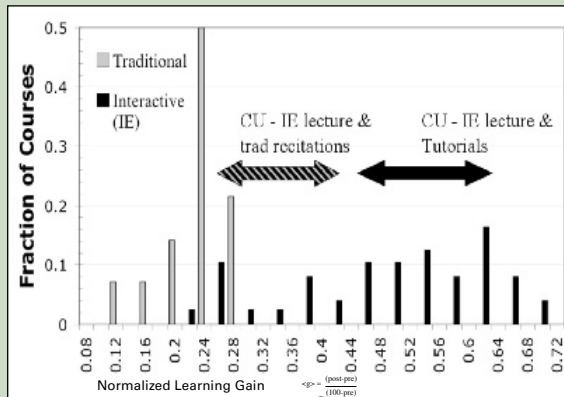
# IMPROVING STEM EDUCATION

## through course transformation

### Transforming undergraduate STEM courses by:

- Making science education a science,
- Building on a base of proven research,
- Emphasizing interactive engagement,
- Assessing student learning objectively.

Already, physicists have successfully improved the University of Colorado's introductory physics sequence by introducing interactive engagement (IE) techniques such as small group work, clicker questions and active discussion. Researchers demonstrate that students consistently learn two to three times the national average of those taking traditional lecture-based courses.



Gray bars trad'l; black bars interactive courses (from Hake 1998).

Arrows show span of CU courses in black:

IE 1: partially interactive (Peer Instruction)

IE 2: fully interactive courses (Peer Instruction, Tutorials and LAs)

Pollock and Finkelstein 2008. *Phys. Rev. ST Physics Ed. Research* 4, 010110 (2008)

### Impacts:

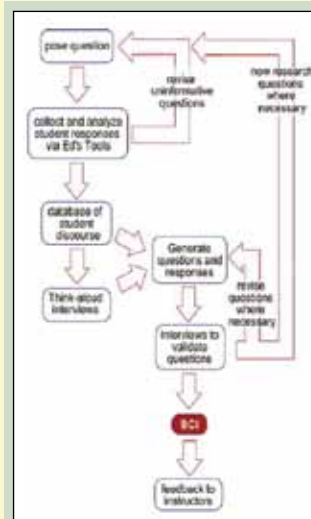
At the University of Colorado, more than 35 undergraduate courses have been transformed across 8 departments, involving more than 50 faculty and affecting more than 9,000 students per year--more than 25 percent of CU's undergraduate population.

# RESEARCH IN STEM EDUCATION

## discipline-based education research

### Research in STEM education and student learning:

- Treating STEM education as a scholarly endeavor,
- Conducting fundamental studies on learning,
- Enhancing tools, practices, and assessments for course transformation and improved learning,
- Applying education research to STEM classrooms



University of Colorado Biologists have developed a validated instrument for measuring student learning. Through their research-based approach, they formulated and validated the Biology Concept Inventory (BCI). This included the development of Ed's Tools, a suite of tools for general analysis of student data in education research. The BCI is becoming a staple tool for research on learning and evaluating student understanding in biology.

BCI is becoming a staple tool for research on learning and evaluating student understanding in biology.

Klymkowsky, & Garvin-Doxas. 2008. *PLoS Biology*, 6(1): e3

### Impacts:

Over 10 departments and 20 faculty across the College of Arts and Science and the College of Engineering and Applied Science have active research representing over 18 NSF grants. Research has resulted in work published in *Science*, *Nature*, *Physical Review*, *Physics Today*, *PLoS Biology*, *Life Science Education*, and elsewhere. University of Colorado faculty have an significant presence nationally disseminating their work.

# STEM TEACHER PREPARATION

## recruitment, preparation & support

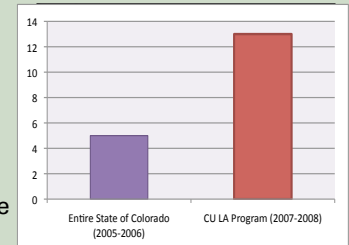
### Transforming STEM Teacher Preparation by:

- Recruiting the best and brightest into teaching,
- Transforming teacher certification to tailor teacher preparation to the STEM disciplines,
- Coupling teacher preparation with course transformation and research on learning
- Creating programs for post-secondary teachers.

**CU Teach:** Through new courses designed to provide early field experiences in the classroom, CU Teach is transforming teacher certification. Additionally, teacher certification is tailored to STEM backgrounds through partnerships with the School of Education and STEM departments.

### Colorado Learning Assistant Program:

High performing STEM majors are recruited from introductory courses and encouraged to consider teaching as a career. LAs facilitate small-group interaction in large-enrollment courses, supporting course transformation. Their experience includes a School of Education pedagogy course and weekly disciplinary preparation.



Otero et al, *Science*. 313(5786), 445-446 (2006).

### Impacts:

The number of undergraduate STEM students considering teaching as a career had dramatically increased, resulting in double the number of discipline-trained high school science and math teachers in Colorado. Students recognize teaching as a challenging and intellectually rewarding career.

Integrating STEM Education links existing programs and supports new efforts in STEM education at CU

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University of Colorado at Boulder

Integrating STEM Education: Committed to Excellence in STEM Education for Colorado