Brief report on the "Educational Ecology"
of the CU Physics department

As observed by SJP, Fall 2018
CREDITS/ACKNOWLEDGMENT/KUDOS – part 1

This presentation is an informal and personal accounting by Steve Pollock. There are many significant contributions to the "teaching ecology" of Physics that I either don't know about or have forgotten or have inappropriately left off. My apologies to all such parties!

More than half the faculty and many staff, researchers, and students in and out of the Physics department have actively and repeatedly participated in brown-bag lunches, faculty meetings, and/or engaged in the CU Physics "educational ecology". I don't name them (I would miss too many who have helped if I tried) but for starters, see www.colorado.edu/physics/people

Alas, that pages still misses so many: all the many Learning Assistants, staff, people from other departments and other institutions who contribute significantly to the "ecology" and this story!

Current PER grad students who all make direct contributions to the efforts described in this presentation include:
Julian Gifford, Jessica Hoehn, Simone Hyater-Adams, Allie Lau, and Katie Rainey.

Our PAST graduate students also all deserve shout-outs. They contributed materials, research, time, energy, support and ideas, and have a measurable impact on many aspects of teaching and department educational culture. See www.colorado.edu/per/people for some of them. But that page still misses many, e.g. non-PER students who contribute to our efforts.
CREDITS/ACKNOWLEDGMENT/KUDOS – continued!

The Research-based aspect of course transformations mentioned in this talk have also been supported directly by many people in the CU-PER group. The list below is surely not inclusive, because many contributions happen in ways I do not always know about.


Outreach, departmental-level transformation, Learning Assistant efforts and other elements (some mentioned in the final slide) have seen PER research-based contributions from Mike Bennett, Joel Corbo, Melissa Dancy, Brett Fiedler, Claudia Fracchiolla, Katie Hinko, Ed Johnson, Emily Moore, Valerie Otero, Ariel Paul, Alanna Pawlak, Gina Quan, and Jacob Stanley.
Undergraduate classes

• Service courses
  1110, 1120: PHYS1 & 2 for engineers
  2010, 2020: PHYS 1 & 2 for other sciences
  1140: Lab 1 *
  2130: PHYS 3 for engineers *
  1010, 1020, 1230, 1240, 3070: A&S Core Electives for non-scientists
  *

• Majors courses
  1115, 1125: NEW PHYS1 & 2 for majors *
  2170: PHYS 3 for majors
  Total 36 PHYS credits ( some * )
  + 9 PHYS elective + 10 Chem + 16-21 Math

Research experience required for "Plan 1"

No TTT Faculty "owns" a class
Fall Headcount (please select a term)
PHYS Intro Course Enrollment - Fall semesters
PHYS Intro Course Enrollment - Spring semesters
Service courses - pedagogy

**ALL:** - 3x lectures with clickers and extensive demos
  - Help Room staffed 9-5 M-F
  - Online (computer based and graded) homeworks

**ALL large:** - Team teaching, typically instructor or experienced
  teamed with newer or inexperienced faculty

**MOST large** - Pre/post conceptual tests
  - Additional paper homework graded by TAs

• **1110/15/20/25:** - 1 hr/week Tutorials (UW PER) with LAs
  - Prelecture videos (from Illinois PER)

• **2010/20:** 2 hr/week lab/Tutorials (homebrew), no LAs

• **1140 labs:** LA supported

4 instructors, 2 new this year
PHYSICS MAJORS

• New/reformed classes (last 1-4 years)
  1115, 1125: Phys 1 and 2 for majors (PHYS, EPEN, APS) ~130-150
  1140: Freshman lab (PER effort, led by Lewandowski and Bolton)
  2600: Scientific Computation (led by Neil)
  3220: Spins-first Quantum (led by SJP)

• 6 Modified courses (SEI effort) (Upcoming slides)
PHYS & EPEN Majors at Fall Census
PHYS/EPEN Major required course enrollment – Fall semesters
Transformed courses

www.colorado.edu/sei/departments/physics

Additional significant curriculum-transformation work in Phys 1400 (CU-Prime, a grad-student driven initiative), Phys 1140 (Freshman lab) and Phys 3330 (Junior/Electronics Lab) are not listed on this SEI page.

See also http://jila.colorado.edu/lewandowski/research/physics-education-research
What Changed?

- Faculty collaboration
- Explicit learning goals
- Collect student data!

- Interactive classroom techniques
- Concept Tests
- Modified Homework
- Tutorials
- Homework Help Sessions
### Upper-div Clickers at CU

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Upper-Level Course Transformation
Spread of transformations

Course #1 (Class Mech)

PER /developer faculty teaching

SEI support ended

Spread of transformations

ASSESSMENTS

• FMCE and BEMA (Phys 1&2, every term for 12 years)
• FCI and CSEM (Phys 1&2 for other majors, most terms)
• ECLASS and PMQ (1140, every term recently)
• Upper division (4 of them, most terms, ~10 years)
Fraction of Courses

- "Hake - Trad (FCI)"
- "Hake - IE (FCI)"
- CU - IE with LAs and Tutorials (FMCE)
- CU - IE but not LAs or Tutorials (FMCE)

UPPER DIVISION: CUE score distribution

traditional lecture  interactive engagement

\[ N_{\text{tot}} = 540 \]

Other (education related) notes:

• DAT -> R³ committee (Recruitment, Retention, Representation)
• Department self-initiated a "vision" statement with 1/3 pillars focused on undergrad education
• Mandatory mentoring each semester for all majors
• New freshman group mentoring sessions (this semester)
• Active SPS, CU', Women in Physics, PISEC groups.
• I must still be missing lots!
QUESTIONS!

Thanks.