

Studio Seating Arrangements and the Gender Gap in Introductory Physics

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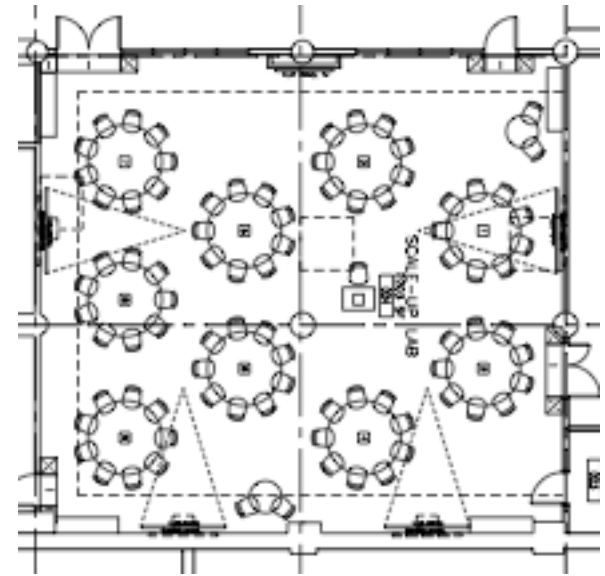
AAPT Summer Meeting, Minneapolis

Acknowledgments: PhysTEC, Bennett Goldberg, and Pankaj Mehta



Studio physics at BU

- 1st year of large-scale studio implementation.
- Algebra-based intro physics



3 Studio sections of
81 = 240;
three 2-hour sessions
per week.

2 Lecture sections = 198
three 1-hour classes + 1 hour
recitation + 3-hour lab (not every
week).

- **All students** do the same tests, homework, pre-class quizzes, pre/post tests, and use the same book (Duffy, *Essential Physics*). > 60% female

Studio compared to lecture, fall 2013

- Better CLASS and FMCE outcomes in studio
- Considerably lower DFW rate in studio
- Better grades on tests and in the course overall
- A gender gap consistent with recent research:

Gender gap on concept inventories in physics, A. Madsen, S. B. McKagan, and E. C. Sayre
PHYS. REV. ST PHYS. EDUC. RES. 9, 020121 (2013)



Test, final exam, and overall results

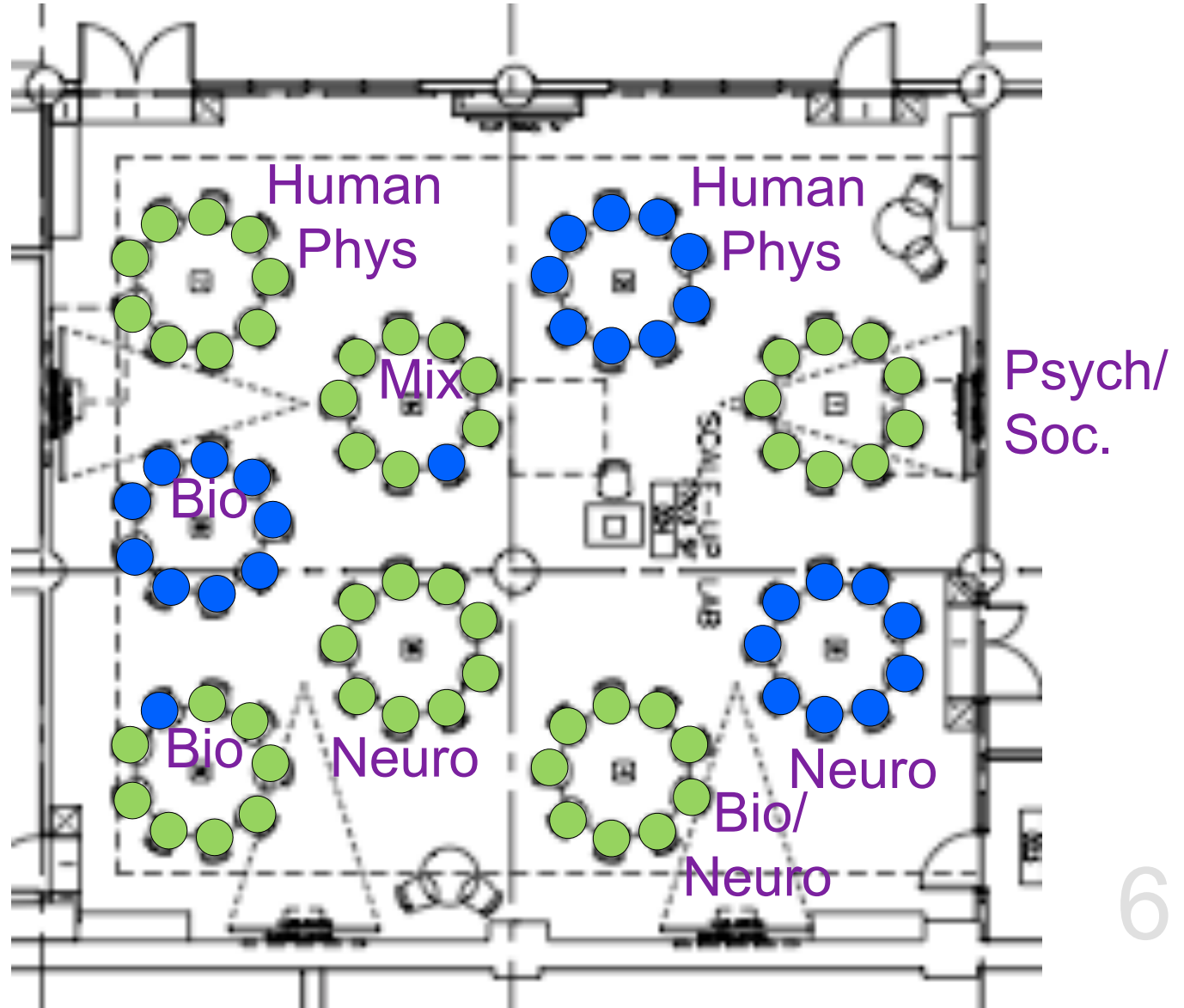
| Section | N | Test 1 | Test 2 | Final | Overall |
|------------------|-----|--------|--------|-------|---------|
| studio - male | 76 | 71.6 | 75.3 | 73.0 | 81.3 |
| studio - female | 135 | 67.2 | 72.0 | 66.7 | 78.4 |
| lecture - male | 36 | 70.1 | 72.0 | 70.8 | 80.0 |
| lecture - female | 79 | 64.0 | 66.8 | 65.9 | 77.1 |

Changes for the second semester

- Studio sections did different grouping arrangements for groups of three. One section had completely **random** groups; one section grouped students by **gender**, major, and ability; one section had students of mixed abilities (**high/medium/low**).
- Grouping by gender/major/ability was suggested by Wendy Adams of the University of Northern Colorado, as a way to decrease the gender gap.

The gender-sorted section

- Female
- Male



Gender gaps (male - female averages)

| Section | Test 1 | Test 2 | Final | Overall |
|-----------|--------|--------|-------|---------|
| random | 7.8 | 9.2 | 7.7 | 4.4 |
| gender | 2.7 | 0.4 | 3.1 | 0.7 |
| hi/med/lo | 7.4 | 5.6 | 4.7 | 3.5 |
| lecture | 10.3 | 4.0 | 9.2 | 4.3 |

Test, final exam, and overall results

| Section | N | Test 1 | Test 2 | Final | Overall |
|--------------------|----|--------|--------|-------|---------|
| random - male | 25 | 74.1 | 77.9 | 77.1 | 83.9 |
| random - female | 51 | 66.3 | 68.7 | 69.4 | 79.5 |
| gender - male | 28 | 71.2 | 73.7 | 74.2 | 81.5 |
| gender - female | 51 | 68.5 | 73.3 | 71.1 | 80.8 |
| hi/med/lo - male | 24 | 75.5 | 74.8 | 73.9 | 82.7 |
| hi/med/lo - female | 41 | 68.0 | 69.2 | 69.2 | 79.2 |
| lecture - male | 24 | 76.3 | 74.1 | 77.4 | 83.5 |
| lecture - female | 58 | 66.0 | 70.1 | 68.2 | 79.2 |

CSEM pre/post results

| Section | N | Pre % | Post % | Gain |
|--------------------|----|-------|--------|-----------------|
| random - male | 25 | 26.9 | 50.6 | 0.32 ± 0.03 |
| random - female | 51 | 21.9 | 42.4 | 0.26 ± 0.02 |
| gender - male | 28 | 25.0 | 50.4 | 0.35 ± 0.04 |
| gender - female | 51 | 23.5 | 47.4 | 0.32 ± 0.02 |
| hi/med/lo - male | 24 | 25.1 | 47.8 | 0.30 ± 0.03 |
| hi/med/lo - female | 41 | 22.0 | 43.1 | 0.27 ± 0.03 |
| lecture - male | 24 | 28.9 | 53.3 | 0.35 ± 0.04 |
| lecture - female | 58 | 25.1 | 42.6 | 0.23 ± 0.02 |

Gender gaps (male - female averages)

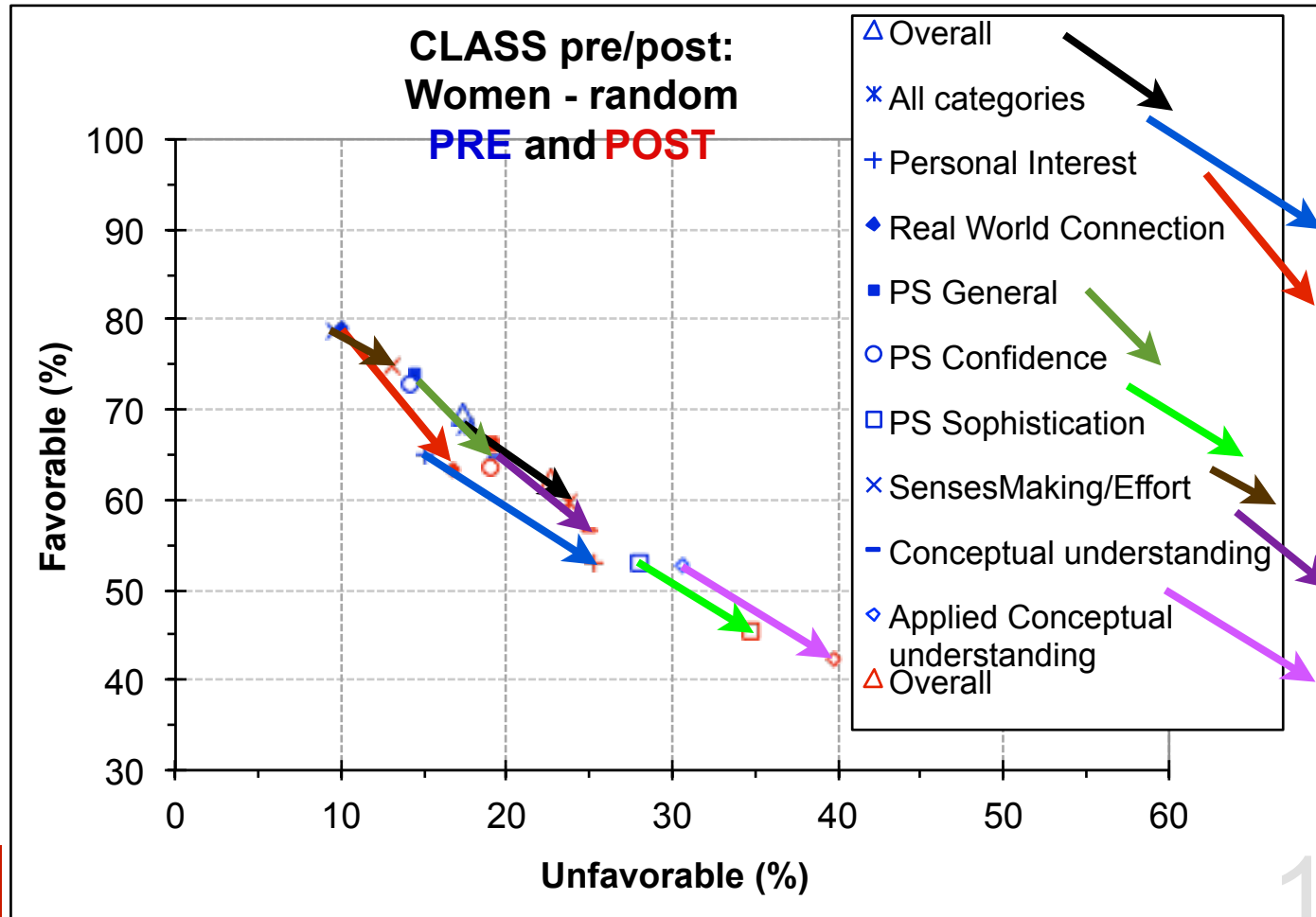
| PY106 Section | PY105 Test Average | | | PY106 Test Average | | |
|-------------------------|--------------------|--------|-----|--------------------|--------|-----|
| | Male | Female | Gap | Male | Female | Gap |
| random 20 M, 43 F | 77.0 | 71.3 | 5.7 | 76.3 | 68.7 | 7.6 |
| gender 26 M, 40 F | 75.3 | 69.8 | 5.4 | 74.2 | 70.5 | 3.6 |
| hi/med/lo 24 M, 37 F | 73.0 | 68.7 | 5.7 | 74.7 | 68.6 | 6.1 |
| lecture 19 M, 51 F | 76.2 | 67.2 | 9.0 | 74.7 | 67.8 | 6.9 |



A sub-set: students who also took the first-semester course (PY105) in Fall 2013

CLASS - random, women

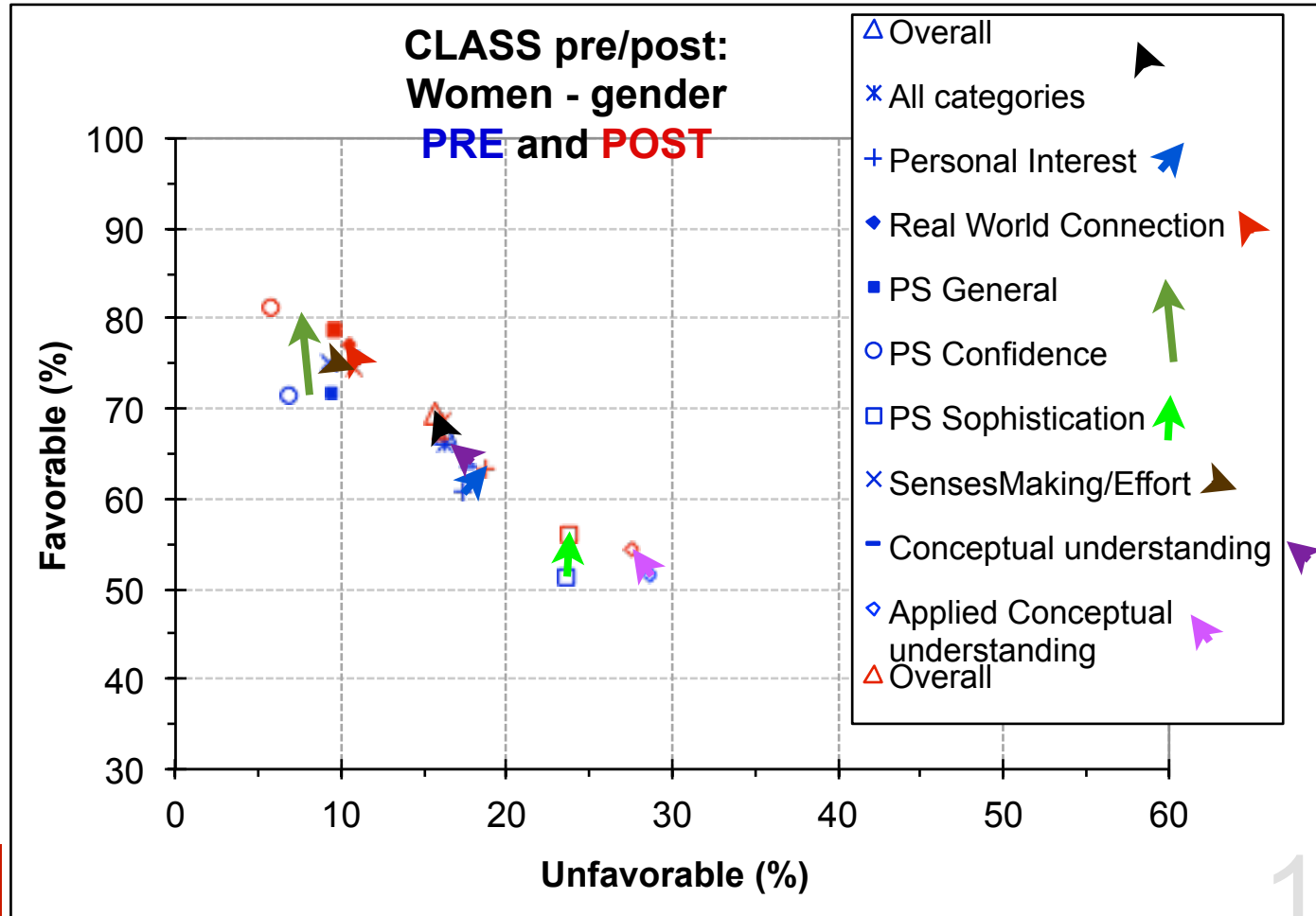
Colorado Learning Attitudes about Science Survey



Shifts down and right – more unfavorable

CLASS - gender, women

Colorado Learning Attitudes about Science Survey



Much more favorable results