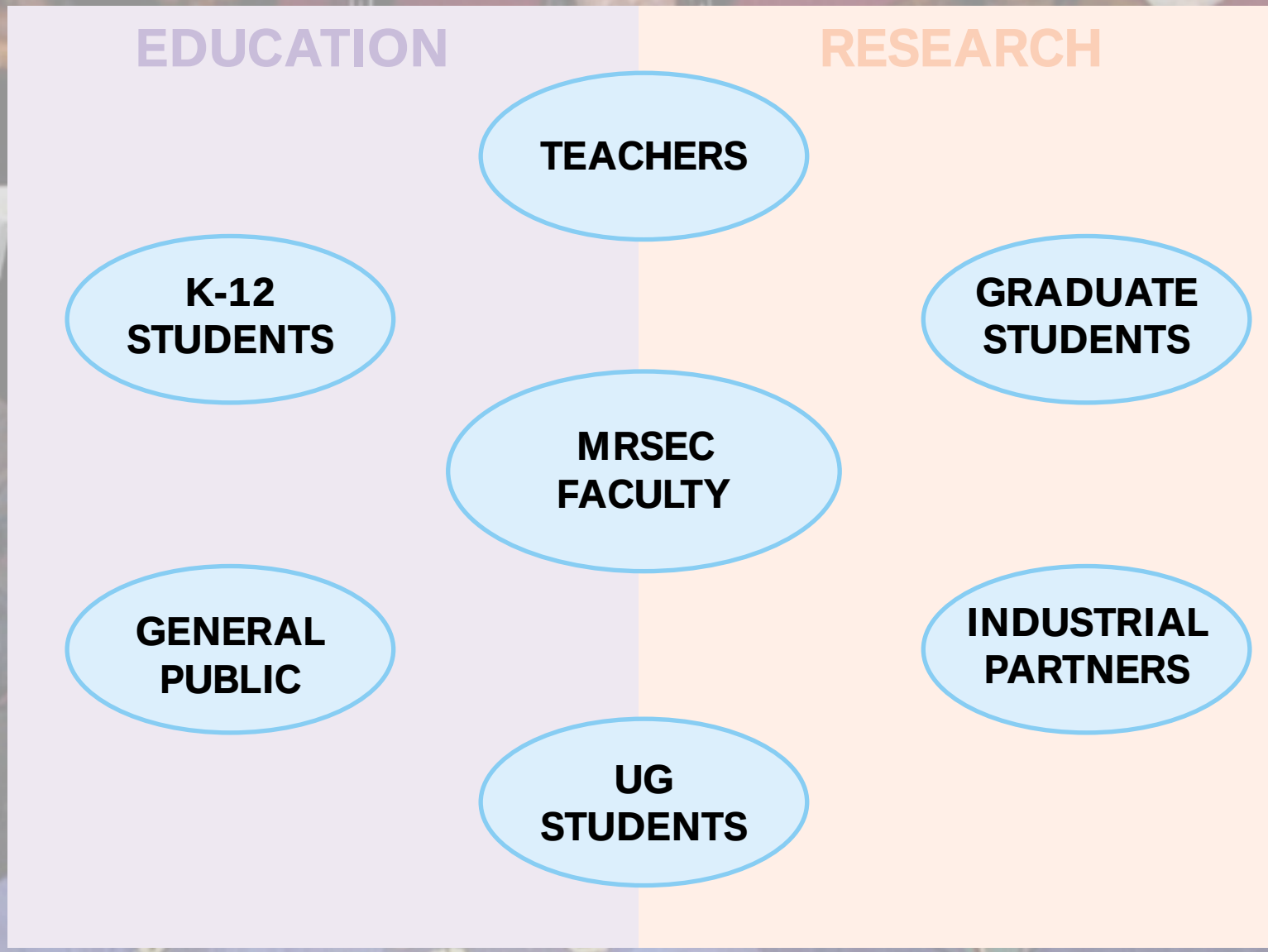
# Research Experience for Teachers: a fruitful collaboration

**Kristy Lenihan**
**Eric Mazur**

**MRS Spring Meeting**
**San Francisco, 18 April 2001**

# *Making connections*



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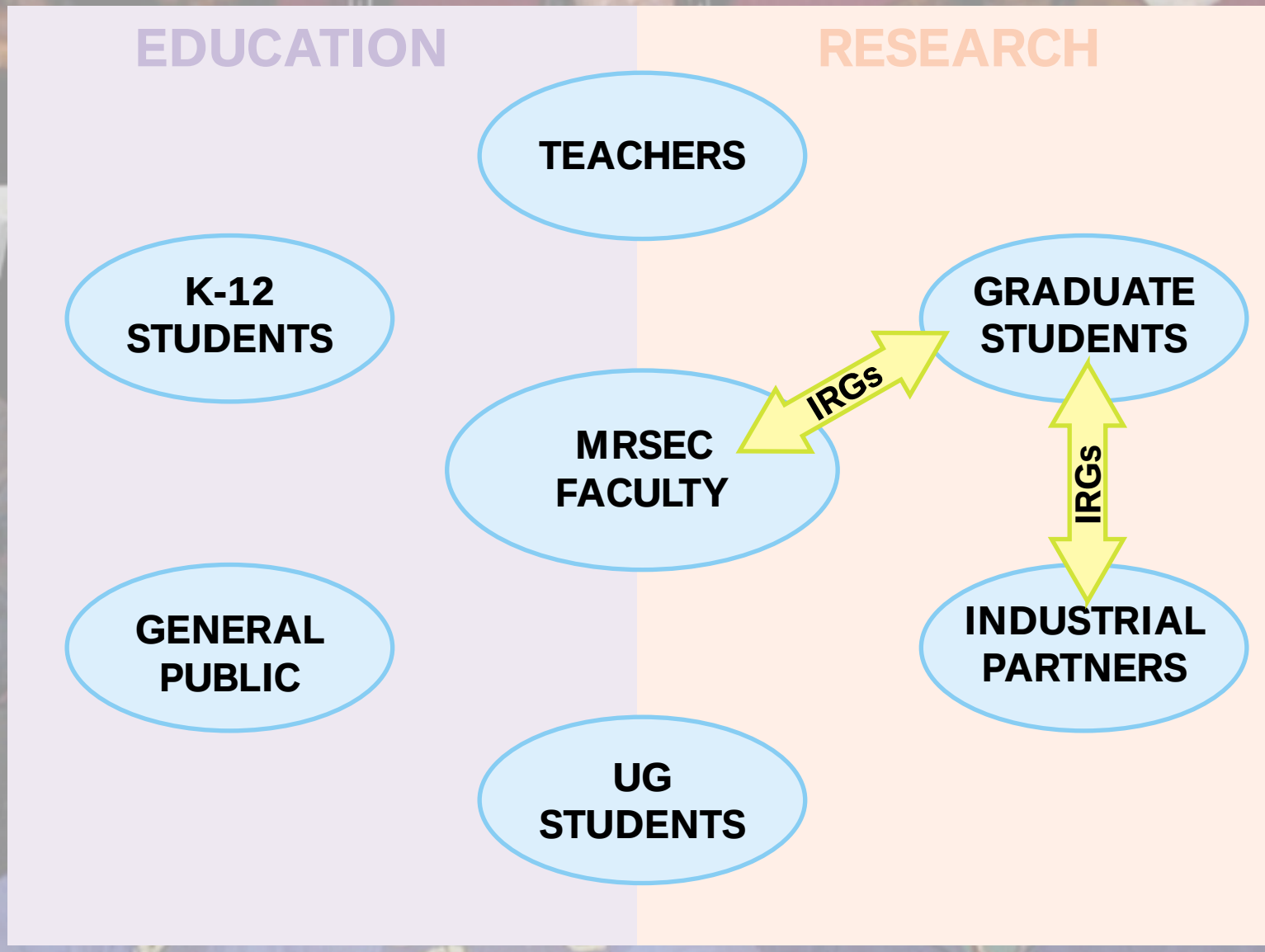

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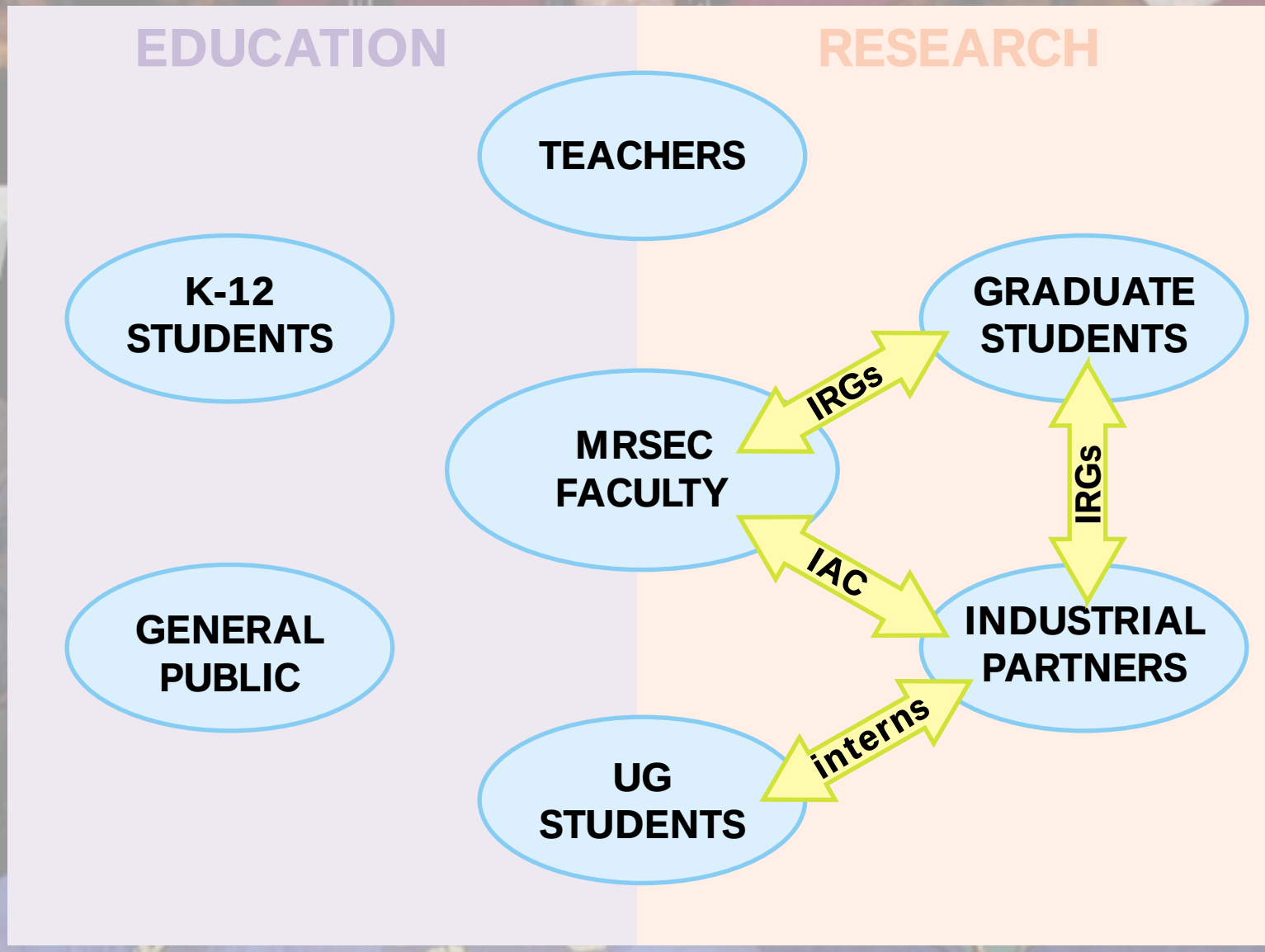

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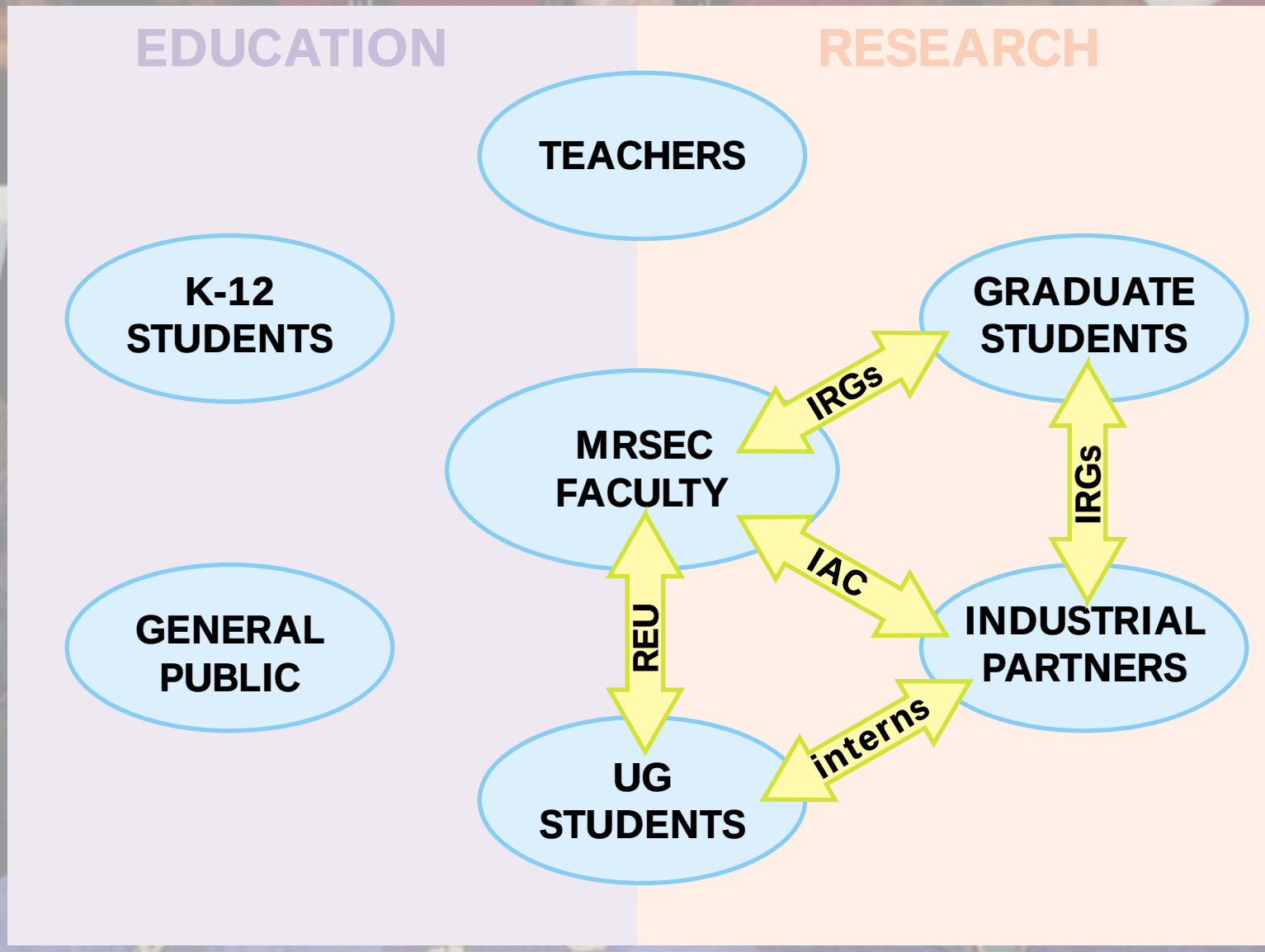

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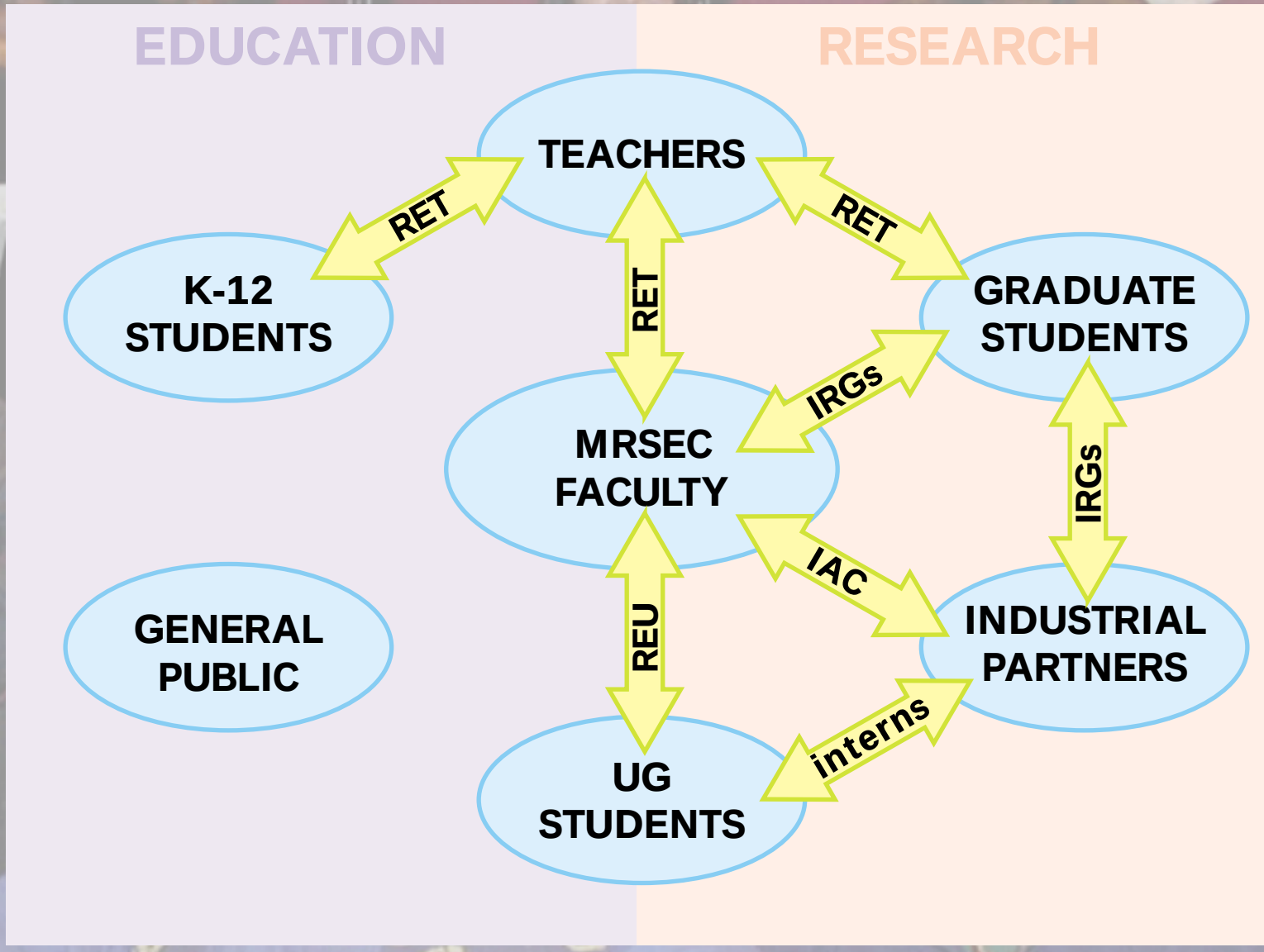

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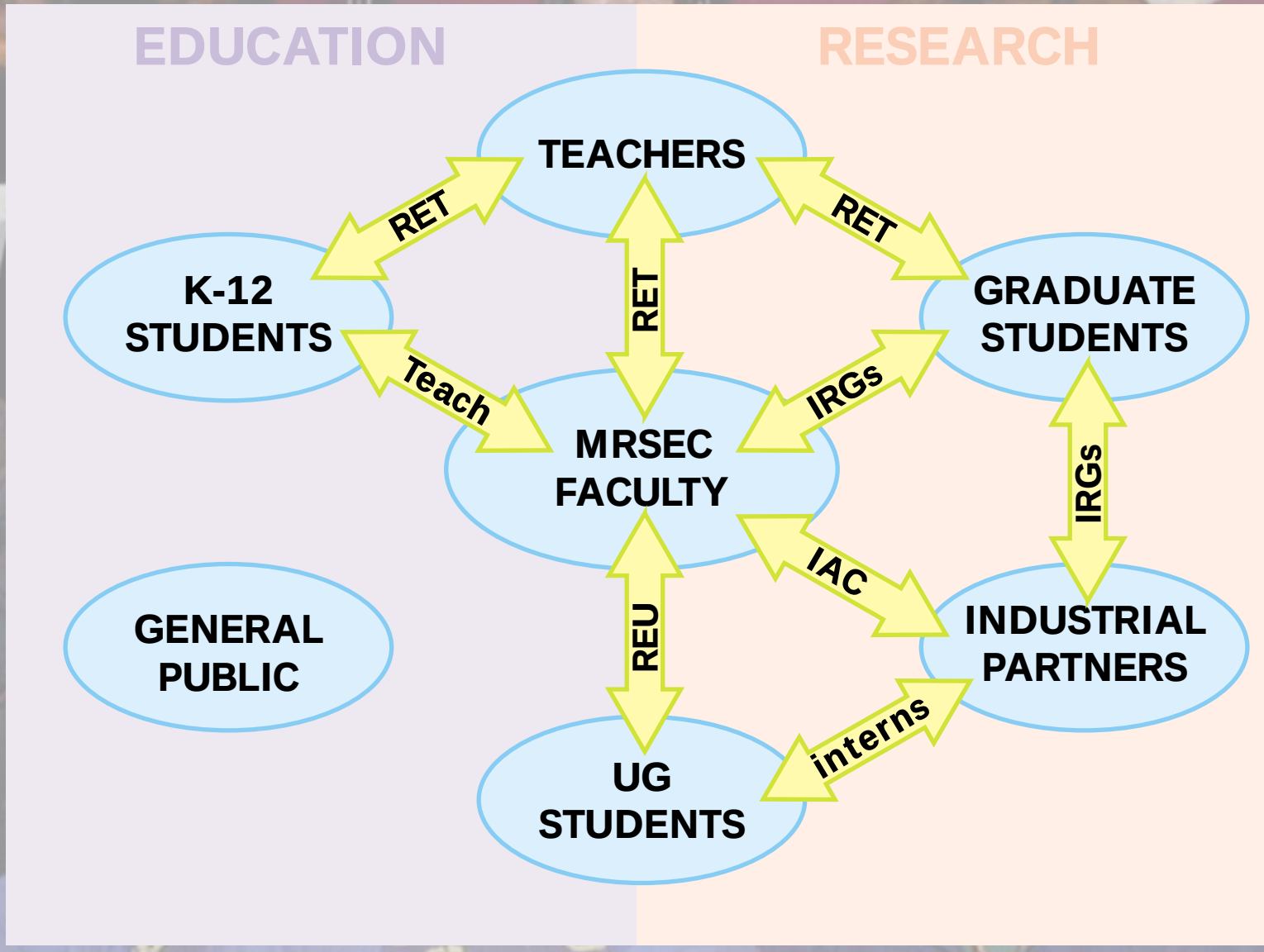

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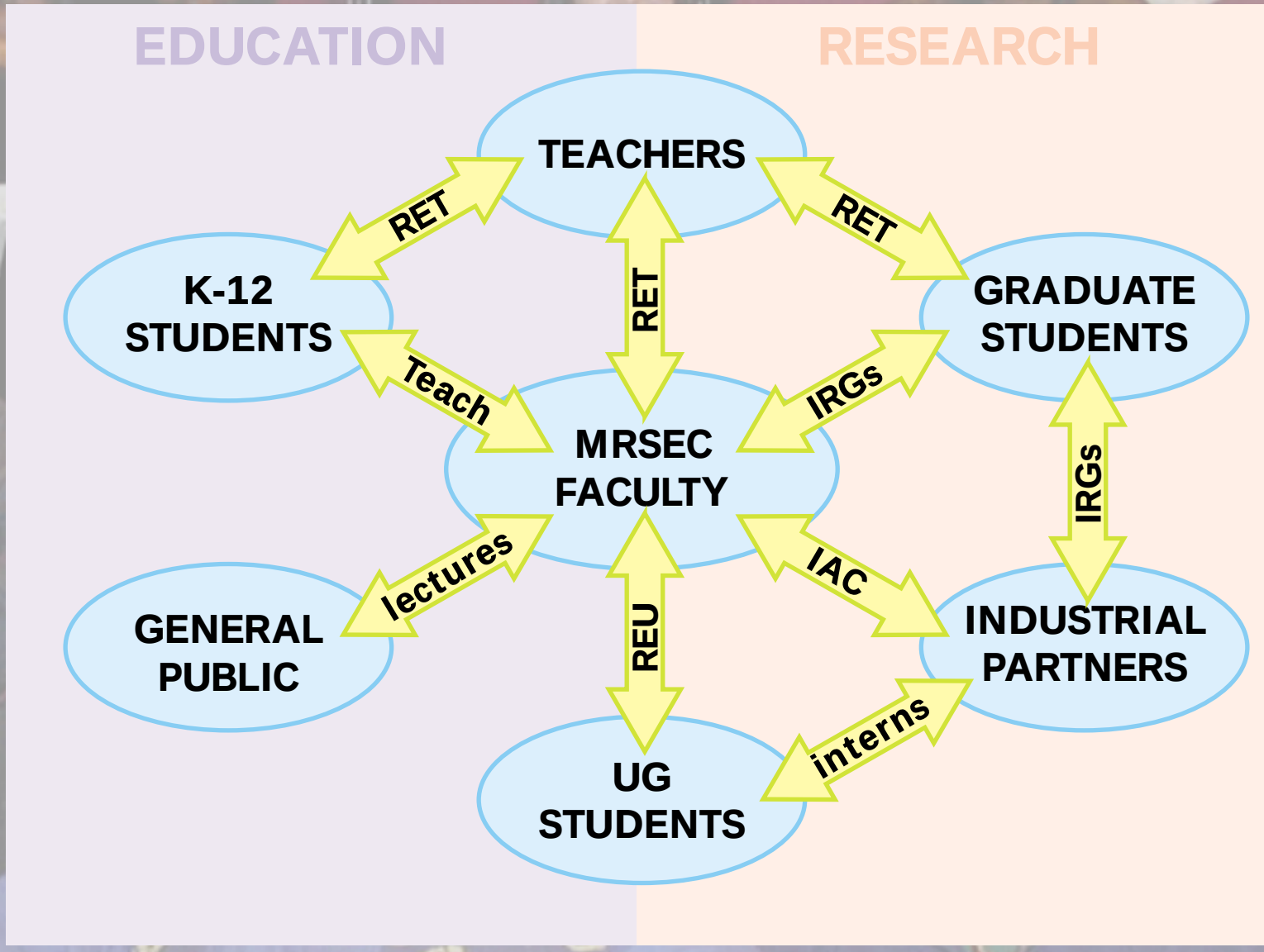

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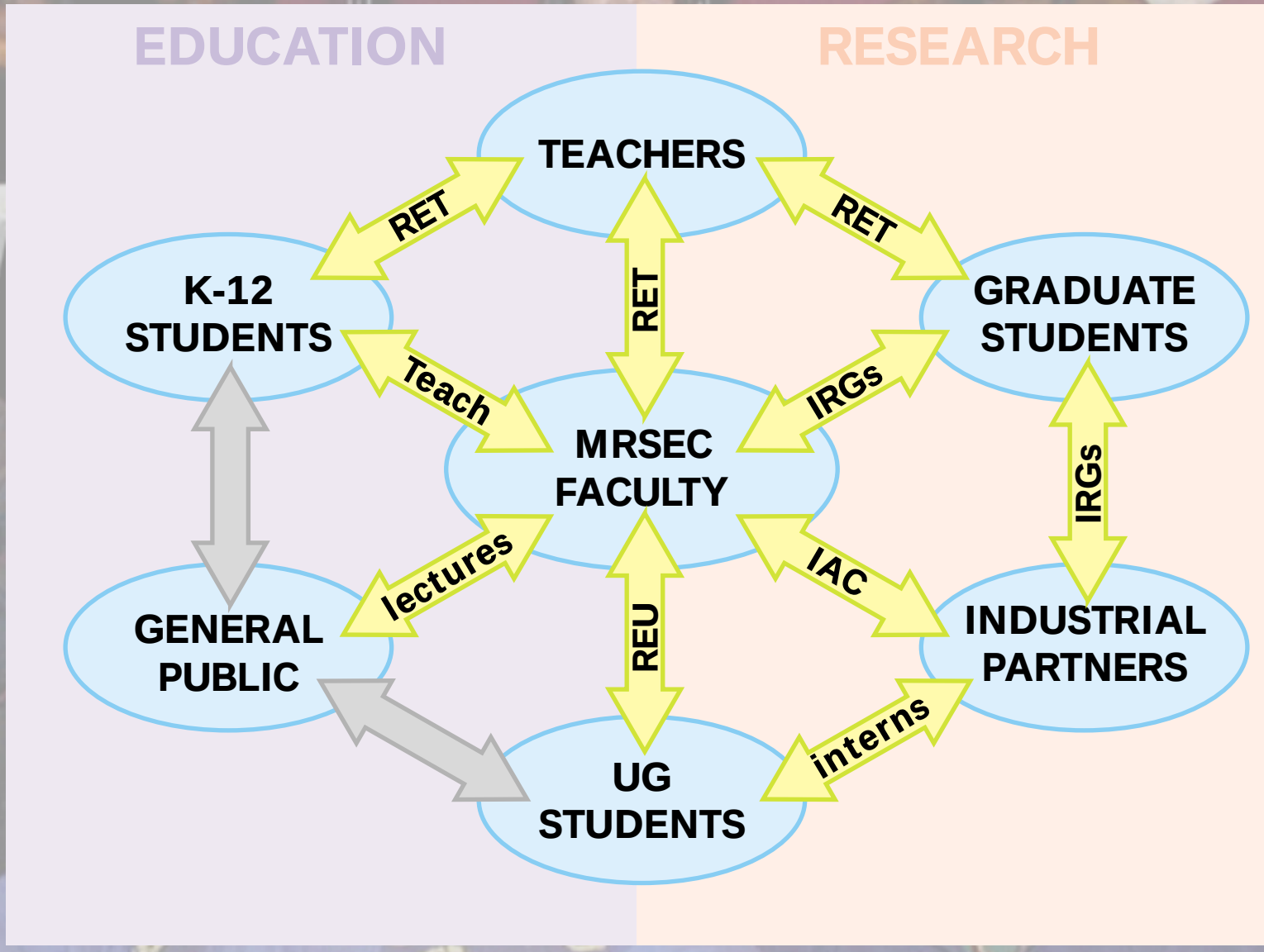
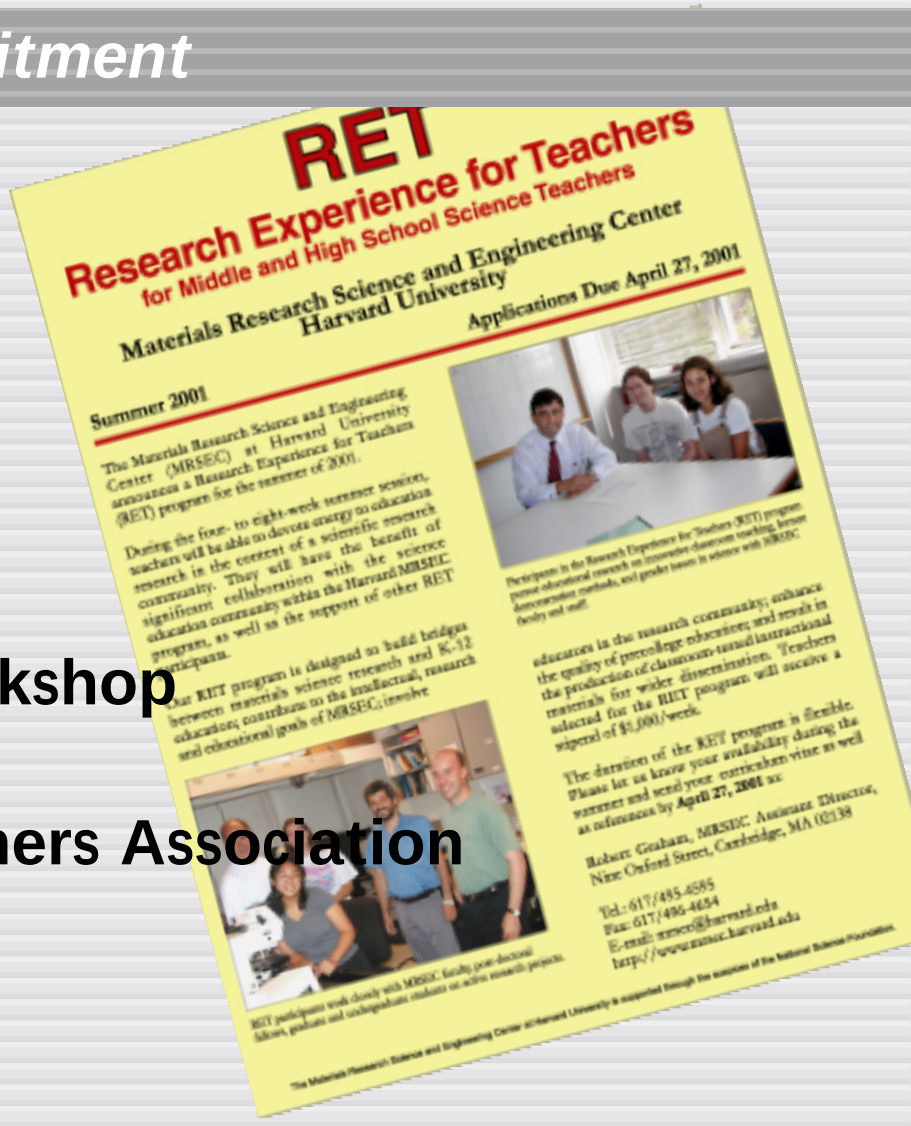


# RET recruitment

- RET flyer
- MASS newsletter
- Peer Instruction Workshop
- Boston Science Teachers Association



RET

Research Experience for Teachers

for Middle and High School Science Teachers

Materials Research Science and Engineering Center

Harvard University

Applications Due April 27, 2001

Summer 2001

The Materials Research Science and Engineering Center (MRSEC) at Harvard University announces a Research Experience for Teachers (RET) program for the summer of 2001.

During the four- to eight-week summer session, teachers will be able to devote energy to education research in the context of a scientific research community. They will have the benefit of significant collaboration with the science education community within the Harvard MRSEC program, as well as the support of other RET participants.

Our RET program is designed to build bridges between materials science research and K-12 education; contribute to the intellectual, research and educational goals of MRSEC; involve

Participants in the Research Experience for Teachers (RET) program pursue educational research on innovative classroom teaching, lecture demonstration methods, and grades issues in science with MRSEC faculty and staff.

educators in the research community; enhance the quality of precollege education; and result in the production of classroom-tested instructional materials for wider dissemination. Teachers selected for the RET program will receive a stipend of $1,000/week.

The duration of the RET program is flexible. Please let us know your availability during the summer and send your curriculum vitae as well as references by April 27, 2001 to:

Robert Graham, MRSEC Assistant Director,
Nine Oxford Street, Cambridge, MA 02138

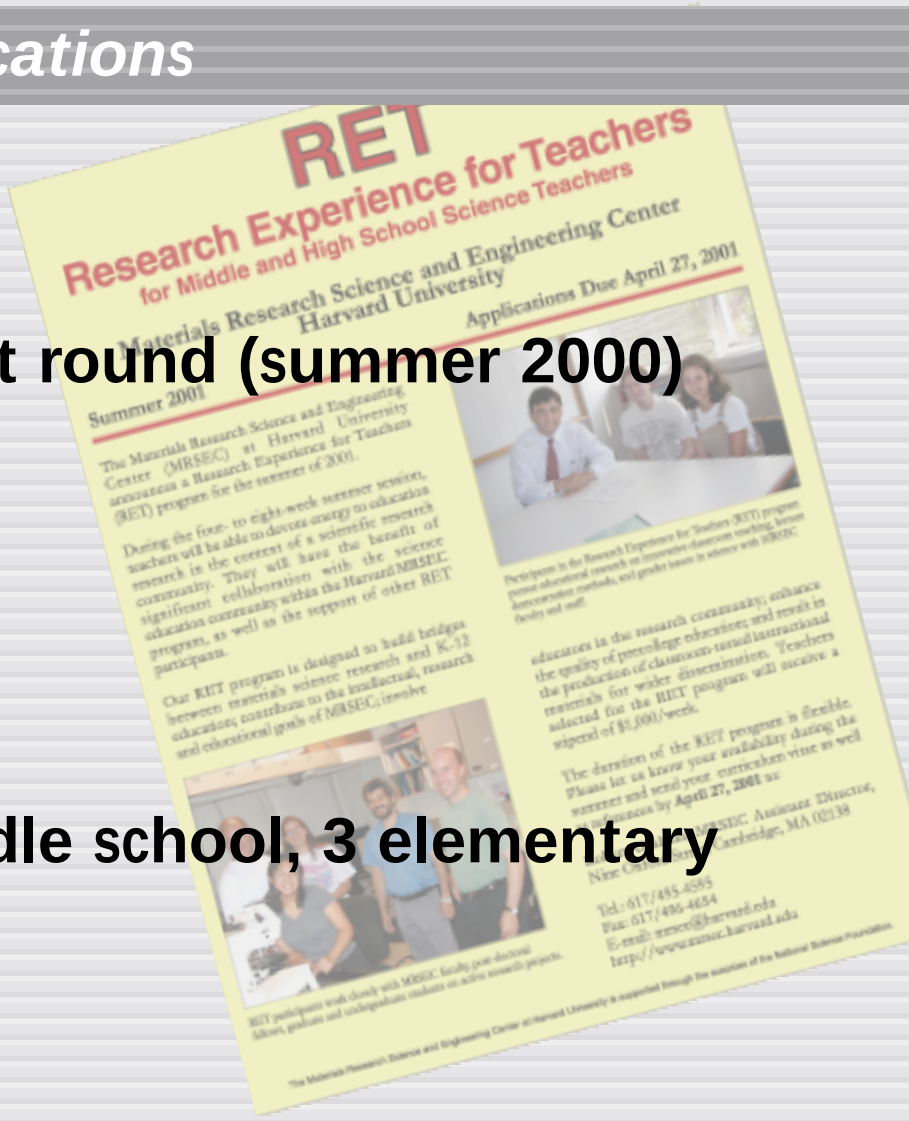
Tel.: 617/495-3585
Fax: 617/496-4654
E-mail: mrsec@harvard.edu
http://www.mrsec.harvard.edu

RET participants work closely with MRSEC faculty, post-doctoral fellows, graduate and undergraduate students on active research projects.

The Materials Research Science and Engineering Center at Harvard University is supported through the auspices of the National Science Foundation.

# RET applications

- 13 applicants for first round (summer 2000)
- 10 women, 3 men
- 13 public school
- 7 high school, 3 middle school, 3 elementary



# *RET participants 2000*

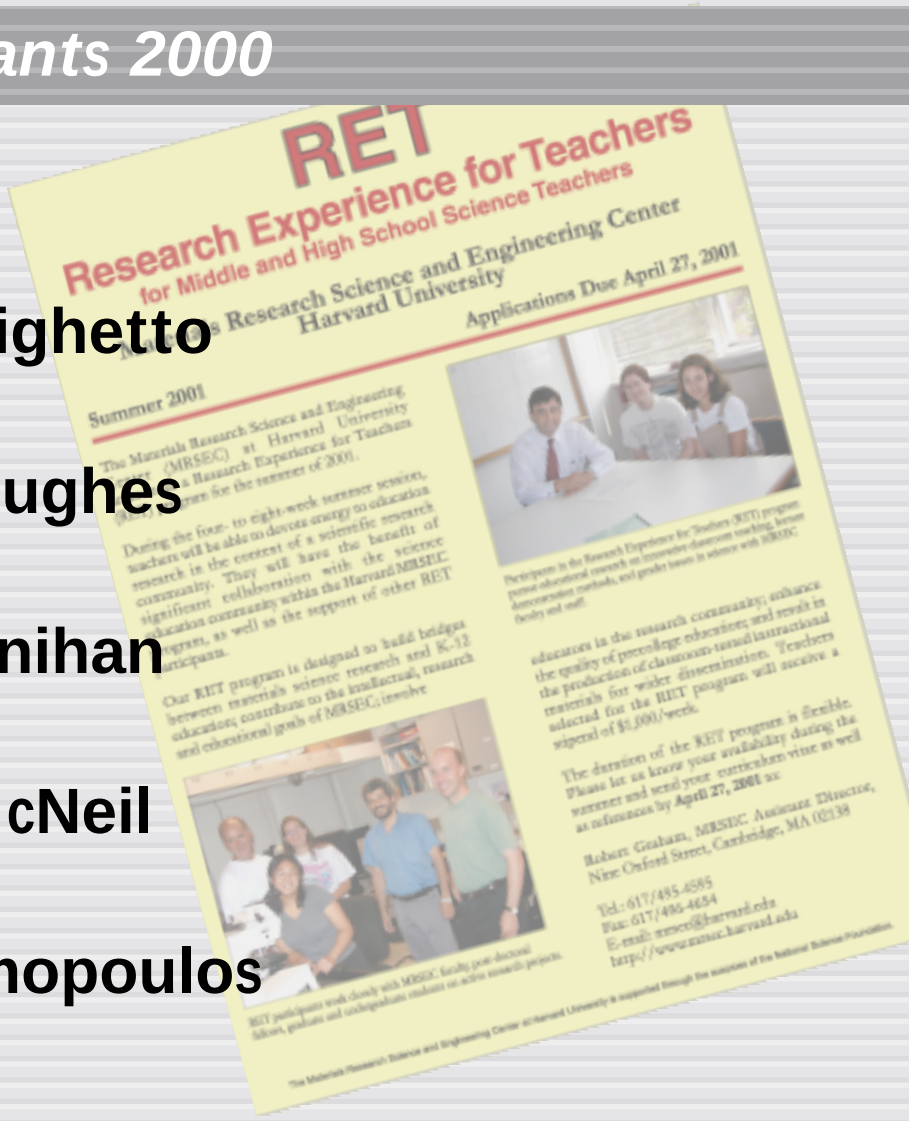
**Gina Andrighetto**

**Charles Hughes**

**Kristy Lenihan**

**James McNeil**

**Ceanne Tzimopoulos**


RET
Research Experience for Teachers
for Middle and High School Science Teachers
Research Science and Engineering Center
Harvard University
Applications Due April 27, 2001
Summer 2001

**Adam Fagen, RET coordinator**

# *RET participants 2000*

**Gina Andrighetto**

**High School, Chemistry**

**Project (Mazur Group):**

**Research: laser-etching of silicon**

**Education: effectiveness of student-centered classroom**

# *RET participants 2000*

**Charles Hughes**

**Elementary School, Science**

**Boston Public School coordinator**

**Project (Weitz Group):**

**Multiparticle tracking in cells**

# *RET participants 2000*

**Kristy Lenihan**

**High School, Physics**

**Project (Mazur Group):**

**Research: Micromachining of transparent materials**

**Education: Development of optics curriculum**

# *RET participants 2000*

**James McNeil**

**Middle School, Geology**

**Project (Stone Group):**

**Effect of bubble size on foam drainage**

# *RET participants 2000*

**Ceanne Tzimopoulos**

**High School, Biology**

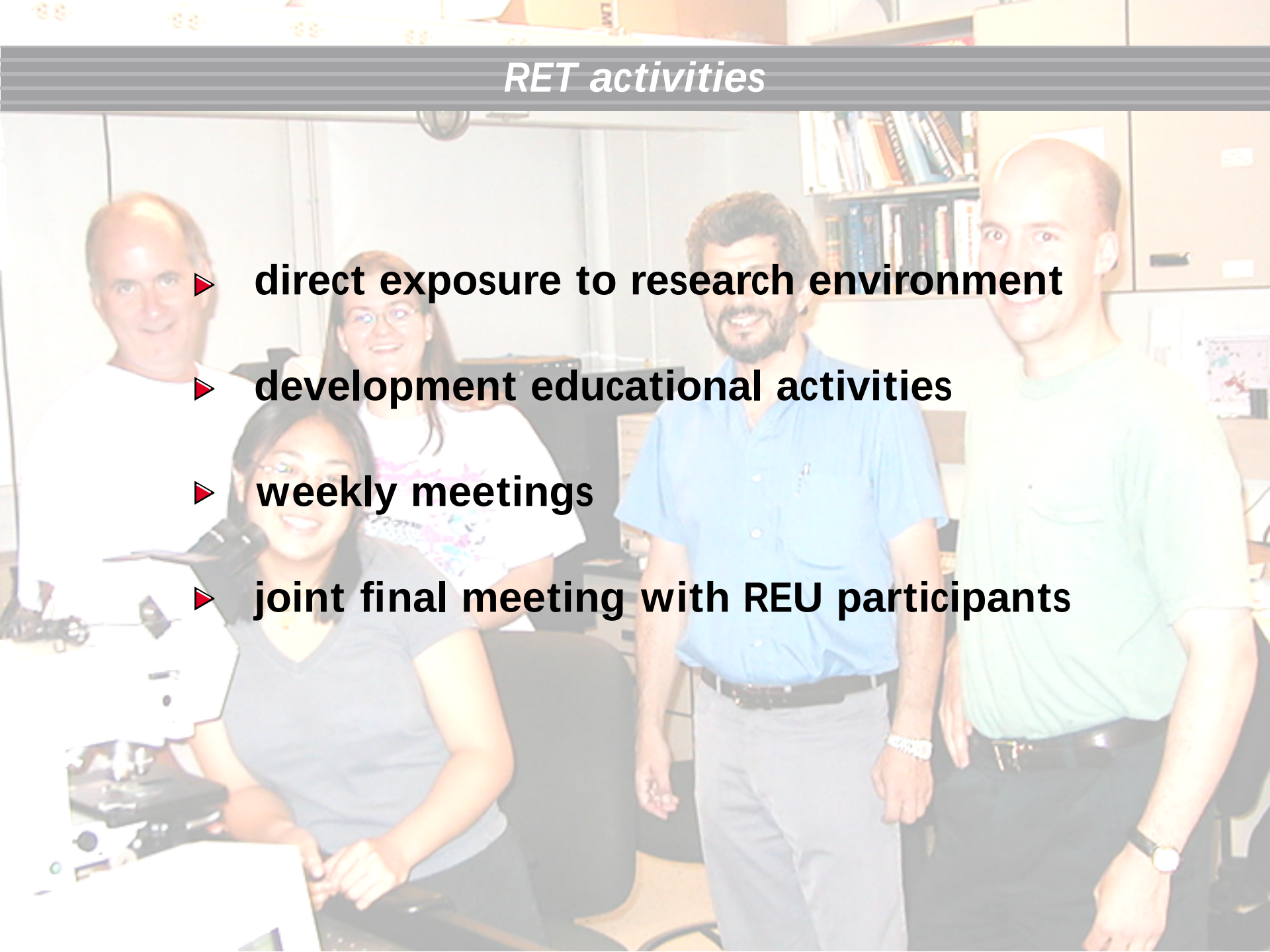

**Project (Mazur Group):**

**Research: photodisruption of biological tissue**

**Education: development of Biology ConcepTests**

# RET activities

# *RET activities*



- **direct exposure to research environment**
- **development educational activities**
- **weekly meetings**
- **joint final meeting with REU participants**

# *Goals*

**interact with practicing scientists to enhance understanding of science and technology**

# *Goals*

- learn and participate in graduate level physics
- design lesson plans for AP students
- observe procedures and interactions
- augment and improve instructional strategies

# *Activities*

**Goal 1: learn and participate in graduate level physics**

- **surveyed literature on nonlinear optics and lasers**
- **assisted in setup of experiments**
- **worked with graduate student on data collection**

# *Activities*

**Goal 2: design lesson plans for AP students**

- **Lesson 1: introduction to basics of lasers**
- **Lesson 2: specifics of femtosecond lasers**
- **Lesson 3: applications of femtosecond lasers**
- **Classroom presentation by REU participant**
- **Classroom visit to laboratory (planned)**

# *Activities*

**Goal 3: observe procedures and interactions**

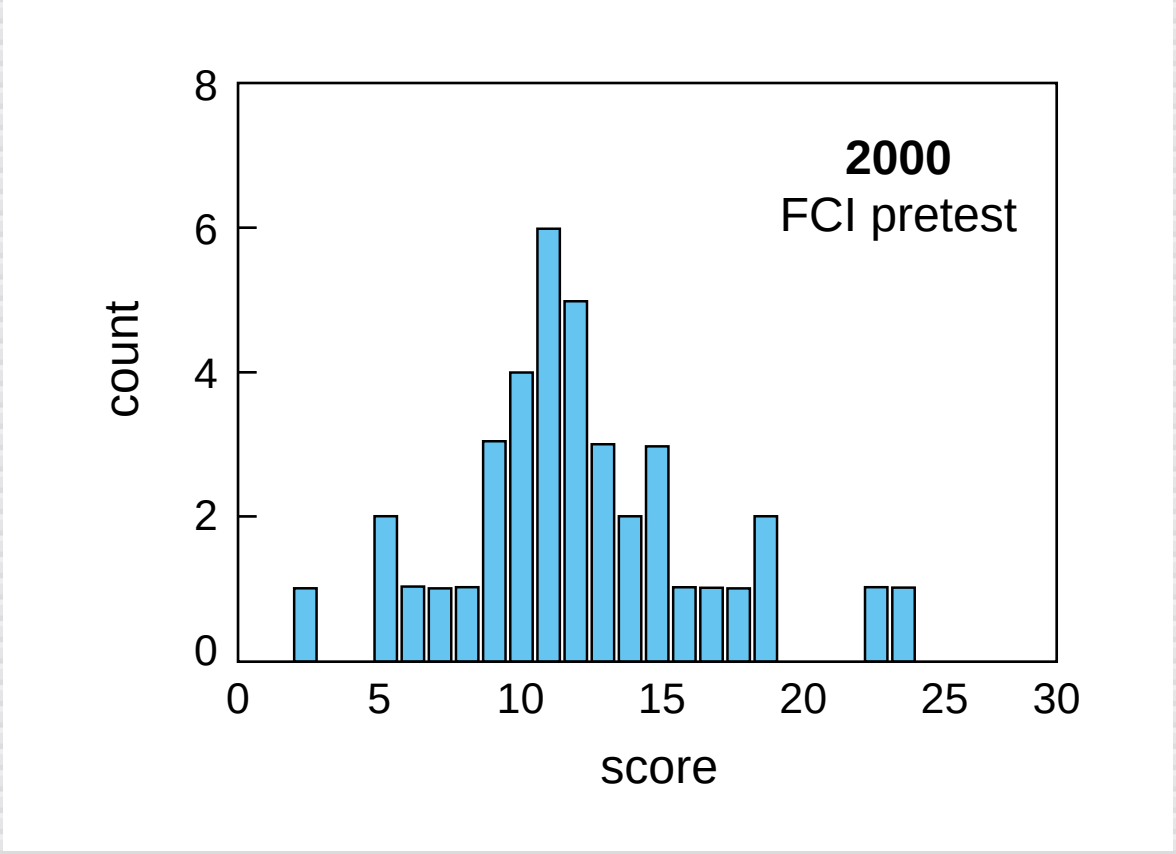
- **laboratory notebooks**
- **planning time**
- **use of collaborative strengths**

# *Activities*

**Goal 4: augment and improve instructional strategies**

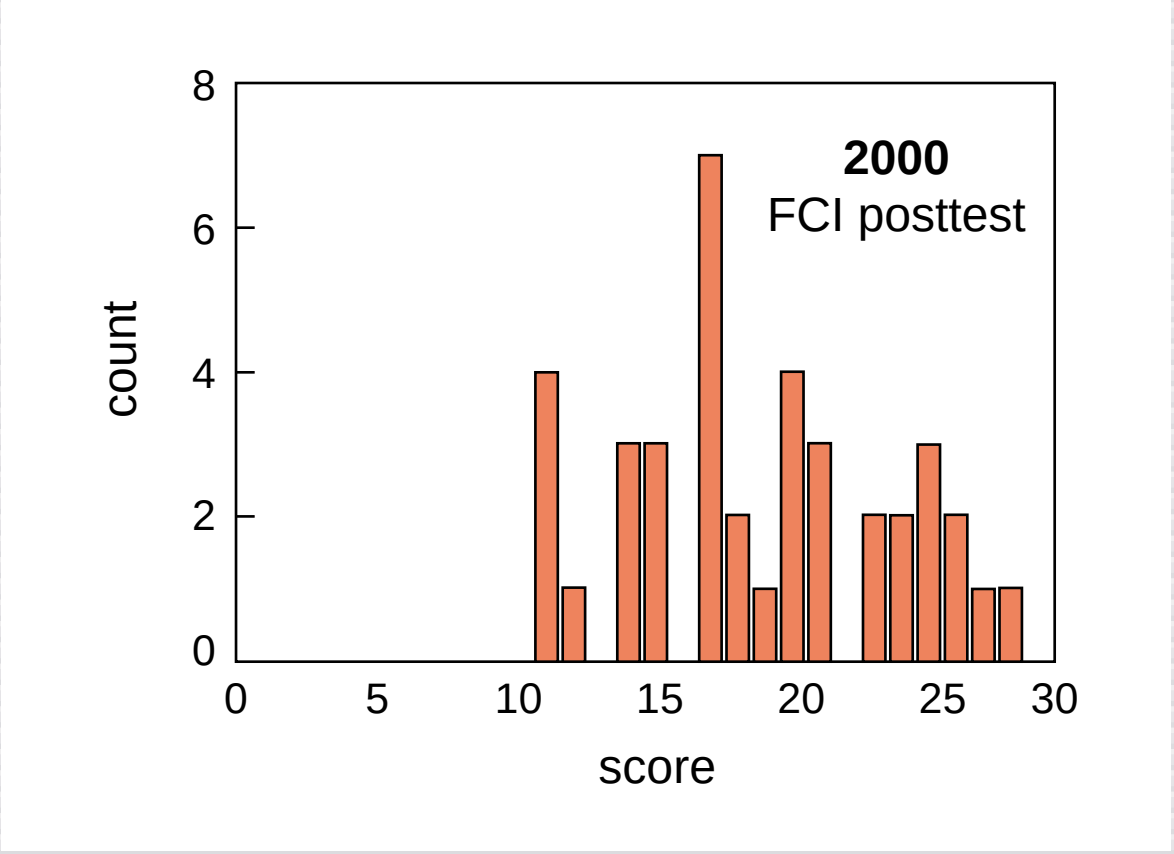
- **survey of physics education literature**
- **assessment tools: FCI and MBT**
- **Peer Instruction**
- **administered pre- and posttest to 3 honors sections**

# FCI data



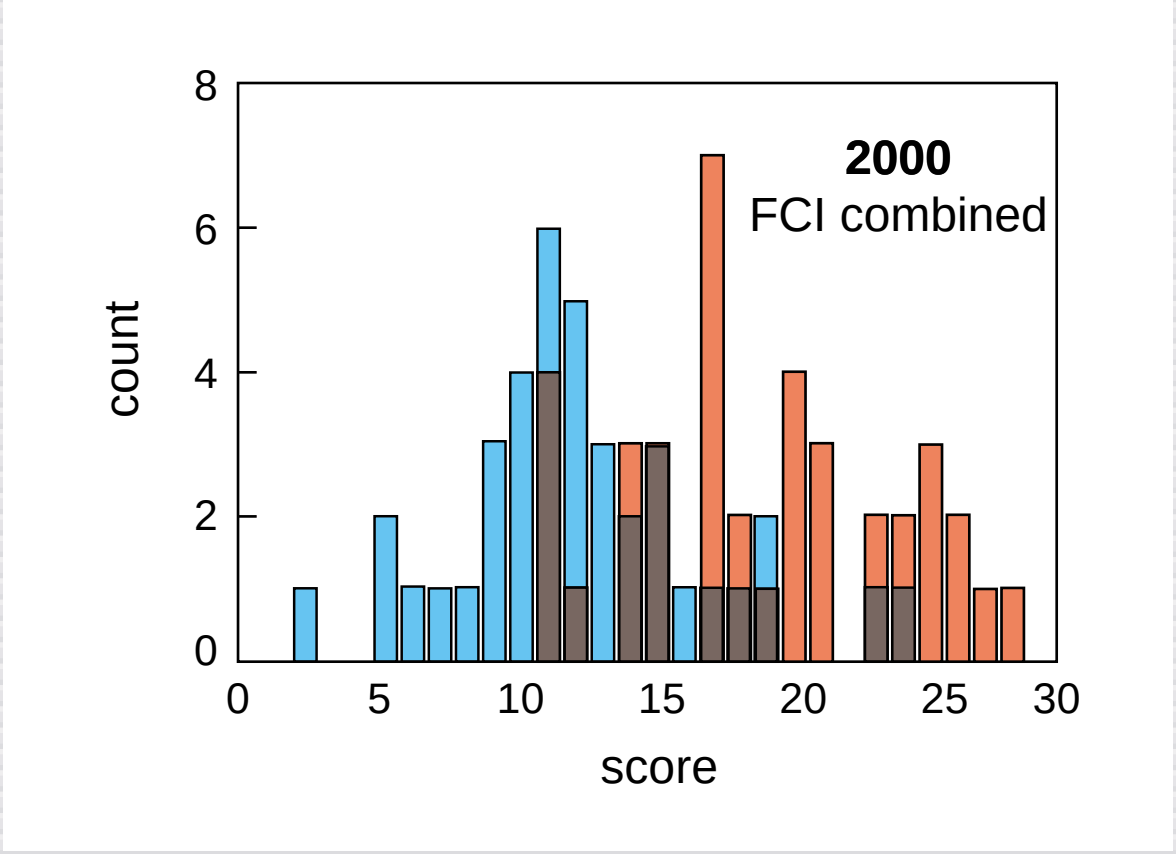

**average: 44%**

# FCI data



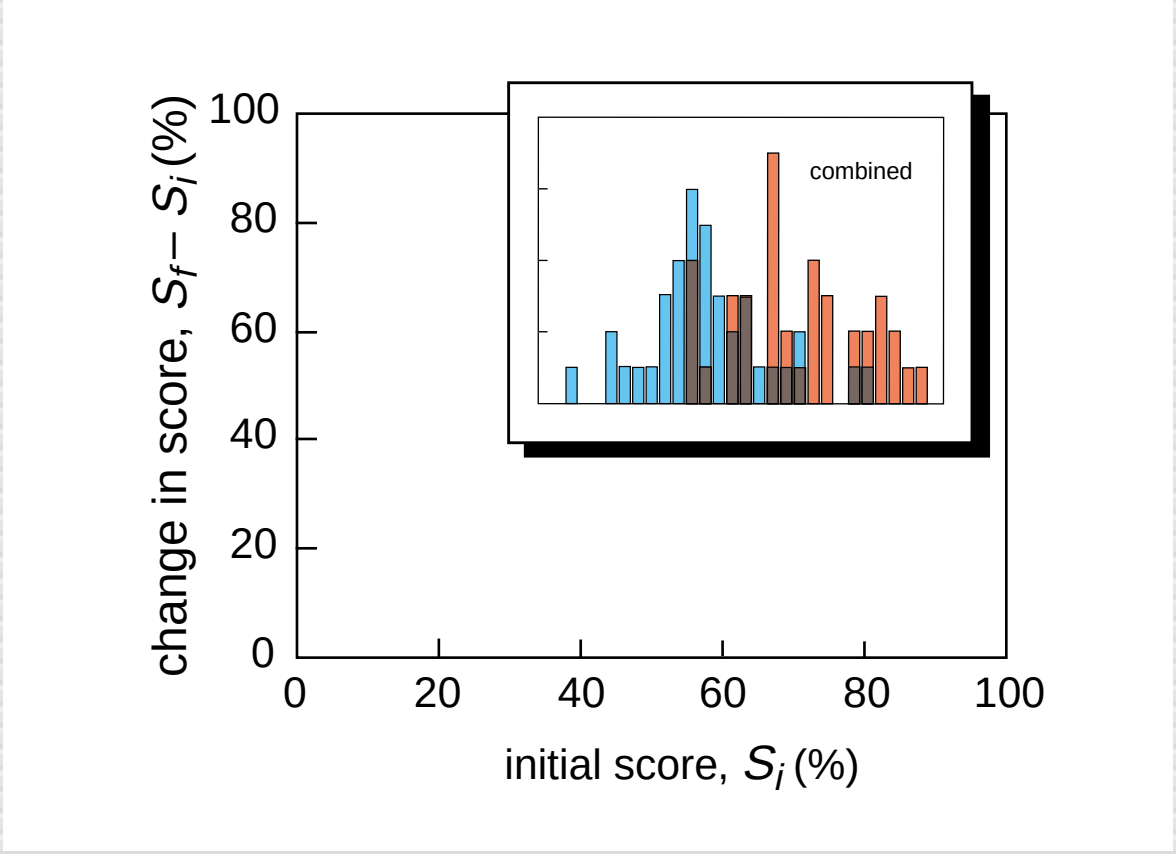

**average: 66%**

# FCI data

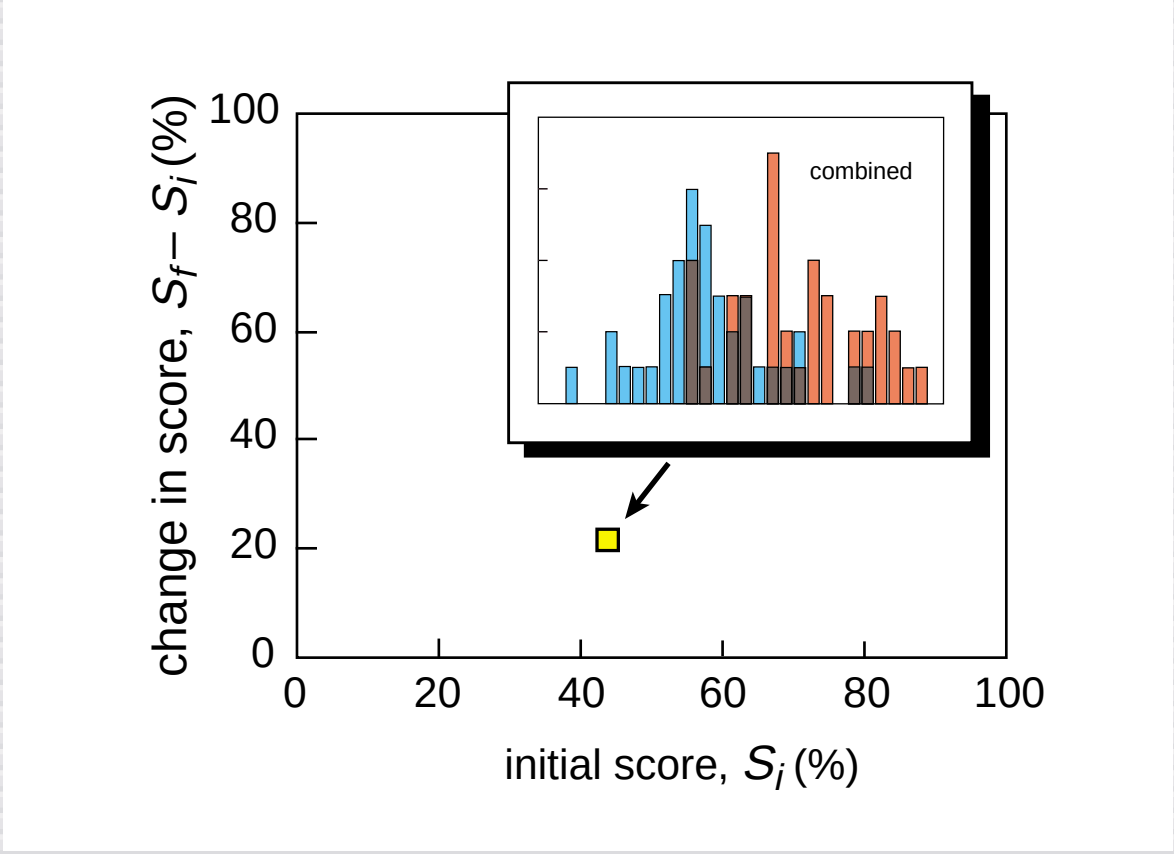



**gain: 22%**

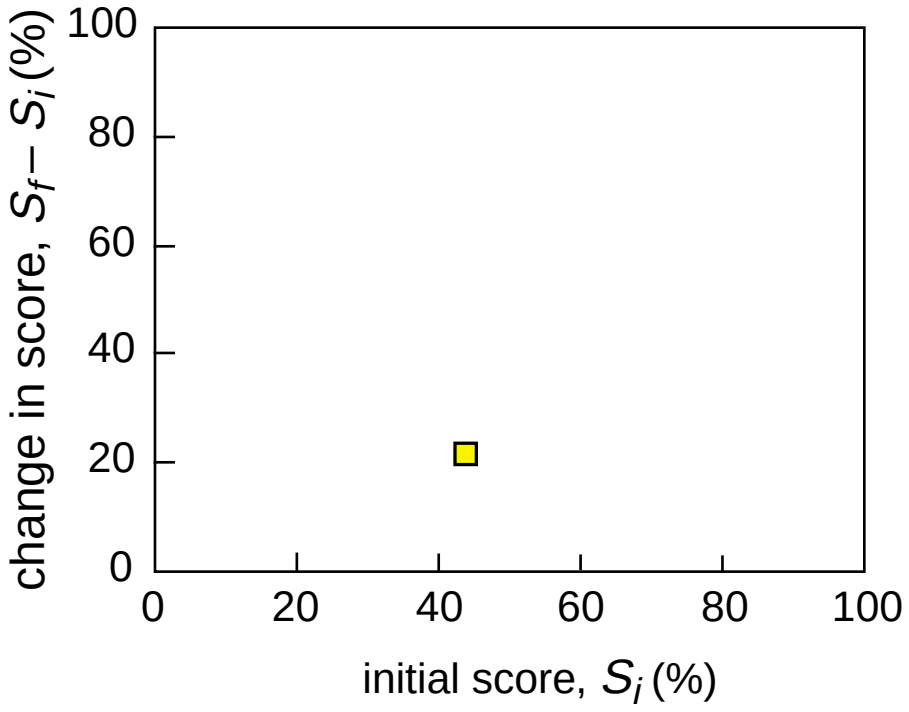
# FCI data


change in score, $S_f - S_i$ (%)
100
80
60
40
20
0
0
20
40
60
80
100
initial score, $S_i$ (%)
combined

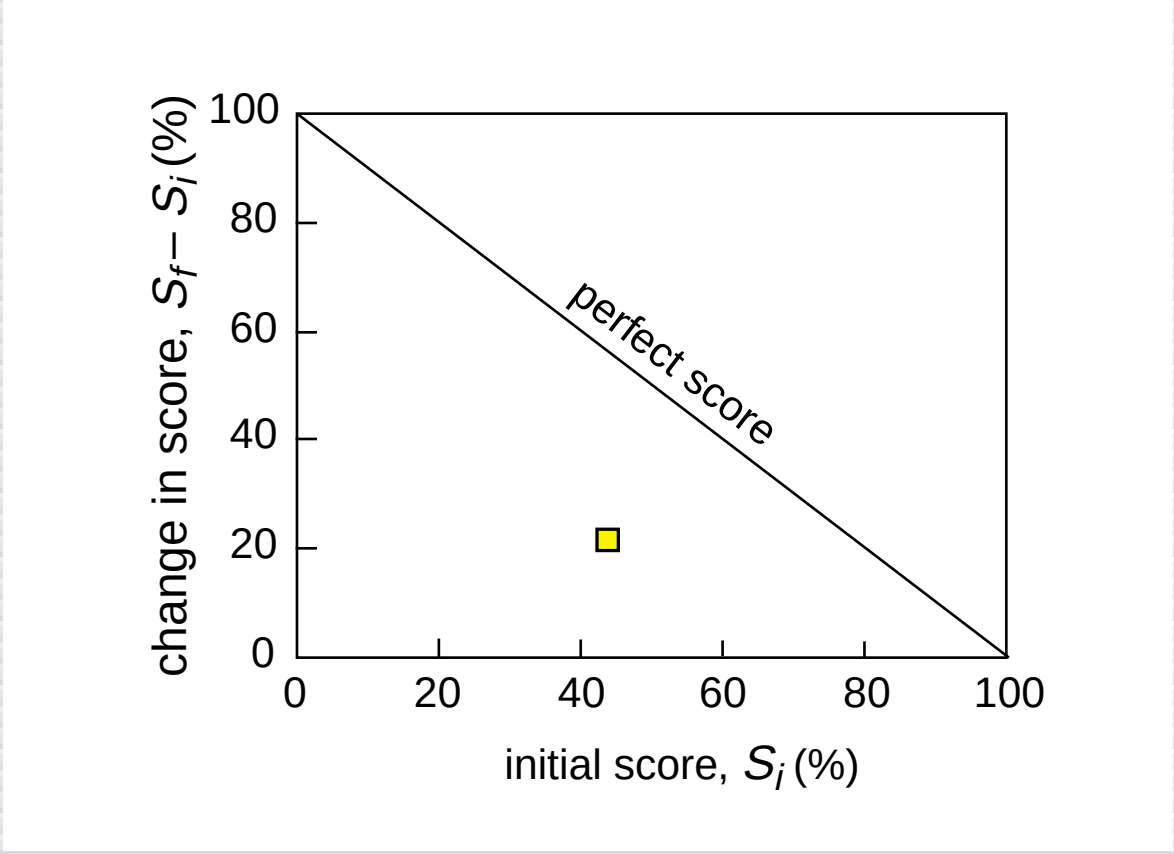
# FCI data


combined
change in score, $S_f - S_i$ (%)
initial score, $S_i$ (%)
0
20
40
60
80
100

# FCI data

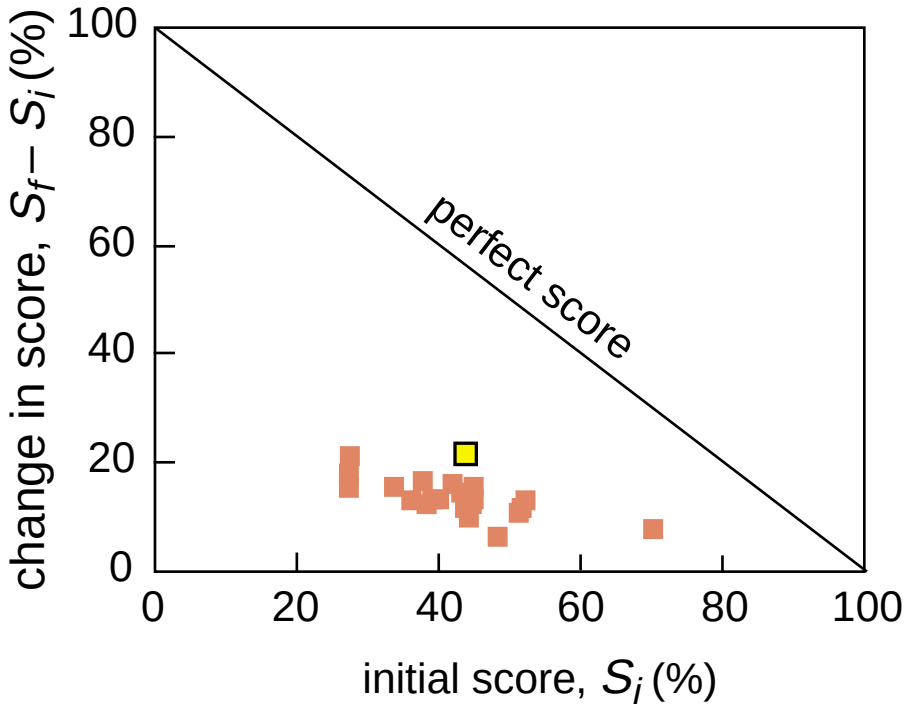

change in score, $S_f - S_i$ (%)
100
80
60
40
20
0
0
20
40
60
80
100
initial score, $S_i$ (%)

# FCI data


change in score, $S_f - S_i$ (%)
100
80
60
40
20
0
0
20
40
60
80
100
initial score, $S_i$ (%)
perfect score

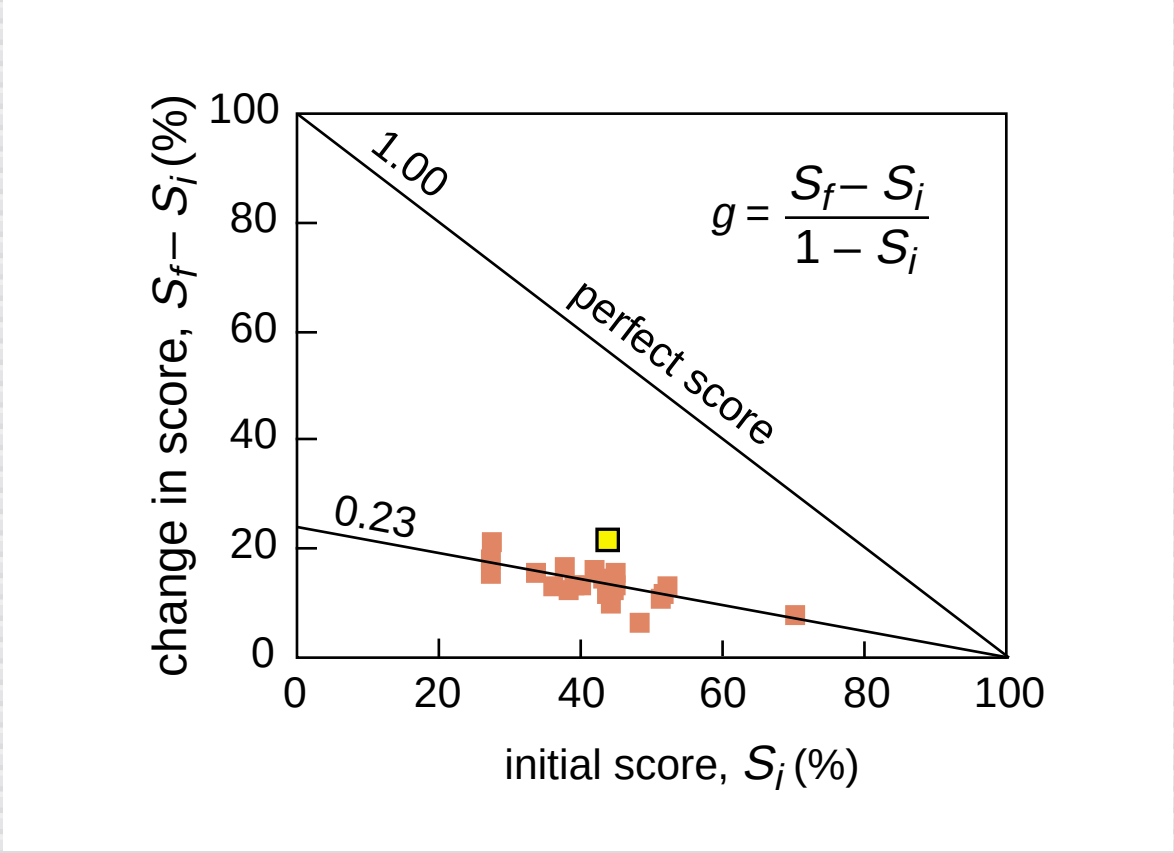
# FCI data

**traditionally taught courses**



# FCI data

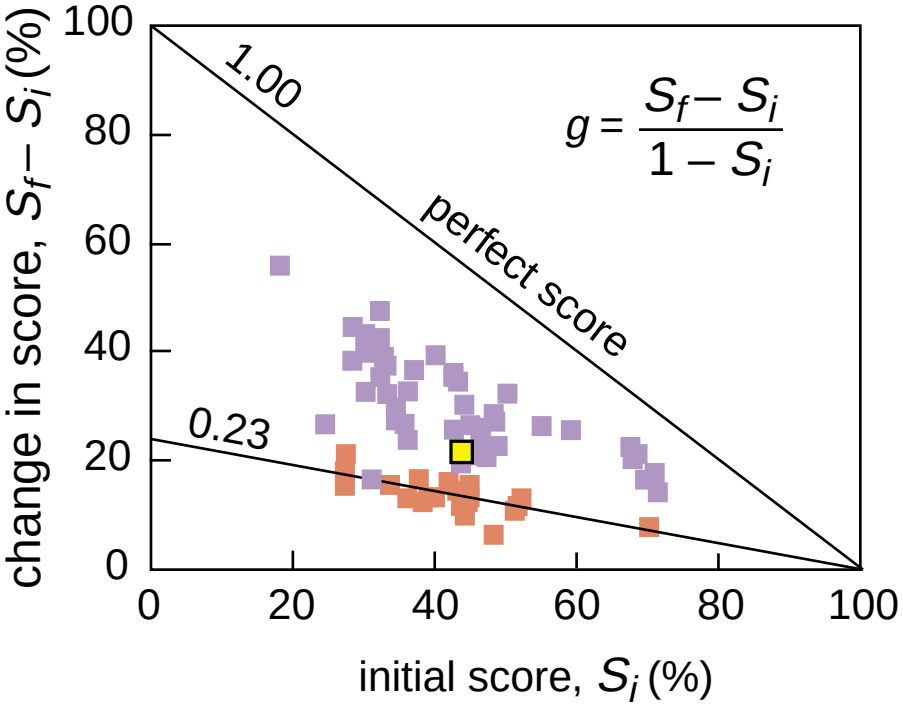
**traditionally taught courses**




**R.R. Hake, *Am. J. Phys.* 66, 64 (1998)**

# FCI data

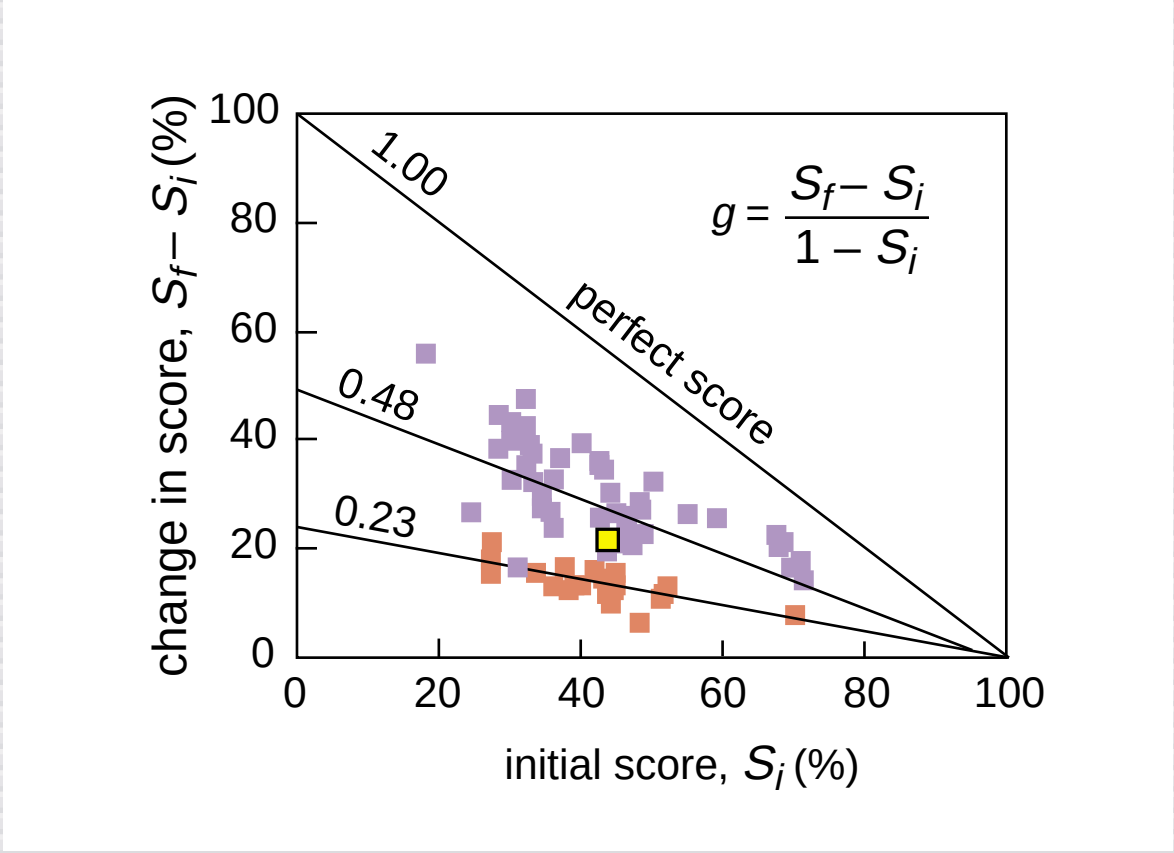
**interactively taught courses**




**R.R. Hake, *Am. J. Phys.* 66, 64 (1998)**

# FCI data

**interactively taught courses**




**R.R. Hake, *Am. J. Phys.* 66, 64 (1998)**

# *Conclusions*

- **mutually beneficial**
- **broad impact**
- **ongoing collaboration**

# *Future endeavors*

- return to Mazur group this summer
- continue to adapt instructional strategies
- continue in-depth study of Peer Instruction
- assess Peer Instruction in high-school environment


**Acknowledgments:**
**National Science Foundation**
**Harvard MRSEC**
**Northwestern University**

**For a copy of this talk and additional information, see:**

**http://mazur-www.harvard.edu**