Research Experience for Teachers: a fruitful collaboration

Kristy Lenihan
Eric Mazur
Making connections

**EDUCATION**
- K-12 STUDENTS
- GENERAL PUBLIC
- UG STUDENTS

**RESEARCH**
- TEACHERS
- MRSEC FACULTY
- GRADUATE STUDENTS
- INDUSTRIAL PARTNERS

**GENERAL PUBLIC**

**K-12 STUDENTS**

**UG STUDENTS**

**GRADUATE STUDENTS**

**TEACHERS**

**MRSEC FACULTY**

**INDUSTRIAL PARTNERS**
Making connections

EDUCATION

K-12 STUDENTS

GENERAL PUBLIC

TEACHERS

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UG STUDENTS

RESEARCH

GRADUATE STUDENTS

INDUSTRIAL PARTNERS

IRGs

IAC

interns
Making connections

Education:
- K-12 Students
- General Public

Research:
- Teachers
- Graduate Students
- MRSEC Faculty
- Industrial Partners
- UG Students

Connections:
- REU
- IRGs
- IAC
- Interns
Making connections

EDUCATION

K-12 STUDENTS

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IAC

IRGs

RET

REU

interns
Making connections

Educational Connections:
- K-12 Students
- General Public
- Teachers

Research Connections:
- Graduate Students
- Industrial Partners
- UG Students

Pathways:
- RET
- Teach
- IRGs
- IAC
- Interns
Making connections

EDUCATION

- K-12 STUDENTS
- GENERAL PUBLIC
- TEACHERS
- GRADUATE STUDENTS
- INDUSTRIAL PARTNERS

RESEARCH

- UG STUDENTS
- GENERAL PUBLIC
- TEACHERS
- RET STUDENTS
- INDUSTRIAL PARTNERS

Connections:

- Teach
- RET
- IRGs
- IAC
- Interns
- Lectures
Making connections

- **EDUCATION**
  - K-12 Students
  - General Public
  - UG Students
- **RESEARCH**
  - Graduate Students
  - Industrial Partners
  - RET
  - RET
  - IRGs
  - IAC
  - RET

- **TEACHERS**
- **MRSEC FACULTY**
- **UG STUDENTS**
- **GENERAL PUBLIC**
- **K-12 STUDENTS**

- Lectures
- Teach
- REU
- Interns
- RET flyer
- MASS newsletter
- Peer Instruction Workshop
- Boston Science Teachers Association
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

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
Charles Hughes
Elementary School, Science
Boston Public School coordinator

Project (Weitz Group):
Multiparticle tracking in cells
Kristy Lenihan
High School, Physics

Project (Mazur Group):
Research: Micromachining of transparent materials
Education: Development of optics curriculum
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
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
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)
Goal 3: observe procedures and interactions

- laboratory notebooks
- planning time
- use of collaborative strengths
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%
gain: 22%
FCI data
FCI data
FCI data

The graph illustrates the change in score, \( S_f - S_i \) (%), against the initial score, \( S_i \) (%).
change in score, $S_f - S_i (%)$

initial score, $S_i (%)$

**FCI data**
traditionally taught courses

FCI data
change in score, $S_f - S_i$ (%) vs initial score, $S_i$ (%)

$g = \frac{S_f - S_i}{1 - S_i}$

$g = \frac{S_f - S_i}{1 - S_i}$

FCI data

interactively taught courses

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