

Changing the Way We Teach

2004 NRCEN Conference

Lisa Hunter

Associate Director, Education & Human Resources

Center for Adaptive Optics

NSF Science and Technology Center

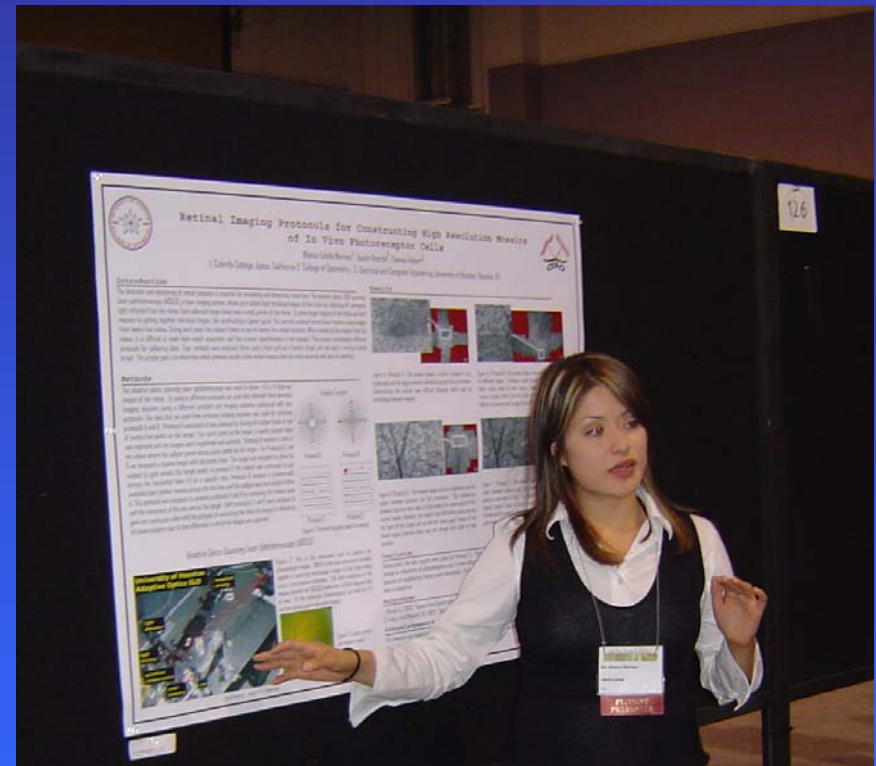
March 5, 2004



Needs in collegiate STEM education



- Engage all students in STEM
- Broadly recruit more students into STEM workforce
 - (Courses that are “pumps rather than filters”)



What can Centers do to change the way we teach?

What is the role of partners?

CfAO focus for change: INQUIRY



- Mirrors research process
- Promoted nationally, including in National Science Standards
- Not usually taught as a teaching tool at universities
- Strong basis in educational theory (and visible)
- Transformative
 - Can generate a major re-thinking about teaching
 - Good foundation for other strategies and subtle shifts



CfAO Approach for incorporating inquiry



Broader access to CfAO fields

Junior researchers



Training

Professional Development Workshop (inquiry)



“Teaching Labs”

- Short Courses
- High school program
- Saturday Open Labs



Long-term Changes:

- Practices
- Formal courses
- Partners

(Grad students, postdocs, early career staff)



College & high school students

Professional Development Workshop for CfAO Junior Researchers



2004 workshop (5 days):

*“Connecting science education theory
and practice”*



Partnership Building



Inquiry Training



**Graduate Student
Community**

35-40 participants/year; no advisors

Inquiry Components of Workshop



“3 Kinds of Hands-on”



Experiencing inquiry as a learner



Facilitated discussions



Facilitated design

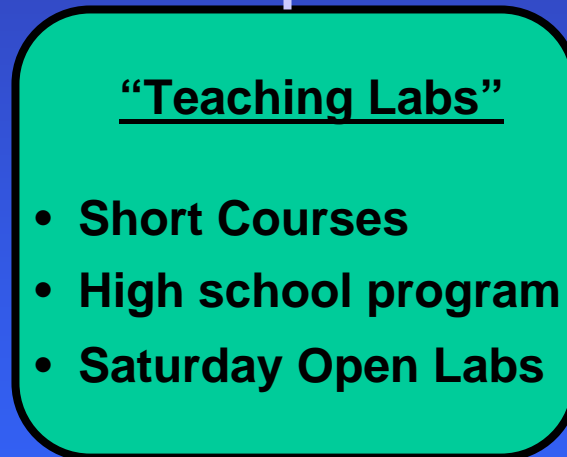
Partners: UCSC Education Dept., Exploratorium

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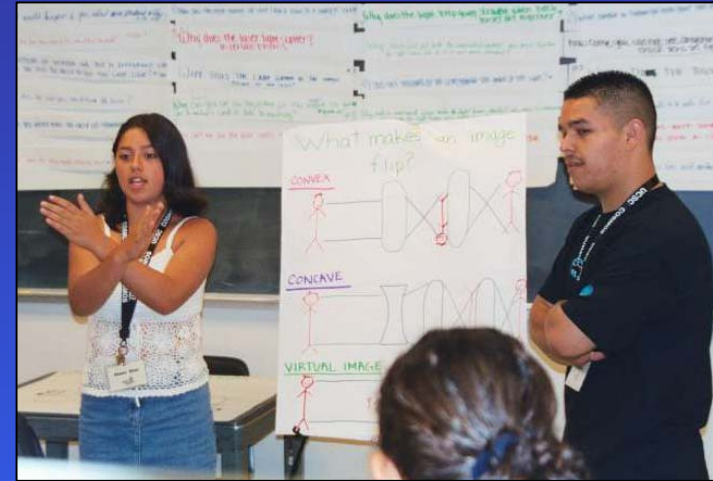
Unconstrained “Teaching Labs”



- Environments where learning goals are flexible
- Teaching in pairs or small groups
- Support from CfAO EHR staff
- Current “Teaching Labs” embedded in bigger programs
 - Short Courses (first week of undergraduate internship)
 - High school program
 - Saturday Open Labs

Partners: Educational Partnership Center, community colleges, industry, Air Force, other intern hosts

Inquiry in action



- "It made us develop questions and then look within our own knowledge to find or research possible answers."
- "They didn't give me the answer, but pushed in a direction so I could find it myself! So perfect!"

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Long-term impacts



- **Short Courses for credit at partner cc's**
- **Components used in cc intro course (partners!)**
- **Center faculty/PI's influenced to incorporate inquiry elements**
- **Faculty members now pushing to be included**
- **Education course for STEM graduate students**
- **Graduate student TA's proposing changes in:**
 - **Non-majors astronomy course (UCSC)**
 - **Freshman seminar (UCLA)**

Partners: UCSC Education Dept., Center institutions, community college partners, Center for Informal Learning and Schools (CILS)

Lessons Learned



- **Workshop (an entire talk, but here's a few examples):**
 - Integrate research and education
 - Reading material choice (for example “Seven Principles of Learning” from Learning with Understanding, NRC)
- **Training combined with practical experience (“Teaching Labs”)**
- **Unconstrained teaching environments ideal for first try with a new strategy (flexible syllabus)**
- **Center environment:**
 - Recognition for innovation
 - Built into all Center activities
 - National audience
 - Community of practice (vs. “lone innovator”)
 - Longer term funding
- **Involvement of graduate students in these activities has made them bigger players in Center - and in some cases *contributes to retention***

Lessons Learned: Partners



- **Bringing a “building block” to the table has catalyzed our most successful partnerships**
- **Designed in for long-term benefits**
- **Everybody contributes; everybody benefits**
- **Center has been essential to starting and maintaining partnerships**
- **Partners will be the key to leaving a legacy - institutionalization**

