

Center for the Integration of Research, Teaching and Learning

Rique Campa

Michigan State University

Robert Mathieu

University of Wisconsin - Madison





Center for the Integration of Research, Teaching and Learning

Mission

**To develop a national STEM faculty
committed to implementing and advancing
effective teaching practices
for diverse student audiences
as part of their professional careers.**





Strategy: Leveraging the System

Undergraduate Education

Comprehensive University
2-yr College
Liberal Arts
Masters University
Research University

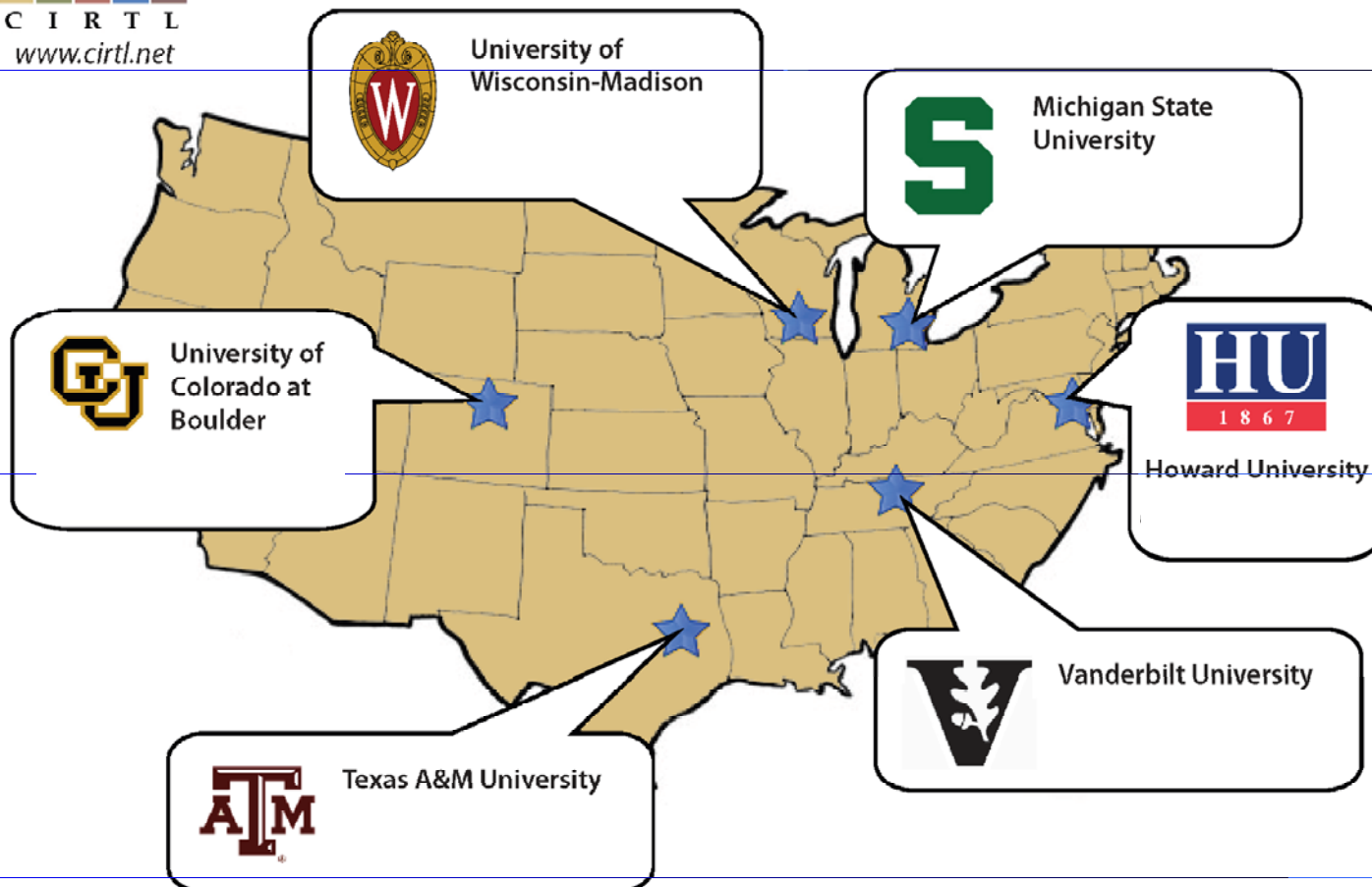
80% Ph.D.'s

100 Research Universities





CIRT L National Network





The Core Ideas of CIRTL

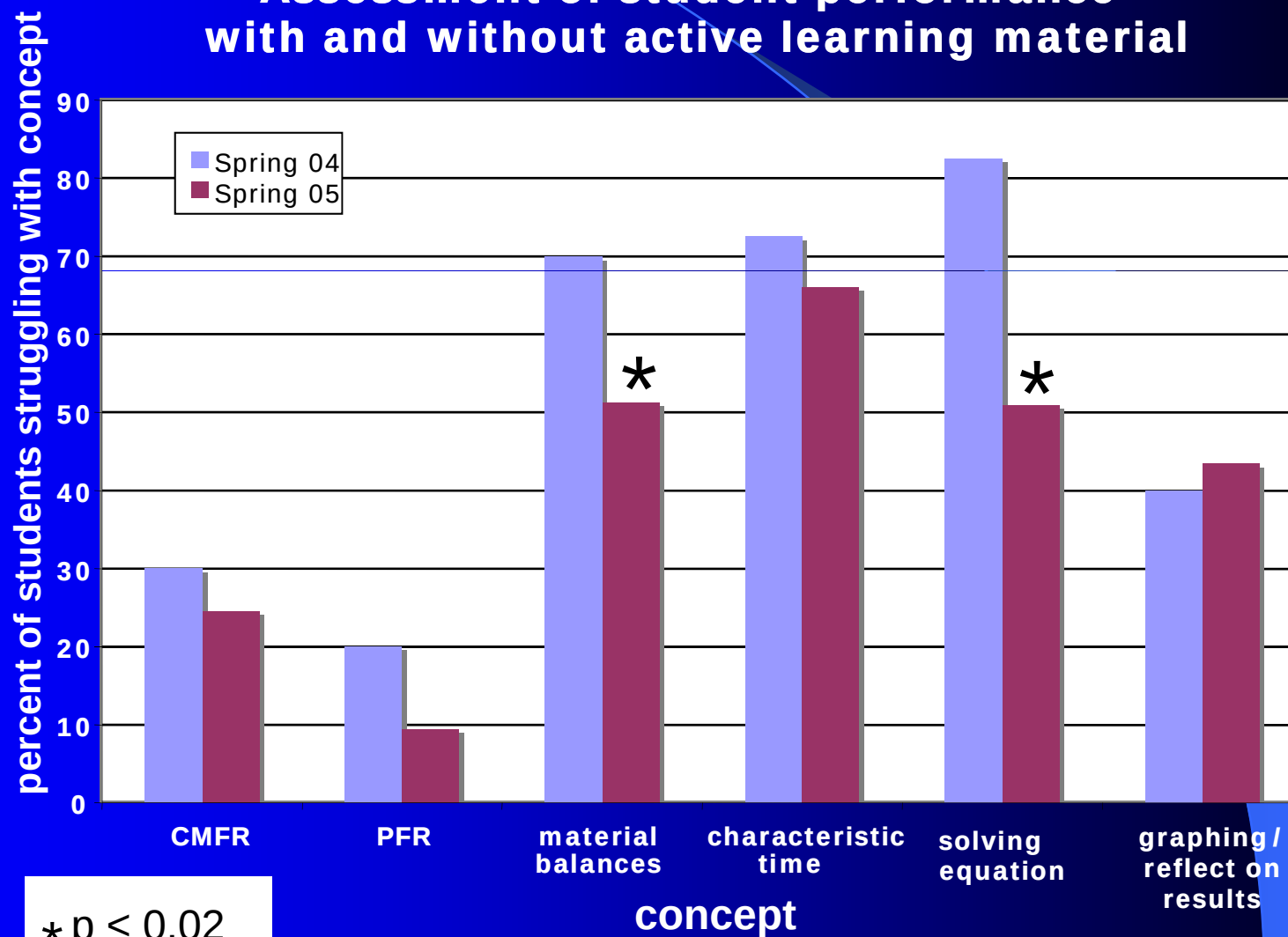
- **Teaching-as-Research**
- **STEM Professor as Change Agent**
 - Hypothesize, experiment, observe, analyze, improve
 - Self-sustained improvement of STEM education





Leveraging the Research Model Teaching-as-Research

Assessment of student performance
with and without active learning material





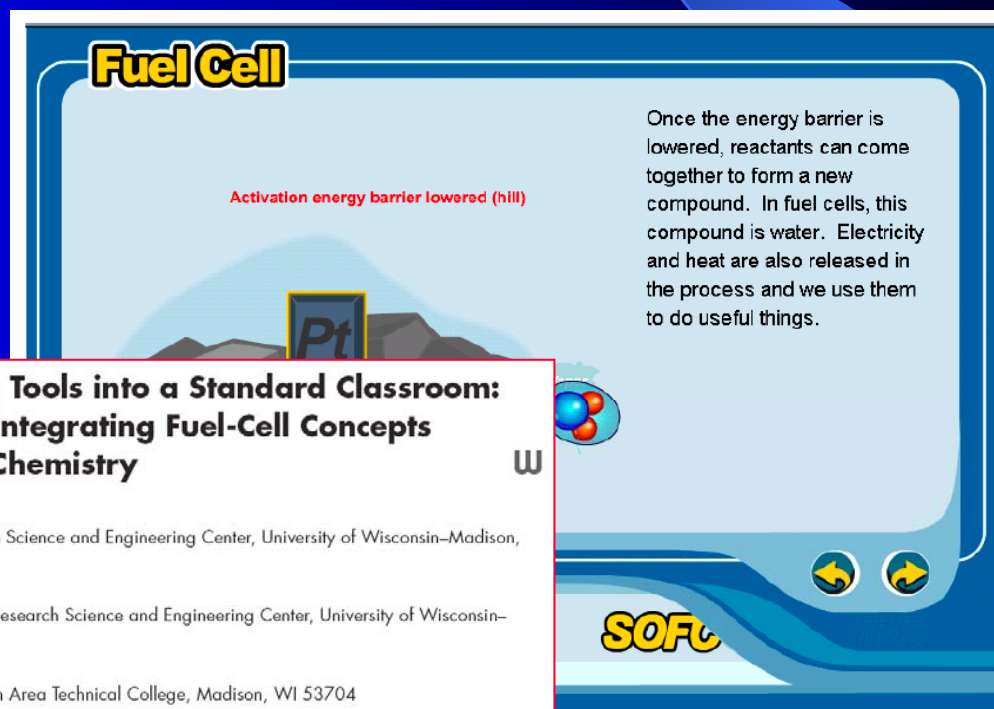
Leveraging the Research Model

“Research Assistantships in Teaching”



Materials Science

Although the assessment of the first implementation proved to be somewhat inconclusive, the more rigorous assessment of the “Heart of a Fuel Cell” LO during the second implementation revealed a large improvement in the pre- and post-quiz scores from 42% to 80% ($n = 35$). In this case, the



Introducing New Learning Tools into a Standard Classroom: A Multi-Tool Approach to Integrating Fuel-Cell Concepts into Introductory College Chemistry

Matthew J. D'Amato^{*,†}

Materials Science Program and Materials Research Science and Engineering Center, University of Wisconsin–Madison, Madison, WI 53706; *mjdamoto@wisc.edu

Kenneth W. Lux[‡]

Department of Engineering Physics and Materials Research Science and Engineering Center, University of Wisconsin–Madison, Madison, WI 53706

Kenneth A. Walz and Holly Walter Kerby

Chemistry Department, Arts and Sciences, Madison Area Technical College, Madison, WI 53704

Barbara Anderegg

Consortium for Education in Renewable Energy Technologies, Madison Area Technical College, Madison, WI 53704





Leveraging the Research Model

Leveraging the NSF Broader-Impacts Criterion for Change in STEM Education

BY ROBERT D. MATHIEU, CHRISTINE PFUND, AND DON GILLIAN-DANIEL

The call for a more scientifically literate society is a constant drumbeat coming from the mainstream media and from reports of concerned organizations like the National Academy of Sciences. And they see improved education and outreach

from institutions of higher learning as key to any proposed solution to this major national challenge. In higher education, the need to integrate research, teaching, and learning has been a theme woven through decades of calls for improvement. In reality, the weight of external research fund-

faculty. Indeed, through the training of graduate students and post-docs, programs that are working to improve STEM (science, technology, engineering, and mathematics) teaching and learning—such as the Center for the Integration of Research, Teaching, and



Change Magazine, May/June 2009



The Core Ideas of CIRTL

- **Teaching-as-Research**
- **STEM Professor as Change Agent**
 - Hypothesize, experiment, observe, analyze, improve
 - Self-sustained improvement of STEM education
- **Learning Community**
- **Support growth in teaching and learning**
 - Graduate student, post-doc, faculty community
 - Foundation for institutional and national change
- **Learning-through-Diversity**
- **Excellence and diversity are necessarily intertwined**
 - All students bring an array of experiences and skills
 - Learning of all students is enhanced if all engaged



[illegible]

The Delta Program in Research, Teaching and Learning



"The Delta program allows me to develop—and practice—new modes of teaching science." He believes his experience will be a great asset when he starts looking for a job.

—Get your graduate title
Materials Science Program

**TO BE
SKILLED
TEACHER
SCIENCE
ENGINEERING
AND MAT**

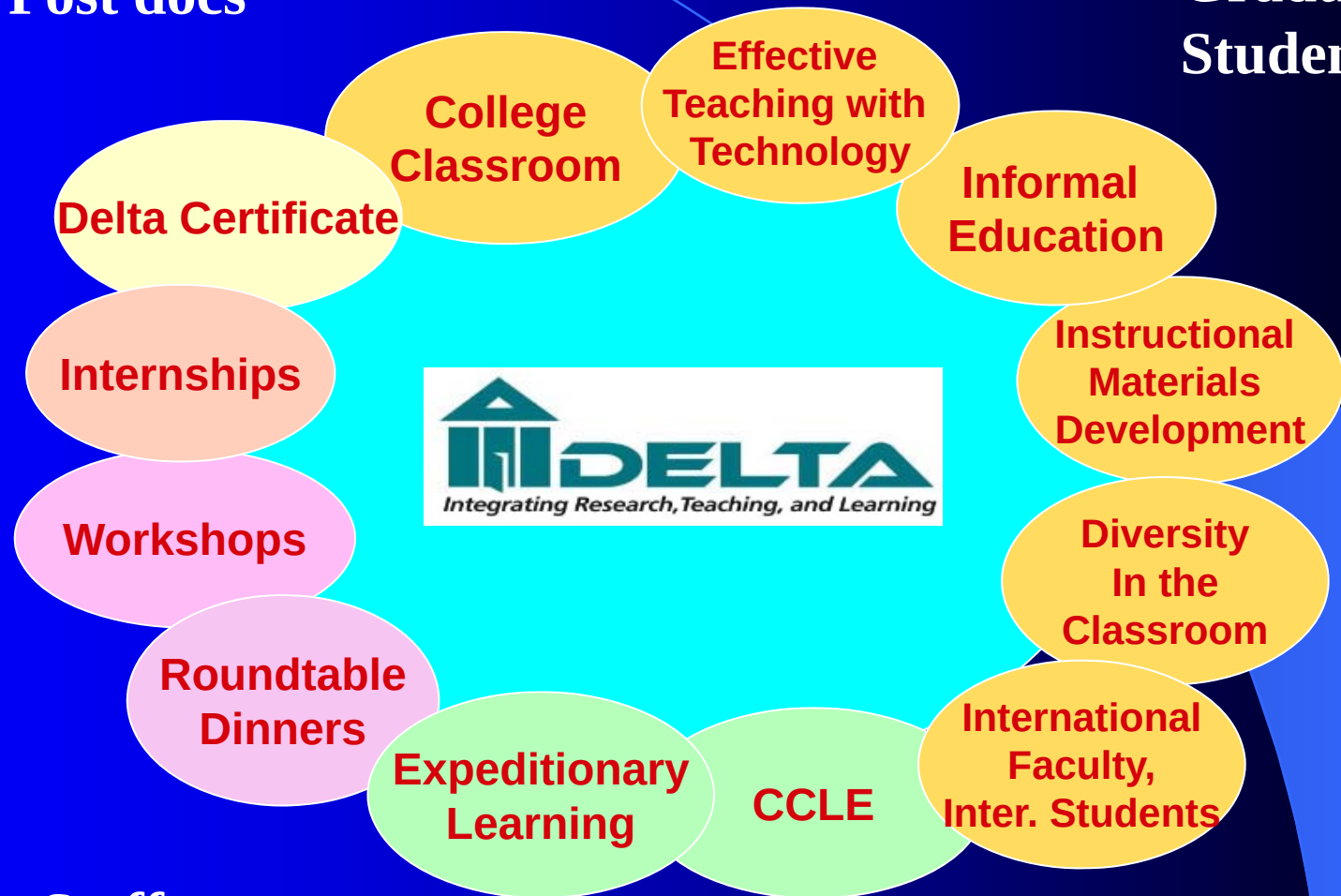




Delta Program

Post docs

Graduate Students



Staff

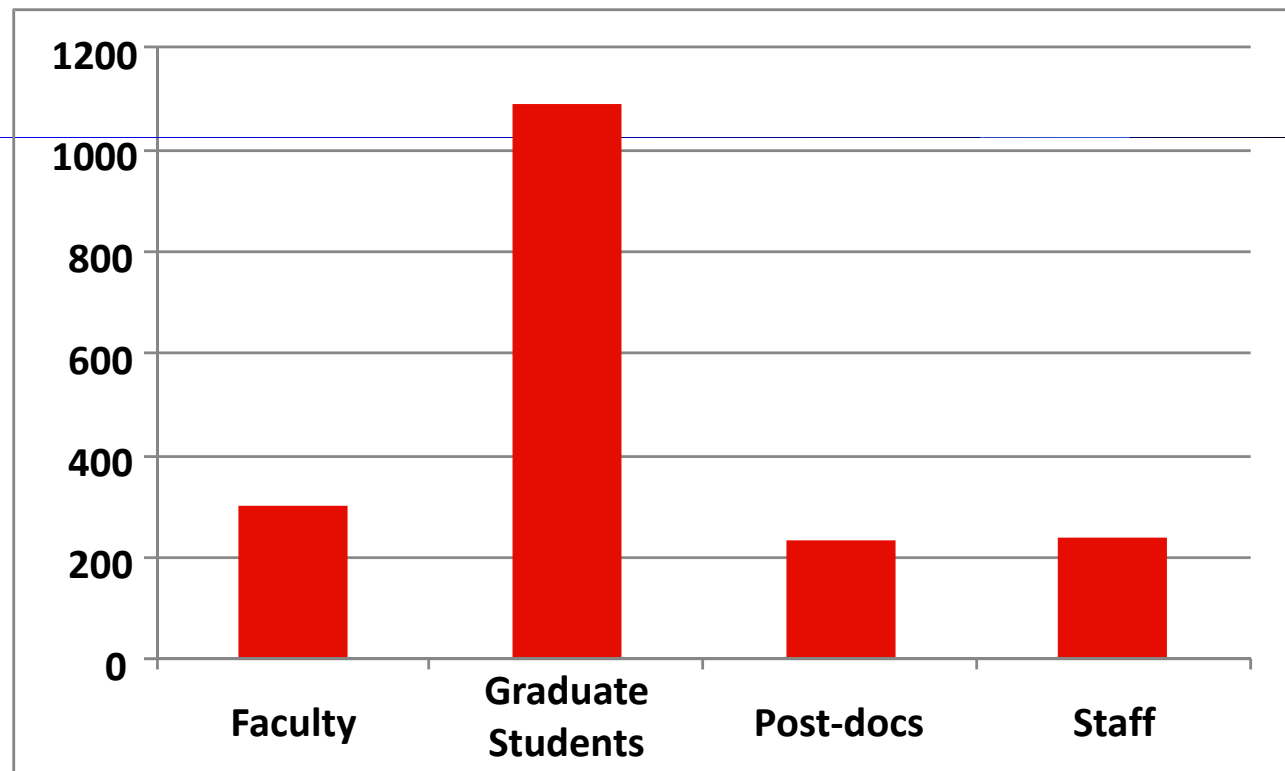
Faculty





Graduate Student Demand more than 1300 future faculty

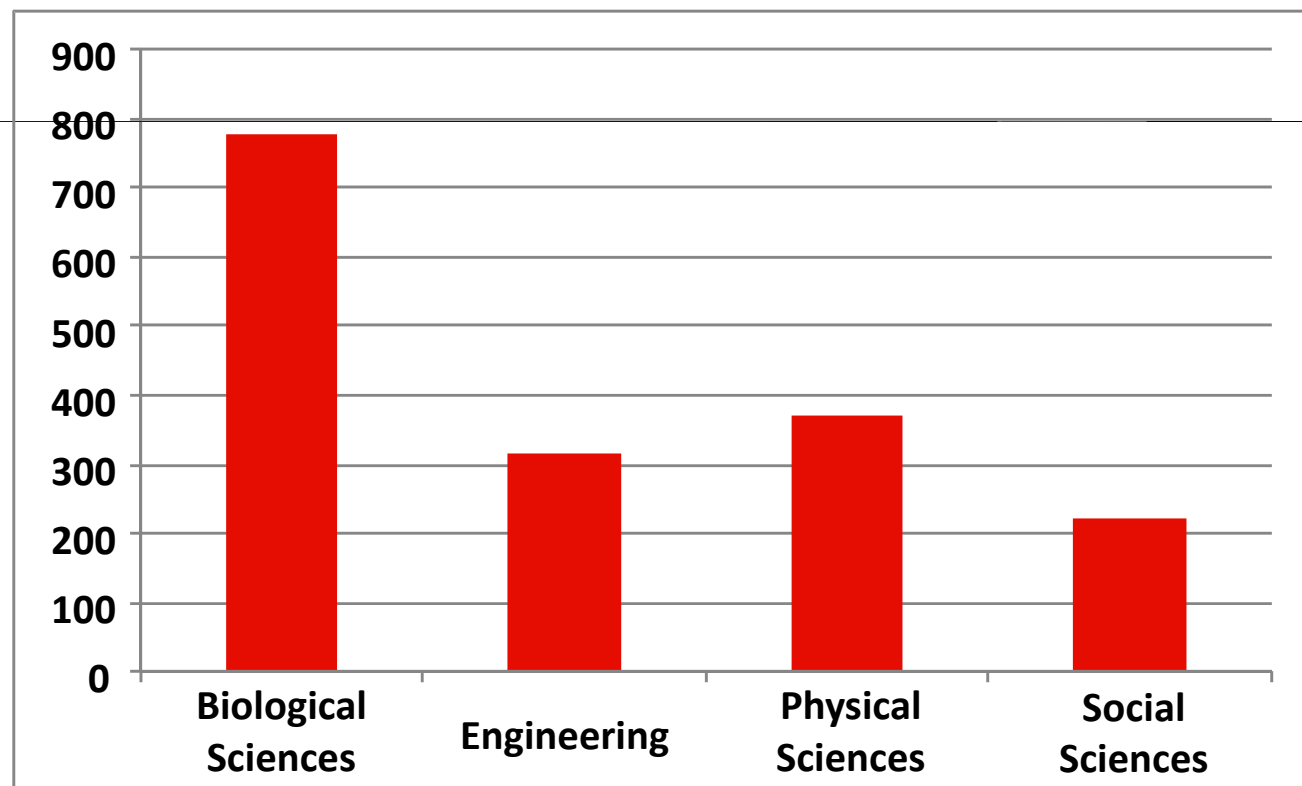
Delta Participation
Summer 2003 – Summer 2010





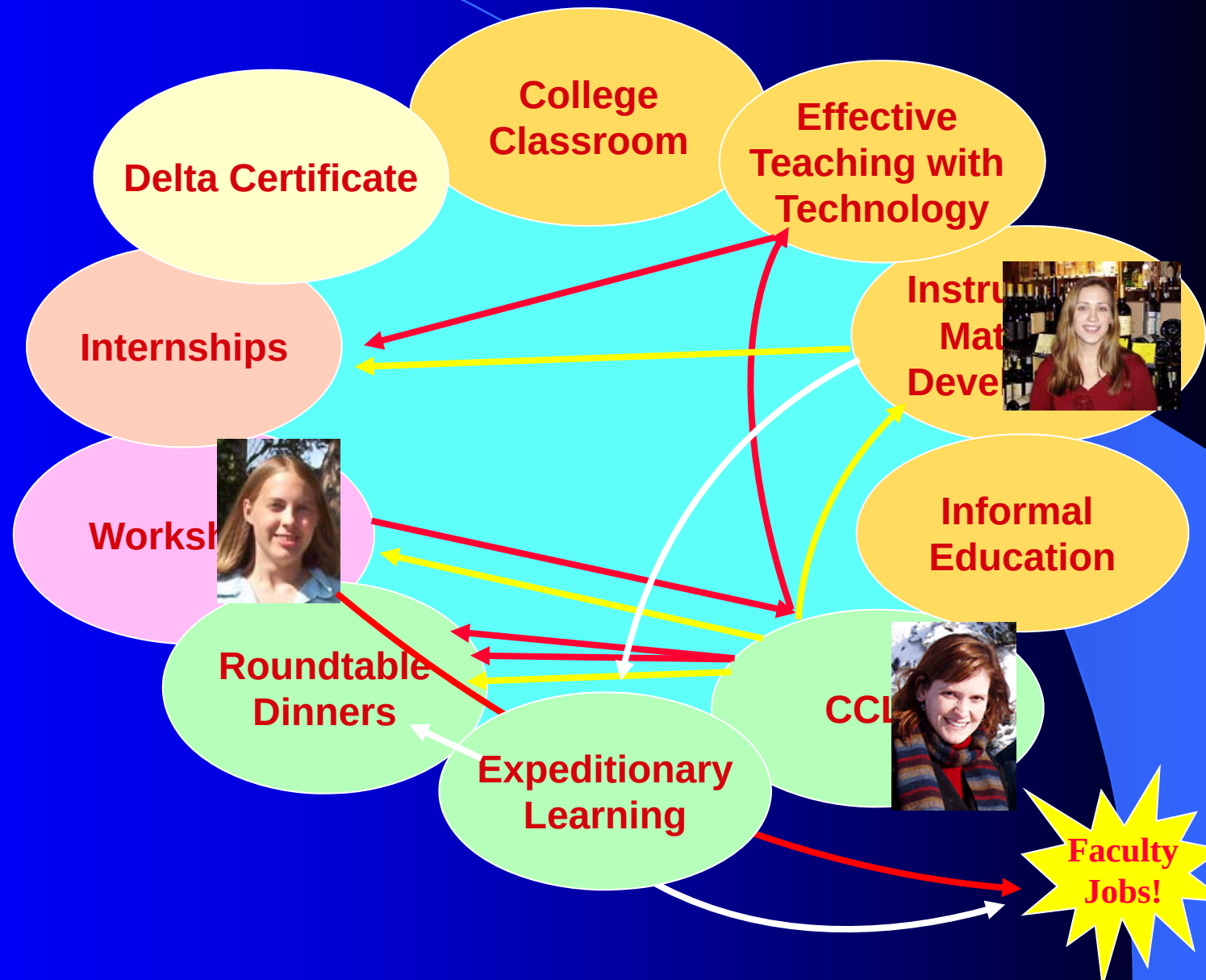
Interdisciplinary Connections

Delta Participation
Summer 2003 – Summer 2010





The Learning Community in Action





The Learning Community in Action

Delta Central



College Classroom: Multi-campus

Gillian-Daniel (Delta)
Manske (Delta)
Petto (UWM)

Teaching Statistics

Nordheim (Stats)

College Classroom

Walz (MATC)
Balster (Soil Science)

Informal Ed. – After-School clubs

Dolly Ledin (CBE)

Effective Teaching w. Tech

Blanchard (Eng. Phys)
Wolf (DoIT)

College Classroom: Online

Courter (ELC)
Gruber (Biochem)

Instructional Materials Development -Biology

Tong (CBE)
Jeanne (Entomology)

Diversity in the College Classroom

Gillian-Daniel (Delta)
Manske (Delta)

Informal Ed.

Crone (Eng. Physics)
Dunwoody (Journ)

Teaching Large Classes

Balser (Soil Science)

International Faculty, International Students

Barger (WCER)
Wu (CEE)

CCLE

Bubnezer (L&S)

Roundtable Dinners

Ackerman (AOS)
Callahan (Grad School)

Expeditionary Learning

Harris (Zoology)
Desmond (Delta)
Underwood (Physics)

Workshops

Bubnezer (L&S)
Masters (BioEng)
Timbie (Physics)

Internships

Gillian-Daniel (Delta)
Mathieu (Astro)
Manske (Delta)

Delta Certificate

Gillian-Daniel (Delta)

Broader Impact Workshops

Masters (BioEng)
Pfund (Delta)
Gillian-Daniel (Delta)

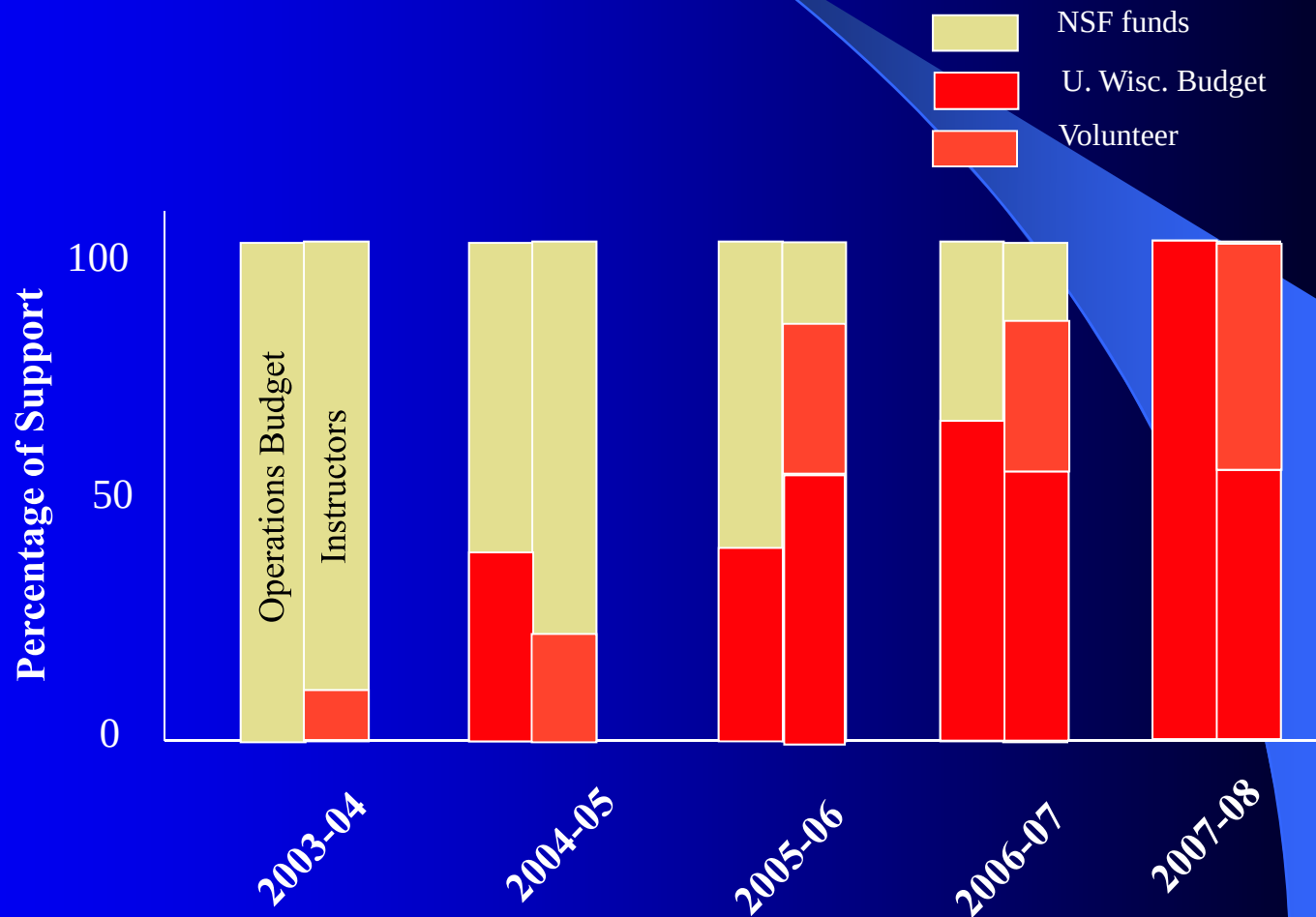
Research Mentor Training

Pfund (Delta)
STEM faculty and staff



Impact on the Institution

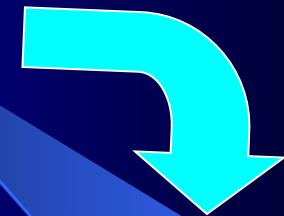
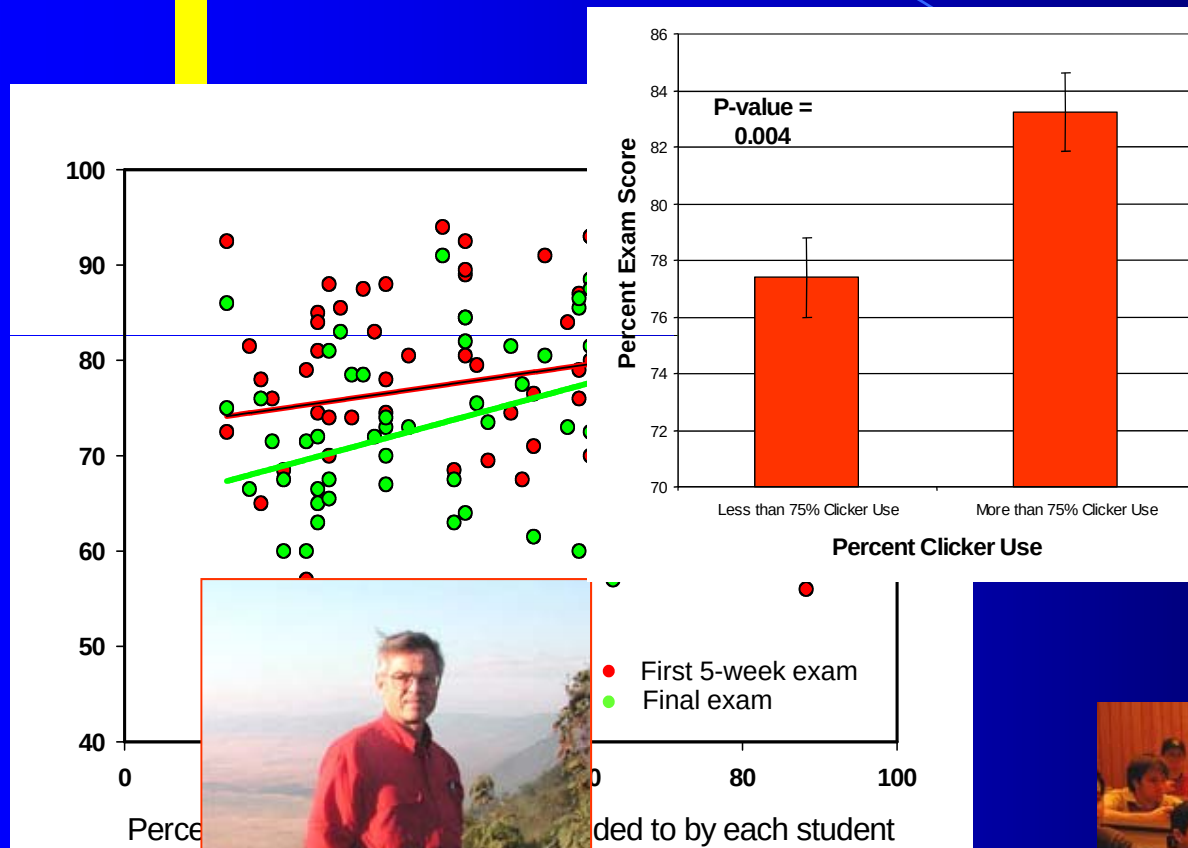
Institutionalization of the Delta Program





Impact on the Institution

Enhanced Undergraduate Education



1000 students
per year





Impact on the Institution

Enhanced Undergraduate Education

“The Trickle-Up Effect”

Dear Bob:

It has been my pleasure to work with Sarah and Eric, not only because they are fine individuals, but because it has permanently changed the way I look at teaching. I would never have come up on my own with the approaches these two are trying. Sarah's concept quizzes have turned out to be an extraordinary avenue to get weekly feedback on what the students do and do not understand.

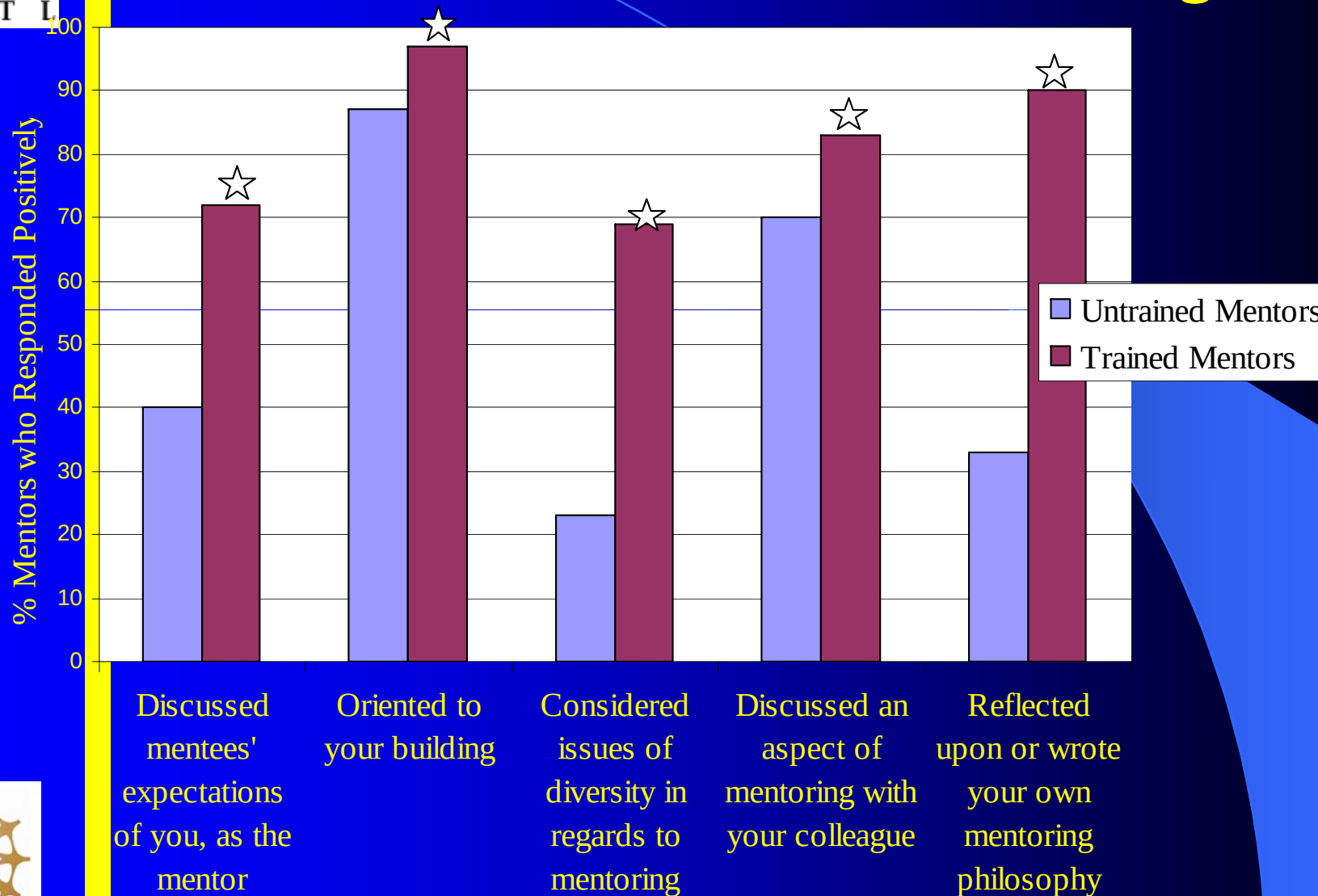
- *Professor Laurel Goodwin*
UW Geology Department





Impact on the Institution

Enhanced Research Mentoring



Pfund et al. Science 311, 473 (2006)



Impact on the Institution Success of Graduate Students

“Truly Delta was a major part of me securing the job at Augustana. When I talked to people there about my application, they all said how impressed they were that I had made the time for teaching training as well as research, and how well I formed my application specifically to their position (a skill I learned in a Delta course!). This experience has been SO valuable!

I have learned so much being a part of Delta, and I really cannot imagine starting such a job without the strong foundation that I have.”

*Asst. Professor
Augustana College*





Impact on the Institution

Success of Graduate Students

“Jenny has been a great PhD student. She has accomplished so much in research and graduate with at least 4 first author papers to her credit. Jenny is my first PhD student and I am therefore especially vested in her success. While I was able to contribute in her research journey, her training in teaching would not have been possible had it not been for the Delta program. Thanks to the Delta program for training students like Jenny in the art and science of teaching, which were central to her success in moving right into a faculty position.

I look forward to contributing to the Delta program. So please let me know how I can help.”

Assistant Professor, Obstetrics and Gynecology
Advisor, Asst. Professor, Augustana College





Impact on the Institution

Enhanced Research Funding

“A strength of the proposal is the broad impact that will result from the synergistic involvement of three graduate students simultaneously, all of whom are involved in the Center for Integration of Research, Teaching and Learning. These students are being trained in outreach skills and will participate in the application of Digital Data Maps, which will have wide use in teaching and research.”

*- Panel Review for funded NSF research proposal
Department of Geology, UW-Madison*





Impact on the Institution

Enhanced Research Funding

Ò[This proposal] describes a systematic program that will involve both graduate students learning to teach and undergraduate students learning organic chemistry, within a strong infrastructure at Wisconsin (É CIR TL, an NSF Center) dedicated to similar educational objectivesÉ possibly the most important impact of the work will be the preparation of faculty-to-be for teaching at the university level. American faculty receive outstanding training in research, but É often never understand fundamental issues related to quality learning. Any project addressing these problems is significant.Ó

Panel review for funded NSF CAREER proposal
Department of Chemistry, UW-Madison





Impact on the Institution

Enhanced Research Funding



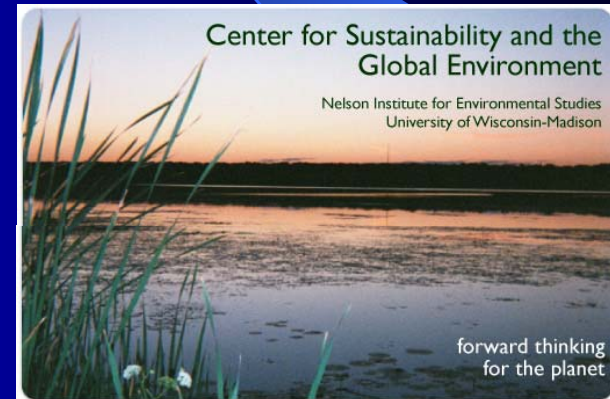
Materials Research Science
And Engineering Center

Center for



Limnology

UNIVERSITY of WISCONSIN-MADISON
CENTER for NEUROSCIENCE



University of Wisconsin-Madison Space Science and Engineering Center

Cooperative Institute for
Meteorological Satellite Studies



Impact on the Institution

Summary

- Legacy of enhanced learning on campus
- Growth of teaching and learning community
- Enhanced research success (funding and performance)
- Expanded impact of graduate education
- Faculty success (tenure, student hiring ...)
- Enhanced recruitment of grad. students and post-docs

*Institutional change toward
integrating
research, teaching and learning*



Ultimate Impact on the Nation



*Ain Shams
Univ., Cairo*

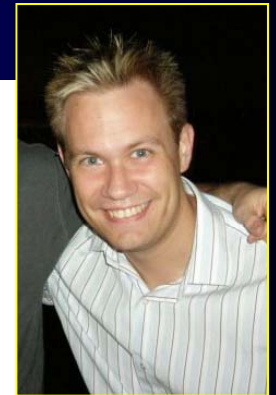


*University of Illinois
Urbana-Champaign*

*Unity
College*



University of Michigan



*Madison Area
Tech College*



UW - Madison

*Saint Lawrence
University*



Gillette College



U.S.G.S

*Purdue
University*



*Carleton
College*

*Tufts
University*



*Lawrence
University*





The CIRTL Network – Why?

- 1. No single university can develop the future STEM faculty ... but 100 universities can.**
- 2. No single university can know or prepare their students for the diversity of teaching needs across the nation.**
- 3. A learning community of universities can reap the benefits of collective experience, collaborative initiatives, and shared resources.**





Cross-Network Learning Community

CIRTL Capstone Seminar: Assessing Student Learning



CIRTL NETWORK ONLINE COURSES

Spring 2011

DIVERSITY IN THE COLLEGE CLASSROOM

INSTRUCTORS
Don Gillian-Daniel, Associate Director, Delta Program, UW-Madison and Cori Fata-Hartley, Assistant Professor, Michigan State University

SCHEDULE
Wednesdays - January 19, 2011 through April 27, 2011
11:00-12:30 ET / 10:00-11:30 CT / 9:00-10:30 MT / 8:00-9:30 PT

COURSE DESCRIPTION
Become a better college instructor by considering the complex issues of diversity and how to address them effectively in your classroom practice. Current graduate students and faculty are recognizing that the way we teach differentially impacts the success of all our students. This course is for graduate students and post-docs who have an interest in advancing diversity issues as educators. Participants in this course will take a critical yet practical look at how we define diversity and for what purposes, and discuss the ways different definitions of diversity might influence what and how we teach our disciplinary topics. Participants will also create a diversity-focused plan of action for their future teaching practice.

EFFECTIVE USE OF TECHNOLOGY IN TEACHING AND LEARNING

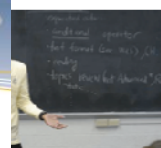
INSTRUCTORS
Alan Wolf, UW-Madison, Center for Biology Education and Folahan Ayorinde, Howard University, Professor of Chemistry

SCHEDULE
Thursdays - January 20, 2011 through April 28, 2011
2:30-4:30 ET / 1:30-3:30 CT / 12:30-2:30 MT / 11:30-1:30 PT

COURSE DESCRIPTION
Develop new approaches to effective use of instructional technology in your teaching practice. You will learn how technological choices can affect the learning of today's diverse student populations and affect student learning. The goals of the class are: to provide participants with a foundation for choosing appropriate technological tools based on learning needs; give participants hands-on experience, through class sessions and an independent project, in the effective use of learning technologies such as interactive web applications, video/audio lectures, "clickers", course management tools; and to promote the importance and scholarship of the evaluation of instructional technology efficacy.

Enrollment is limited. All are welcome, with first option given to students at CIRTL Network Institutions. For more information on technology and equipment requirements for the course, and additional course details see www.cirtl.net/course_overview.

www.cirtl.net

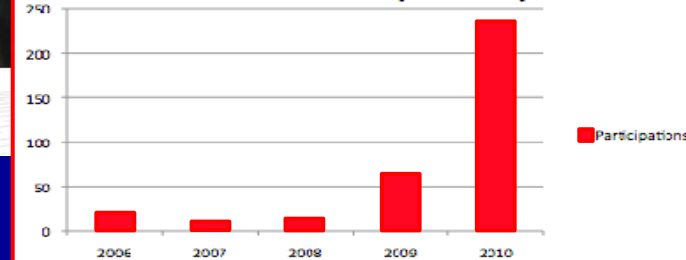


The CIRTL Network Exchange Program is a two to three day visit to a host campus within the Network. This program is designed to give applicants the opportunity to give a Teaching-as-Research colloquium and interact with disciplinary colleagues at the CIRTL Network institution. Participants also have the opportunity to practice professional skills before entering the job market.

The opportunity to present or do disciplinary research at another university is often a formative experience in a graduate student career. The same is true of teaching-as-research, and indeed disciplinary and teaching-as-research activities will each enhance the other. Our experience shows that providing a research presence both in the discipline and in teaching increases the appeal and respect of each.



Cross-Network Participations by Year





The CIRTL Network – Why?

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- 3. A learning community of universities can reap the benefits of collective experience, collaborative initiatives, and shared resources.**



CIRTL at Michigan State: Integration into Existing Programs

PLANNING ■ RESILIENCE ■ ENGAGEMENT ■ PROFESSIONALISM



MICHIGAN STATE UNIVERSITY

A GATEWAY TO YOUR CAREER
THROUGH PROFESSIONAL DEVELOPMENT RESOURCES

- Planning for career and professional goals, from entry to exit
- Resilience and tenacity through multiple career and life stages
- Engagement in decision-making and skill development
- Professionalism in research and teaching

The PREP Program offers workshops and resources for development for every stage of the graduate experience.

FAST Fellowship Program
(Future Academic Scholars in Teaching)
A mentored Teach-as-Research program

44 Fellows 2006-10

Internet Explorer - Windows Internet Explorer
http://www.msu.edu/user/gradschl/fast/

MSU FAST Fellows



Fast Fellows
Future Academic Scholars in Teaching
Michigan State University Graduate School

Menu

- Home
- FAST Fellows Bios
- CIRTL Steering Committee Bios
- Projects
- Related Programs

News

Welcome to the new web site for Michigan State University Fast Fellows

Welcome

The Graduate School at Michigan State University (MSU) and the MSU Center for the Integration of Research Teaching and Learning (CIRTL) Steering Committee are sponsoring an opportunity for graduate students—the FAST Fellowship Program (Future Academic Scholars in Teaching). The primary goals of the FAST Fellowship Program are to provide opportunities for a diverse group of graduate students to have mentored teaching experiences and to gain familiarity with materials on teaching and assessment techniques.

The FAST program is for doctoral students with interests in teaching, learning, and assessment in higher education who are enrolled in programs associated with the Colleges of Natural Science, Agriculture and Natural Resources, Engineering, and Veterinary Medicine and whose college or department has an approved Certification in College Teaching Program.** This program was developed in response to the national





Michigan State University > CIRTL Network

“Diversity in the College Classroom”

**National
Leadership**

CIRTL Network COMMITTED TO ADVANCING THE TEACHING OF STEM DISCIPLINES IN HIGHER EDUCATION

Home About News & Events Courses CIRTL Café Resources

Spring 2011: Diversity in the College Classroom

Students: * THIS COURSE IS FULL.*****

Link To Course Site for enrolled students: <http://www.cirtl.net/spring11/dcc>

Description

Become a better college instructor effectively in your classroom practice consider that the way we teach college graduate students and post-docs this course will take a critical yet many ways different definitions of diversity will also create a diversity-focus

Welcome to the CIRTL Café!

Here you can connect, network, share, and build a learning community of college graduate students, post-docs, and faculty.

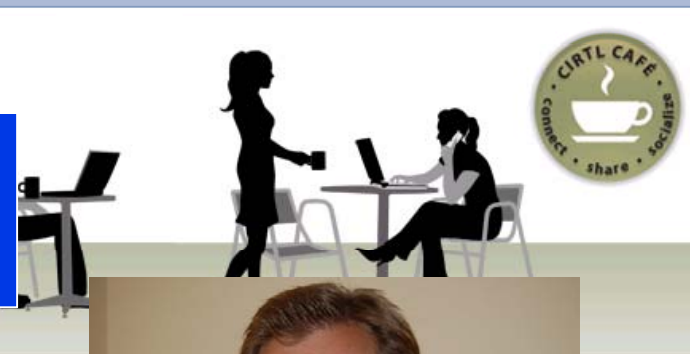
[Read more](#)



C. Fata-Hartley
*Professor of
Microbiology*

Welcome! If you are interested in accessing the full CIRTL Network website, please take a few minutes to

**Coffee
Hours**



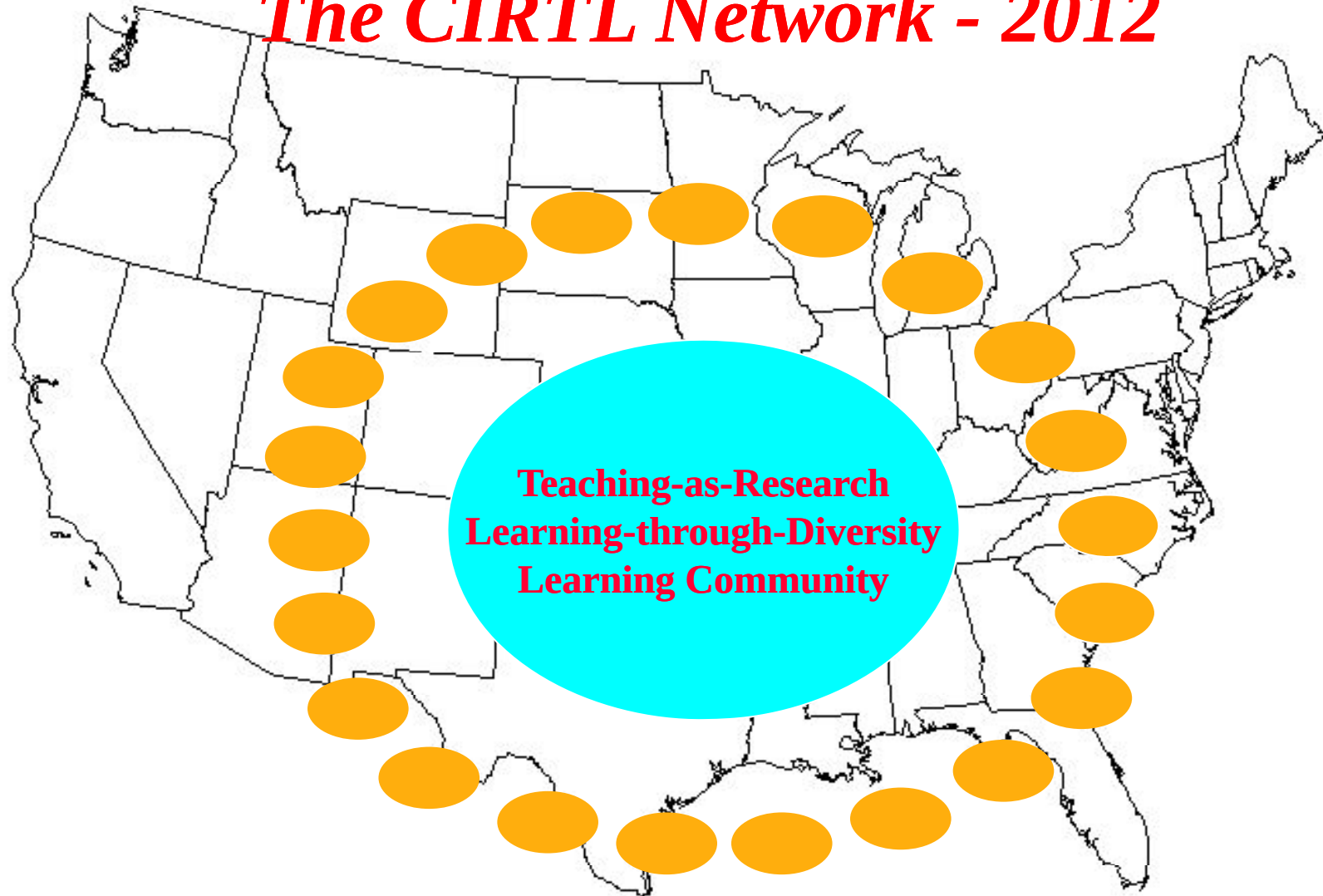
**Student
Exchanges**





The Next Step

The CIRTL Network - 2012





The Next Step

The CIRT L Network - 2012

- 2003** NSF funds CIRT L
- 2003** *Delta Program* opens as prototype
- 2005** *FAST Program* at MSU
- 2007** NSF funds CIRT L Network
- 2010** *Growth Plan* for CIRT L Network
- 2011** **Recruitment for Expansion**
- 2012** NSF Proposal *CIRT L for the Nation*





The Next Step

The CIRTL Network - 2012

Advantages for member universities:

- **NSF proposal to establish local CIRTL programs**
- **Diverse Cross-Network programs for grad students and post-docs**
- **Access to developed program resources, evaluation instruments, and active community of peers**
- **National dissemination channel for local successes**
- **Leverage to enhance research funding proposals**
- **National presence as leader in graduate education**





The Next Step

The CIRTL Network - 2012

Process for Expansion:

March 14, 2011	Application process opens
April 15, 2011	Video/telecon for Q&A
April 22, 2011	Letter of Intent deadline
May 20, 2011	Video/telecon for Q&A
May 27, 2011	Application deadline
Summer, 2011	Review of applications
October, 2011	CIRTL Network Meeting, Madison, WI





The Next Step

The CIRTL Network - 2012

Interested?

Visit

www.cirtl.net/expansion

or

**contact Bob Mathieu at
mathieu@astro.wisc.edu**





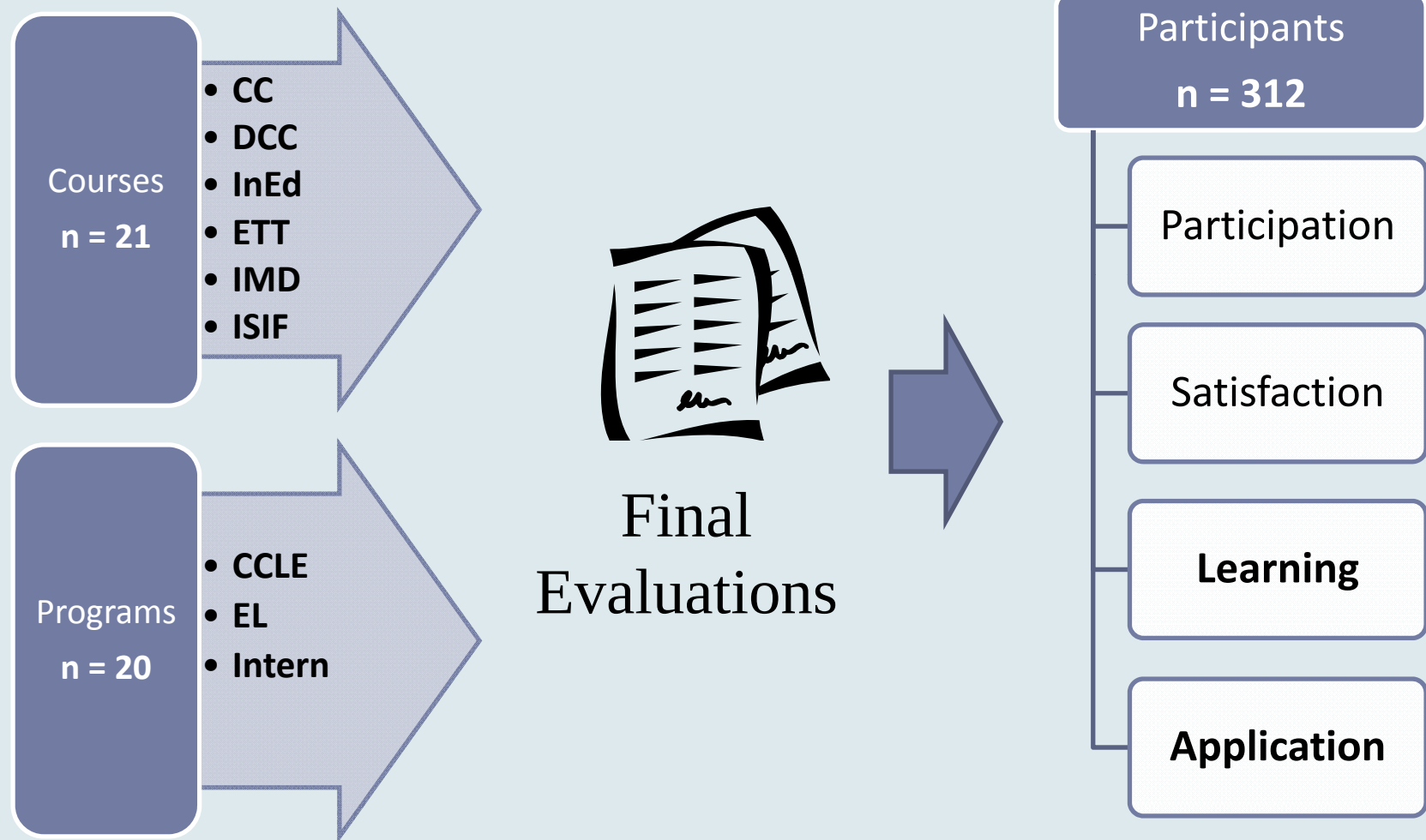
Taking Stock Research and Evaluation

- Emerging Findings: Impact on Students
 - Provide knowledge and skills
 - Especially concerning research-informed teaching



Pillar Study

Research Data



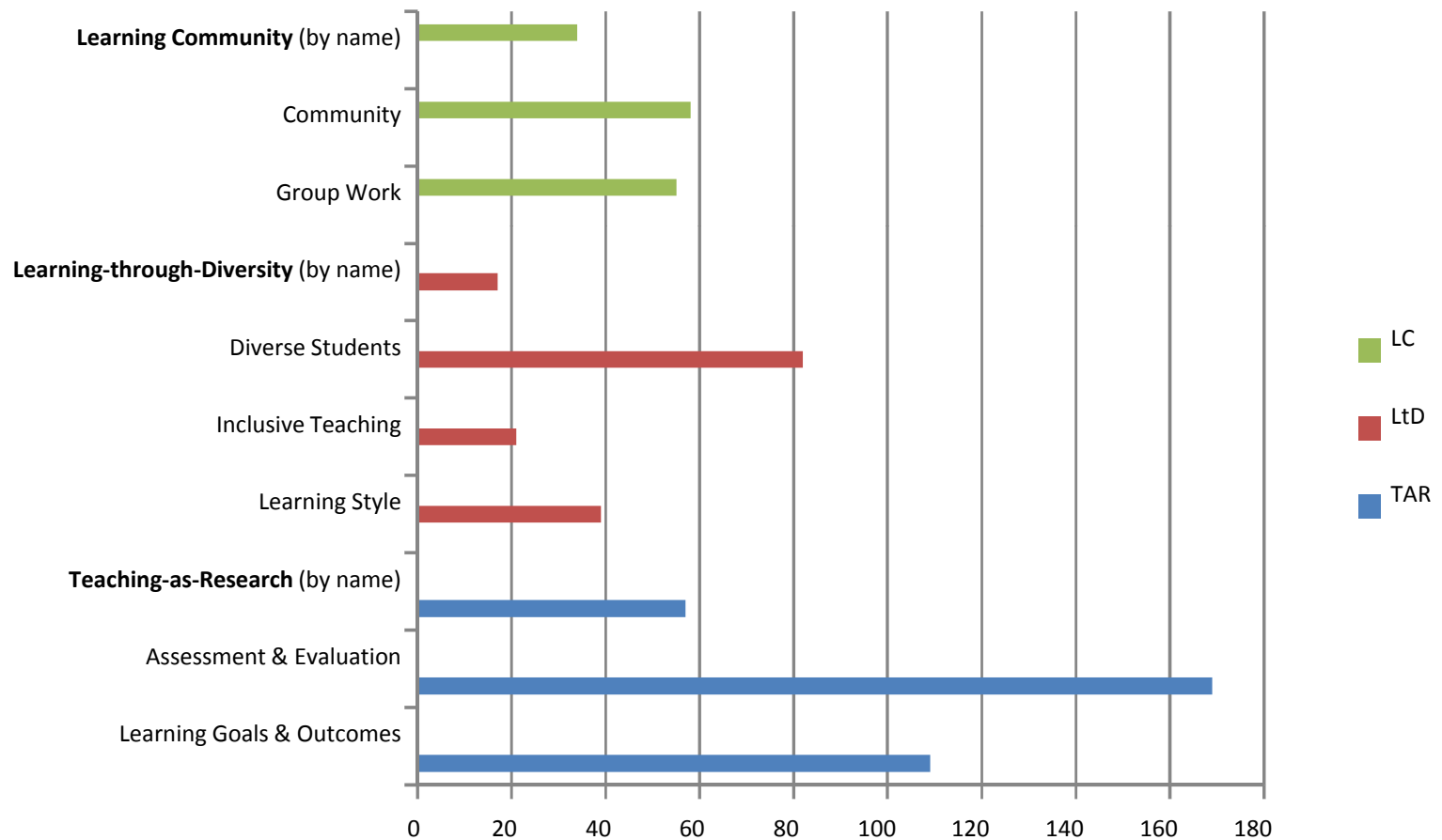
CC= The College Classroom, **DCC** = Diversity in the College Classroom, **InEd** = Informal Education, **ETT** = Effective Teaching with Technology, **IMD** = Instructional Materials Development, **ISIF** = International Students, International Faculty; **CCLE** = Creating a Collaborative Learning Environment, **EL** = Expeditions in Learning, **Intern** = Internship Seminar

Final Evaluation Questions

1. What **major concepts*** are you taking away from this course, program or activity that will affect your practice as an educator? If possible, please give 2-3 specific examples.
2. Suppose that you were **preparing to teach** some scientific concept from your discipline (e.g., the nitrogen cycle, amplitude, statistical significance, human development in early childhood). **Describe the steps that you would take to do so**, based on what you've learned in this course, program or activity.

*Please note: Questions did NOT specifically ask participants to name or describe the pillars

Pillar Related Themes





Taking Stock Research and Evaluation

- Emerging Findings: Impact on Students
 - Provide knowledge and skills
 - Especially concerning research-informed teaching
 - Influence attitudes and values – self-report
 - Better prepared for undergraduate teaching
 - Greater sense of self-efficacy regarding teaching
 - Better prepared for various faculty roles
 - Value opportunities for teaching-as-research
 - Provide opportunities for interaction with others with similar interests





Taking Stock Research and Evaluation

- Emerging Findings: Cross-Network Courses
 - Student ratings of courses are high (4.25/5.0)
 - Students appreciate exposure to diverse ideas and experiences provided through interaction with classmates and faculty





Taking Stock Research and Evaluation

- Emerging Findings: Network
 - The CIRTL inter-institutional network functions as a learning community and contributes to institutional learning about ways to support doctoral students' professional development.
 - Benefits:
 - Opportunities to share ideas about resources, evaluation instruments, and programs
 - The intellectual template (i.e., the CIRTL Pillars) for organizing a coherent, effective graduate professional development program
 - Encouragement provided by examples of CIRTL impact and success





What is CIRTL about?

**Preparing
graduate students and post-docs
for
successful careers
that integrate
forefront research
and
superb teaching and learning**

