Innovative Ways to Engage Students in STEM

Dana Richter-Egger
UNO Math-Science Learning Center Director
Context

- Omaha metro area
  - Pop ~750,000

- The University of Nebraska at Omaha
  - A metropolitan university of ~14,000 students

- Chemistry Department
  - 500-600 students in Gen Chem I per year
  - Undergraduate only
4 projects – briefly

- UNO Math-Science Learning Center
- STEM Talent Expansion Program
- Course Integration of Early-Undergraduate Research
- College of Education Collaboration
1: MSLC - Mission

To increase student learning achievement in Math and Science
To foster sustained learning
And to advance the academic community in Math and Science most interested in student success.

The MSLC strives to aid the entire spectrum of UNO students.
MSLC - Quick Facts

- Student centered
- Faculty connected
- Campus hub/partner
- Highly visible location
- Permanent budget
- ~1300 student visits/week

Improved my grades? 84%
Would have otherwise dropped a course? 36%
MSLC – Annie’s Story

The word SCIENCE was a synonym to me of TRAUMATIC experiences from Junior High.

I was tempted to drop out again thinking that "I'm just NOT a science person“…when I saw a sticker that read "new TUTORING SCIENCE CENTER AT DURHAM".... I was there last week and have been attending ever since.

Today, thanks to little sessions that complement my work at home and in class with WONDERFUL YOUNG TUTORS I have gotten A's in all my science tests...A’s!!!!!!!

For the first time in my life I can say proudly that I love Science.
2: STEP

STEM Talent Expansion Program
2004-2009

1. Articulation of complete STEM programs MCC → UNO
2. Scholarships to help attract and retain students
3. Expand, align, and strengthen experiential education opportunities and student support services
4. Develop new STEM degree/certificate options
5. Increase outreach and recruitment initiatives targeting prospective STEM students.
Pathways – made straight

- **Articulation of Complete Programs (MCC → UNO) Is Now Available in Seven STEM Areas**
  - biology, chemistry, biotechnology, mathematics, physics, bioinformatics and computer science

- **Six New Associate Degrees Created at MCC**
  - pre-biology, pre-biotechnology, pre-chemistry, pre-mathematics, pre-physics, and pre-bioinformatics

- **Three New Bachelor’s Degrees (or Degree Tracks) Created at UNO**
  - Bioinformatics, Information Assurance, Medicinal Chemistry

- **Math-Science Learning Center** – opened Sep 2007
- **MCC STEM Recruitment Coordinator**
- **Increased Undergrad Research Awareness**
## UNO STEM Graduates

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### NSF STEP Grant
- 22% increase

*The chart includes data from 1999-00 to 2008-09 for various STEM subjects.*
### MCC Student Activity

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<th>03-04</th>
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3: Course Integration of Early-Undergraduate Research

- Drinking water analysis
- Soils analysis

- Analysis of archeological samples
- Phytoremediation studies and geochemical prospecting
- Acid and mineral analysis of rain water
- Collaboration with sociology studying lead in hair samples
EUR Structure

- **Geology students collect samples** which are then distributed to the chemistry students
- **Chemistry students analyze samples** and return the analysis data
  - Accompanied by an **oral presentation** of the method, techniques and experimental uncertainty
- **Geology students analyze the data** for geologic/geographic correlations
  - Followed by an **oral presentation** of the findings/conclusions to the chemistry students
EUR Topics

- **Why lead in soil?**
  - Within the city of Omaha is a well documented area of lead contamination currently being remediated (EPA Superfund)
  - Health/community impact
  - Multiple possible sources of lead origin
    - Lead smelting plant, paint chips, leaded gasoline, others?

- **Why drinking water?**
  - *We all use/consume it on a daily basis*
  - It is variable
    - By day, geography, home, etc.
  - Its quality is closely monitored/regulated
Important Factors

- Relevant
- Accessible
- New/fun/exciting
- Repeatable
- Authentic research experience
- Equipment availability and cost
- Modern/high-tech
- Integrated into existing courses
I found this project boring.

This lab course would benefit from more research based projects.

I felt like I was doing work similar to a real scientist.

This project increased how much I like science in general.

I found this project to be interesting.

Percent Agree

education
geology
chemistry
4: College of Education Collaboration

- NU-Teach (modeled after U-Teach)
  - Increase the number of STEM graduates
  - Double the number of secondary math and science teachers
  - Strengthen the content knowledge of current and future math and science teachers
  - Features targeted freshmen recruitment, targeted content and pedagogy courses and inquiry based experiences
General challenges to overcome

- Lack of faculty time
- Faculty resistance to change
- Isolated courses
- Generational differences
- Perceptions and misconceptions
- Students’ self-confidence in science
- Social isolation (e.g., ethnic, gender)
- Short-term reward mindset
- Summer attrition
Acknowledgements

- The National Science Foundation
  - NSF-DUE STEP award #336462
  - NSF-DUE CCLI award #0411164
  - Nebraska Research Initiative award
  - NASA Nebraska Space Grant
For more information visit

www.unomaha.edu/STEP

www.unomaha.edu/MSLC

water.unomaha.edu