What Advisors and Faculty Need to Know About Science, Engineering, and Math Majors

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Project for Inclusive Undergraduate STEM Success

The STEM Gateway program is funded through a U.S. Department of Education TITLE V grant, 2011-2016, 100% grant funded (total anticipated funding $3.82 million).
What Advisors and Faculty Need to Know About Science, Engineering, and Math (STEM) Majors

Objectives:

• A dialogue to improve understanding about the challenges STEM students face in pursuing and completing their degrees

• Explanation of STEM Gateway components that can assist advisors in their work with students
Which area of study for a major is of greatest interest to incoming UNM freshmen?

A. Social and behavioral sciences
B. STEM (physical/natural sciences, engineering, math)
C. Humanities or foreign languages
D. Education
E. Business administration
STEM fields top the list of aspired-to majors among UNM freshmen

Summary of declared and aspired majors, UNM Fall 2006 freshmen cohort

Number of students

Fall, freshman year
Which area of study suffers the greatest loss of declared or aspiring majors at UNM after the freshman year?

A. Social and behavioral sciences
B. STEM (physical/natural sciences, engineering, math)
C. Humanities or foreign languages
D. Education
E. Business administration
STEM disciplines suffer the greatest undergraduate student attrition.

Summary of declared and aspired majors, UNM Fall 2006 freshmen cohort
Based on national studies, which of these aspects of pursuing a STEM degree is of greatest concern to STEM majors?

A. Tests in STEM courses are too hard.
B. Poor teaching in STEM courses
C. The rigor of STEM courses compared to non-STEM classes
D. Course curriculum for STEM degrees is overwhelming
Faculty instructional and curricular choices are the top reasons that students leave STEM majors; but curriculum complexity is also a factor

(Seymour and Hewitt, 1997, *Talking About Leaving*)
Discover the Disciplines:

- Pre-Calculus Math
- Calculus
- Physics
- Chemistry
- Biology
- Statistics
- Earth & Planetary Sciences
- Math
- Physics & Astronomy
- Engineering
- Computer Science
- Environmental Science

Disciplinary foundations

STEM GATEWAY
“Killer courses” are significant challenges to student persistence

Courses enrolling more than 100 students and where >20% do not complete with a C or higher grade

Spring 2011:
• 81 courses with 27,858 “enrollments”
• Account for 1/3rd of undergraduate SCH
• 8846 “enrollments” did not succeed in these courses
STEM courses are prominent entries on the “Killer course” list.
Student preparation for science and math courses lags other fields (based on ACT)

ACT Benchmark
50% chance of B or higher; 75% chance of C or higher in entry level:
- English Composition
- Algebra
- Social Science
- Biology

University of New Mexico Project for Inclusive Undergraduate STEM Success (STEM Gateway)

- STEM Gateway aims to increase the number of Hispanic and other low-income students attaining STEM degrees
- Participation is open to all students
- The positive impact of STEM Gateway initiatives will be felt by the entire STEM student population
1st Year Funding $608,000

Funded by: U.S. Department of Education

$3.8 Million over 5 years

Program Description:
• This project concentrates on widening the gateway for student success in courses that commonly represent barriers for pursuing STEM degrees at UNM, by **addressing the instruction and pedagogy in STEM Gateway courses that have traditionally had low student success rates**
STEM Gateway Components

- Peer Learning Facilitators
- Institutional Research
- STEM Student Interest Groups
- Gateway Course Reform
PLF Section
Project includes:
• Peer Learning Facilitator training
• MOUs with instructors
• In-class assistance with active learning
• Out-of-class office hours held by PLFs
• Survey of student satisfaction completed by enrolled students

Peer Learning Facilitators: Peer-assisted collaborative learning activities in large gateway sections. The assistance of peer learning facilitators allows instructors to incorporate a wider variety of effective instructional strategies.
What students in PLF-supported classes tell us:

To what extent does working with other students in class help you learn more than you would otherwise?

- A great deal
- Considerably
- Moderately
- Slightly
- Not at all

Fall 2010/Spring 2011 PLF-class surveys

n = 2650
What students in PLF-supported classes tell us:

To what extent do the PLFs help you learn effectively when your classmates and you are working together in class?

Fall 2010/Spring 2011 PLF-class surveys

n = 2642
STEM Student Interest Groups: One-credit shadow seminar courses that connect core STEM courses to other STEM majors. These courses introduce students to the connections between STEM disciplines, while encouraging them to explore their own career and professional interests.
“SSIG”s for Fall 2012 – UNIV 175

HELP! Please help us fill these sections

Chemistry 121
Math 150
Physics 151
Math 180

STEM Student Interest Groups for
STUDENTS EXPLORING BIOLOGY DEGREES

STEM Student Interest Group for
STUDENTS EXPLORING CHEMISTRY DEGREES

STEM Student Interest Groups for
STUDENTS EXPLORING DEGREES IN EARTH
& PLANETARY SCIENCES AND
ENVIRONMENTAL SCIENCES

STEM Student Interest Groups for
STUDENTS EXPLORING ENGINEERING DEGREES
Gateway Science and Math Course Reform: Faculty-driven projects designed to change instruction and curriculum to better serve low-income and minority students.
Institutional Research Strategies

• Develop deeper understanding of our Hispanic and Low Income students exploring STEM degrees
• Better understand why Hispanic and Low Income students shift away from STEM degrees
• Answer specific research questions related to Hispanic and Low Income students and STEM disciplines

Institutional Research Progress:

• Working on a cohort comparison analysis
• Nearly completed with an analysis of which math courses were taken by successful STEM graduates
• Conducting a qualitative study into the STEM student experience as perceived by Hispanic students
• Key research questions have been defined

Data-driven Prioritization: Data collection and analysis to assist UNM in better understanding the course-taking patterns and success rates of UNM students and CNM transfers in relation to STEM degree attainment.
Where Transforms

SSIGs  Course Reform  PLFs

Reason for switching to non-STEM major
Concern for students who switched
Concern for students who did not switch

Turned off to science
Better education, interest in non-STEM major
Poor teaching by STEM faculty
Curriculum overload

(Seymour and Hewitt, 1997, Talking About Leaving)
Curricular pathways for STEM majors are complicated by prerequisites

STEM faculty and departmental advisors want to work with these students as soon as possible, even if the students have not yet been admitted to Engineering or Arts & Sciences.
FROM AN ADVISOR’S PERSPECTIVE

How do you feel the STEM learning experience could be improved?

What does the STEM Gateway program need to know in order to better serve STEM students?