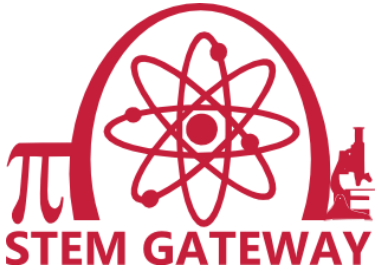
# What Advisors and Faculty Need to Know About Science, Engineering, and Math Majors

**Gary Smith**
**Director, Office of Support for Effective Teaching**
**Professor, Earth & Planetary Sciences**

**Tim Schroeder**
**STEM Gateway Project Director**




## 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

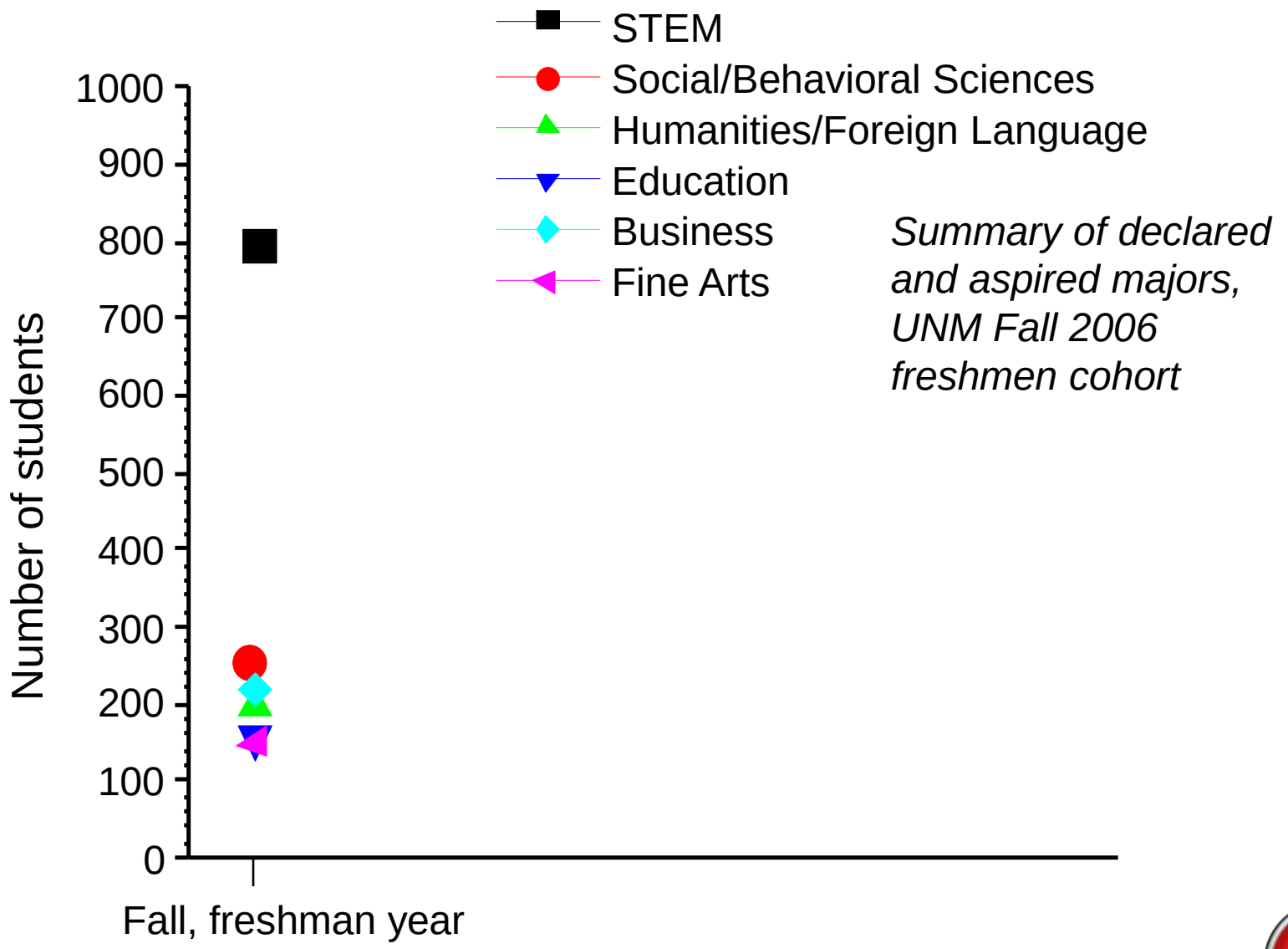
Objectives:

- 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

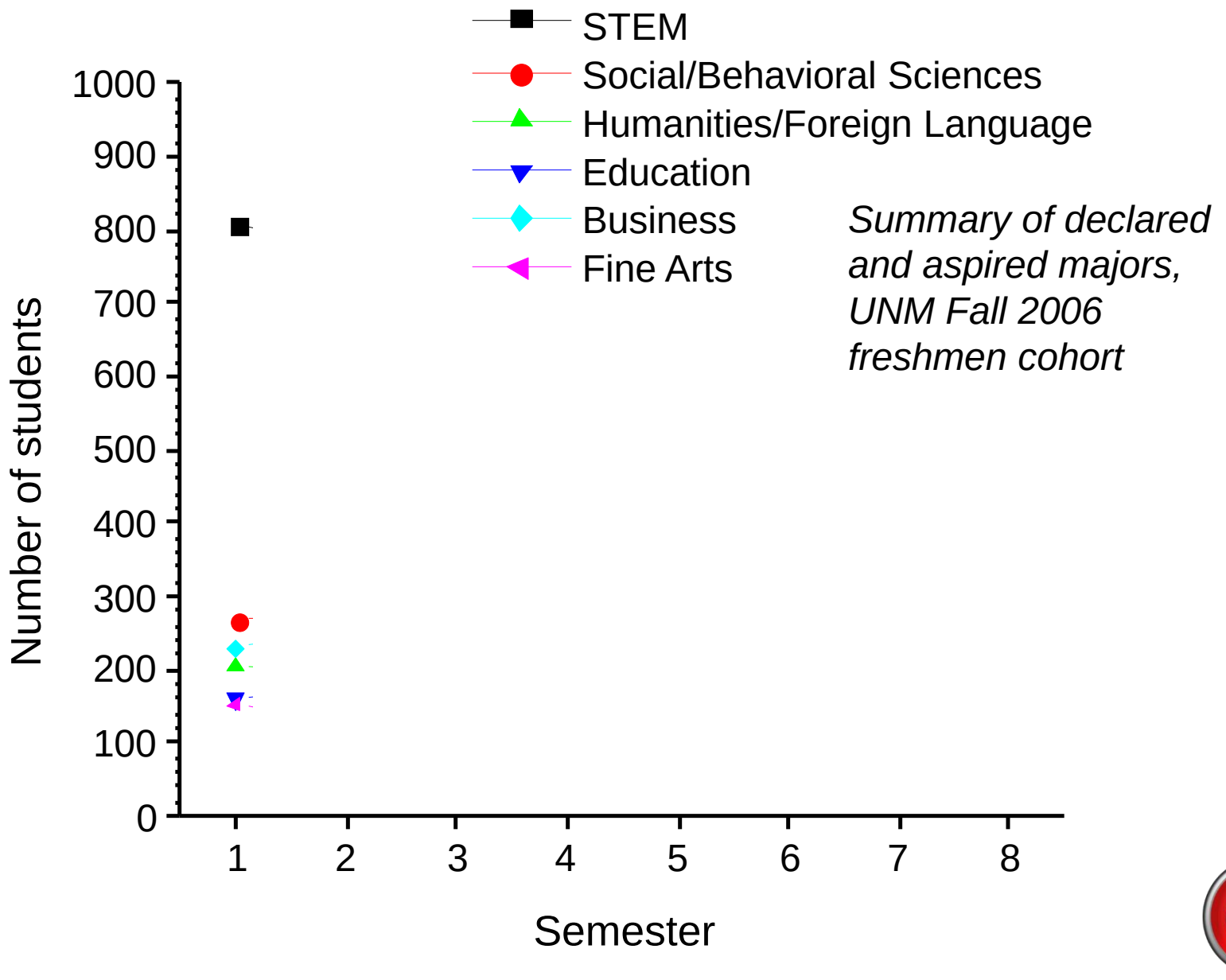



*Summary of declared and aspired majors, UNM Fall 2006 freshmen cohort*


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

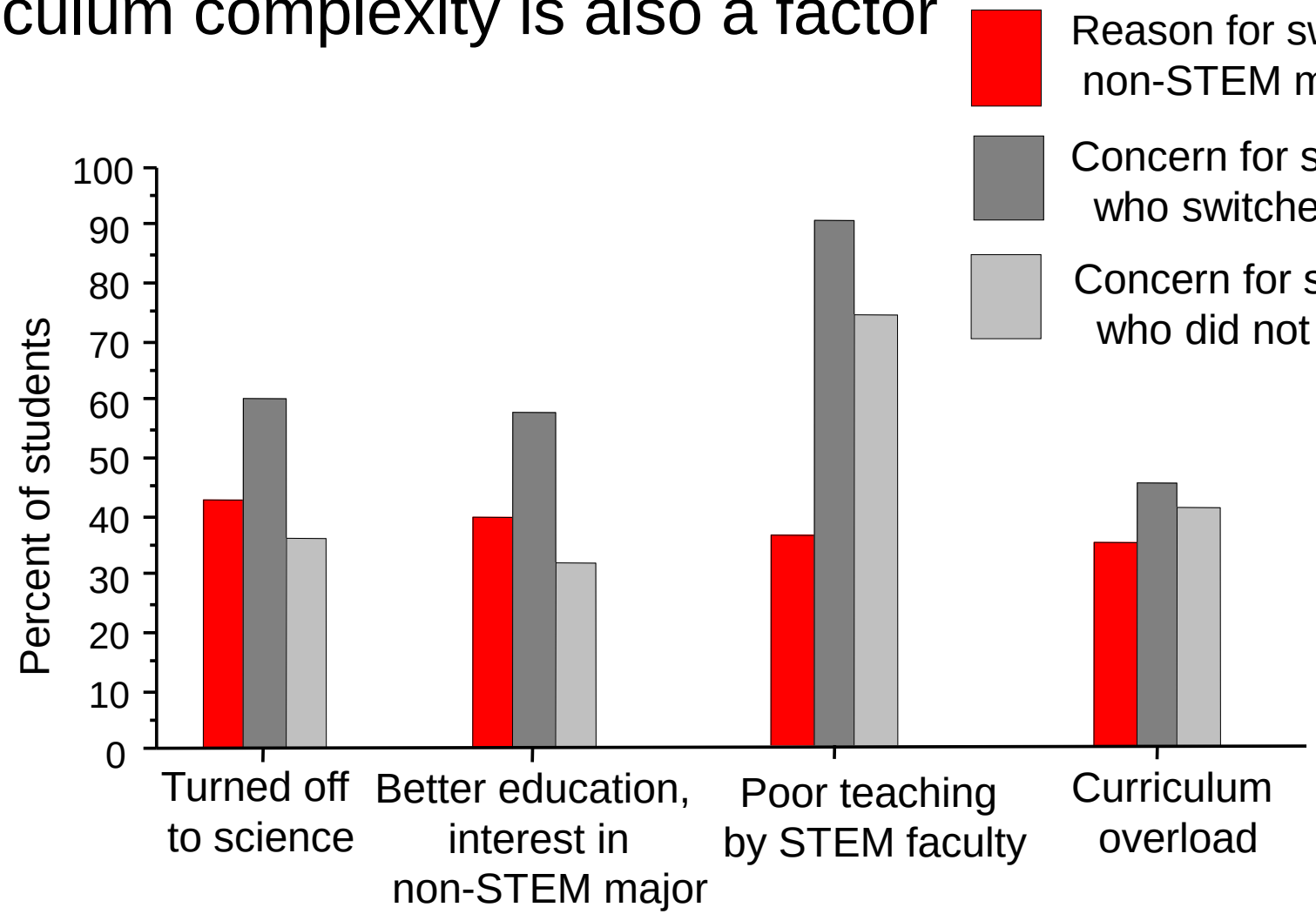
# STEM disciplines suffer the greatest undergraduate student attrition.



Based on national studies, which of these aspects of pursuing a STEM degree is of greatest concern to STEM majors?

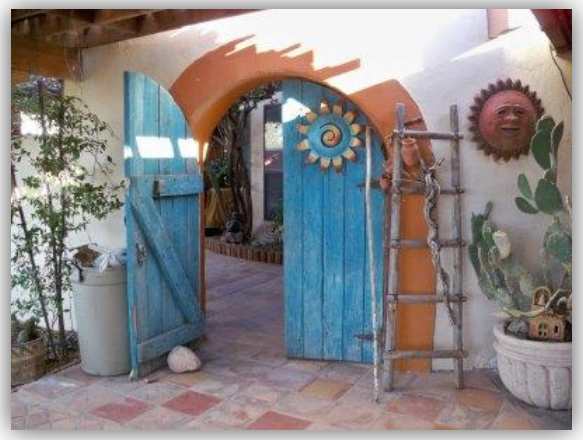
A. Tests in STEM courses are too hard.
B. Poor teaching in STEM courses
C. The rigor of STEM courses compared to non-STEM classes
D. Course curriculum for STEM degrees is overwhelming

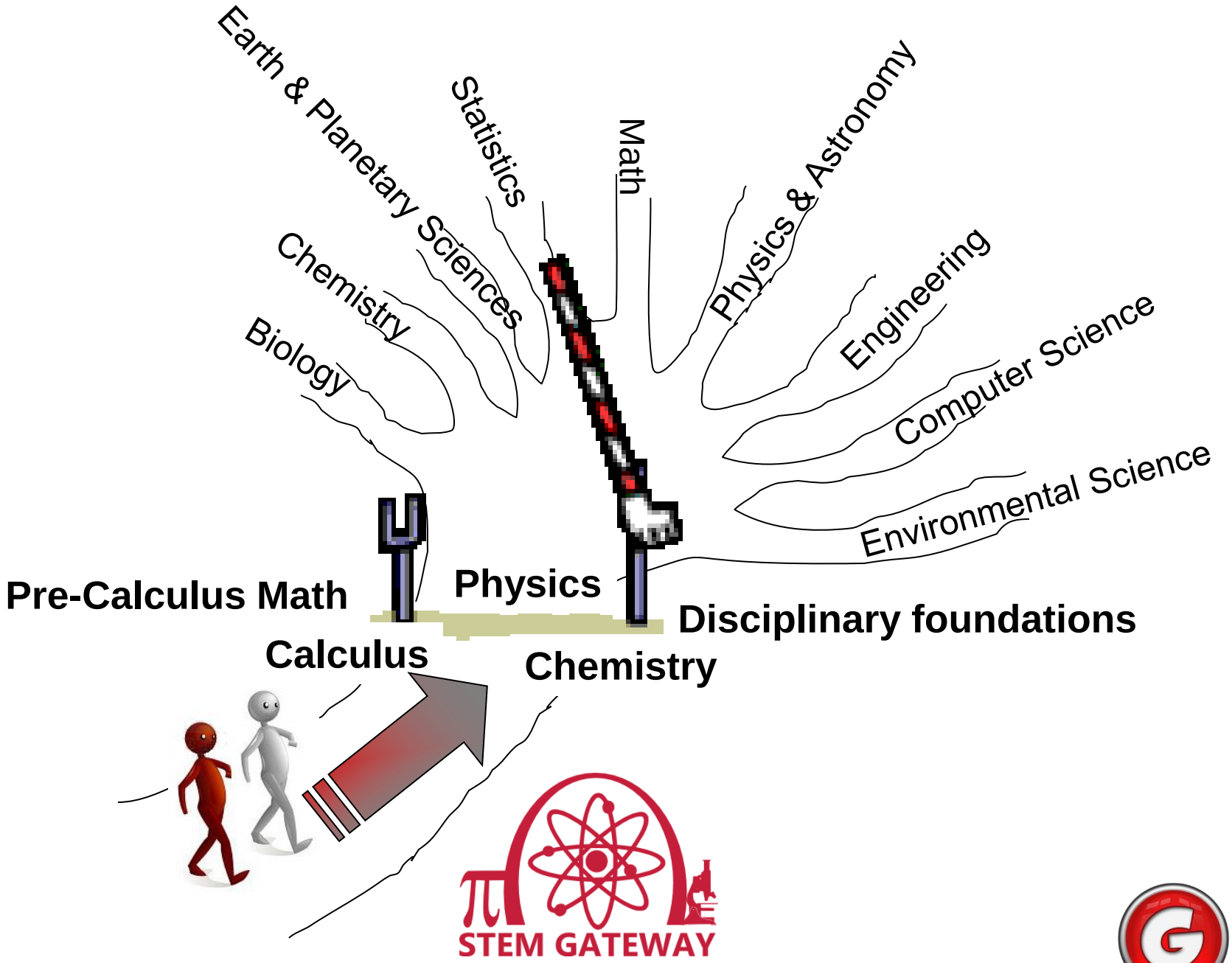
# Faculty instructional and curricular choices are the top reasons that students leave STEM majors; but curriculum complexity is also a factor




(Seymour and Hewitt, 1997, *Talking About Leaving*)

STEM GATEWAY



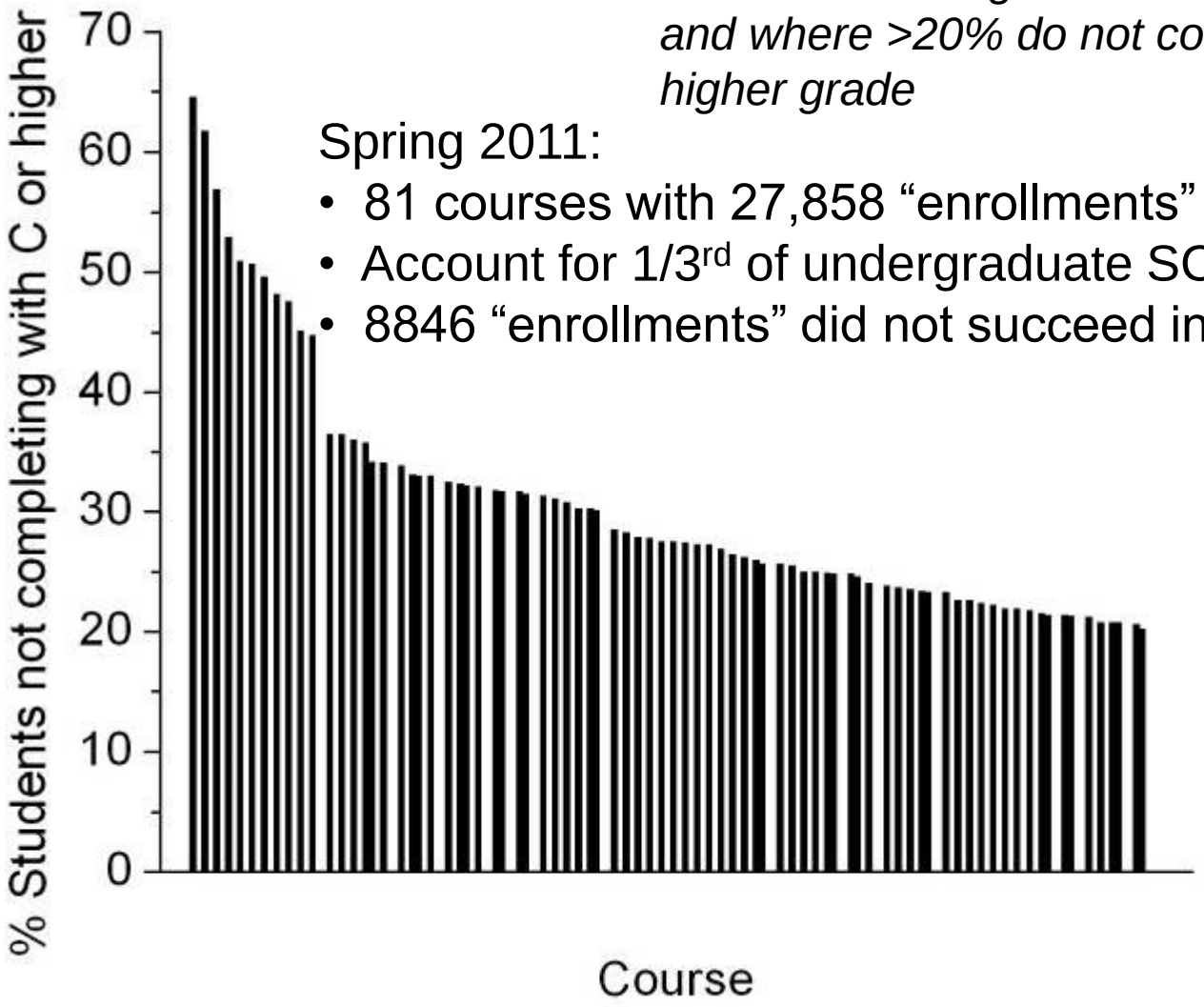

Earth & Planetary Sciences
Statistics
Math
Physics & Astronomy
Chemistry
Biology
Engineering
Computer Science
Environmental Science
Pre-Calculus Math
Physics
Disciplinary foundations
Calculus
Chemistry
STEM GATEWAY

# “Killer courses” are significant challenges to student persistence

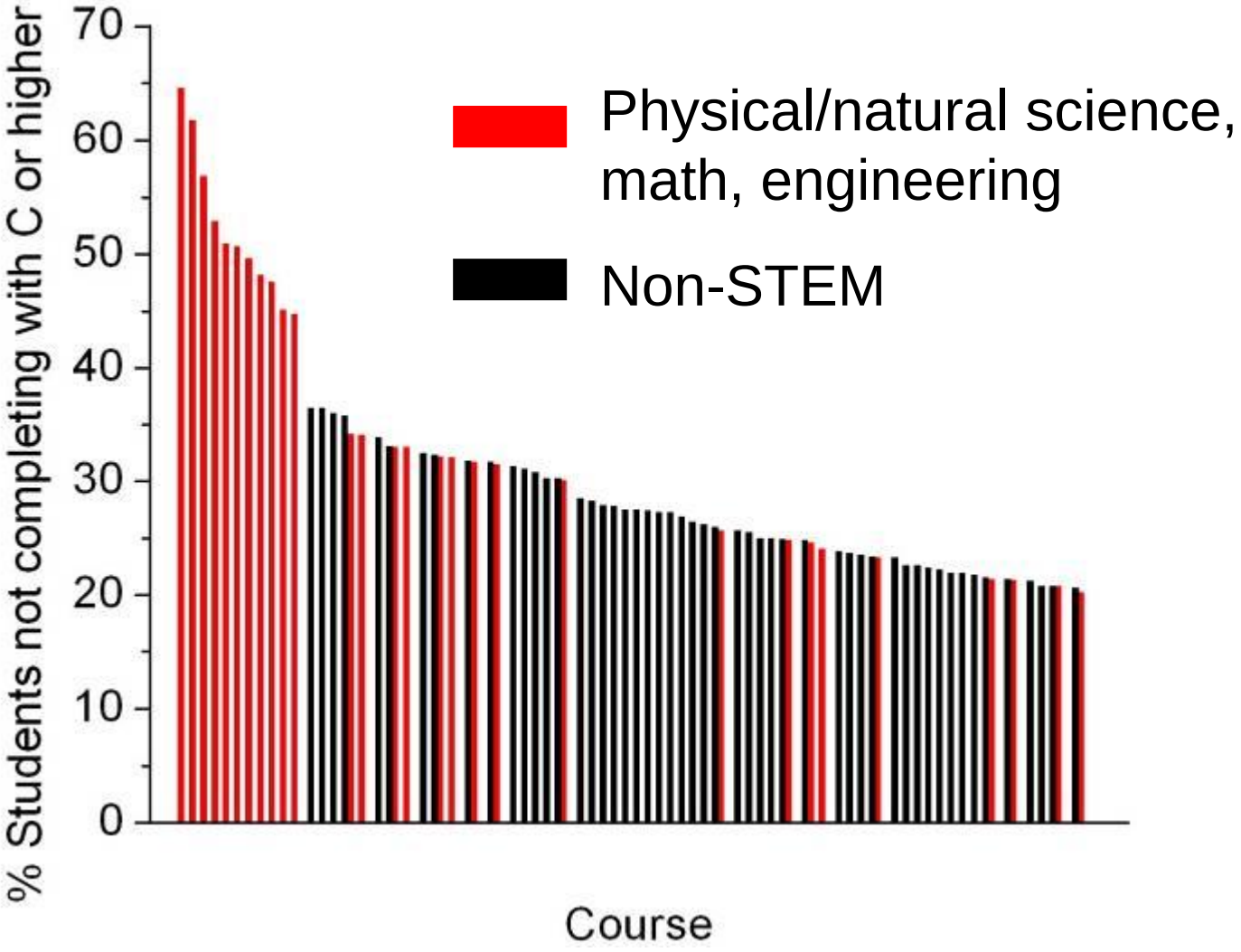
*Courses enrolling more than 100 students and where >20% do not complete with a C or higher grade*

Spring 2011:

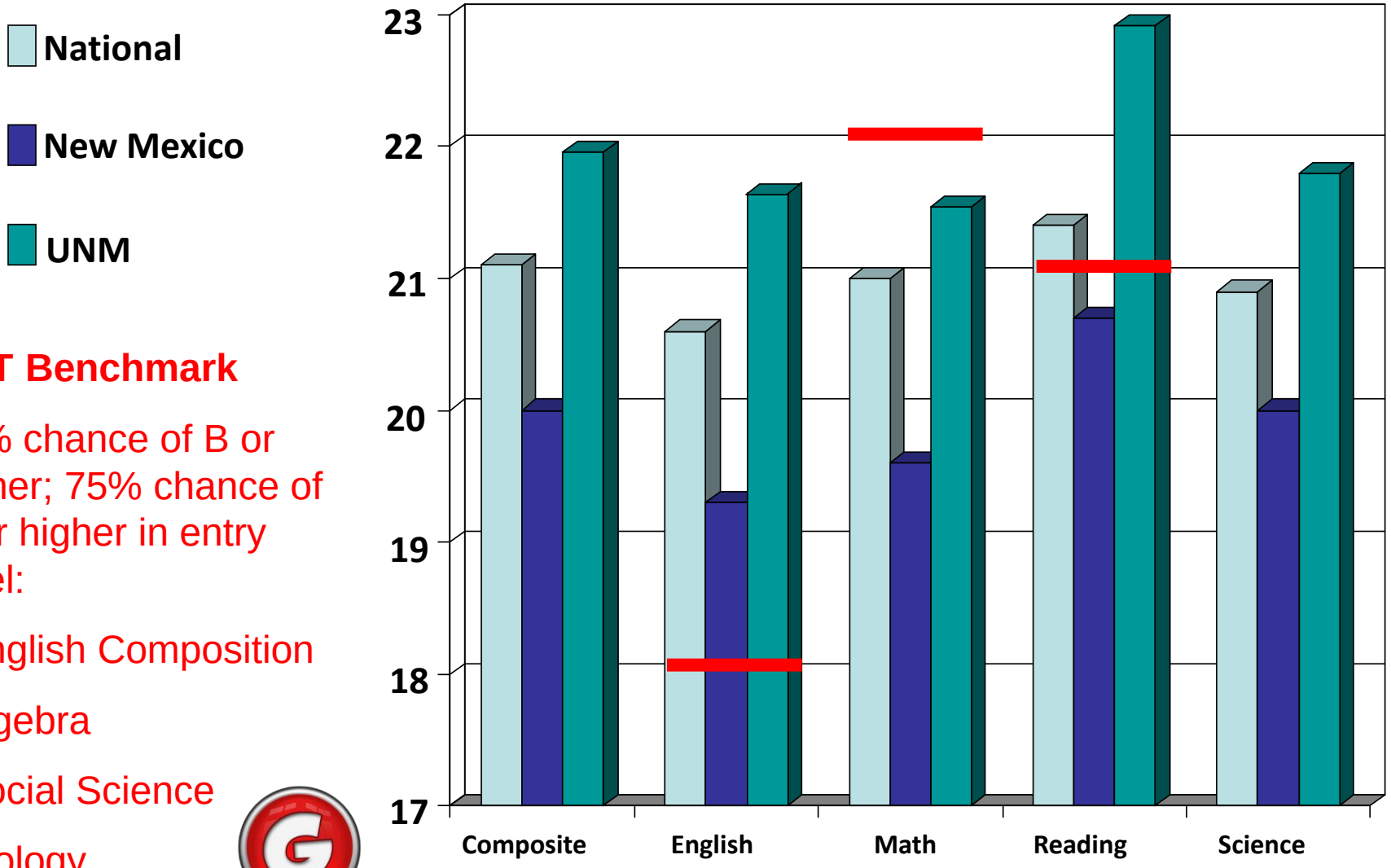
- 81 courses with 27,858 “enrollments”
- Account for 1/3rd of undergraduate SCH
- 8846 “enrollments” did not succeed in these courses



# 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

Source: ACT, 2009, Measuring College and Career Readiness, The Class of 2009

**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

# PEER LEARNING FACILITATORS

**PLF Section Project includes:**

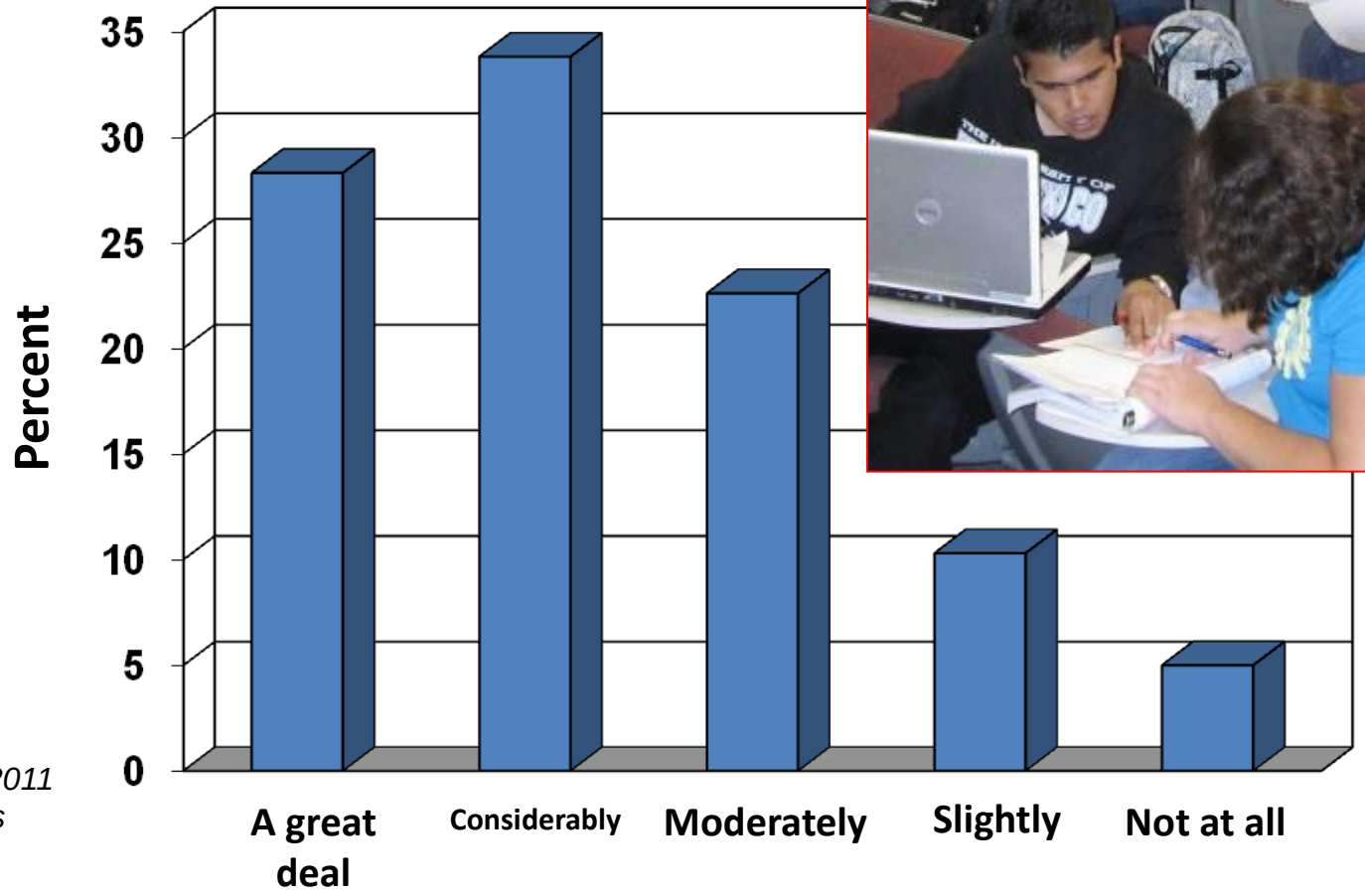
- Peer Learning Facilitator training
- MOUs with instructors
- In-class assistance with active learning
- Out-of-class office hours held by PLFs
- Survey of student satisfaction completed by enrolled students

| FA 2012 COURSES |
|---|
| Math 121-009 |
| Math 121-010 |
| Math 121-013 |
| Math 121-017 |
| Math 121-018 |
| Math 180-010 |
| |
| Physics 160-001 |
| Physics 167-001 |
| Physics 167-003 |
| Physics 167-004 |
| Physics 167-005 |
| Physics 167-006 |
| |
| Chem 121-001 |
| Chem 122-004 |
| |
| EPS 101-002 |
| EPS 101-006 |

**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?

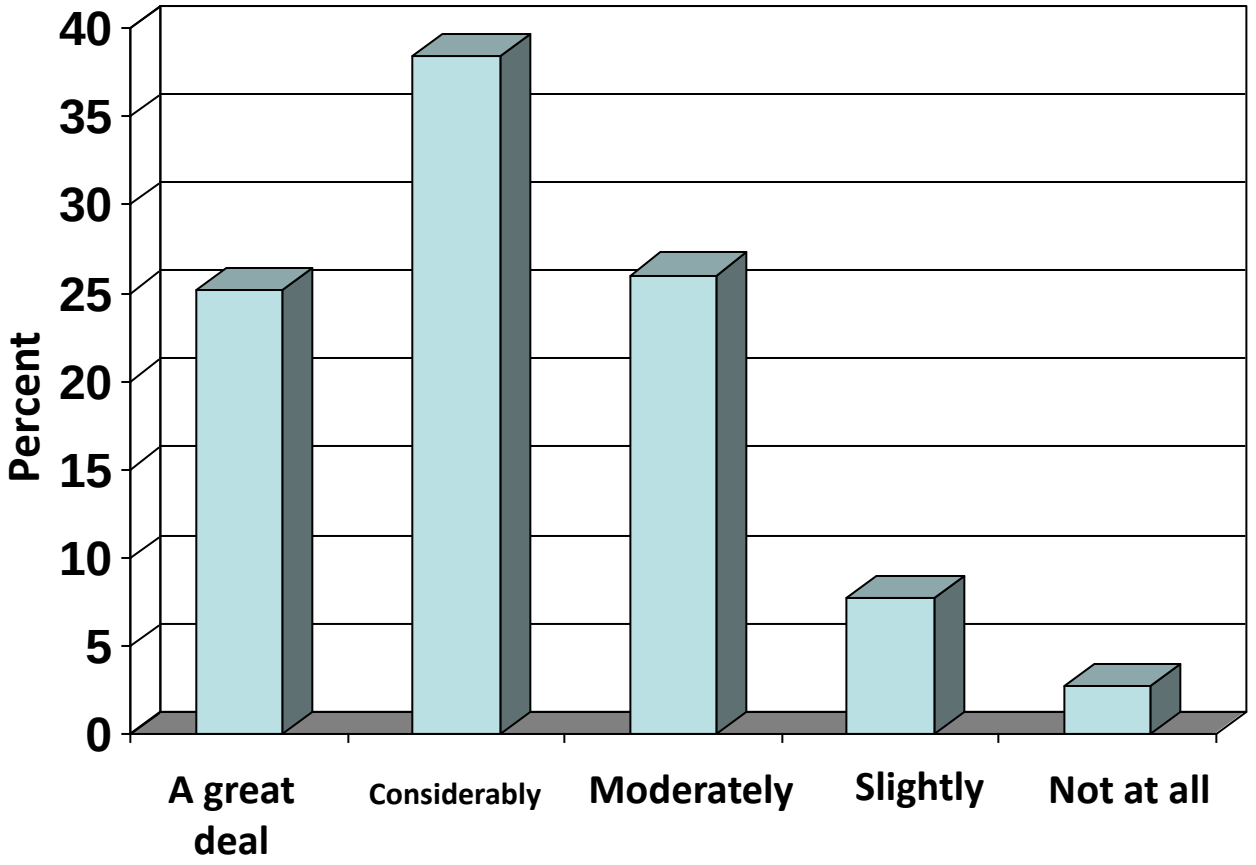



n = 2650

*Fall 2010/Spring 2011 PLF-class surveys*

# What students in PLF-supported classes tell us:

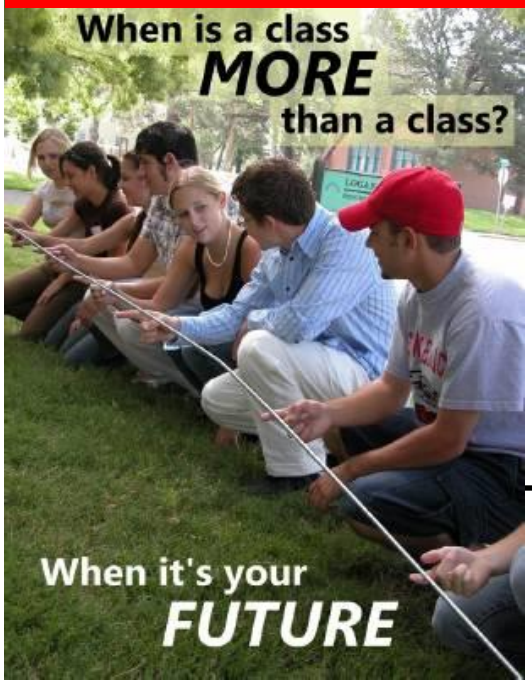
To what extent do the PLFs help you learn effectively when your classmates and you are working together in class?




*Fall 2010/Spring 2011 PLF-class surveys*

n = 2642

# STEM STUDENT INTEREST GROUPS




## Fall 2012 SSIG Sections

- 12 sections will be offered
- Course number for Fall will be UNIV 175 (eventually UNIV 190)
- Help students understand the interconnectedness of science disciplines
- Expose students to their STEM majors earlier in the college careers
- Will be taught by graduate TA's in the major disciplines
- Are listed in the Freshman Academic Choices handbook

**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

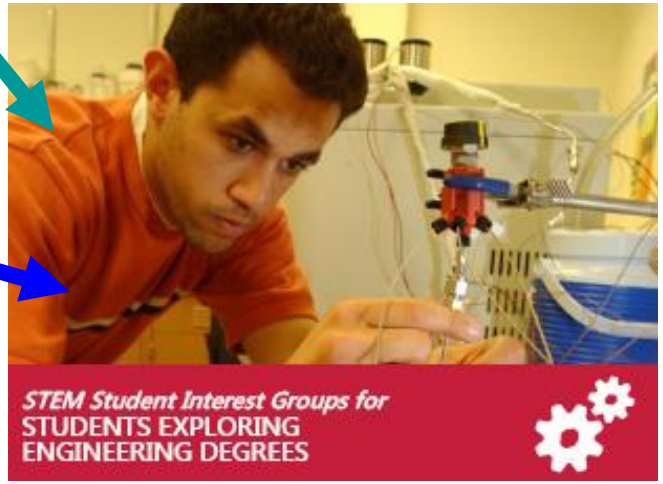
Math 180

Physics 151

Chemistry 121

Math 150



# GATEWAY COURSE REFORM

**Three sections scheduled for summer design and fall implementation:**

- CHEM 122
- MATH 121
- PHYC 160

**Course reform projects include:**

- Summer Course Design Institute
- Summer Curriculum Development and Planning
- Fall/Spring Brownbag Lunches
- Fall/Spring Pilot and Implementation

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

## Institutional Research Strategies

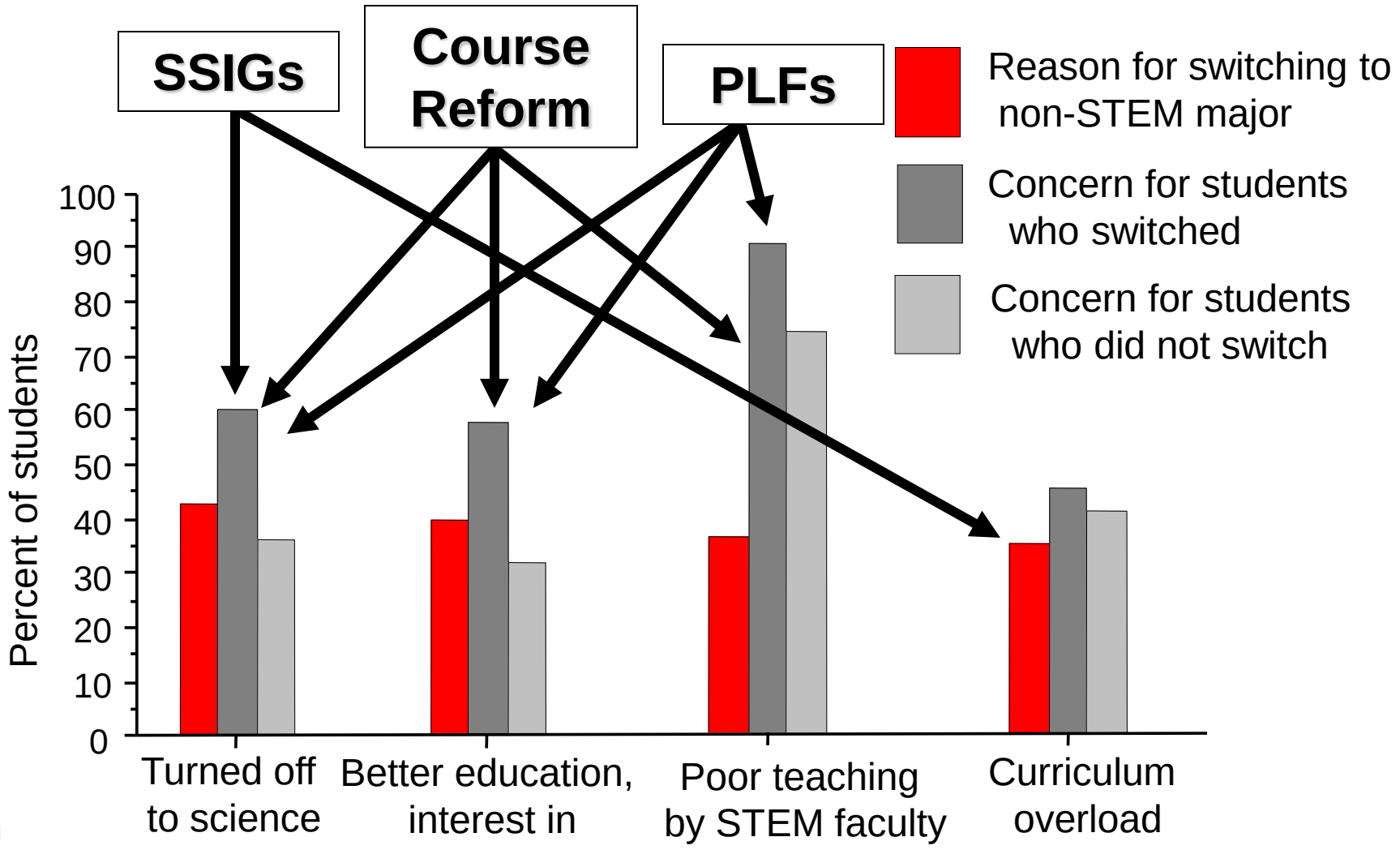
- Develop deeper understanding of our Hispanic and Low Income students exploring STEM degrees
- Better understand why Hispanic and Low Income students shift away from STEM degrees
- Answer specific research questions related to Hispanic and Low Income students and STEM disciplines

## 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 STEM GATEWAY Transforms

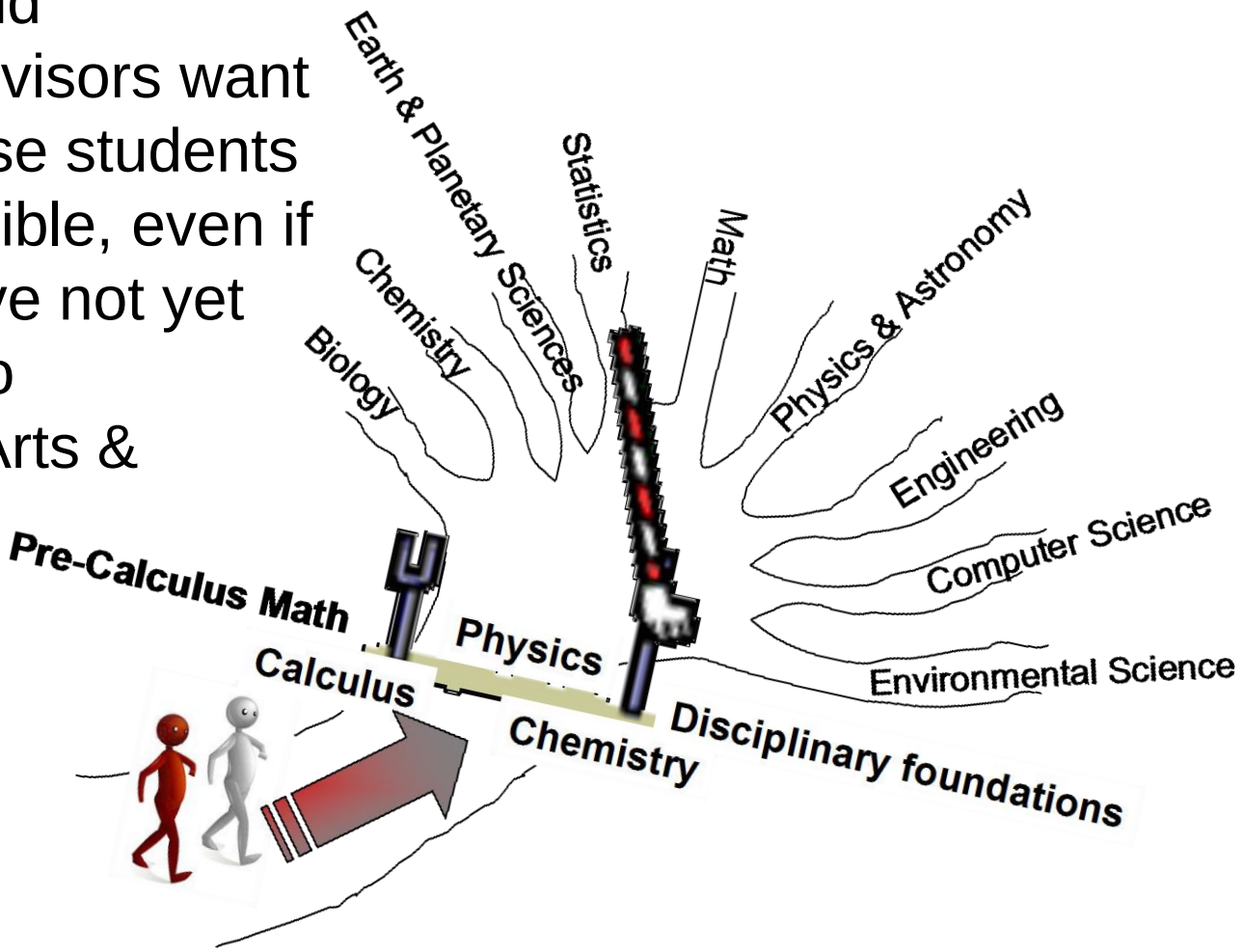



(Seymour and Hewitt, 1997, *Talking About Leaving*)

# DISCUSSION

# 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?

STEM GATEWAY