

Stop, Switch or Stay:

Research into STEM persistence at the
University of New Mexico



STEM Gateway Contact Information...

TIM SCHROEDER

Project Director

STEM Gateway Program

University of New Mexico

timschroeder@unm.edu

505-277-1761

<http://unmstemgateway.blogspot.com/>

IMPACT Tab > Presentations > Tim Schroeder's
Presentation to STEM UP



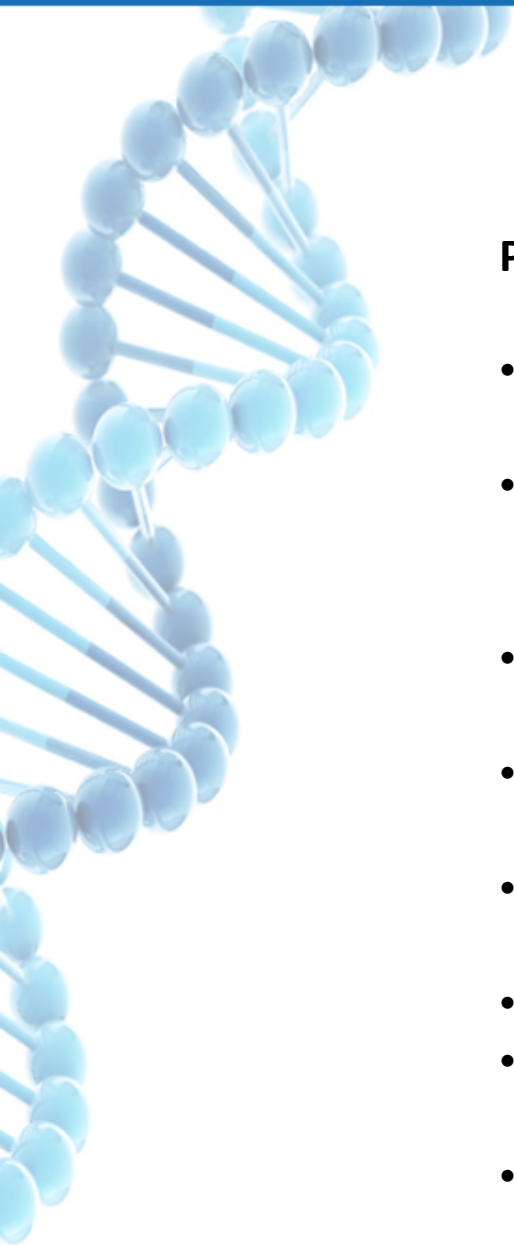
MISSION OF STEM GATEWAY:

- Improve STEM instruction and student support at the University of New Mexico
- Improve STEM graduation rates among Hispanic and/or low-income students



GRANT OVERVIEW:

- Funded by US Department of Education Hispanic Serving Institution STEM Program
- \$3.8 million over five years
- October 2011 through September 2016



Project Team

- Patrick Coulombe, Graduate Assistant, STEM Gateway, University of New Mexico
- Vicky Dueer, Senior Institutional Researcher (former STEM Gateway Institutional Researcher), University of New Mexico
- Phil Handwerk, formerly Office of Institutional Analytics, University of New Mexico
- Heidi Rodenbeck, formerly STEM Institutional Researcher, Office of Institutional Analytics
- Danielle Rudder, Graduate Assistant, STEM Gateway, University of New Mexico
- Tim Schroeder, Project Director, STEM Gateway
- Gary Smith, Principal Investigator, STEM Gateway, University of New Mexico
- Terry Turner, Office of Institutional Analytics, University of New Mexico



Goal of this Study

OUR GOAL IS TO STUDY THE UNM STEM UNDERGRADUATE STUDENT EXPERIENCE FROM BEGINNING TO END, AND WITH A REASONABLE EXPECTATION OF A MAXIMUM SIX YEAR TIME TO GRADUATION.

This information will be used to improve the STEM education experience at UNM.

This data should not be used to blame departments or individuals in any way. Our data does not go deep enough to draw such conclusions.

A light blue, semi-transparent graphic of a DNA double helix is positioned on the left side of the slide, extending from the top to the bottom.

Definition of STEM

For the purpose of this study, STEM (Science, Technology, Engineering and Mathematics) degrees are defined narrowly as those bachelor's degrees within the following disciplines: astrophysics, biology, biochemistry, chemistry, computer science, earth & planetary sciences, engineering (all majors), environmental science, mathematics, physics, and statistics.



STOP, SWITCH OR STAY...

Research Questions

Explores STEM degree completion patterns at UNM through two primary lenses:



Degree outcomes. How do undergraduate students who graduate with STEM degrees differ from those who switch majors out of STEM, and from those who stop attending UNM prior to completing their degrees?



Course outcomes. How do undergraduate STEM students perform in the core math & science gateway courses that lead into their STEM degrees?



POPULATION DESCRIPTION / DEFINITIONS

For both of these lenses, we studied:

- 1503 **first-time full-time freshmen** students from the falls of 2005, 2006 and 2007 ...
- **who initially stated they were interested in STEM degrees ...**
- **representing 16.6% of the freshman population during these three fall semesters.**

These students indicated an interest in STEM majors when completing their admissions applications, or when visiting with academic advisors during their first semesters.



DEGREE OUTCOMES LENS

Student Outcomes

This portion of the study seeks to identify patterns regarding four subsets of STEM students from the 2005, 2006 and 2007 cohorts as described above:

- **ENROLLED:** Students who are still enrolled in courses at UNM, and who indicate that as of Fall 2012 they were still working towards STEM degrees.
- **GRADUATED:** Students who graduated with STEM degrees prior to the Fall 2012 semester.
- **SHIFTED:** Students who switched out of STEM areas, but who continued taking courses at UNM. These students may or may not have graduated with degrees in non-STEM disciplines.
- **STOPPED:** Students who stopped attending courses at UNM.



Table 1. Overview of Population

Total Number of Students	1503
Number of students who changed majors out of STEM (SHIFTED)	639 (42.5%)
Number of students who graduated with STEM degrees (GRADUATED)	334 (22.2%)
Number of students who stopped attending UNM (STOPPED)	444 (29.6%)
Number of students still enrolled at UNM (ENROLLED)	86 (5.7%)



DEGREE OUTCOMES LENS

Variables

This study attempts to define patterns related to each group that could help UNM identify for whom the status quo is working best and for whom we most need to redesign the ways that we teach and support students. In exploring these patterns, we considered the following student variables:

- Ethnicity
- Gender
- Pell eligibility and median estimated family contribution (family income level)
- Lottery scholarship status
- First generation college student status
- Average high school GPA
- Average ACT scores
- ACT scores and high school GPAs correlated to account for possible grade inflation
- Cumulative college GPA at most recent semester completed
- Average number of semesters taken to matriculate into a STEM program
- Average number of remedial courses completed
- Number of credit hours completed at the time of shifting out of STEM (for “shifted” and “stopped” subgroups only)
- Number of semesters completed at the time of shifting out of STEM (for “shifted” and “stopped” subgroups only)
- Cumulative UNM GPA when shifting out of STEM (for “shifted” and “stopped” subgroups only)



COURSE OUTCOMES LENS

Definition for STEM Gateway Courses

For purposes of the STEM Gateway Title V Program, STEM Gateway Courses are defined as those which meet at least one of the following criteria:

- Entry level (100 and 200 level) program-requirement courses that lead to degrees in the approved STEM disciplines
- Companion courses (labs, problem solving courses, etc) that are connected to Core Requirement or Program Requirement courses (as specified above)
- Pre-requisite courses that are required by students to take Core Requirement or Program Requirement courses (as specified above)
- Large-enrollment (>500 students/year) courses required for degrees in the approved STEM disciplines and typically taken within the first two years in the field.





GATEWAY COURSES STUDIED

BIO	201	Molecular Cell Biology
BIO	202	Genetics
BIO	203	Ecology and Evolution
CHEM	121	General Chemistry I
CHEM	122	General Chemistry II
CHEM	123	General Chemistry I LAB
CHEM	124	General Chemistry II LAB
CHEM	301	Organic Chemistry
CHEM	302	Organic Chemistry
CHEM	303	Organic Chemistry LAB
CHEM	304	Organic Chemistry LAB
CS	152	Computer Programming Fundamentals
ECE	131	Program Fundamentals
ENVS	101	The Blue Planet
ENVS	102	The Blue Planet LAB
EPS	101	Intro Geology, How Earth Works
EPS	105	Physical Geology LAB
EPS	201	Earth History

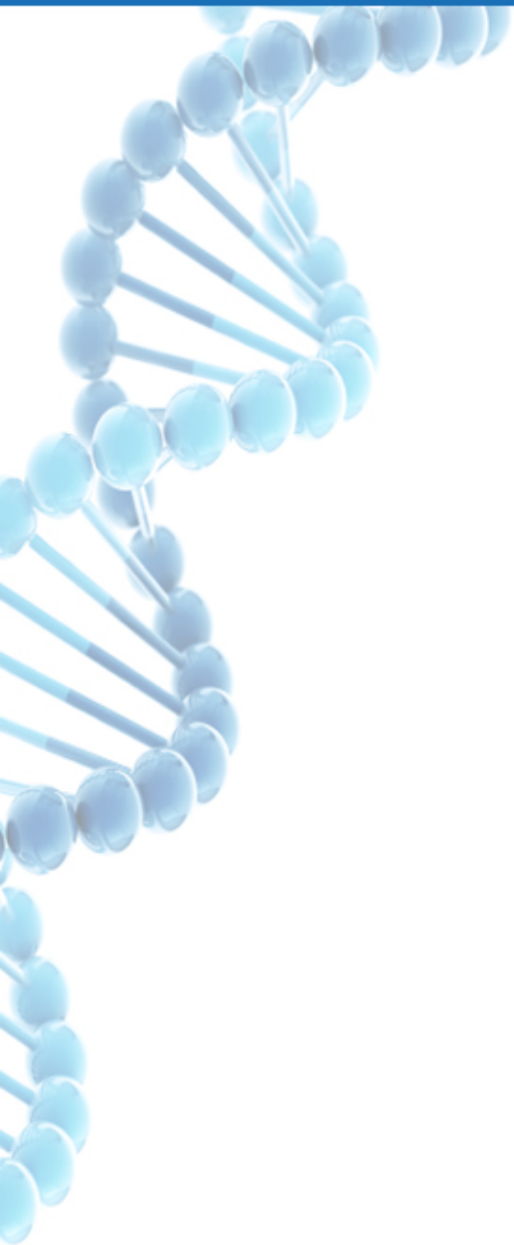




GATEWAY COURSES STUDIED, continued

MATH	107	Problems in College Algebra
MATH	110	Problems in Elementary Calculus
MATH	120	Intermediate Algebra
MATH	121	College Algebra
MATH	123	Trigonometry
MATH	150	Pre-Calculus Math
MATH	162	Calculus I
MATH	163	Calculus II
MATH	180	Elements of Calculus I
MATH	181	Elements of Calculus II
PHYC	151	General Physics
PHYC	151L	General Physics LAB
PHYC	152	General Physics
PHYC	152L	General Physics LAB
PHYC	157	Problems in General Physics
PHYC	158	Problems in General Physics
PHYC	160	General Physics
PHYC	160L	General Physics LAB
PHYC	161	General Physics
PHYC	161L	General Physics LAB
PHYC	167	Problems in General Physics
PHYC	168	Problems in General Physics





SELECTED FINDINGS DEGREE OUTCOMES LENS

SUBPOPULATIONS

Ethnicities in Students Opting to Go Into STEM



	THIS POPULATION OF STEM STUDENTS	THE GENERAL POPULATION OF FRESHMEN ONLY FROM UNM FACTBOOKS (Falls 05,06,07 combined)
Percent American Indian	6.4%	5.27%
Percent Asian/Pacific Islander/Native Hawaiian	5.5%	4.22%
Percent Black/African American	2.3%	3.29%
Percent Hispanic	35.5%	37.6%
Percent White, Non-Hispanic	46.2%	45.45%
Percent Male	62.3%	<i>Not available</i> 44.4% of general population of all UNM Main campus students
Percent Female	37.7%	<i>Not available</i> 55.6% of general population of all UNM Main campus students



SUBPOPULATIONS

Ethnicities in Degree Outcomes

	Stopped	Graduated	Enrolled	Shifted	
American Indian	48	8	4	36	96
Asian/Pacific Islander	17	25	6	33	81
Black/African American	7	7	0	20	34
Hispanic	169	94	41	229	533
Non-Resident Alien	0	1	1	0	2
Native Hawaiian	2	0	0	0	2
Race/Ethnicity unknown	15	17	7	22	61
White, non-Hispanic	186	182	27	299	694
	444	334	86	639	1503



SUBPOPULATIONS

Ethnicities in Degree Outcomes

Group within each ethnicity

	Stopped	Graduated	Enrolled	Shifted	
American Indian	50.0%	8.3%	4.2%	37.5%	100.0%
Asian/Pacific Islander	21.0%	30.9%	7.4%	40.7%	100.0%
Black/African American	20.6%	20.6%	0.0%	58.8%	100.0%
Hispanic	31.7%	17.6%	7.7%	43.0%	100.0%
Non-Resident Alien	0.0%	50.0%	50.0%	0.0%	100.0%
Native Hawaiian	100.0%	0.0%	0.0%	0.0%	100.0%
Race/Ethnicity unknown	24.6%	27.9%	11.5%	36.1%	100.0%
White, non-Hispanic	26.8%	26.2%	3.9%	43.1%	100.0%



SUBPOPULATIONS

Ethnicities in Degree Outcomes

American Indian STEM students are 2.55 times as likely to stop attending UNM ($p < .001$) and are 0.30 times as likely to graduate with STEM degrees ($p < .001$) as non-American Indian students.



MORE
LIKELY



LESS
LIKELY

	ODDS RATIO	P-VALUE
STOPPED	2.55	< .001
SHIFTED	0.80	.338
GRADUATED	0.30	< .001



SUBPOPULATIONS

Ethnicities in Degree Outcomes

Hispanic STEM students are .65 times as likely to graduate with STEM degrees than non-Hispanic students ($p=.001$).



	ODDS RATIO	P-VALUE
STOPPED	1.17	.175
SHIFTED	1.03	.827
GRADUATED	0.65	.001



SUBPOPULATIONS

Ethnicities in Degree Outcomes

Black/African American STEM students are 1.96 times as likely to switch majors out of STEM than non-African American students ($p=.001$).



	ODDS RATIO	P-VALUE
STOPPED	0.61	.341
SHIFTED	1.96	.055
GRADUATED	0.91	> .999



SUBPOPULATIONS

SES in Degree Outcomes

Pell-Eligible STEM students are 1.43 times as likely to stop attending UNM ($p=.007$) and are .46 times as likely to graduate ($p<.001$) than non-Pell-eligible students.

First Generation STEM students are 1.62 times as likely to stop attending UNM ($p<.001$) and are .42 times as likely to graduate ($p<.001$) than non-First Generation students.



PELL ELIGIBLE	ODDS RATIO	P-VALUE
STOPPED	1.43	.007
SHIFTED	1.10	.456
GRADUATED	0.46	< .001
ENROLLED	1.34	.234

FIRST GENERATION	ODDS RATIO	P-VALUE
STOPPED	1.62	< .001
SHIFTED	1.12	.380
GRADUATED	0.42	< .001



SUBPOPULATIONS

Gender in Degree Outcomes

Female STEM students are .48 times as likely to pursue STEM degrees ($p=.001$), and are 1.36 times as likely to switch majors out of STEM ($p=.005$) than male students.



	ODDS RATIO	P-VALUE
STOPPED	0.88	.294
SHIFTED	1.36	.005
GRADUATED	0.89	.406



Men and Women of Color

	Stopped	Graduated	Shifted	Enrolled	Total
White Male	126	114	176	23	439
Non-White Male	160	101	196	41	498
White Female	60	68	123	4	255
Non-White Female	98	51	144	18	311
Total	444	334	639	86	1503

	Stopped	Graduated	Shifted	Enrolled	Total
White Male	28.7%	26.0%	40.1%	5.2%	100.0%
Non-White Male	32.1%	20.3%	39.4%	8.2%	100.0%
White Female	23.5%	26.7%	48.2%	1.6%	100.0%
Non-White Female	31.5%	16.4%	46.3%	5.8%	100.0%
Total	29.5%	22.2%	42.5%	5.7%	100.0%

Odds Ratios (Significance)

	Stopped	Graduated	Shifted	Enrolled
White Male	0.94 (0.664)	1.35 (0.029)	0.87 (0.229)	0.88 (0.714)
Non-White Male	1.20 (0.133)	0.84 (0.211)	0.82 (0.086)	1.91 (0.004)
White Female	0.69 (0.024)	1.34 (0.069)	1.32 (0.044)	0.23 (0.001)
Non-White Female	1.12 (0.403)	0.63 (0.006)	1.21 (0.139)	1.02 (1.000)



SUBPOPULATIONS

Gender in Degree Outcomes

White females are .69 times as likely to stop attending ($p=.024$), 1.34 times more likely to graduate ($p=.069$), 1.32 times as likely to switch majors out of STEM ($p=.044$) and .23 times as likely to still be enrolled as students who are not white females ($p=.001$)



Non-white females are .63 times as likely to graduate as students who are not non-white females ($p=.006$).





SUBPOPULATIONS

Gender in Degree Outcomes

White males are 1.35 times as likely to graduate than students who are not white males ($p=.029$).



Non-white males are .82 times as likely to shift out of STEM degrees ($p=.086$) and are 1.91 times as likely to still be enrolled than students who are not non-white males ($p=.004$).





SUBPOPULATIONS

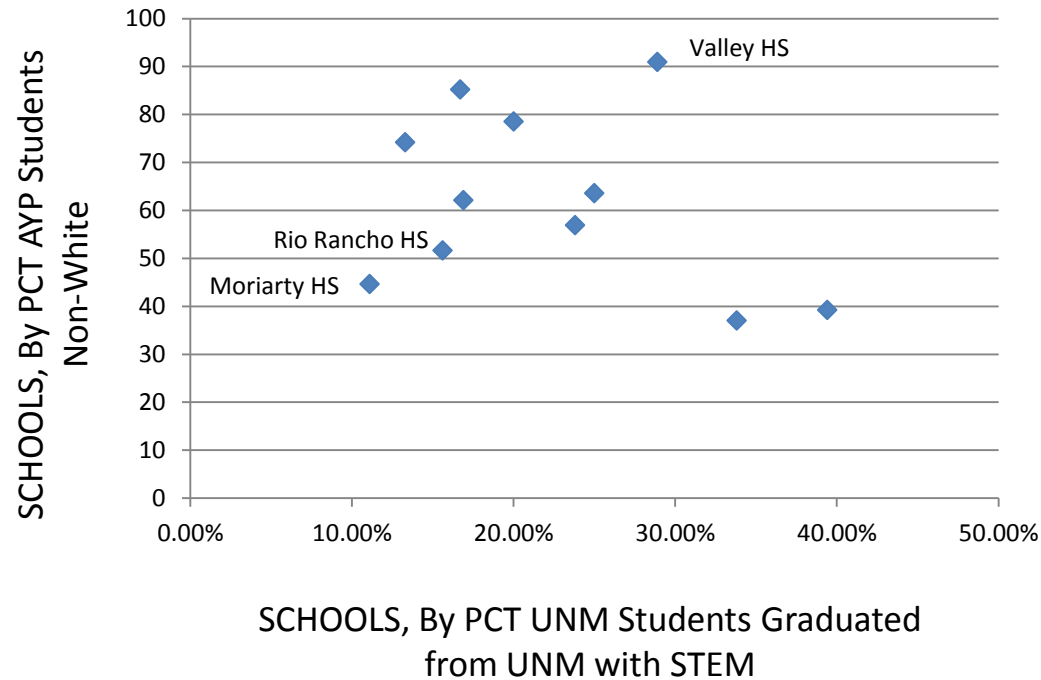
High School Origin in Degree Outcomes

HIGH SCHOOL NAME	UNM STUDENTS	GRADUATED	AYP Students PCT Non-White	AYP Students PCT Econ Disadvant
MORIARTY HIGH SCHOOL	27	11.1%	44.6	40.3
DEL NORTE HIGH SCHOOL	45	13.3%	74.2	52.6
RIO RANCHO HIGH SCHOOL	90	15.6%	51.6	37.9
HIGHLAND HIGH SCHOOL	36	16.7%	85.2	71.8
MANZANO HIGH SCHOOL	59	16.9%	62.1	45.5
LOS LUNAS HIGH SCHOOL	25	20.0%	78.5	66.9
SANDIA HIGH SCHOOL	80	23.8%	56.9	24.6
CIBOLA HIGH SCHOOL	96	25.0%	63.6	30.1
VALLEY HIGH SCHOOL	38	28.9%	90.9	47.5
SAINT PIUS X HIGH SCHOOL	59	30.5%	na	Na
ELDORADO HIGH SCHOOL	80	33.8%	37.0	15.2
ALBUQUERQUE ACADEMY	26	38.5%	na	na
LA CUEVA HIGH SCHOOL	104	39.4%	39.2	9.6



SUBPOPULATIONS

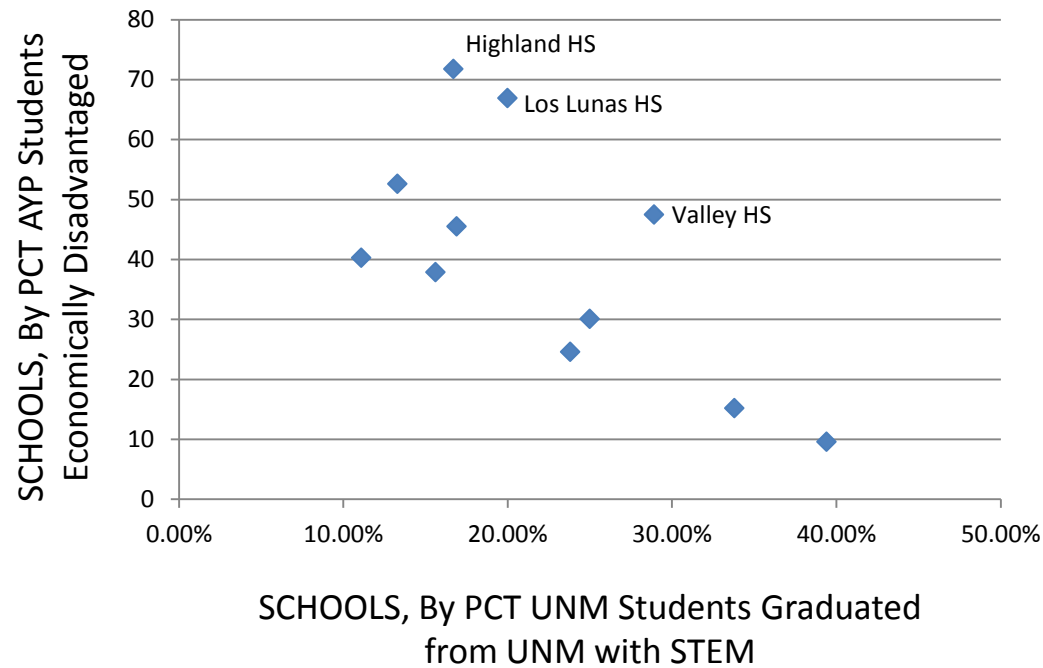
High School Origin in Degree Outcomes





SUBPOPULATIONS

High School Origin in Degree Outcomes





Possible Implications

UNM needs to do focus resources on recruiting women to STEM fields.

*UNM needs to **provide resources to connect STEM academic and support to the faculty, staff and departments who most understand the needs of Hispanic, American Indian, African American, Low-income, First-generation and Female students.***



Possible Implications

*UNM needs to **improve instruction** to better meet the learning needs of students who are Hispanic, American Indian, African American, Low-income, First-generation and Female.*



INSTITUTIONAL PRIORITY OF OUTCOMES

Graduate STEM

Switch Majors

Stop Attending



PRIORITY OF OUTCOMES

Variables

VARIABLE	GRADUATE	SHIFT	STOP
Percent of this group who are Pell Eligible	13.5%	23.6%	27.3%
Average of High School GPAs within this group	3.75	3.45	3.27
Average of ACT Composite scores within this group	25.8	22.9	22.2
Average of ACT Math scores within this group	26.3	22.8	22.0
Percent of this group who are First Generation	19.5%	34.2%	40.6%
Average of College GPAs within this group	3.51	2.95	2.09



PRIORITY OF OUTCOMES

Variables

VARIABLE	GRADUATE	SHIFT	STOP
Percent of students in this group who required remediation	12%	30.7%	39.5%
Percent of students in this group who required MATH remediation	4.2%	18.2%	26.4%
Percentage of students in this group who received a Lottery Scholarship	91%	77.5%	36.9%
Percentage of Lottery-receiving students in this group who lost their Lottery Scholarship	18.4%	28.7%	42.1%



Unanswered Questions

None of these numbers are surprising, since they often appear in the literature.

But how well do these factors, when combined to produce the most effective predictor, predict whether a student will graduate, shift or stop?

Stated another way, how much of the variance in student outcomes can be related to these factors that UNM routinely collects and reports?

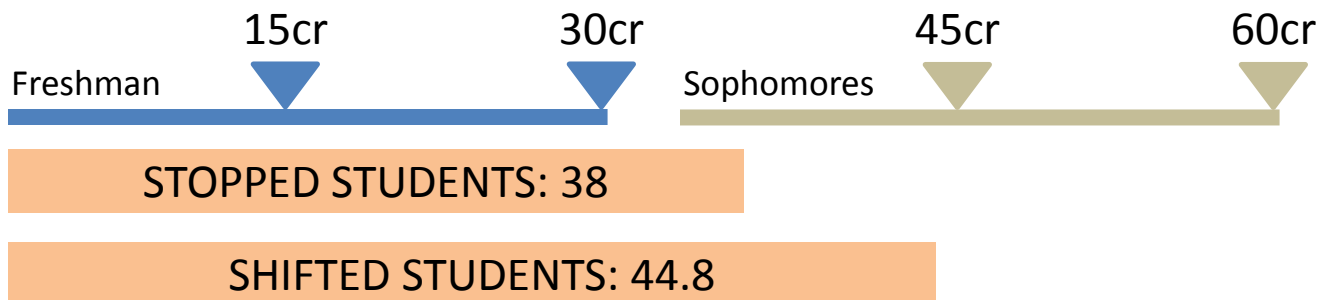


TRIGGERPOINTS

Number of Credits

The average number of credits completed when STEM students stop attending UNM is 38.

The average number of credits completed when STEM students shift majors is 44.8.



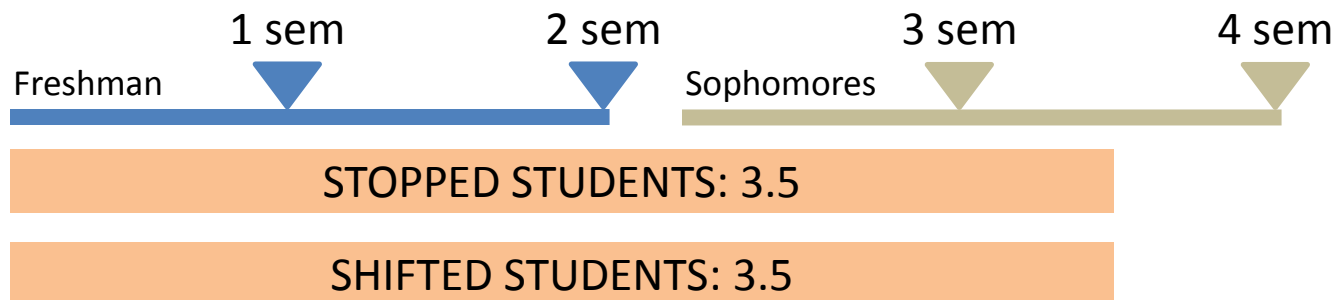


TRIGGERPOINTS

Number of Semesters

On average, STOPPED students leave UNM after 3.5 semesters.

On average, SHIFTED students changed majors after 3.5 semesters, the same as for STOPPED students.





Possible Implications

Students who SHIFT appear to be taking more credits per semester than students who STOP.

Leaving STEM may be more related to the number of semesters completed than it is to the number of credits completed. If so, what are the implications?



TRIGGERPOINTS

Grade Point Average

On average, STOPPED students left UNM with an average cumulative GPA of 2.08. This is contrasted by SHIFTED students, who had an average 2.94 cumulative GPA when they changed majors.



2.09

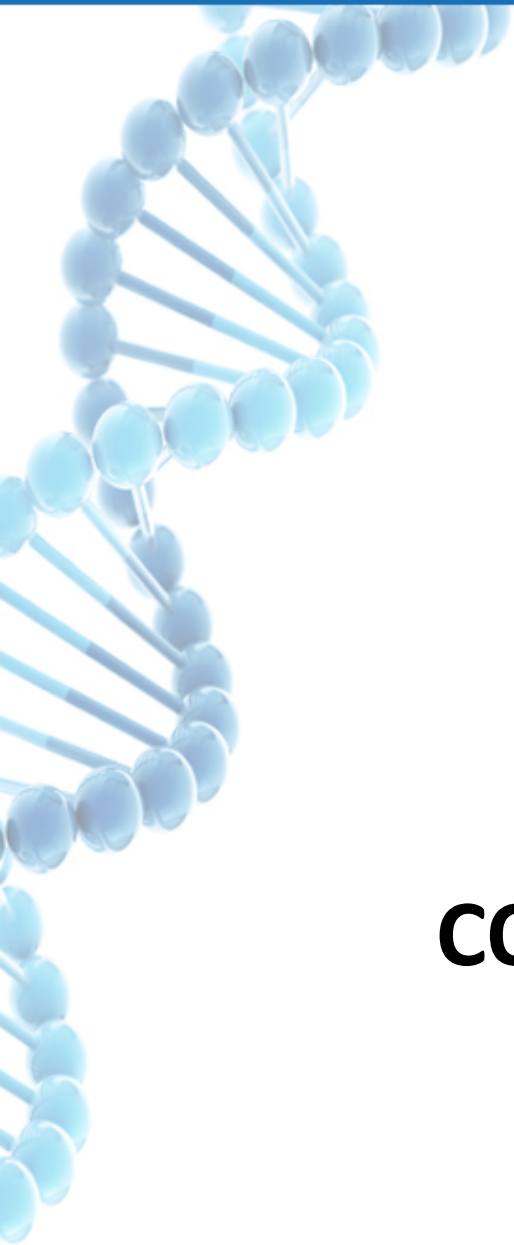


2.95



Unanswered Questions

Does this imply that students who leave UNM may be heavily impacted by academic performance issues, while SHIFTED students may be less impacted by poor grades and more impacted by other factors?



SELECTED FINDINGS COURSE OUTCOMES LENS



STEM Bachelor's Graduates, by UNM Math Course Completion (n=427)

SUB	NUMBER	COUNT	PCT
ISM	100	10	2.34%
MATH	106	3	0.70%
MATH	107	11	2.58%
MATH	110	7	1.64%
MATH	111	5	1.17%
MATH	112	2	0.47%
MATH	116	3	0.70%
MATH	120	79	18.50%
MATH	121	176	41.22%
MATH	123	115	26.93%
MATH	129	16	3.75%
MATH	150	130	30.44%
MATH	162	139	32.55%
MATH	163	144	33.72%
MATH	180	197	46.14%
MATH	181	187	43.79%



**AVERAGE PERCENT OF ENROLLMENTS THAT RESULT IN
GRADUATION FOR ALL STEM GATEWAY COURSES STUDIED:**

36.43%



TEN COURSES WITH...

THE LOWEST PERCENTAGES OF ENROLLMENTS RESULTING IN GRADUATION (enrollments > 100)

SUBJECT	NUMBER	LAB	N	GRAD	SHIFT	STOP	PCT Grad	PCT Shift	PCT Stop
ENVS	101		229	17	162	35	7.42%	70.74%	15.28%
MATH	120		426	35	254	110	8.22%	59.62%	25.82%
EPS	101		189	23	117	37	12.17%	61.90%	19.58%
MATH	121		635	81	368	139	12.76%	57.95%	21.89%
CHEM	123	L	156	25	65	32	16.03%	41.67%	20.51%
MATH	150		518	90	231	136	17.37%	44.59%	26.25%
MATH	123		405	90	159	98	22.22%	39.26%	24.20%
MATH	180		406	111	219	52	27.34%	53.94%	12.81%
CHEM	124	L	169	54	54	22	31.95%	31.95%	13.02%
MATH	162		426	147	126	75	34.51%	29.58%	17.61%



TEN COURSES WITH...

THE HIGHEST NUMBER OF ENROLLMENTS NOT GRADUATING STEM (enrollments > 100)

SUBJECT	NUMBER	N	GRAD	SHIFT	STOP	PCT Grad	PCT Shift	PCT Stop	Number NotGrad
MATH	121	635	81	368	139	12.76%	57.95%	21.89%	507
CHEM	121	804	290	302	140	36.07%	37.56%	17.41%	442
MATH	150	518	90	231	136	17.37%	44.59%	26.25%	367
MATH	120	426	35	254	110	8.22%	59.62%	25.82%	364
MATH	180	406	111	219	52	27.34%	53.94%	12.81%	271
MATH	123	405	90	159	98	22.22%	39.26%	24.20%	257
CHEM	122	560	253	169	80	45.18%	30.18%	14.29%	249
MATH	162	426	147	126	75	34.51%	29.58%	17.61%	201
ENVS	101	229	17	162	35	7.42%	70.74%	15.28%	197
BIO	201	383	153	143	51	39.95%	37.34%	13.32%	194



TEN COURSES WITH...

**THE HIGHEST PERCENTAGES OF ENROLLMENTS RESULTING IN
STOP (enrollments > 100)**

SUBJECT	NUMBER	LAB	N	GRAD	SHIFT	STOP	PCT Grad	PCT Shift	PCT Stop
MATH	150		518	90	231	136	17.37%	44.59%	26.25%
MATH	120		426	35	254	110	8.22%	59.62%	25.82%
MATH	123		405	90	159	98	22.22%	39.26%	24.20%
MATH	121		635	81	368	139	12.76%	57.95%	21.89%
CHEM	123	L	156	25	65	32	16.03%	41.67%	20.51%
EPS	101		189	23	117	37	12.17%	61.90%	19.58%
MATH	162		426	147	126	75	34.51%	29.58%	17.61%
CHEM	121		804	290	302	140	36.07%	37.56%	17.41%
ENVS	101		229	17	162	35	7.42%	70.74%	15.28%
MATH	163		382	186	79	57	48.69%	20.68%	14.92%



TEN COURSES WITH...

THE HIGHEST NUMBER OF ENROLLMENTS WHO STOP (enrollments > 100)

SUBJECT	NUMBER	N	GRAD	SHIFT	STOP	PCT Grad	PCT Shift	PCT Stop
CHEM	121	804	290	302	140	36.07%	37.56%	17.41%
MATH	121	635	81	368	139	12.76%	57.95%	21.89%
MATH	150	518	90	231	136	17.37%	44.59%	26.25%
MATH	120	426	35	254	110	8.22%	59.62%	25.82%
MATH	123	405	90	159	98	22.22%	39.26%	24.20%
CHEM	122	560	253	169	80	45.18%	30.18%	14.29%
MATH	162	426	147	126	75	34.51%	29.58%	17.61%
MATH	163	382	186	79	57	48.69%	20.68%	14.92%
MATH	180	406	111	219	52	27.34%	53.94%	12.81%
BIO	201	383	153	143	51	39.95%	37.34%	13.32%



PERCENTAGE OF ENROLLMENTS THAT ARE REPEATS
(enrollments > 100)

COURSE	PERCENT
CHEM 301	23.06%
MATH 123	17.79%
MATH 162	17.14%
CHEM 302	16.93%
MATH 163	16.91%
MATH 150	16.15%
MATH 121	15.14%
MATH 180	15.9%



CHEMISTRY CLOSE-UP

(enrollments > 100)

COURSE	PCT REPEATER	PCT GRADUATE
CHEM 121	9.67%	32.17%
CHEM 121L	6.36%	36.92
CHEM 122	8.6%	43.8%
CHEM 122L	3.81%	50.89
CHEM 123L	9.34%	13.7%
CHEM 124L	8.28%	30.9%
CHEM 301	23.06%	31.44%
CHEM 302	16.93%	55.3%
CHEM 303L	1.74%	53.6%
CHEM 304L	1.01%	55.05%



ALL THE WAY TO “A”

Overview

The “UNM Killer Course List” from Fall 2011 includes eighty two courses with high enrollments (121 and above) and low student pass rates.

STEM Gateway studied the grade distribution patterns for the following sixteen STEM-based courses on this list: MATH 120, 121, 123, 150, 162, 163, 180, 181; ENVS 101; CHEM 121, 122, 301, 302; BIOL 201, 202; PHYC 160. Taken together, these courses represent a sizable portion of the gateway courses that STEM students complete en route to their degrees.

	GRADUATED	SHIFTED	STOPPED
Percentage of enrollments in this group that resulted in an A, B or C	86.18 %	65.33% (20.85 points lower than GRADUATED)	54.36% (31.82 points lower than GRADUATED)



ALL THE WAY TO “A”

Grade Distribution Patterns

Comparing GRADUATED to SHIFTED									
	A	B	C	D	F	WD	CR	NCR	ABC
Graduated	37.78	32.74	15.66	3.72	0.84	7.09	1.80	0.04	86.18
Shifted	15.19	26.05	24.09	10.88	4.73	15.68	1.55	1.60	65.33
Difference	22.59	6.69	-8.43	-7.16	-3.89	-8.58	0.25	-1.56	20.85
Comparing GRADUATED to SHIFTED									
	A	B	C	D	F	WD	CR	NCR	ABC
Graduated	37.78	32.74	15.66	3.72	0.84	7.09	1.80	0.04	86.18
Stopped	11.09	22.53	20.74	12.96	9.46	21.82	1.20	1.61	54.36
Difference	26.69	10.21	-5.08	-9.24	-8.61	-14.73	0.60	-1.58	31.82



Unanswered Questions

How much of this difference in “A” grades is actually a function of other factors (pre-college preparation, ACT scores, etc)?

How would this same pattern hold in non-STEM disciplines?



Possible Implications

Colleges and universities often stress successful passing (A,B or C) as the desired course outcome for their students, and as a measure for their programs meeting student learning needs.

*However, in STEM, it may be more important to stress **mastery** (in this case, as measured by “A” percentage) over passing or course completion.*



COURSE CATEGORIES

In the table below, for each course category listed, we see the Graduation percentage for all enrollments from that category

SUBJECT	N	GRAD	SHIFT	STOP	PCT Grad	PCT Shift	PCT Stop
All Courses	9540	3475	3558	1470	36.43%	37.30%	15.41%
All Math Courses	3440	854	1523	693	24.83%	44.27%	20.15%
All Pre-Calc Math Courses	2044	309	1047	492	15.12%	51.22%	24.07%
All 100 Level Courses	7510	2451	2943	1288	32.64%	39.19%	17.15%
All <151 Level Courses	4359	1016	2016	878	23.31%	46.25%	20.14%
All 151-199 Level Courses	3151	1435	927	410	45.54%	29.42%	13.01%
All 200+ Level Courses	2030	1024	615	182	50.44%	30.30%	8.97%

Of the enrollments in this population from pre-calculus mathematics courses, only 15.12% led to STEM bachelors degrees at UNM.

Of the enrollments in this population from STEM Gateway courses at the 150 level or lower, only 23.31% led to STEM bachelors degrees at UNM.



COURSE CATEGORIES

The FLIPSIDE: Of students who began at UNM as first-time freshmen, and who graduated with a STEM degree in 2010-2011...

Sub-population of students	Percent of these students who completed Intermediate Algebra at UNM	Percent of these students who completed College Algebra at UNM
All STEM degree recipients	18.5%	41.2%
All Engineering degree recipients	9.8%	21.3%
All Arts & Sciences (A&S) degree recipients	23%	51.5%
A&S: Biology degree recipients	27.8%	56.8%
A&S: Non-Biology degree recipients	12.2%	40%



Possible Implications

Resources and strategies for keeping students engaged in STEM should be focused on mathematics courses and first-year STEM courses.



PRE-CALC MATH, ETHNICITY AND PELL-ELIGIBILITY

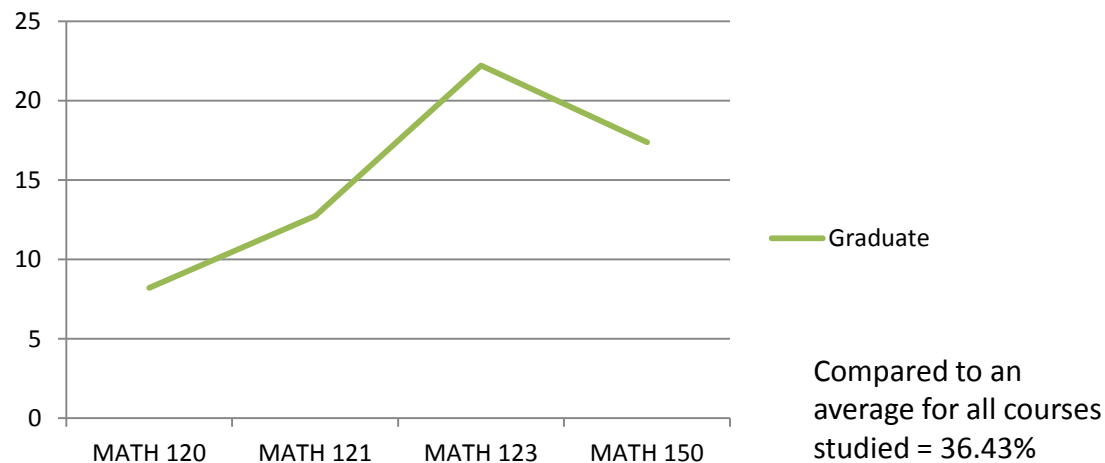
The following tables show grade distribution patterns for enrollments in our population for the four primary pre-cal math courses: Intermediate Algebra, College Algebra, Trigonometry and Pre-Calculus Mathematics.

Pre-Calc Math and Student Achievement

Percent of enrollments that resulted in the following outcomes...

Student Outcome	MATH 120	MATH 121	MATH 123	MATH 150
Stop	25.82	21.89	24.01	26.25
Shift	59.62	57.95	39.25	44.59
Graduate	8.21	12.75	22.22	17.37
Enroll	6.33	7.40	14.32	11.77

Graduate





Pre-Calc Math, Ethnicity and Pell-Eligibility

MATH 120, Intermediate Algebra			
Subpopulation	N at end of semester	Pct "A"	Pct "A-B-C-CR"
Hispanic	188	14.8	72.1
American Indian	45	8.9	50.0
Asian / Pacific Islander	18	5.3	73.8
Black / African American	18	16.7	72.2
White, Non-Hispanic	145	23.1	60.1
Pell-Eligible during first semester	136	17.3	67.2



Pre-Calc Math, Ethnicity and Pell-Eligibility

MATH 121, College Algebra			
Subpopulation	N at end of semester	Pct "A"	Pct "A-B-C"
Hispanic	252	9.9	63.8
American Indian	41	7.7	59.6
Asian / Pacific Islander	29	18.9	67.5
Black / African American	16	31.6	57.9
White, Non-Hispanic	328	14.3	65.7
Pell-Eligible during first semester	198	13.8	63.0



Pre-Calc Math, Ethnicity and Pell-Eligibility

MATH 123, Trigonometry			
Subpopulation	N at end of semester	Pct "A"	Pct "A-B-C"
Hispanic	131	13.2	57.2
American Indian	29	5.7	48.5
Asian / Pacific Islander	20	18.2	59.1
Black / African American	4	14.3	42.9
White, Non-Hispanic	198	18	61.2
Pell-Eligible during first semester	92	13.1	55.7



Pre-Calc Math, Ethnicity and Pell-Eligibility

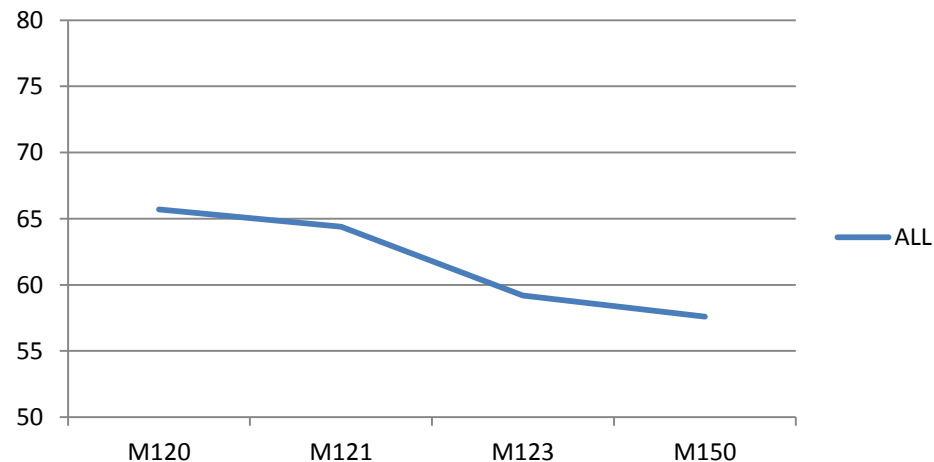
MATH 150, Pre-Calc Math			
Subpopulation	N at end of semester	Pct "A"	Pct "A-B-C"
Hispanic	184	12.2	53.0
American Indian	41	0.0	52.4
Asian / Pacific Islander	29	20.6	55.9
Black / African American	6	22.2	33.3
White, Non-Hispanic	231	14.7	62.5
Pell-Eligible during first semester	126	8.0	52.0

Pre-Calc Math, All Students Combined



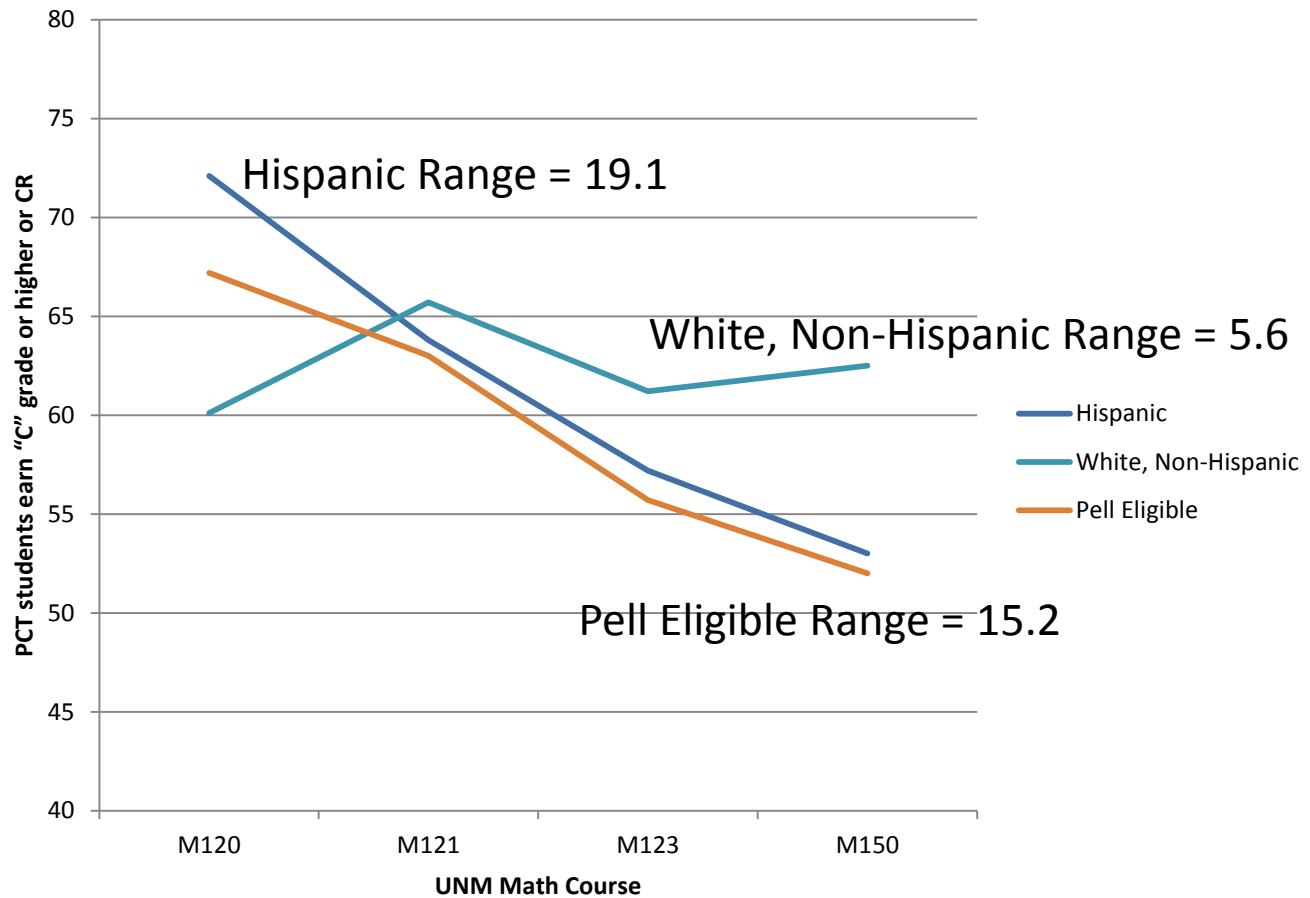
Subpopulation	N at end of semester	Pct "A"	Pct "A-B-C-CR"
MATH 120	426	15.4	65.7
MATH 121	635	12.9	64.4
MATH 123	405	15.4	59.2
MATH 150	518	13.4	57.6

ALL STUDENTS COMBINED





Pre-Calc Math, Ethnicity and Pell-Eligibility



Other ethnicities excluded from this chart because their "N" in one or more of these classes was too small to be considered conclusive.

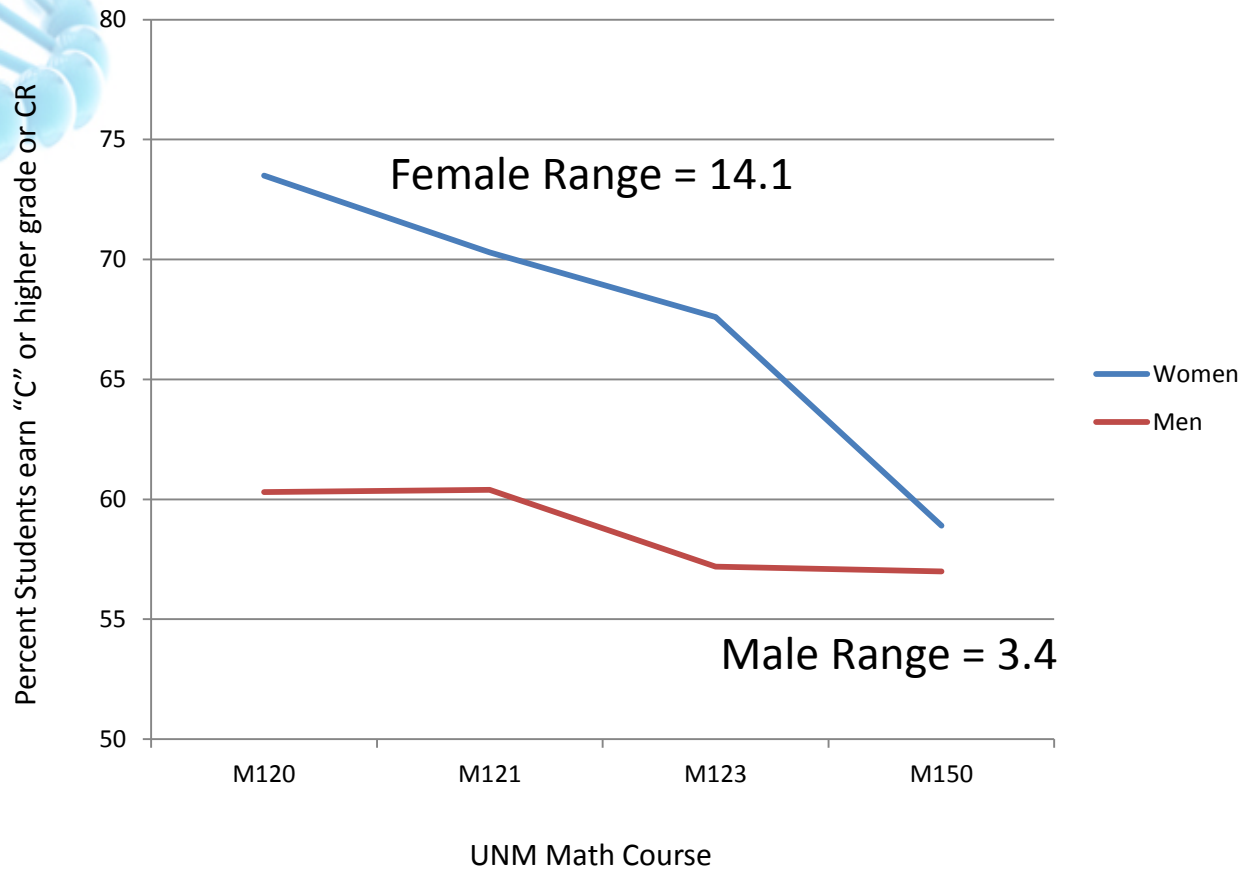


Pre-Calc Math, Gender

MATH 120												
	A	B	C	D	F	W	I	CR	NCR	AU	TOTAL	ABC-CR
F	22.5%	25.5%	7.0%	2.0%	0.0%	9.0%	0.0%	18.5%	15.5%	0.0%	100.0%	73.5%
M	10.5%	22.0%	5.4%	4.4%	0.0%	17.3%	0.0%	22.4%	18.0%	0.0%	100.0%	60.3%
MATH 121												
	A	B	C	D	F	W	I	CR	NCR	AU	TOTAL	ABC
F	17.4%	25.5%	27.4%	12.3%	0.6%	15.5%	0.0%	0.6%	0.3%	0.3%	100.0%	70.3%
M	9.8%	22.6%	28.0%	18.8%	2.9%	16.6%	0.0%	0.4%	0.7%	0.2%	100.0%	60.4%
MATH 123												
	A	B	C	D	F	W	I	CR	NCR	AU	TOTAL	ABC
F	18.6%	32.4%	16.7%	13.7%	1.0%	16.7%	0.0%	1.0%	0.0%	0.0%	100.0%	67.6%
M	14.7%	18.0%	24.6%	12.3%	6.1%	24.3%	0.0%	0.0%	0.0%	0.0%	100.0%	57.2%
MATH 150												
	A	B	C	D	F	W	I	CR	NCR	AU	TOTAL	ABC
F	17.9%	28.0%	13.1%	21.4%	4.2%	14.9%	0.0%	0.6%	0.0%	0.0%	100.0%	58.9%
M	11.7%	20.4%	24.9%	20.6%	5.8%	15.9%	0.0%	0.2%	0.4%	0.0%	100.0%	57.0%

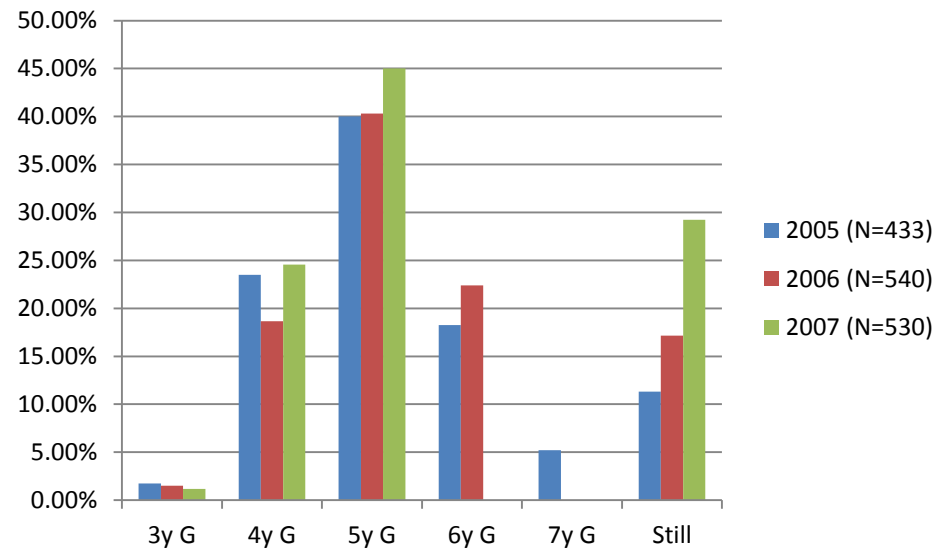


Pre-Calc Math, Gender





Time to Graduation for STEM at UNM





Unanswered Questions

To what degree are Pell-eligibility and Hispanic ethnicity related?

Why are Hispanic and Pell-eligible students decreasing in achievement as they proceed through the pre-calc math sequence at rates more pronounced than other subpopulations?



Quick Summary

- *Degree programs make a difference in outcomes, but we do not yet understand how.*
- *Ethnicity is important to understanding STEM degree attainment.*
- *Gender is important to understanding STEM degree attainment.*



Quick Summary

- *Traditionally collected institutional variables (such as high school GPA) do align with student outcomes, but we do not yet know the ability of these to predict student achievement.*
- *Students stop attending and shift majors at roughly the same number of semesters, though major switchers collect more credits en route to that point than stoppers.*
- *Major switchers leave STEM at a “B” average, while stoppers leave UNM at a “C” average.*



Quick Summary

- *In STEM Gateway “killer courses” the greatest difference between graduating students and non-graduating students are at the “A” range.*
- *STEM-interested students who take pre-calculus mathematics course are unlikely to graduate with STEM degrees at UNM.*
- *Hispanic students and Pell-eligible students are less successful in pre-calculus math the further in they go.*



TIM SCHROEDER

Project Director

STEM Gateway Program

University of New Mexico

timschroeder@unm.edu

505-277-1761

<http://unmstemgateway.blogspot.com/>