STEM Majors at NMHU

A report prepared by the Office of Institutional Effectiveness and Research, August 2009

Between fall 2006 and summer of 2008 Highlands awarded 44 undergraduate degrees in STEM fields (not including behavioral sciences).

STEM Undergraduate Degrees Awarded
AY 06-07 and AY 07-08

Non- STEM	STEM	Total	% STEM
678	44	722	6.1%

STEM degree recipients included a higher percentage of students who began at NMHU as freshmen than did undergraduate degree recipients as a whole. This is at least partly due to the fact that the STEM majors are only offered on the main campus, which is also the only campus where students can begin as freshmen.

Start-state of STEM Undergraduate Degree Recipients
AY 06-07 and AY 07-08

	STEM Degrees		All Degrees	
	#	%	#	%
freshmen	15	34.1%	94	13.4%
transfer	25	56.8%	505	72.0%
other	4	9.1%	102	14.6%
Total	44		701	

The percentage of STEM degrees earned by Hispanic students is equal to the percentage of all degrees earned by Hispanic students.

Ethnicity of STEM Undergraduate Degree Recipients
AY 06-07 and AY 07-08

	STEM Degrees		All Degrees	
	#	%	#	%
African American	3	6.8%	20	2.9%
American Indian	0		55	7.8%
Asian or Pacific Islander	0		8	1.1%
Caucasian White	11	25.0%	200	28.5%
Hispanic	25	56.8%	394	56.2%
Non-Resident Alien	2	4.5%	3	0.4%
No Response	3	6.8%	21	3.0%
Total	44		701	

As with many things at Highlands it is difficult to determine an appropriate standard by which to measure our success with our STEM students. While there is a great deal of agreement that we need to educate more students in STEM fields nationally (National Academy of Science, 2005), there is little clear data regarding the actual progress of students studying STEM majors. In July of 2009, the National Center for Education Statistics issued a report "Students Who Study Science, Technology, Engineering, and Mathematics (STEM) in Postsecondary Education" that was designed to partly meet this need (US Department of Education, NCES 2009-261).

The data in the report is based upon a longitudinal study of students who first enrolled in postsecondary education in the 1995-96 academic year. Data were collected from the students in three surveys (1995-96, 1998 and 2001). Any student who reported a STEM major during any of those data collections was included in this study. For the purposes of this study STEM majors were restricted to mathematics, biological/agricultural sciences (including biomedical sciences), physical sciences, engineering/engineering technologies, and computer/information sciences.

The following table presents a small sampling of the data reported in the study. The researchers found that 26.5% of students who ever majored in a STEM field received a bachelor's degree in a STEM field within six years. That percentage drops to 16.3% of Hispanic STEM students. It should be noted that these percentages apply to all students, including those who began at two-year colleges.

Degree Attainment and Persistence in STEM Field as of 2001 (percentages)

	STEM completers		STEM persisters	STEM leavers	
	Attained a degree or certificate in a STEM field	Attained a bachelor's degree in a STEM field	No STEM degree or certificate but still enrolled in STEM field	No STEM degree or certificate and changed to a non-STEM field	Left without a degree or certificate
Total	40.7	26.5	12	20.6	26.7
Ethnicity					
White	43.9	29.5	12.1	19.4	24.6
Hispanic	33.1	16.3	15.7	19.7	31.6
Institution selectivity					
Less selective	36.1	30	16.4	22.1	25.5
Selective	51.8	49.1	8.1	24.4	15.6
Very selective	66.2	65.6	5.8	19.2	8.8

Adapted from page 16 of "Students Who Study Science, Technology, Engineering, and Mathematics (STEM) in Postsecondary Education", National Center for Education Statistics, 2009.

To attempt a comparison to Highlands, data from all first-time, full-time freshmen from the fall 2000, 2001 and 2002 semesters was considered. Of those students, 169 students declared a STEM major while at Highlands. The following table shows the percentage of students who declared a STEM major while at Highlands who received a baccalaureate degree in a STEM field, received a degree in another field, or did not graduate. These numbers include those students who began at Highlands but then received degrees at other institutions (according to data from the National Clearinghouse).

Outcomes of NMHU STEM Majors, First-time Freshmen 2000 through 2002

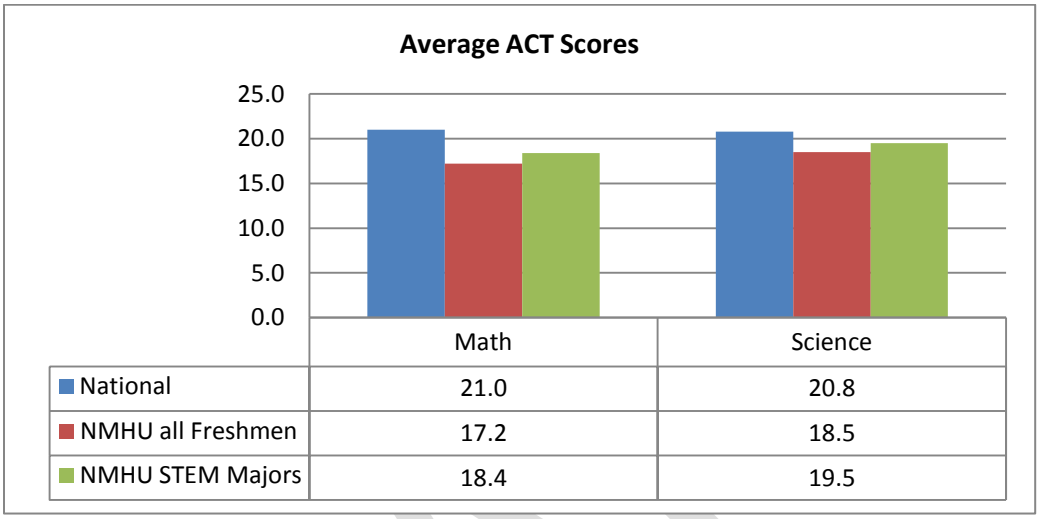
	STEM degree	other degree	did not graduate	Total	% STEM degree
African American	0	1	3	4	0.0%
American Indian	1	1	10	12	8.3%
Asian or Pacific Islander	0	1	1	2	0.0%
Caucasian White	4	5	10	19	21.1%
Hispanic	18	29	80	127	14.2%
No Response	2	0	1	3	66.7%
Non-Resident Alien	0	1	0	1	0.0%
Puerto Rican	0	0	1	1	0.0%
Total	25	38	106	169	14.8%

Overall, 26.5% of STEM majors nationally (including those who begin at a two-year school) attained a bachelor's degree in a STEM field. This compares to 14.8% of STEM majors starting at NMHU, a difference of 12.3 percentage points. That difference, however, decreases dramatically when we look at the success rate of Hispanic STEM majors. Nationally 16.3% of Hispanic students declaring a STEM major will graduated with a baccularette degree in a STEM field. At Highlands that number is 14.2%, a difference of only 2.1 percentage points. This suggests that at Highlands we do a better job of supporting our Hispanic student STEM majors than do other institutions nationally.

Of course, those comparisons involved comparing Highlands to all students in the national study, including those who began at two-year schools and may never have intended to complete a four-year degree. Even the "less selective" four-year institutions had a STEM graduation rate of 30%, double the Highlands rate. The study did not report graduation rates by ethnicity for just four-year institutions.

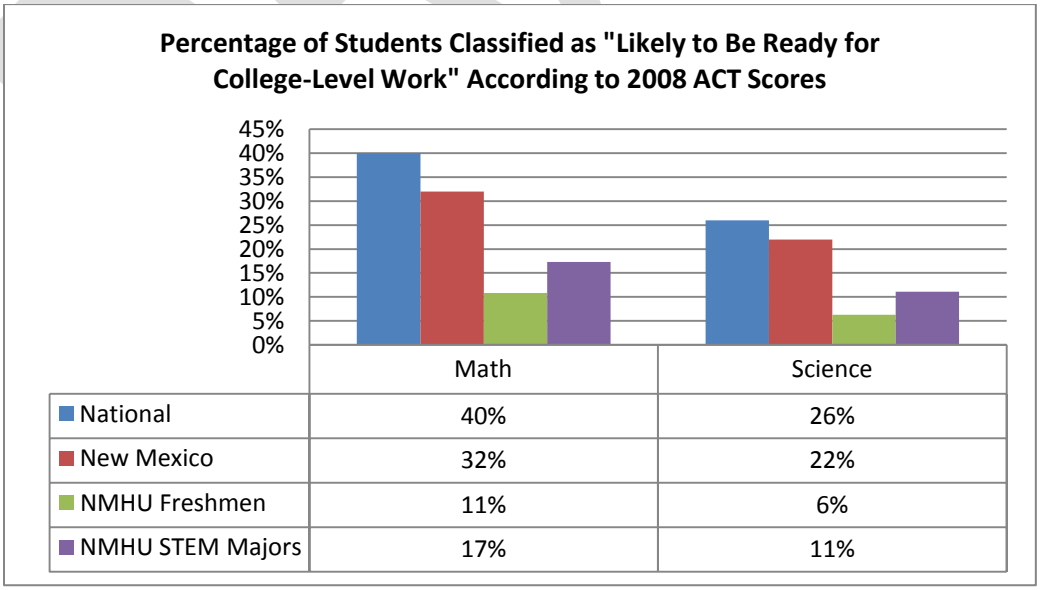
The problem with this comparison is that Highlands is an open enrollment institution, which is much different than "less selective". In the national study "Very selective" institutions were ones in which the 25th percentile ACT/SAT scores of incoming freshmen exceeded 1,000. "Selective" institutions were research universities I and II, baccalaureate I institutions and private not-for-profit doctoral I and II institutions that did not meet the "very selective" criteria. All other four-year institutions were classified as "less selective". As can be seen, there was a 16.6 percentage point difference in STEM bachelor's degree attainment between the "very selective" and "selective" institutions and another 19 percentage point difference between the "selective" and the "less selective" institutions. We can only guess at what the national rate for open enrollment institutions would be.

An analysis of ACT scores from our entering freshmen students and entering STEM students strongly suggests that students at NMHU are much less prepared for college than are students nationally. The following tables are based upon data from the first-time freshmen cohorts of 2000, 2001 and 2002 (the same group used for the graduation tables above). National ACT data is from 2008. As an been seen, Highlands STEM majors are only slightly better prepared than their non-STEM peers, and less prepared than students nationally.



	Math	Science
National	21.0	20.8
NMHU all Freshmen	17.2	18.5
NMHU STEM Majors	18.4	19.5

This difference between NMHU students and students nationally becomes even more marked when you consider the ACT definitions of "college ready". The ACT testing service defines "college ready" as students who earn a score of 24 or higher on the ACT Science Test and a 22 or higher or the ACT Math Test. Students with these scores have a 75% chance of earning a C or higher, and a 50% chance of earning a B or higher, in college biology and algebra (ACT, 2008).



	Math	Science
National	40%	26%
New Mexico	32%	22%
NMHU Freshmen	11%	6%
NMHU STEM Majors	17%	11%

As can be seen, NMHU students are much less likely to be ready for college work than are students nationally or in the state as a whole. These percentages are even starker when presented as raw numbers. Of the 169 STEM majors, only 22 scored as "college ready" in math and only 15 scored as "college ready" in science.

	Total	College Ready Math			College Ready Science		
		Yes	No	No ACT Scores	Yes	No	No ACT Scores
All Freshmen	696	52	431	213	33	490	173
STEM Majors	169	22	105	42	15	120	34

Interventions at NMHU

Highlands has a number of initiatives aimed at increasing the number of graduates in STEM fields. To increase the number of students entering the STEM pipeline, Highlands serves as fiscal agent and partner for a number of collaborative programs with local school districts designed to increase the academic preparedness of our incoming students. These programs include GEAR UP, MESA, Upward Bound, and Highlands' 54 years of sponsorship of the Northeast Regional Science and Engineering Fair.

Highlands also offers summer programs to midschool and high school students. Among these are t**he New Mexico Highlands University/Luna Community College Science and Agriculture Summer Experience (SASE) Project which** provides high school juniors and seniors students with an opportunity, early in their academic career, to conduct hands-on research in the natural sciences using state-of-the-art scientific instrumentation and encourages students through experiential learning to pursue a degree and an eventual career in an agriculturally related field and the Project GUTS/Supercomputing Challenge Summer Round Up, a free, five-day summer camp for middle and high school students, in June of 2009. The camp was funded by Project GUTS - Growing Up Thinking Scientifically, which is a summer and after-school science, technology, engineering and math (STEM) program for middle school students in New Mexico. Students and teachers learned about how scientists and others use computer modeling in cutting-edge research. Participating teachers also learned how to start a Project GUTS club and sponsor a Supercomputing Challenge team. On the Highlands campus the program was sponsored by the ARMAS program (see Criterion Four), which is continuing to work with Project GUTS to develop an after school club for local middle school students this fall.

There are also several programs that seek address the needs of STEM students currently at Highlands.

ARMAS (Achieving in Research, Mathematics and Science) Center

The Achieving in Research in Math and Science (ARMAS) program began at NMHU in the 2008-2009 academic year. ARMAS is funded through the "Bridging Careers for Success" program, a two-year grant funded by the US Department of Education with the goal of increasing the number of Hispanic students who complete their bachelor's degree in science, technology, engineering and math. The grant funded the establishment of physical centers on both campuses and provided funds to hire a center

coordinator, an academic coach, part-time tutors, and one administrative support staff member on each campus.

The program has three objectives, to develop a seamless transfer of science, technology, engineering and math students from Luna Community College to Highlands University through a model course alignment and transfer articulation agreement , to provide support for STEM students and faculty through the centers on each campus, and to engage in targeted infrastructure improvements for STEM students and faculty on each campus (ARMAS Program Description). Two key student performance outcomes for the program include a 100% increase in Hispanic enrollment in STEM courses and 80% of Hispanic students participating in the program passing STEM gatekeeper courses with a C+ or higher grade.

To date, the program has constructed the Centers, hired staff, and held a two-day workshop with Highlands and Luna STEM faculty to discuss course alignment and articulation agreements. That meeting has resulted in a schedule for alignment activities (ARMAS LCC/NMHU Faculty Workshop, May 2009).

The Pilot Pre-Med Education and Development Program

The Pre-Med Education and Development program was funded by the New Mexico State Legislature in 2008 to develop a demonstration project at NMHU that would "better prepare undergraduate students from small universities for successful entry into medical school or related health fields". The project began at Highlands in the fall of 2008 and included a 4-week MCAT review course, a series of four workshops covering the specifics of applying to medical school, stipends and scholarships for students, and a summer internship in which students in the program shadow and are mentored by local physicians.

STEM-focused Learning Communities

In an effort to recruit new majors into the STEM field and to support incoming students with an interest in those fields the science faculty members regularly propose several science-based learning communities. In the fall of 2009 these include "Mineral Logic" with Geology 101, "Do the Math" with Math 100, and "Reach for the Stars" with Math 135 and Physics 110. Students in the "Reach for the Stars" learning community will build and launch a scientific experiment from Spaceport America. The students' experiment will be launched in a UP Aerospace Space Loft XL sounding rocket designed specifically for scientific research. The 20-foot-long rocket will soar approximately 70 miles into space before dropping back to earth by parachute. Funding for the program comes from a NASA grant to the New Mexico Space Grant Consortium.