

University of New Mexico Project for Inclusive Undergraduate STEM Success

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Introduction: The University of New Mexico (UNM) proposes the Project for Inclusive Undergraduate STEM Success (hereafter, UNM STEM Project) to (1) increase the number of Hispanic and other low-income students attaining STEM degrees and (2) provide a model for collaboration, transfer and articulation between two-and four-year Hispanic-serving institutions that enhances achievement of the first goal. The UNM STEM Project has four components:

- Gateway Science and Math Course Reform: Faculty-driven projects with a two-year HSI, Central New Mexico Community College, largest provider of transfer students to UNM.
- Peer-Learning Facilitators: Peer-assisted collaborative learning to improve Hispanic and other low-income student success in STEM classrooms.
- STEM Student Interest Groups: Beginning-student socialization with STEM experiences to inclusively engage students in fields dominated by non-Hispanic students and faculty.
- Enable More Data-Based Decision Making: Developing UNM institutional research capacity to collect and analyze student-tracking and achievement data on STEM students.

The UNM STEM Project focuses on widening the gateway for Hispanic and other low-income student success in courses that commonly impede pursuit of STEM degrees. Within the STEM fields, UNM is particularly concerned with the paradox of high levels of interest among Hispanic and other low-income incoming freshmen, but low persistence to degree completion in the life and physical sciences, engineering, mathematics and statistics, and computer science.

1. Need for the Project

a. Magnitude of the needs for the services to be provided or activities to be carried out

UNM needs to address New Mexico (NM) challenges of a high proportion of disadvantaged individuals and low socioeconomic status coupled with highly technical and STEM-based industries within the state: New Mexico's statewide economic and educational disparities coupled with its diverse population and high-tech industries, national laboratories, and

alternative energy sources (e.g. wind, solar, biofuels) require a model for effective STEM educational pathways particularly for Hispanic, Native American, and other low-income students leading to higher education achievement, promising careers in STEM industries, and creative development of alternative energy sources. NM has a population of 2.1 million and is one of only four majority-minority states with a 63% minority population, and 46% Hispanic residents (U.S. Census, 2010).

New Mexico's largest postsecondary institutions the University of New Mexico (UNM) and Central New Mexico Community College (CNM) provide education to central New Mexico, the state's most populous area with over 46% of its population centered in and around Albuquerque. CNM and UNM provide educational services to this area with a joint student enrollment of 66,075. As economic trends cause simultaneous enrollment increases and budget cuts that particularly challenge higher-education achievement for students from disadvantaged backgrounds, it is critical for UNM, the state's flagship university, to provide students the quality education and educational support necessary to succeed in the promising fields of science, technology, engineering and mathematics. Equally important is the establishment of solid 2/4 transfer pathways particularly between CNM and UNM leading to degree attainment especially in STEM fields. Resources to meet these needs have been challenged by a 12% decrease in NM state fiscal support to higher education between FY09 and FY11, compared to the national average of -2.8% (*Grapevine*, Center for the Study of Education Policy, 2011), and additional reductions for FY12. With more than 2/3rds of UNM's instructional and general operating budget dependent on state funding, these reductions limit the university's ability to respond.

New Mexico is the 3rd poorest state in the U.S. with 43% of families living in poverty (NM Voices for Children, 2008). The *Quality Counts 2011* report (Editorial Projects in Education,

2011) ranked New Mexico 49th among the 50 states in chance for success, an index that evaluates educational and developmental promise for children based on family-income and education factors. These NM factors include only 44.2% of adults living at or above the national median income, high-school graduation rate of 54.9%, and only 35.6% of children with at least one parent possessing a postsecondary degree. The 2010 U.S. Census reports that 36.5% of New Mexicans speak a language other than English at home (compared to the U.S. average of 17.9%). Thus, many New Mexicans, regardless of innate capabilities, have difficulty envisioning postsecondary success and even more trouble picturing success in STEM fields.

UNM is positioned to be a leader in addressing national needs in STEM reform: The need for increasing STEM-degree graduates has been loudly stated for several decades (e.g. Rutherford, 1990; National Science Foundation, 1996; U.S. Department of Labor, 2007; Rising Above the Gathering Storm Committee, 2010). Increasingly, the call to action emphasizes the critical need to diminish the STEM-degree achievement gap between White-non-Hispanic and minority students (e.g. Anderson and Kim, 2006; Dowd et al., 2009; Higher Education Research Institute, HERI, 2010). Support for the UNM STEM Project will permit the development of essential components for UNM to achieve national leadership in both the national and state-level pursuits of higher Hispanic and other low-income students' STEM-degree attainment.

UNM is one of only two Carnegie Research University Very High institutions in the nation also designated as a Hispanic-Serving Institution and the only state flagship university in the US that is also a majority-minority undergraduate institution. UNM is accredited by the Higher Learning Commission with a special emphasis to work with students from diverse backgrounds. In Fall 2010 Hispanic students comprised 40% of 20,655 undergraduate students (and 49% of freshmen) enrolled on UNM's main campus. UNM is positioned, therefore, to recruit and

graduate a large number of Hispanic students in STEM disciplines to supply the New Mexico workforce and to provide Hispanic candidates for graduate and professional schools nationwide. The world-class caliber of UNM STEM faculty and research laboratories along with internships at nearby national laboratories provide unparalleled opportunities to engage Hispanic students in research that can help launch STEM students into future educational and professional pursuits.

UNM needs to develop the ability to better serve STEM workforce needs in New Mexico:

Increasing the number of STEM college graduates particularly among cohorts of Hispanic students is critical to New Mexico's future economic development. The state ranks 9th in the nation for percent of the workforce employed in STEM occupations (National Center for Higher Education Management Systems, NCHEMS, 2006 data). With a 46% Hispanic population (U.S. Census, 2010), New Mexico's current and future directions depend on the educational and professional successes of its Hispanic citizens, especially since Hispanic high-school graduates will be more than twice as numerous as White, non-Hispanic graduates by 2021 (Western Interstate Commission for Higher Education, WICHE, 2008). Only 25% of NM workers over 25 possessed a Bachelors or higher degree in 2007 (NM Workforce Report), but one study (Carnevale et al., 2010) estimates 60% of all 2018 job openings in the state will require an undergraduate or graduate degree with 18% of these new jobs in STEM disciplines. Combining large projected increases in private-sector workforce demand in STEM areas, New Mexico's emerging national importance in private-aerospace and renewable-energy industries and continued expansion of two national Department of Energy laboratories and Air Force research and development facilities adds urgency to the need for NM's flagship university UNM to increase the number of STEM graduates. Coupled with changing demographics of high school graduates, these workforce priorities require a clear focus on the retention, graduation, and

graduate/professional-school preparation of Hispanic youth in STEM disciplines. To meet this need, the UNM STEM Project enables the university to develop, test, and assess integrated data-driven solutions to Hispanic student success in STEM education and promising STEM fields.

Two-to-four-year college transfer students need to be ready to complete their STEM degree:

UNM and nearby Central New Mexico Community College (CNM) must develop a more integrated approach to defining and assessing course outcomes to assure transfer and co-enrollment students are prepared to succeed in the completion of STEM degrees at UNM. The success at UNM of students who begin their education at CNM (located only 5 blocks from UNM) has not been systematically studied. Not only does 59% of UNM’s in-state, two-year-transfer students arrive from CNM, but many UNM students co-enroll at CNM particularly to complete STEM gateway-course requirements. Completion of STEM majors at UNM following completion of gateway prerequisites at either institution requires alignment of course curricula, outcomes and assessment that currently does not exist. The UNM STEM Project will enable joint CNM and UNM faculty development to align these key components of gateway courses and build capacity for data collection and analysis critical to (a) evaluate the success of the Project and (b) promote successful articulation and transfer.

UNM needs to develop capacity to systematically collect and analyze data to identify strategies to improve STEM-degree attainment, particularly by Hispanic and other low-income students:

Data collected and analyzed in formulating the answers to the question categories in Table 1 will help to prioritize student and instructional interventions proposed by the UNM STEM Project, contribute to project evaluation, and when sustained, will permit monitoring of data critical to future efforts to continue Hispanic and/or low-income student success in STEM fields.

Table 1: Using data to answer questions generated by UNM STEM Project	
Question	Potential Questions generated by UNM STEM Project

Category	Target Populations: Hispanic and other Low-income Students
1	Where in the course of their curriculum do aspiring or declared STEM majors within first-time, beginning-freshmen cohorts either leave UNM or leave STEM majors?
2	How do ACT and Compass scores currently used for STEM course placement predict student performance in their first gateway courses?
3	What happens to two-to-four-year college transfer students (particularly Hispanic and low-income) in STEM fields after they reach the UNM main campus?
4	Are there differences in student course success/persistence in a STEM field based on completion of gateway-STEM courses at UNM vs. a two-year institution (CNM)?

b. Specific gaps or weaknesses in services, infrastructure & opportunities are identified & addressed by the proposed project, including nature & magnitude of gaps or weaknesses.

The need to focus on the success of aspiring STEM students and address gaps in achievement:

Concerns about the STEM-degree-attainment gap between high-attaining Asian and White, non-Hispanic students versus under-represented groups, including Hispanics, is superimposed upon completion contrasts between all students aspiring to STEM degrees as freshmen and their non-STEM classmates. For example, national five-year completion rates of 56% for aspiring White, non-Hispanic STEM majors and 42% for Hispanic STEM aspirants contrast with 74% and 67%, for respective non-STEM students (HERI, 2010). At NM four-year institutions, Hispanic students are twice as likely (29.5%) to drop out as their White, non-Hispanic peers (15.1%) (2007 UNM Provost Report). Improving Hispanic STEM-student success can be seen as part of a larger issue of overall production of STEM students at risk of becoming more acute as the proportion of Hispanic students increases.

National (HERI, 2010) and UNM data reveal that approximately equal proportions of White, non-Hispanic and Hispanic students begin college with aspirations to obtain STEM degrees, so pre-college experiences are not producing disparate student pursuit of STEM majors; STEM attainment differences relate to what happens at college. At UNM, 15-20% of both Hispanic and White, non-Hispanic freshmen aspire to STEM majors each year. However, the number of students of both ethnicities within these freshmen cohorts who aspire or declare a major in the

life and physical sciences, engineering, and mathematics *decreases* by 30-35% over eight semesters. In contrast, other majors (e.g., social and behavioral sciences, humanities, education, business) experience *stable or increasing* numbers of both Hispanic and White, non-Hispanic majors within the same cohorts. Thus, traditional core disciplines within the STEM area suffer a problematic loss of aspiring and declared majors not seen in other disciplinary clusters.

Figure 1 (below) shows that the proportion of Hispanic STEM graduates among all STEM graduates is decreasing at UNM despite rising Hispanic enrollment. Although the pipeline of aspiring Hispanic and White, non-Hispanic STEM majors at UNM is strong, a disproportionate number of these students either change their majors or depart UNM with an overall greater impact on Hispanic STEM graduation. The UNM STEM Project identifies improved success of aspiring students along with recruitment of STEM majors from among initially undecided students as critical to increasing the number of Hispanic and other low-income STEM graduates.

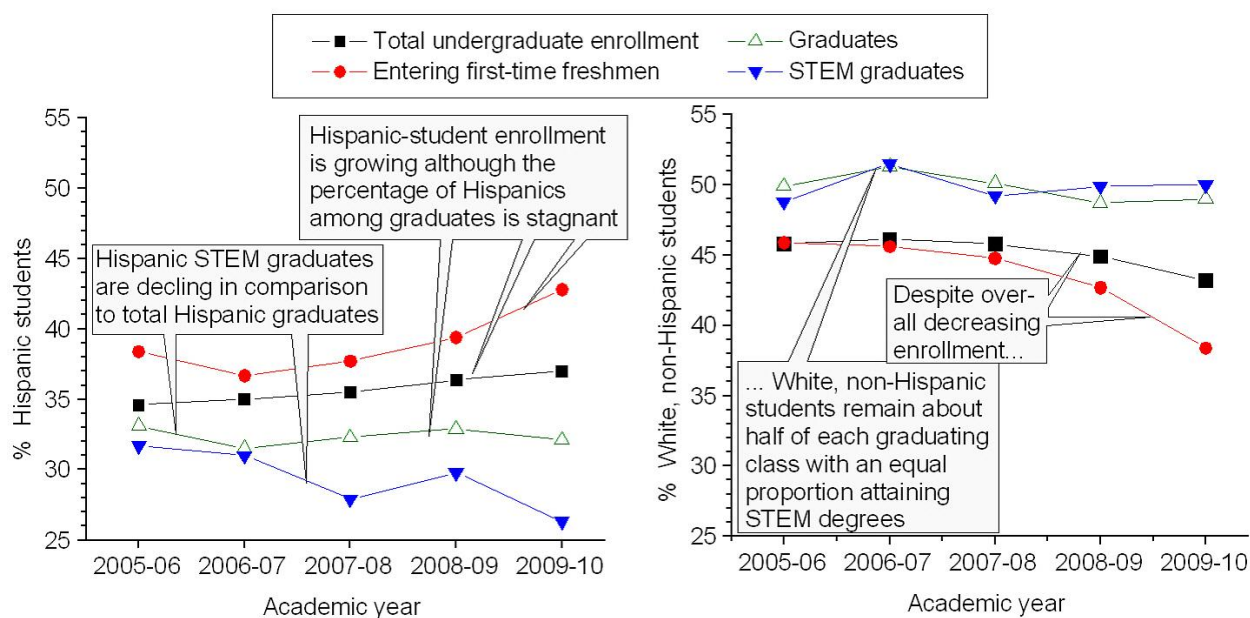


Figure 1. Comparison of the percentage of Hispanic and White, non-Hispanic students among entering freshmen, all degree-seeking undergraduate, graduate, and STEM-graduate cohorts emphasizing disparity in comparative graduation and particularly STEM-graduation percentages between the two ethnic groups (Source: UNM OIR, 2011)

UNM needs to make curricular and instructional changes in gateway courses to strengthen STEM course instruction, improve student learning, and improve STEM student success:

Pedagogy of the instructors is the single most important attribute of college courses for recruiting and retaining STEM majors. Seymour and Hewitt (1997) found that departing STEM majors were turned off to the discipline with 90% of those changing majors citing poor teaching as a prominent concern. Departing students universally rated concerns related to curricula, pace of courses, course assessment, and workload as less of a concern than quality of teaching (Seymour and Hewitt, 1997).

STEM curricula add an additional challenge to persistence and graduation. Students in most non-STEM degrees typically complete their major-specific course work within a single department and sequencing of courses is relatively unimportant. In contrast, STEM students must complete a battery of gateway-supporting science and mathematics courses – particularly calculus, chemistry, and physics – regardless of their degree-granting department. The gateway courses must be completed in a particular sequence and are prerequisites to courses offered in the major field. Difficulties encountered while completing these courses (Tobias, 1990), which typically do not include explicitly relevant learning for students’ majors, impede persistence and degree completion helping to explain contrasting degree-completion rates in STEM and non-STEM fields (HERI, 2010).

Therefore, STEM degree attainment is most negatively affected by students’ failure to succeed in gateway courses that develop essential skills and introduce students to disciplinary studies (Tobias 1990, Seymour and Hewitt 1997). Teacher-centered pedagogies focused on passive learning from lecture combined with instruction at levels exceeding students’ abilities are key components of gateway-course failure (Tobias 1990). The cultural activity of teaching - how

teachers and students interact with the subject - is more powerful for successful learning than curriculum materials that teachers use (Stigler and Hiebert, 2004). Student success, especially for those aspiring to STEM fields but who are academically underprepared and from groups underrepresented among STEM faculty, strongly depends upon faculty-development programs that promote inclusive student success while maintaining rigor. UNM STEM Project addresses the need for pedagogical reform particularly in STEM gateway courses by involving UNM and CNM faculty in gateway course reform and promoting enhanced student engagement and learning through Peer Learning Facilitator and Stem Student Interest Group project components.

c. The extent to which the proposed project will provide services or otherwise address the needs of students at risk of educational failure.

UNM identifies the lack of student success in gateway courses to STEM majors as the primary problem to be addressed in the UNM STEM Project. Each semester there are about 25 UNM courses that enroll more than 100 students and in which more than one third fail to complete the course with a grade of C or better. More than half of these courses are gateway STEM offerings (examples in Table 2, pg. 11). Students not obtaining at least a C are unable to advance with their STEM coursework that required that class. Affecting nearly half of the students in several courses, this setback leads learners to retake courses or reconsider their choice of major. Repeating courses delays time to graduation because the student has to retake classes and entry to other courses in the major is delayed.

Program delays resulting from failed classes also impact financial aid, because nearly 75% of UNM freshmen are initially eligible to earn the New Mexico Success Scholarship, which pays for 8 consecutive semesters of tuition. However, when low grades (which are disproportionately given for work in STEM gateway courses) terminate scholarship eligibility or delay progress

toward degree completion within the 8 semesters of scholarship support, UNM’s largely low-income students are strongly challenged to persist in their STEM studies.

Table 2: Lack of student success in principal UNM STEM gateway courses		
Course	Avg. % of Students Not Passing*	Avg. No. of Students Not Passing Each Semester*
Biology for science majors(first semester)	32.6	109
Chemistry I for life/physical sciences/ engineering	34.4	173
Chemistry II for life/physical sciences/ engineering	31.5	92
Organic Chemistry (first semester)	42.9	97
Organic Chemistry (second semester)	39.8	97
College Algebra for students requiring calculus	45.6	480
Pre-Calculus for physical science and engineering	48.2	173
Calculus I for physical science and engineering	50.1	115
Calculus II for physical science and engineering	49.1	97
Calculus I for life science	45.6	283
Physics I for life science	38.1	94
Physics I for physical science, engineering	46.1	86

*Passing, in this case, means completing the course with a grade of C or higher
(Source: UNM Office of Institutional Research, 1998-2010 data for most courses in list)

d. The extent to which the proposed project will focus on serving or otherwise addressing the needs of disadvantaged individuals.

UNM needs to address socioeconomic status and higher education achievement in New Mexico:

Successful completion of STEM undergraduate degrees must be placed within overall context of college graduation in New Mexico. Socioeconomic status (SES) is the primary predictor of six-year graduation rates (Carnevale, 2008; Bowen et al., 2009). NM ranks 43rd in per capita income (Bureau of Economic Analysis, 2010) and 45th in the percentage of K-12 children (35.6%) with at least one parent who attained a post-secondary degree (Editorial Projects in Education, 2011). Hispanic residents have generally lower SES than White, non-Hispanic residents: The Hispanic poverty rate is 30% compared to 12% for White, non-Hispanics (U.S. Census Bureau Current Population Survey, 2009) and only 20 % of Hispanics have attained a college degree in comparison to 47% for White, non-Hispanics (Lumina, 2010). Therefore, a large number of

college-age New Mexicans, especially Hispanics, are the first generation to college and from low-income families. Given strong correlations between these SES indicators and graduation, it is notable that NM ranks 48th in 6-year graduation rate (NCHEMS, 2002 freshman cohort).

UNM enables access through adoption of only moderately selective admissions criteria that are perhaps the most inclusive of any flagship university in the country (admitting ~68% of freshman applicants). This assures opportunities for traditionally under-represented students but also promises a student body that mirrors the SES challenges of NM. More than 1/3rd of UNM undergraduates are Pell Grant recipients (the largest proportion of any public flagship research university; *J. Blacks Higher Ed.*, 2009) and 44% of incoming freshmen are first-generation students (UNM freshmen orientation survey data, 2009-2010). Six-year graduation rates averaged just 42.6% over the last six years with modest differences in Hispanic (40.0%) and White, non-Hispanic (46.2%) graduation achievement (UNM Office of Institutional Research, 2010). The strategies of the UNM STEM Project must not only improve Hispanic STEM student success in order to improve these statistics but also serve as a model for other institutions that face similar challenges.

2. Quality of the Project Design

a. Goals, objectives, outcomes to be achieved by proposed project are specified/measurable.

The UNM STEM Project goals mirror the two Absolute Priority goals and the Competitive Preference Priority of the HSI STEM and Articulation FY 2010 Grant Request for Applications.

For each goal, objectives and measurable outcomes are specified in Table 3.

Table 3: UNM STEM Project: Goals, Objectives and Measures/Outcomes	
Goal A: To increase the number of Hispanic and other low-income students attaining degrees in the field of science, technology, engineering, or mathematics.	
Objectives	Measures/Outcomes
Objective A.1: Increase student success and retention by developing 12 faculty-driven STEM gateway course-reform	A.1.a: Percentage of students completing each reformed course will improve with course completion by Hispanic and/or low income (measured as Pell

<p>projects to ultimately reach at least 7200 students annually.</p>	<p>Grant recipients) students <i>to</i> 75% by 2nd semester of reform implementation and 80% by 3rd semester. <u>A.1.b.</u> Percentage of students completing each reformed course with a grade of C or higher will improve by 2nd second semester of reform implementation with an improvement of successful course completion by Hispanic and/or low income students <i>by</i> at least 10% by 2nd semester of implementation and 20% by 3rd semester, compared to the comparable pre-reform statistics for the course.</p>
<p>Objective A.2: Increase engaging, collaborative classroom learning through the training and deployment of undergraduate peer-learning facilitators (PLFs) in large-enrollment STEM gateway courses; to affect at least 3000 students annually.</p>	<p><u>A.2.a.</u> Faculty in at least one gateway course in <i>each</i> of the departments that teach a gateway life/physical science or mathematics course (Biology, Chemistry, Earth & Planetary Sciences, Mathematics & Statistics, Physics & Astronomy) will adopt a collaborative-learning pedagogy supported by PLFs by the end of the second project year. <u>A.2.b.</u> Percentage of students completing each PLF-supported course section with a grade of C or higher will improve by 2nd semester of implementation the completion by Hispanic and/or low-income students by 10% by 2nd semester and 20% by 3rd semester, compared to the prior success percentage in sections of the same course taught by the same instructor. <u>A.2.c.</u> Anonymous surveys of students in these classes will show PLF-supported collaborative learning meets needs of at least 80% of surveyed students.</p>
<p>Objective A.3: Increase student retention and success in STEM gateway courses by developing and piloting STEM Student Interest Groups (SSIGs) to shadow sections of at least four gateway courses (two courses during the first year); impacting at least 700 students.</p>	<p><u>A.3.a.</u> During Years 2-5 of the grant, 15 SSIG sections will be completed by at least 150 Hispanic and/or low-income students (total initial enrollment of 20-25 students of all races/ethnicities per section). <u>A.3.b.</u> By Grant Year 4, at least 80% of students enrolled in an SSIG complete the companion gateway course with a grade of C or better. <u>A.3.c.</u> By Grant Year 4, at least 80% of students enrolled in an SSIG enter or continue in a STEM field as their declared or aspired-to major. <u>A.3.d.</u> Anonymous surveys of students in SSIG sections show at least 80% of students identify SSIG experience as supportive in pursuit of STEM degrees and success in STEM-gateway courses.</p>
<p>Objective A.4: As a consequence of the above objectives (A.1 – A.3), the number of Hispanic and other low-income students receiving Bachelors</p>	<p><u>A.4.a.</u> Year-over-year increases in Hispanic and/or other low-income students obtaining STEM degrees will be apparent by the end of Year 3. (Note: As the UNM STEM Project focuses on student success in</p>

<p>degrees in life/physical sciences, engineering, and mathematics will increase.</p>	<p>gateway courses and in preparing transfer students, impact of these changes on degree attainment will likely not be visible during the first two years). <u>A.4.b:</u> By Year 4, the proportion of STEM graduates who are Hispanic will equal or exceed the proportion of Hispanic students among all graduates.</p>
<p>Objective A.5: Improvement of student persistence and degree attainment in the STEM fields will improve campus-wide retention-rate and graduation-rates as STEM aspirants represent a significant proportion of incoming students.</p>	<p><u>A.5.a:</u> By Grant Year 3, increase percentage of full-time, degree-seeking students who were in their first year of postsecondary enrollment in the previous year and enroll in the current year at the same institution. <u>A.5.b:</u> By Grant Year 4, increase percentage of first-time, full-time, degree-seeking undergraduate students enrolled at UNM graduating within 6 years of enrollment.</p>
<p>Goal B: To provide a model for collaboration between two-year (Central New Mexico Community College) and four-year (University of New Mexico) HSI institutions leading to development of STEM transfer and articulation agreements that enhance the success of Goal A.</p>	
<p>Objectives</p>	<p>Measures/Outcomes</p>
<p>Objective B.1: CNM and UNM departments will concur on learning outcomes and assessment of learning achievement for essential STEM-gateway courses in order to improve curriculum alignment for transferring students.</p>	<p><u>B.1.a.</u> Over grant period, UNM and CNM will reach mutual agreement on measured learning outcomes necessary for transfer of credits for at least 12 STEM-gateway courses. Agreements include expectations of institutional collaboration on future modification of outcomes, essential curriculum, learning assessments. <u>B.1.b.</u> Percentage of Hispanic students among total transfers from CNM to UNM will increase during the grant period from current level of 35% to >40%.</p>
<p>Goal C: To enable more data-based decision making by developing a data-driven decision-making structure for prioritization and evaluation of project activities and goals that will persist as a basis for data-driven decision-making to continue to improve STEM student success.</p>	
<p>Objectives</p>	<p>Measures/Outcomes</p>
<p>Objective C.1: To develop sustainable capacity to track student achievement, by race/ethnicity and income level (measured by Pell Grant or similar parameter), through the STEM-majors curricula and based on courses taken at UNM or other institutions.</p>	<p><u>C.1a:</u> Establish by Grant Yr. 1 end, query structures in enrollment data needed to build/analyze data sets for: *Final-grade-achievement distribution of students in STEM Gateway Courses to track effectiveness of project programs & identify intervention priorities especially for courses where Hispanic and/or low-income student achievement is disproportionately low. *Where in course-by-course progress toward a STEM degree, students change to non-STEM major or depart UNM to identify barriers for pedagogical, focused curriculum and advisement interventions particularly for barriers disproportionately affecting Hispanic and other low-income students. *Course-retaking patterns of students withdrawing or failing gateway courses with prior course grades and entrance-exam scores to identify prerequisite requirements/placement criteria</p>

	<p>not well aligned with subsequent course expectations.</p> <p>*Success of declared or aspirant STEM majors among transfer students (with focus on Hispanic, low-income and students transferring from CNM) in subsequent STEM courses at UNM to identify needs for inter-institutional curricular and assessment adjustments and to guide articulation and transfer agreements.</p> <p><u>C.1.b.</u>: By Grant Year 5 establish plans to sustain the data-driven decision-making structure into the future.</p>
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b. The extent to which the design of the proposed project is appropriate to, and will successfully address, the needs of the target population or other identified needs.

The Project for Inclusive Undergraduate STEM Success (UNM STEM Project) is inspired by the view expressed by a national leader in inclusive science education in colleges and universities:

It now appears that all traditionally taught college courses are markedly (though unintentionally) biased against many non-traditional students, and, indeed, against most students who have not attended elite preparatory schools. Thus, when we teach merely in traditional ways we probably discriminate strongly on grounds quite different from those we intend. Easily accessible changes in how we teach have been shown repeatedly to foster dramatic changes in student performance with no change in standards (Craig Nelson, 1996).

We plan to infuse these changes in sustainable ways to produce long-lasting impact on the success of Hispanic and low-income students in attaining STEM degrees.

Gateway Science and Math Course Reform: Based on needs at UNM, in NM and nationwide, *UNM identifies curricular and instructional changes in gateway-STEM courses as the focus of efforts to improve STEM-student success particularly for the increasing number of Hispanic and other low-income students who express early aspirations to pursue STEM fields.* Course-level changes offer the greatest opportunity to improve degree attainment for a large number of students. The project follows the conclusion of national leaders in student-success research:

Student learning is central to student success and by extension that without learning, students are not successful regardless of whether or not they persist. A model of institutional action, whatever its final dimension, must therefore treat student learning as part and parcel of the process of student success, and that success, however it is defined and measured, must have at its core success in individual classes (Tinto & Pusser, 2006).

Therefore, each year of the grant period, UNM STEM Project will support three, gateway-STEM course-reform projects facilitated and overseen by the Office of Support for Effective Teaching (OSET), UNM's faculty-development center. Each course reform effort will be defined by internally-solicited proposals from departments targeted by the project (those teaching one or more of 25 gateway life/physical science or mathematics courses: Biology, Chemistry, Earth & Planetary Sciences, Mathematics & Statistics, Physics & Astronomy). The proposals will specify commitment of the core regular and part-time faculty who teach the course and will require the collaborative participation of key faculty members from Central New Mexico Community College (CNM) identified by the CNM Dean of Math, Science and Engineering, who has agreed to assist with this project. Submitted proposals must show understanding of the discipline's pedagogical content and knowledge of research-based models for course reform. OSET workshops preceding submission of department proposals will assist faculty to develop proposals by providing opportunities to experiment with and utilize proven approaches particularly important for success of low-income and minority students (e.g., Handelsman et al., 2007; Sellers et al., 2007, Saul and Beichner, 2005).

Each course-reform team composed of four UNM and one CNM faculty will work during two summers that enclose an academic year of initial implemented changes. The first summer will include high expectations for course reform, such as outcomes plans; course-curriculum revision; outcomes-aligned in-class assignments developed or borrowed from open-course resources; inquiry-based lab exercises; reliable and valid summative assessment instruments; and assembly of a resource archive of teaching and learning aids for all future instructors to use. The resource archive is critical for sustainability as many gateway course sections are taught by temporary, adjunct instructors or graduate teaching assistants. The first-summer work will begin

with a STEM-focused version of OSET's 2-day course-design institute, which will include faculty from peer institutions who are leaders in this area (e.g. University of Colorado, Boulder) to provide guidance, assistance, and advice in STEM reform. During implementation the following academic year, OSET will host brown-bag lunches open to all – inviting participants from all UNM and CNM STEM and education departments – to share challenges and successes that promote constructive discussion, feedback and modification to the reforms. The brown-bag series will also recruit other faculty to submit course-reform proposals. During the second summer, faculty teams will make adjustments based on project evaluation and outcomes assessment during the previous year. Faculty teams receive summer-salary compensation for work in course-reform (first summer: 1 month; second summer: 2 weeks).

Peer Learning Facilitators: Peer-assisted collaborative learning: The most important pedagogical changes are those that move faculty away from extensive lecturing to greater utilization of active, collaborative, inquiry-based assignments during class time (Sellers et al., 2007; Wieman et al., 2010; Welsh, 2010). UNM research shows that these strategies are particularly important for engaging New Mexico Hispanic students (Sanchez, 1996, 2000). Many instructors are interested to replace lectures with time for students to collaboratively problem-solve, develop projects, or respond to short assignments with classmates, but are appropriately intimidated by the prospects of low success in large classes. Key to successful implementation is the availability of “experts” who learners can consult when needing clarification and who provide assistance with collaboration, an alternative prompt or a confidence check on progressing work. As class size rises above 50, it is nearly impossible for a single instructor to serve this expert role and it is increasingly difficult for instructors to formatively assess student work. Therefore, the UNM STEM Project will support Peer Learning Facilitators (PLFs), a

classroom learning-assistance effort by undergraduates working with instructors to facilitate active, collaborative learning during class time.

The UNM STEM Project will support a STEM PLF Program Coordinator with responsibility to hire and supervise PLFs and coordinate PLF training and evaluation with OSET personnel and the Project Director. The Program Coordinator will work with other project personnel to develop strategies to successfully recruit and hire PLFs, effectively match PLFs with instructors and deploy them to classes, and assess the highest impact training requirements for PLFs. PLFs will work 10-12 hours per week with tasks varying in consultation with instructors and necessarily including in-class work with students and preparatory time under guidance from instructors. PLFs may review student in-class work and summarize problem points and misconceptions upon which instructors can then focus. PLFs will receive intensive pre-semester training and will attend 1-2 hours of training each week during the semester.

STEM Student Interest Groups: Beginning-Student Socialization with STEM Experiences:

The UNM Project will develop and pilot STEM Student Interest Groups (SSIGs) for future institutionalization. SSIGs will be new 1-credit shadow seminars limited to 25 students per section to accompany gateway-STEM courses with high “do-not-succeed” rates. A single gateway course section may be linked to multiple SSIGs. SSIGs will provide opportunities for students to relate the gateway-STEM course to their goals and interests in pursuing a STEM degree. Weekly, one-hour meetings will vary between developing learning-success strategies (e.g., how to read textbooks for understanding; note-taking to promote thinking; developing metacognitive skills), exploring relevance of current topics in the gateway course to other STEM disciplines, tours of laboratories where undergraduate students conduct research (emphasizing concepts from the gateway course), presentations of research by undergraduate researchers,

approaches to thinking promoting effective learning in STEM courses, etc. SSIG curriculum will be guided by OSET advice to SSIG leaders/instructors during pre-course training with flexibility to take advantage of instructor expertise, department resources, and demonstrated interests and needs of enrolled students. SSIGs place students inside a STEM department in midst of advanced undergraduate students, graduate students, and faculty who are pursuing work in the field of interest to the entry-level, STEM-interested student. An example: Students interested in engineering may enroll in the engineering SSIG shadowing the general gateway chemistry course. The SSIG, led by an engineering graduate student, will meet at a location in the School of Engineering. The chemistry-course students sharing an interest in engineering form a cohort (SSIG) based on their shared course while engaging with applications of the chemistry course to their (potential) future engineering curriculum. Opportunities to meet faculty, graduate students, and advanced undergraduate students prior to formal acceptance or enrollment in a prospective department will connect students with resources and people in their chosen field; familiarity with the prospective-major department is otherwise limited while enrolled in large gateway classes primarily offered in other departments. SSIGs provide opportunities for STEM-fields exploration while addressing many students need for an academic and social STEM community, which research shows influences performance in science courses and students' overall university experience particularly for minority students (Welsh, 2010).

The SSIG program will be coordinated by the UNM STEM Project Director with co-PI and OSET Director Smith charged with recruitment of gateway-course departments for the SSIG initiative and the training of SSIG session leaders. SSIG leaders will be recruited from STEM-department graduate students with Office of Graduate Studies assistance. Graduate students who apply to be SSIG leaders will need to include how their personal or developing professional

experiences qualify them to inspire STEM success and interest among students who may be academically underprepared, under resourced, and from populations underrepresented in STEM.

STEM gateway-course faculty in partnership with advisors in UNM College Enrichment and Opportunity Programs and University Advisement will recruit STEM gateway-course students into the SSIG sections. All students who simultaneously enroll in companion-SSIG gateway courses may enroll in a SSIG, but incoming freshmen and transfer students will be targeted. STEM-interested students who are Hispanic, low-income, first generation, or any combination thereof will be encouraged to take advantage of this success-enhancing opportunity.

Data-driven prioritization and evaluation of project activities and goals: The UNM Project will collect and analyze data to drive project priorities; evaluate project activities, goals and objectives; and make timely and data-based decisions on project modifications. This work will be centered in the Office of Institutional Research (OIR) with expectation of both independence from and collaboration with the Project Director and Principal Investigators. As indicated in the “Need for the Project” section, a variety of data-analysis functions are required. These include assembling and analyzing data related to past course-taking patterns and success rates of UNM freshmen and CNM transfer students in STEM gateway courses (baseline data) with particular attention to disparities relative to ethnicity and financial need. These baseline data will inform UNM STEM project leaders of departments to prioritize for project recruitment. Baseline data will be analyzed along with data collected from courses that benefit from UNM STEM Project components (i.e., Course-Reform Initiatives, Peer Learning Facilitators, STEM Student Interest Groups) to evaluate project effectiveness. Once programming and querying structures are built and used for evaluating priorities, activities, and goals during the funding period, continued data-base building and periodic analysis can be sustained by OIR or by OIR in cooperation with other

units. However, there are no current resources for developing the data-driven activities and decisions envisioned for the UNM STEM Project. Thus, the grant will support an instructional researcher position dedicated full time to supporting the needs of the UNM STEM Project. Hired only for the grant period, this individual will build necessary capacity for continued data-driven decision making for Hispanic and low-income student success in STEM education and fields.

3. Quality of Project Services

a. Quality of design of the proposed project

The UNM STEM Project has four main components: 1.) Gateway Science and Math Course Reform; 2.) Peer Learning Facilitators; 3.) STEM Student Interest Groups; and 4.) Enhancing Data-based Decision Making in STEM. Adoption of known successful course-reform initiatives and other proposed UNM STEM Project services are of particular importance to the University of New Mexico where situational factors, such as a large proportion of low-SES students, relatively poor preparation for college, and a culturally and ethnically diverse student population with a high proportion of first-generation college students, can limit student persistence particularly in the very challenging STEM-degree programs. The UNM STEM Project design is based on these characteristics of learning at universities with higher-than expected persistence rates as identified in Table 4 from the research of Nelson Laird et al (2008).

Table 4: Characteristics of Learning at Universities with Higher than Expected Persistence

<i>1. Supportive campus environment:</i> Institutional emphasis on support and the quality of student relationships with other students, faculty, and administrators.
<i>2. More active and collaborative learning by students:</i> In- and out-of-class participation in discussion, presentation, and small-group exercises and projects.
<i>3. Faculty emphasis on active-classroom practice:</i> Time spent in class on small group work, in-class writing, student presentations and teacher-student led activities.
<i>4. Courses structured to emphasize intellectual and practical skills:</i> Assignments emphasize writing and speaking clearly, learning on one’s own, solving real-world problems, working with others, and computer use.
<i>5. High level of academic challenge:</i> Reading and writing for courses, emphasis on higher-order thinking skills, as well as student time on task and effort.

The UNM STEM Project design strategy differs from the develop-and-disseminate model of commonly funded STEM-course reforms, which has been criticized (Dancy et al., 2008; Henderson and Dancy, 2008) for a lack of institutionalization. Instead, general-education course reform at Miami University (http://www.units.muohio.edu/celt/engaged_learning/top25/) and STEM-focused initiatives at the University of Colorado (<http://www.colorado.edu/sei>) and the University of British Columbia (<http://www.cwsei.ubc.ca/>) provide models for anticipated institutionalization and sustainability of the UNM STEM Project initiatives. Example course-reform proposals provided at these websites also serve as models for UNM faculty to follow.

b. Quality & sufficiency of strategies for ensuring equal access/treatment for participants traditionally underrepresented based on race, color, national origin, gender, age, disability.

The UNM STEM project will help students complete courses - particularly STEM gateway courses - in a timely and satisfactory manner, continue to pursue a college education (retention), and progress toward graduation. With success in gateway courses, time to graduation and cost of one's education will decrease, thus increasing the likelihood of students facing financial difficulties having the opportunity to complete their education. In addition, the UNM STEM Project components aimed at increasing student participation, collaborative learning, and interest in STEM fields (i.e. Peer Learning Facilitators and STEM Student Interest Groups) are known best practices for improving student success for Hispanic and other low-income students as they encourage a sense of community and belonging. PLFs and SSIG leaders can also serve as role models for beginning STEM students as UNM makes every effort to hire from student populations of similar backgrounds. Project components have been constructed with understanding of the interventions critical to reducing barriers such as insufficient academic preparation to succeed in postsecondary studies, lack of familiarity with college demands and

services, lack of confidence or motivation, lack of role models or mentors, lack of computer skills, and all the socioeconomic barriers often interfering with student success.

c. Additional Quality of Project Services Indicators:

(i) Goals, objectives, outcomes to be achieved by project are clearly specified & measurable

As indicated in Table 3 (pg. 12-15), each project goal has specific objectives with measurable outcomes. The four project components are tied to the goals, objectives and outcomes as follows:

Key Project Components	Goals	Objectives	Measures/Outcomes
STEM Gateway Course Reform	A,B,C	A.1 A.4 B.1 C (all)	A.1.a; A.1.b A.4.a; A.4.b B.1.a; B.1.b C (all)
Peer Learning Facilitators	A, C	A.2 A.4 C (all)	A.2.a; A.2.b; A.2.c A.4.a; A.4.b C (all)
STEM Student Interest Groups	A,C	A.3 A.4 C (all)	A.3. a – d A.4.a; A.4.b C (all)
Data-Driven Evaluation & Decision Making	A,B,C	All	All

(ii) Project Services provided appropriate/address needs of target population/other needs:

Gateway science and math course reform supported by Peer Learning Facilitators (PLFs) and enhanced with Stem Student Interest Groups (SSIGs) focuses on accessible and demonstrated effective changes connected to replacing passive lecturing, algorithmic problem solving, competitive curve-based grading, and “cookbook” laboratory assignments known to dissuade students from continuing in STEM courses (Seymour and Hewitt, 1997; Handelsman et al., 2007; Tobias, 1990) with more actively engaging, relevant, inquiry-based, and collaborative instructional designs (Handelsman et al., 2007; Hake, 1998; Fraser and Tobin, 1998; Sellers et al., 2007; Mintzes and Leonard, 2006; Wieman, 2007). Research (Sellers et al., 2007) shows active, collaborative learning approaches are more inclusive of students who come from backgrounds traditionally not well represented among those who are in STEM fields, such as

Hispanic and Native American, low-income, and/or first-generation students. Active, social, collaborative learning opportunities in class are closely aligned with culturally-rooted approaches to learning prominent among NM Hispanic and Native American students (Sanchez, 2000).

(iii) Services provided appropriate to needs of intended recipients/beneficiaries of services.

The UNM STEM Project will be staffed by experienced student-services professionals and faculty who know the target population and are advocates for students by providing service appropriate to the known needs of Hispanic and low-income students with gaps in preparation and knowledge of higher education expectations. All project components emphasize learning in the classroom. UNM-student responses to national surveys (NSSE, 2010; Profile of the American College Student, 2008) show that (a) about half of UNM students work more than 20 hours each week about 50% above the national norm; (b) UNM students are twice as likely as nationally surveyed peers to work primarily to support themselves and their families; (c) nearly half of UNM students provide care to parents, children, and /or siblings. Given commitments to family and job, UNM instructors must maximize learning during scheduled class time.

(iv) Services provided reflect up-to-date knowledge from research and effective practice

Gateway science and math reform: Instructional methods to generate learning and higher student achievement are well known (Handelsman et al., 2007; Wieman, 2007); the challenge is achieving sufficient widespread adoption to be successful. However well intentioned, most previous reforms at classroom levels have not led to the hoped for magnitude of change in student learning or retention in STEM majors in spite of empirical evidence of effectiveness of the proposed innovations (Rising Above the Gathering Storm Committee, 2010; HERI, 2010; Fairweather, 2008). UNM's course-reform approach differs from past efforts that focus on a develop-and-disseminate model, which emphasizes development of innovations disseminated to

instructors who are then expected to use them successfully. Table 5 outlines factors that have limited the success of efforts to achieve widespread adoption of research-based curriculum and pedagogical reforms (Sunal et al., 2001; Fisher et al., 2008; Dancy and Henderson, 2008; Fairweather, 2008) that are essential to the course-reform component of UNM’s proposal.

Table 5: Factors Limiting Success of Widespread Adoption of Research-based Curriculum and Pedagogical Reforms and are Essential to Successful Course-Reform Projects		
Factor	Limiting Success	Success Engendered by:
1. <i>Faculty want to be part of the solution.</i>	The develop-and-disseminate model encourages a mentality where change agents and other faculty find themselves in opposition to one-another.	Instructors prefer collaboration with a change agent to develop instructional practices that fit individual situations. Rather than needing “education” to be more effective teachers, most faculty recognize the problems with traditional instruction as documented in the education-research literature.
2. <i>Course-reform must involve all instructors.</i>	Single gateway STEM courses are taught by multiple instructors at various ranks. Effective reforms adopted by one instructor have limited impact if others do not adopt the changes.	Lasting results can only be expected by involving all instructors of a targeted course in the change process. Project involves UNM full and part time faculty & CNM faculty
3. <i>Faculty must be rewarded for their work in course reform.</i>	Changes in attitudes and behavior toward teaching among STEM faculty mostly rely on work allocation and rewards rather than on evidence of instructional effectiveness (Dancy and Henderson, 2008; Fairweather, 2008). After all evidence about the relative ineffectiveness of lecturing, the dominant STEM teaching method, has not led to dramatic changes in teaching.	At research-intensive institutions like UNM, STEM faculty are highly engaged in research work that includes compensation through external grants, supporting staff and infrastructure, and recognition at the institution and beyond. Advances in scholarly teaching require similar reward and support structures.

Essential elements of the UNM STEM Project build on other programs (Fairweather, 2008; Wieman et al., 2010) to address these three factors as shown in Table 6.

Table 6: List of Strategies to Address Three Key Factors to Success in Course Reform
1. Faculty are part of the solution, because <i>they</i> make the changes to curriculum and instruction. Expert Office of Support for Effective Teaching (OSET) guidance and resources from workshops help to disseminate ideas, but faculty are empowered as informed change agents. No cookie-cutter templates for course reform are expected. Each faculty team contributes its own disciplinary expertise and a consensus view of supporting pedagogical content knowledge.

2. Most or all instructors teaching the targeted courses, not just an interested individual, will be involved, increasing likelihood of high-impact success. Instructional and assessment resources will be archived for use by all instructors including part-time and graduate-student instructors, so as to sustain the reform despite instructor turnover.
3. The process is rewarded through compensation for curriculum and instructional reform work. GA support, PLF assistance during implementation, and OSET resources are also available. Faculty work will be publicly recognized on both campuses, and they will be encouraged to undertake publishable classroom action research.
4. Each course-reform-project Graduate Assistant (GA) will be part of a team with other GAs working on other courses. This team will join Office of Support for Effective Teaching (OSET) activities that build science-education expertise and provide a “preparing-future-faculty” component to the project.

Up-front investment to develop and implement significant curricular and instructional changes to STEM gateway courses during the grant program will create long-lasting impact on student success with relatively little further investment. Once in place, these changes can be used and updated with assistance from OSET with relatively little additional investment making it relatively easy to institutionalize the impact of this project component. The three course-reform projects implemented each year will directly affect at least 1800 student learners initially and cumulatively more than 7200 students annually by project end. Due to the archives of STEM courses which have been reformed and continued course reforms, these numbers will continue to increase and STEM course reform will impact tens of thousands of students well into the future.

Peer Learning Facilitators: Peer-assisted collaborative learning: The PLF program builds from UNM’s pilot experience supported by the Walmart Minority Student Initiative and examples set by other institutions. Embedding student assistants in classrooms to provide peer guidance for problem solving and enhancing collaborative learning has been well established as effective. For example, Peer Learning Assistants are the cornerstone to support in-class, group learning across the curriculum at Worcester Polytechnic Institute after initiation in biology courses nearly 20 years ago (Groccia and Miller, 1996). Sparked by a five-year private-foundation grant, Peer Learning Assistants were connected to a course-reform effort similar to that proposed for UNM’s

STEM Project. Catterall (1998) demonstrated the peer-assisted cooperative learning approach at Worcester produced measureable gains in student course success, retention, and graduation, with net time efficiencies for participating faculty. Mostly funded with grant support, STEM Learning Assistants at the University of Colorado, Boulder, promote collaboration among students in large-enrollment classes with an added goal to recruit these assistants into science-education degree programs. The combination of course reform and Learning Assistants deployment produced measureable gains in student learning and grade achievement across the STEM curriculum (University of Colorado, 2009). During the initial PLF pilot at UNM, overall grade performance improved in most class sections where instructors transitioned to PLF-assisted collaborative-learning instruction. In addition, more than 80% of students enrolled in these course sections responded in polls that they prefer to learn in classes where PLF-assisted collaborative learning replaces some or all of instructor lecture. PLFs not only enrich the learning experience for students but also provide important résumé-enhancing, professional development opportunities for PLFs themselves. Recruiting PLF hires from under-represented groups adds the benefit of PLFs serving as role models to the students they assist.

The PLF program will grow beyond the courses that participated in the earlier pilot. Spring 2012 implementation will begin with expanded deployments in departments that participated in the pilot (Mathematics and Statistics, Chemistry, Earth & Planetary Sciences, Biology).

Additional departments and instructors will be recruited to expand the program to 40 positions in 15-20 class sections (potentially impacting more than 1500 learners starting in Fall 2012).

STEM Student Interest Groups: Beginning-Student Socialization with STEM Experiences:

STEM Student Interest Groups provide opportunities for students to relate gateway-STEM courses with their goals and interests in pursuing a STEM degree. SSIG model is based on a

successful model used at UNM - Freshman Interest Groups or FIGS. A FIG is a theme-based pair of classes designed to accelerate successful transition to university life. SSIGs will be developed during the grant period - scaling up from a few test sections during Spring 2011 in General Chemistry I and selected pre-calculus courses with broader implementation beginning in Fall 2012. Information from satisfaction surveys, learning-outcomes assessment, and grade achievement data will guide modifications and expansion of this pilot development effort across the five years with a target to institutionalize the program at the conclusion of the grant period. External funding is critical to develop and implement this project component as an assessment-driven, flexibly redesigned pilot activity that will be ready for institutional adoption.

Enabling data-driven decisions: Data-driven prioritization/evaluation of project activities/goals:

Implementing project activities within the context of evolving insights from relevant data is a centerpiece of the UNM STEM Project. Although anecdotal observations and broad categorical data sets suggest stumbling blocks for STEM degree attainment at UNM, especially by Hispanic and other low-income students, a critical analysis of existing data and systematic capture of future data are essential for achieving the project goals.

UNM also sees opportunity to provide a data-acquisition and analysis model that can be adopted by other institutions to drive similar decisions. In *Making the Pieces Fit*, Quintana-Baker (2001) states:

Findings from this research revealed that there are unique and culturally supportive environments and specific academic and affective strategies at these institutions that, when used in tandem, enhance Hispanic STEM students' abilities to pursue terminal degrees. The research-based best practices highlighted in this study can—and should—be replicated at other HSIs and at mainstream institutions with large Hispanic enrollment.

UNM's project aims to use data to substantiate claims of "what works" that are backed by empirical results substantiating the claims the project and its components actually make a

difference in increasing Hispanic and other low-income student success in attaining STEM degrees and in providing a model for collaboration between two-year and four-year institutions.

Data acquisition and analysis will be a critical part of the project from beginning to end. By starting at the beginning of the funding period, data will be immediately available impacting prioritization of course-reform projects during the first summer. Collection and analysis of class-section data (grades, learning outcomes achievement, attitudes toward project components) will permit persistent longitudinal assessment of project interventions so that adjustments can be made in a timely manner to course designs, SSIG and PLF implementations, and training programs for faculty, SSIG leaders and PLFs. The hired institutional researcher will also serve as a program evaluator by collecting and reporting data on the UNM STEM Project metrics that are described in the Project Evaluation section of this proposal.

4. Quality of Project Personnel (Key Personnel)

a. Quality of personnel who will carry out the proposed project.

The UNM STEM project has identified highly qualified Co-Principal Investigators (Drs. G. Smith and T. Gutierrez), a Project Director (N. Dominguez), an external evaluator (D. Baness King) and other key personnel. Key personnel qualifications, experience, education and training aligned to project quality and to achieving goals and objectives are detailed below.

b. Applicant encourages applications from traditionally underrepresented group members

UNM makes every effort to hire qualified personnel, which includes being members of target populations for which service is sought. In this case qualified personnel will be sought from members of traditionally underrepresented groups in STEM fields and education, particularly individuals who are Hispanic and/or from low-income backgrounds.

c. Additional considerations:

(i) Qualifications of the principal investigators and project director

1.) UNM Associate Vice President of Student Affairs Tim Gutierrez, Ed.D. serves as Co-principal Investigator and will be 100% funded *by the institution* during the grant period. Dr. Gutierrez serves as the ultimate authority on all implementation aspects of the grant and will engage senior UNM administrators to integrate the project into broader planning functions. His qualifications include:

*30 years experience as an administrator/educator providing opportunities to university students.

*15 years administrative experience with U.S. Dept. of Labor WIA and U.S. Dept. of Education diverse student development and retention programs, e.g. Ronald E. McNair; TRIO Student Support Services; College Assistance Migrant Program; and the Educational Opportunity Center.

* PI for privately funded College Prep Program, the ENLACE state and local projects; and the Title V individual grant (2006-2011).

*Supervising administrator for NM Minority Graduate Retention and Recruitment Program.

2.) UNM Earth and Planetary Sciences Professor and Director of the Office of Support for Effective Teaching (OSET) Dr. Gary Smith is Co-principal Investigator and will be in charge of all faculty-development components. Employed by UNM on a nine-month contract, Smith will receive grant compensation *only* for his summer work with course-reform teams.

*25 years experience as a UNM science (STEM) faculty member; Ph.D. in Geology.

*Background and experience in course design and instructional development.

*30 years of published geoscience research and additional publications on relationships between formative and summative assessments, strategies to engage students in learner-centered courses.

*Designs and leads UNM workshops on pedagogy and inclusive teaching strategies, and conducts course-design institutes to develop backwards-designed, student-engaged, inclusive and learner-centered pedagogies and assessments.

*Provides instructional workshops outside UNM for STEM post-docs and faculty.

*Co-Chair of the Faculty Committee formed under UNM 2006-2011 Title V individual grant advising on faculty-development programs and hiring/retaining Hispanic faculty.

*PI on UNM Walmart Minority Student Success grant (2010-11), featuring initial pilot of Peer Learning Facilitators and instructional training for gateway-course temporary adjunct instructors.

3.) Director of UNM Mentoring Institute and part-time faculty in Instructional Design and Training Technologies, Ms. Nora Dominguez, is the UNM STEM Project Program Director (classified as Program Operations Director by UNM Human Resources). The Project Director (100%, full time grant support) is responsible for implementing work scope, providing program/project planning, budgeting, and administration, and assuring interconnected project pieces are working together and milestones and evaluation measures are completed on time. An administrative assistant will be hired on the grant to support her work. Dominquez is a Hispanic, first-generation college student with a wealth of experience including:

*Master of Business Administration at the Autonomous Technological Institute of Mexico

*Ph.D. Candidacy, UNM Organizational Learning and Instructional Technologies (grad. 5/12)

*17 years experience in executive management positions in the banking industry in Mexico City

*10 yrs. professional practice developing/implementing workplace training/mentoring programs

*Consulting experience assisting entrepreneurs, small businesses, and corporations to develop financial strategic plans, risk management strategies, and evaluation programs

*Training and consulting experience with several federally and state funded programs, including Title V, TRIO Programs, and IHEP

*Member, Board of Directors of International Mentoring Association

*Research interest in organizational learning and publications in mentoring including the first book on the theory and practice of mentoring in Spanish.

4) Project Evaluator Outside Evaluator, Deborah Baness King, is the contracted independent evaluator (years 2-5) for the project. Her qualifying experience includes:

*More than 15 years experience in education including 10 years experience working with federal, state and local grant-funded programs.

*Successfully written funded grant applications to the U.S. Department of Education TRiO Programs, Office of Migrant Education Programs, Title V, U.S. Department of Labor.

*Served as a panel reader for federal grant applications and a consultant for proposal review workshops.

*Leadership positions with the Council for Opportunity in Education, Southwest Association of Student Assistance Programs, Mid-America Association of Educational Opportunity Program Personnel, National Association of Student Personnel Administrators, and the College Reading and Learning Association.

(ii) Qualifications of key project personnel

TABLE 7: Qualifications of Key Project Personnel		
Key Project Personnel	Responsibilities	Qualifications
STEM Peer Learning Facilitator Program Coordinator (1@100%)	Direct oversight of STEM Peer-Learning Facilitator (PLF) program. Plan and coordinate day-to-day administrative, fiscal, and operational activities related to PLF component, including hiring, payroll reporting functions, tracking of PLF performance with associated faculty, conducting appropriate training for PLFs in collaboration with other project and regular UNM personnel.	Bachelor’s degree in a related field; Experience working with diverse populations and students; Experience working with low-income and/or Hispanic populations; Experience working with students and/or on a college campus.
Institutional Researcher (1@100%):	Conduct all data compilation and analysis to facilitate data-driven decision making, prioritization and evaluation of	Bachelor's degree and at least 3 years of experience directly related to the duties and responsibilities specified, including knowledge of SAS programming and

	<p>project activities and goals. Acquire, manipulate, develop, and maintain longitudinal data sets, verifying accuracy and consistency over time; Statistical analysis of data and interpretation of results; Assist survey construction to collect data/information from students/ staff/ faculty; Develop/ maintain data bases for tracking student-achievement metrics.</p>	<p>other software used to manipulate, summarize, and produce reports from multiple, large, complex data sets; Apply statistical principles/processes to meet a range of information requirements; Expertise to build query structures and data base integrations to collect and analyze data critical to current and future decisions pertinent to improving Hispanic and low-income student success generally and in STEM fields.</p>
<p>STEM Student Interest Group Leaders (0.15 FTE/semester; 5 in Spring 2012; 15/semester thereafter)</p>	<p>Graduate students hired as part-time instructors. Develop (with guidance from OSET Director) and instruct sections of STEM Student Interest Groups.</p>	<p>Recruited from all STEM departments; Personal or developing professional experiences qualifying them to inspire STEM success and interest in students who may be academically underprepared and from groups under-represented in STEM fields. Preferred: Ph.D. students to prepare future STEM faculty.</p>
<p>UNM/CNM STEM Project Faculty Members (summer)</p>	<p>Course-reform teams: Four (4) core UNM instructors; 1 CNM instructor of the same course for a particular STEM course</p>	<p>UNM and CNM STEM faculty including part-time temporary faculty, lecturers (non-tenurable faculty), tenured and tenure-track faculty.</p>
<p>STEM Peer-Learning Facilitators (26 Spring 2012; 40/semester thereafter; 12/hrs./wk. 17 wks/semester</p>	<p>Provide specialized in-class learning facilitation and other instructional support in collaboration with STEM-course faculty.</p>	<p>Course subject competence indicated by course grade of A or B and recommendation from faculty member; Grade-point average 2.5 or higher; Excellent interpersonal and communication skills; Appreciation for challenges of mastering course learning outcomes, Desire/ability to help students at diverse academic levels with varying personalities and learning styles.</p>

5. Adequacy of Resources

(i) The adequacy of support, including facilities, equipment, supplies, and other resources.

The University of New Mexico is well equipped to undertake the UNM STEM Project. UNM has furnished space necessary to house the small number of staff that will be hired in the project and to provide all necessary training and meeting functions. Some project personnel will be integrated into existing administrative offices including the Office of Support for Effective

Teaching (OSET), the Office of Institutional Research (OIR), and the Mentoring Institute to provide both synergism and sharing of support resources.

New and renovated classroom and laboratory spaces, including those that will be completed during the grant period, will enhance the course-reform and collaborative learning aspects of the project. Opened in January 2011, the Science and Mathematics Learning Center contains new classroom and laboratory space used by Mathematics & Statistics, Chemistry, Biology, and Earth & Planetary Sciences. New instructional laboratory spaces will be available in the Biology Department in Fall 2011, and renovations of existing Chemistry instructional laboratories will be completed in late 2011 or early 2012. The Collaborative Teaching and Learning Building is planned for construction in 2012 (opening in 2013) with a focus on the design of flexible, technology-enhanced classrooms for collaborative learning. The UNM ARTS (Art, Research, Technology, Science) serves as a collaborative space for faculty, students (UNM, CNM and K-12), and NM's scientific and arts community to experiment, design and develop innovative research-driven applications for scientific visualization and transformative media. The coincidence of new and updated instructional spaces and the faculty development initiatives within the UNM STEM Project provides the opportunity to maximize the efforts to produce more inclusive and engaging STEM curricula to promote the success of diverse learners.

(ii) Relevance/demonstrated commitment of partners to project implementation/success

CNM and UNM have a long history of mutually supportive work in strategic planning toward shared vision. In 2008, CNM and UNM presidents signed a collaborative Memorandum of Agreement (MOA) to improve the NM public education system and create seamless educational experiences leading to more opportunities and success for students at all levels. In addition, to this MOA, the 2007 UNM and 2008 CNM Strategic Plans reflect commitment to strategies tied

to measurable outcomes; thus, commitment to the UNM STEM Project with measurable outcomes is part of both institutions’ strategic plans.

UNM’s transfer agreements and course-reform collaborations with Central New Mexico Community College will build upon existing agreements. This includes a recent agreement that allows students completing a CNM Associate Degree in Arts and Sciences direct admission into UNM’s College of Arts and Science. Against this backdrop of institutional cooperation, CNM faculty and administrators stand ready to join the UNM STEM Project. At UNM, a group representing faculty members in each of the departments that teach STEM gateway courses has committed to participating in course-reform projects. Many have already undertaken some level of transformative change including participating in the limited pilot of PLFs. This group will form the nucleus for building the course-reform teams and proposals within each department.

(iii) The budget is adequate to support the proposed project.

Most of the Project budget is tied to personnel compensation. All staff positions have been budgeted at the midpoints of the salary grades as established by the UNM Division of Human Resources. Undergraduate-student compensation is budgeted at levels typical of student employees at UNM. Faculty and graduate-student compensation rates are budgeted in accordance with typical STEM salary levels. Table 8 summarizes the budgeted personnel costs.

Position	Beginning annual salary (per person)*	Total Salary, 5 Years (all personnel)	Salary justification
Project Director (12 mo, 1.0 FTE)	\$76,000	\$391,591	Midpoint of UNM salary for Project Operations Director
OSET Director (1.5 mo summer)	\$10,800	\$55,647	Based on current salary
STEM PLF Program Coordinator (12 mo, 1.0 FTE)	\$39,000	\$200,948	Midpoint of UNM salary for Program Coordinator

Institutional Researcher (12 mo, 1.0 FTE)	\$48,000	\$247,321	Midpoint of UNM salary for Institutional Researcher
Project Assistant - OSET (Year 1: 5 mo, 0.50 FTE; Years 2-5: 10 mo, 0.25 FTE and 2 mo, 0.50 FTE)	\$10,500	\$49,500	Competitive STEM graduate-student assistantship
Administrative Assistant (12 months, 1.0 FTE)	\$29,000	\$152,000	Midpoint of UNM salary for Administrative Assistant I
STEM Student Interest Group Leader (0.15 FTE per semester; 5 positions in spring 2012; 15 positions thereafter)	\$2,000	\$312,500	Standard part-time instructor salary
Graduate Assistant – Course reform projects (3 positions per reform-project cycle at 0.50 FTE for 4 mo; 0.25 FTE for 10 mo)	\$10,500	\$166,500	Competitive graduate-student assistantship in STEM departments
Faculty summer salary – Course reform projects (1.5 mo first summer and 0.5 mo second summer for 3 UNM faculty)	\$12,000	\$442,530	Assumes an average monthly salary of \$6000 per faculty member on a team
Part-time temporary faculty summer salary – Course reform projects (1.5 mo first summer and 0.5 mo second summer for one (1) UNM part-time faculty)	\$5000	\$60,000	Comparable to 1.0 FTE rates for part-time temporary faculty
STEM Peer-learning Facilitator (26 positions spring 2012, 40 positions/semester thereafter; 12 hrs/wk, 17 wks/semester)	\$5280	\$807,840	Competitive pay rate (\$11/hr) for student employees

*2.5% annual pay increases for staff and faculty calculated starting FY13

Fringe benefits were calculated using current and projected rates set by the UNM Office of the Vice President for Research. Graduate student health insurance and tuition are included as a project cost as these benefits are typically provided with UNM assistantships in STEM fields. Table 9 shows the rates and amounts used to calculate fringe-benefit costs. The total fringe-benefit cost to the grant is \$140,955.

	Year 1	Year 2	Year 3	Year 4	Year 5
Faculty (summer)	0.221	0.233	0.238	0.243	0.248
Staff	0.355	0.37	0.377	0.385	0.393
Student employees	0.01	0.01	0.01	0.01	0.01
Grad. student health insurance					
Fall	\$ 675.00	\$ 708.00	\$ 743.00	\$ 780.00	\$ 780.00
Spring/Summer	\$ 912.00	\$ 957.00	\$ 1,004.00	\$ 1,054.00	\$ 1,054.00
Summer only	\$ 316.00	\$ 331.00	\$ 347.00	\$ 364.00	\$ 364.00
Grad. student tuition					
6 credits per sem.	\$ 1,500.00	\$ 1,575.00	\$ 1,653.75	\$ 1,736.44	\$ 1,823.26

Other grant costs are summarized in Table 10. These costs include office supply, photocopying and telephone costs, primarily for the Project Director’s office, travel for the Project Director to Title V meetings, and printed materials and room-rental costs for the workshops that support the course-reform projects, SSIG-leader training and the PLF training sessions. Insala software will be purchased in Year 1 to support workload tracking and assessment of PLF functions through the period of the grant. Costs are budgeted to bring two STEM-faculty course-reform experts from other institutions to work with the UNM/CNM course-reform teams each summer (years 1-4). These costs include travel to and from Albuquerque, accommodations and meals for 3 days in Albuquerque, and a \$1000 honorarium. The UNM STEM Project will contract with an external evaluator (flat fee of \$6000/year in years 2-5) and with Central New Mexico Community College to compensate CNM faculty who participate in the summer course-reform teams. The CNM contract cost is based on a \$5000/mo average salary with fringe benefits equal to UNM and services for 1.5 month during the first summer of each team’s work and 0.5 month during the second summer.

Expense description	Total cost (5-year grant period)
Materials and supplies	

Office supplies, photocopying, and phone cost (Project Director and Administrative Assistant)	\$ 28,900
Workshop printed materials and meeting-room rental (Course-reform projects lead off course-design institute)	\$ 16,000
Training session printed materials (PLF training)	\$ 6,000
Workshop printed materials (SSIG leader workshop)	\$ 2,250
Insala software for tracking and assessing PLF work	\$ 25,000
<u>Travel</u>	
Project Director travel to Title V meetings	\$ 25,000
Travel for two STEM-reform faculty experts to work with UNM/CNM faculty each year, years 1-4	\$ 8,000
<u>Honoraria</u>	
Two STEM-reform faculty experts to work with UNM/CNM faculty each year, years 1-4	\$ 8,000
<u>Contract Services</u>	
Contract to CNM to support faculty in course-reform teams (3 CNM faculty each year)	\$151,886
Contract to external evaluator (years 2-5; \$6000/yr flat fee)	\$ 24,000

(iv.) Costs are reasonable in relation to the objectives, design, and potential significance of the proposed project.

The UNM STEM Project budget strives to achieve value by working toward institutionalization of programs or development of sustainable capacity. Hiring and training of graduate students (SSIG leaders) and undergraduate students (PLFs) yield multiple benefits ranging from the primary project goal of improved STEM achievement by Hispanic and other low-income students, to enhancing the learning and scholarship of PLFs, to preparing future college (SSIG leaders) and K-12 (some PLFs) teachers.

The course-reform projects are investments during the grant period that will continue to return value as redesigned curriculum elements, pedagogical guides, and teaching materials are archived and provided for future instructors under the mentorship of the faculty who led the department-based projects and OSET. Curricular and instructional reforms will take advantage of existing and ongoing institutional investment in new learning environments and teaching and learning technologies.

The data-driven decision-making aspect of the project will provide a model of data compilation and analyses necessary to make strategic decisions that are necessary to improve student success in the STEM fields. Multiple pathways through courses in many departments, along with embracing students who enrolled in some of these courses at different institutions, make it very difficult to know where and what resources are needed to bring about positive change. While the size of UNM adds to the complexity of these interconnected challenges, the institution also brings an experienced Office of Institutional Research (OIR) into the project with a unique opportunity to make quantitative sense out of barriers to degree attainment of Hispanic and other low-income students. With grant support, it will be possible to build and refine the database construction that can then be sustained going forward within the staffing of the OIR.

(v) Costs are reasonable in relation to the number of persons to be served and to the anticipated results and benefits.

Given that UNM is a leading institution in the number of Hispanic graduates in the United States (<http://www.hispanicoutlook.com>), the UNM STEM Project offers the opportunity to serve a large number of Hispanic and other low-income students through the proposed grant-supported programs. In the last five years, overall Hispanic undergraduate enrollment has grown by 30.7% and the number of entering Hispanic freshmen has increased 47.3%. The combination of growing Hispanic enrollment and the project focus on large-enrollment gateway courses maximizes the potential to substantially increase the number of Hispanic students attaining STEM degrees. UNM currently enrolls over 20,650 undergraduate students and each year approximately 3500 new freshmen and 2500 transfer students join the community of learners. At UNM 40% or 8,260 undergraduates are Hispanic students added to CNM's Hispanic population of 42.7% or 12,788 students; this gives a "pool" of potential STEM Hispanic students numbering 21,048. In addition, there are 25 STEM gateway courses with total enrollments of approximately

12,000 students each semester not including summer term. Emphasizing support to improve student outcomes in these large-enrollment gateway STEM courses, UNM STEM project components have the potential to affect hundreds of students at a time with cumulative impacts on thousands of students within a few years. The course-reform projects in particular represent the possibility for high return on investment, because the concentrated effort over one year for each course will produce instructional materials, online resources, syllabi, pedagogical strategies and assessments available for future use with relatively easy updating and modification.

6. Quality of the Management Plan

(i) Adequacy of management plan to achieve project objectives on time and within budget, including clearly defined responsibilities, timelines, and milestones for accomplishing tasks.

The diagram below illustrates the organizational chart for the UNM STEM Project with shaded boxes highlighting the four key project components.

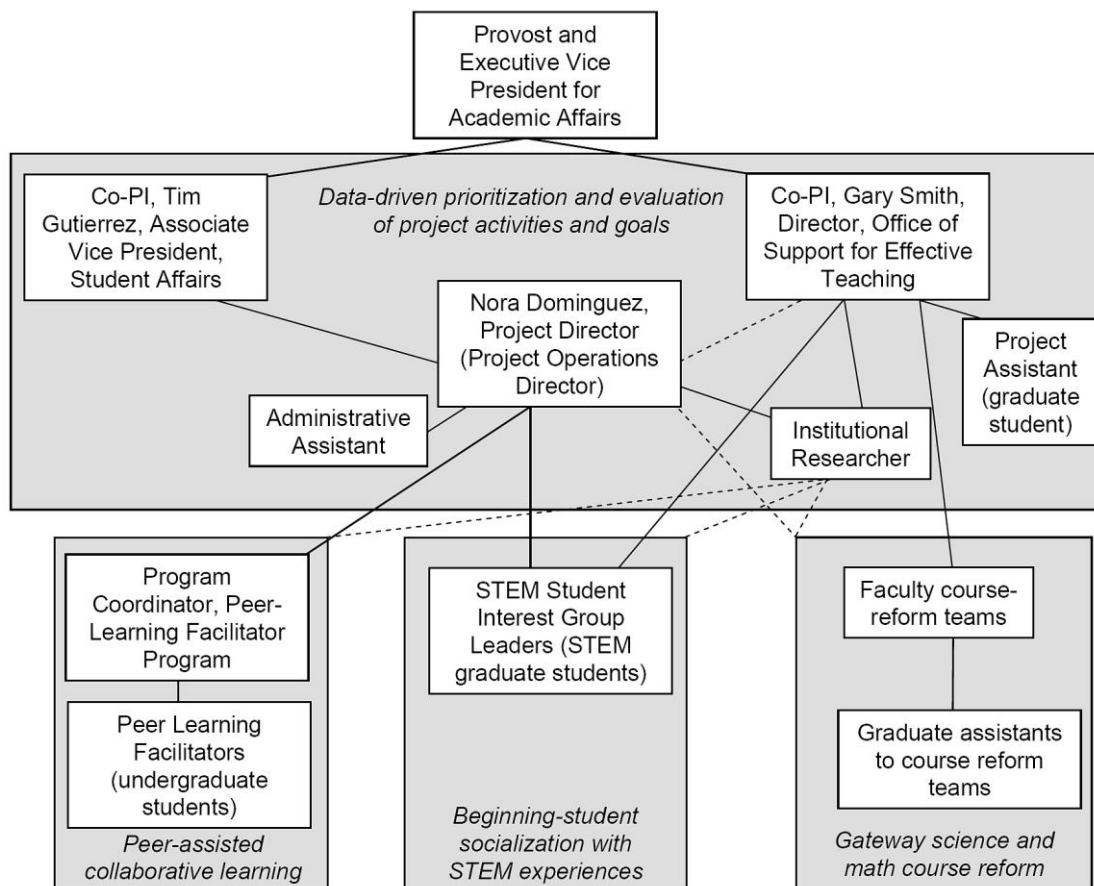


Table 11 details the management plan, including timelines, responsibilities, and milestones.

TABLE 11: Activities, Milestones, Responsible Parties and Timeline for Completion		
Major Activities/Milestones	Responsible Party	Timeline
ACTIVITY: Recruitment & Staffing of Principal Project Positions		
Milestone: Advertise and recruit for institutional researcher, program coordinator, and administrative assistant.	Co-PIs, Project Director, Director of OIR, Human Resources	Within two weeks of award
Milestone: Interviews conducted for institutional researcher, program coordinator, and administrative assistant.	Co-PIs, Project Director, Director of OIR	No later than one week after job posting deadline
Milestone: Hire recommendations for institutional researcher, program coordinator, and administrative assistant.	Co-PIs, Project Director, Director of OIR, Human Resources	No later than two weeks after interviews.
Milestone: Advertise and recruit Project Assistant	OSET Director, Project Director	March 2012
Milestone: Hire Project Assistant	OSET Director, Project Director, Human Resources	To start, May 2012
ACTIVITY: Key Component 1: Gateway science and math course reform		
Milestone: Finalize proposal process, selection criteria for course reforms	OSET Director; review by Project Director	November 2012
Milestone: Solicit course-reform proposals from STEM departments	OSET Director	December of each year, for course-reform projects beginning the following summer.
Milestone: Workshop for UNM/CNM faculty, guide course-reform proposals.	OSET Director	January of each year
Milestone: Internal course-reform project proposals due from STEM Departments (collaboration with CNM)	OSET Director	April 1 of each year
Milestone: Internal course-reform projects selected, departments notified	OSET Director	April 15 of each year
Milestone: Recruit and hire graduate assistants to course-reform projects	OSET Director, Project Director	Between April 15 and May 15 of each year.
Milestone: Course-design institute (2 days) for UNM/CNM faculty and graduate assistants engaged in course-reform projects; will typically include participation by one STEM-reform faculty member from another institution.	OSET Director	Within the 3 rd or 4 th week of May each year
Milestone: Course-reform project work sessions, progress meetings; typically include 1, half-day session with external STEM-reform faculty member	OSET Director (assisted by Project Assistant; collaboration with course-reform faculty)	During June and July each year
Milestone: Implement reformed course	OSET Director (assisted	During academic

curriculum at UNM/CNM, with periodic collection of outcome assessment data, monthly brown-bag discussions to assess progress, challenges.	by Project Assistant; in collaboration with course-reform project faculty)	semesters, August to May each year
Milestone: Survey faculty teaching and students enrolled in reformed course sections to ascertain impacts on faculty/student attitudes, motivation, learning	OSET Director (assisted by Project Assistant) in consultation with Institutional Researcher	Late November and Late April each year
Milestone: Classroom observations in reformed course sections	OSET Director (in collaboration with course-reform faculty)	During academic semesters, August to May each year
Milestone: Course-reform teams provide end-of-year reports documenting effectiveness of curricular and instructional changes and challenges that must be addressed.	OSET Director (in collaboration with course-reform faculty)	May 25 each year
Milestone: Annual report of course-reform projects including summary of projects, project personnel, list of course sections impacted (with enrollment), student learning outcomes and grade achievement data, survey results.	OSET Director, Institutional Researcher	By September 1 for the previous academic year.
ACTIVITY: Key Component 2: Peer Learning Facilitators (PLFs)		
Milestone: Recruitment of instructors for collaborative learning with PLFs and MOUs for instructor and UNM STEM Project responsibilities for implementation of PLFs	Project Director, Program Coordinator, OSET Director	Between weeks 8 and 12 of the semester prior to PLF deployment.
Milestone: Advertise and recruit for PLFs (26 positions in spring 2012; 40 positions each semester thereafter)	Program Coordinator, Project Director	Between weeks 8 and 12 of the semester prior to hire
Milestone: Hire PLFs and provide pre-semester training	Program Coordinator, Project Director, Human Resources	No later than one week before beginning of semester
Milestone: Debriefing and mid-semester training sessions with PLFs	Program Coordinator, (with Project Director, OSET Director)	Biweekly during academic semesters, August-May each year
Milestone: Surveys of faculty, PLFs, and students in PLF-supported class sections to ascertain impacts on faculty/student attitudes, motivation, learning	Program Coordinator in consultation with Institutional Researcher	Late November and Late April each year
Milestone: Annual report of PLF project including list of course sections with instructor and PLF names, section enrollments, learning outcomes and grade achievement data, survey results.	Program Coordinator, Institutional Researcher	By September 1 for the previous academic year.

ACTIVITY: Key Component 3: STEM Student Interest Groups (SSIGs)		
Milestone: Develop generalized curriculum structure and instructional guide for SSIG leaders	OSET Director	By December 1, 2011
Milestone: Advertise and recruit for SSIG leaders (5 positions spring 2012; 15 positions for each fall and spring semester, thereafter)	Project Director (in consultation w/ OSET Director)	Between weeks 8 and 12 of the semester prior to hire
Milestone: Advertise and recruit for SSIG leaders	Project Director (consulting with OSET Director)	Between weeks 8 and 12 of the semester prior to hire
Milestone: Hire SSIG leaders	Project Director (consulting w/ OSET Director), Human Resources	No later than 3 weeks prior to the beginning of the semester
Milestone: Full-day training and curriculum development workshop with SSIG leaders	OSET Director (assisted by Project Assistant)	Two weeks prior to the beginning of the semester.
Milestone: Periodic collection of learning-outcome assessment and student affective data and monthly brown-bag discussions with SSIG leaders to assess progress and challenges.	OSET Director (assisted by Project Assistant)	During academic semesters, beginning spring 2012
Milestone: Collection of summative SSIG student evaluation using course and instructor evaluation form with customized questions.	OSET Director	Within the last two weeks of each semester.
Milestone: Annual report of SSIG project including lists of SSIG sections and companion gateway courses, SSIG names and department, student learning outcomes and grade achievement data (in both SSIG section and companions course), IDEA results.	OSET Director, Institutional Researcher	By September 1 for the previous academic year.
ACTIVITY: Key Component 4: Data-based Decision Making Data-driven prioritization and evaluation of project activities and goals		
Milestone: Build/analyze existing data sets to show the final-grade-achievement distribution of students, by section, in 25 STEM-gateway courses; compare to student ACT and Compass scores	Institutional Researcher (in consultation with Project Director)	December 2011
Milestone: Build/analyze existing data sets to show where students change to a non-STEM major or depart UNM in course-by-course progress toward degree	Institutional Researcher (in consultation with Project Director)	March 2012
Milestone: Build/analyze existing data	Institutional Researcher	July 2012

sets to show the success rate of declared or aspirant STEM majors among transfer students (with focused analyses on Hispanic and/or low-income students and students transferring credits from CNM) in subsequent STEM courses at UNM	(in consultation with Project Director)	
Milestone: Build/analyze existing data sets to show the course-retaking patterns of students who withdrawal from or fail a gateway course, along with prior course grades and entrance-exam scores	Institutional Researcher (in consultation with Project Director)	September 2012.
Milestone: Update grade distributions (broken down by race/ethnicity/gender) for STEM gateway-course sections to compare progress within class sections experiencing project interventions with sections that are not.	Institutional Researcher	Within 60 days following the completion of each fall and spring semester, each year
Milestone: Update grade distributions (by race/ethnicity/gender) for UNM STEM-enrolled students transferring pre-requisite course credit from CNM	Institutional Researcher	Within 60 days following the completion of each fall and spring semester, each year
Milestone: Use grade-achievement, learning outcomes, and survey data to provide feedback for improvement to project participants (course-reform teams, PLFs, faculty using PLFs, Program Coordinator, SSIG leaders)	Co-PIs and Project Director	Ongoing as data are collected and analyzed, semester-by-semester
Milestone: Analyze annual reports described above for key components 1-3 to plan for project adjustments	Co-PIs and Project Director	By October 1 each year
Milestone: Establish a work plan to sustain the data-driven decision-making structure into the future.	Institutional Researcher (in consultation with co-PIs, Director of OIR)	July of the fifth grant year (2016)
ACTIVITY: Project Evaluation		
Milestone: Evaluation of progress toward project outcomes and completion of timeline-defined tasks; includes review of annual reports from key components 1-3.	External Evaluator (with assistance from Project Director and Institutional Researcher)	Annually between September and November
Milestone: Independent survey of STEM department chairs and the Deans of the College of Arts and Sciences and School of Engineering to obtain opinions and suggestions about the ongoing project.	External Evaluator (with assistance from Project Director)	Annually between September and November
ACTIVITY: Articulation and Transfer Agreements between UNM and CNM		
Milestone: Formal agreement between institutions on the measured learning	Co-PIs, UNM Provost and Dean of Arts and	No later than June of the fifth grant year (2016).

outcomes necessary for the automatic transfer of credits for at least 12, STEM-gateway courses	Sciences, CNM Vice President for Academic Affairs; Dean of Math, Science & Engineering	
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(ii) Procedure adequacy to ensure feedback/continuous improvement in project operation

The management plan includes numerous formative-feedback input points to foster continuous improvement. Students, instructors and project staff will be periodically surveyed as part of the course-reform, peer-learning facilitator, and STEM student interest group project components. Learning-outcomes and grade-achievement data will be collected. Classroom observations will be provided in a collegial atmosphere of peer feedback/support offered to instructors. All of these formative-assessment opportunities will provide information that will permit mid-course corrections as well as sharing of innovations that have been most effective.

(iii) Mechanisms for ensuring high-quality products and services from proposed project.

Management plan reporting and evaluation milestones provide annual checks on the quality of project services and progress toward attaining project goals, objectives, and outcomes. Surveys of students and instructors involved in project instruction components supported will provide evidence of the quality of implemented activities. Ongoing data collection and analysis ensures data-driven decision making and continuous project improvement based on data analysis.

Frequent meetings between project participants provide a mechanism to ensure high-quality services and project progress. Faculty and graduate assistants involved in course-reform project implementation will meet at monthly brown-bag sessions. SSIG leaders will also meet monthly with project staff. PLFs will meet with the Program Coordinator (PC) biweekly and the PC will also use Insala software to solicit frequent assessments of PLF attendance and effectiveness from instructors who deploy these learning facilitators in their classes. Co-PIs, Project Director (PD), PC and Institutional Researcher will meet at least monthly (biweekly if deemed necessary) to

track project progress and integration of key components. Co-PIs and Project Director will meet quarterly with the UNM Provost and the CNM Vice President for Academic Affairs to present project progress and to solicit feedback on executive-level perceptions of project functions.

(iv) Time commitments of the project director, principal investigator and other key project personnel are appropriate and adequate to meet the objectives of the proposed project.

Many of the key project personnel will be dedicated full time to the UNM STEM Project. The Project Director (and Administrative Assistant), Program Coordinator for the PLF component of the project, and the Institutional Researcher will all be 100% committed to the project.

Co-PI and OSET Director, Dr. Gary Smith, will be committed full time to the project during the summer months, which is the critical time for efficient facilitation of the course-reform projects. During the academic year, Dr. Smith is assigned half-time to OSET and half-time to the Department of Earth and Planetary Sciences. Dr. Smith will prioritize OSET's commitment to the project so that he will be approximately 0.25 FTE on the project during each academic year. With the assistance of the Project Assistant (0.25 FTE during the academic years; 0.50 FTE during the summers), Dr. Smith will provide the necessary support to the overall project.

(v) How UNM will ensure a diversity of perspectives brought to bear in project operation

The UNM STEM Project sets out as collaboration between Academic Affairs and Student Affairs with the Co-PIs working at the interface of the project and broader constituencies. Besides survey data collected from both students and instructors, STEM Deans and Chairs will be canvassed for their input on the project on an annual basis. The project annual reports and evaluator reports will be publicly available on the project website and frequent news announcements about the project activities will include solicitation for input. Presentations and discussion panels on course-reform projects, STEM peer-assisted learning, and the STEM Student Interest Groups will take place annually at UNM's *Success in the Classroom: Sharing*

Practices that Work conference, which will serve both to keep the UNM community informed about the project and also to solicit comments and suggestions. Selecting the course-reform projects through an internal proposal process is a critical step in assuring that multiple perspectives are considered in this key and lasting component of the project. UNM/CNM faculty teams will be able to justify their proposed reform strategies by utilizing their discipline specific pedagogical content knowledge and their experiences in teaching UNM and CNM students. Students provide perspective by program participation, frequent feedback and survey response.

7. Quality of Project Evaluation

(i) Methods of evaluation are thorough, feasible, appropriate to goals, objectives, outcomes

Table 12 summarizes the measurement sources and data-collection approaches for evaluating the measurable outcomes for the objectives connected to the three project goals:

- **Goal A:** To increase the number of Hispanic and other low-income students attaining degrees in the field of science, technology, engineering, or mathematics.
- **Goal B:** To provide a model for collaboration between two-year (CNM) and four-year (UNM) HSI institutions leading to development of STEM transfer and articulation agreements that enhance the success of Goal A.
- **Goal C:** To enable data-based decision making by developing a data-driven decision-making structure for prioritization and evaluation of project activities and goals that will persist as a basis for data-driven decision-making to continue to improve STEM student success.

Nearly all of measurements will be compiled from already collected enrollment-management information by the institutional researcher as part of the data-driven decision-making and assessment component of the project. Surveys will be administered by the Project Director in collaboration with other project staff. Each outcome is supported with an evaluation measure.

Table 12: Evaluation plan linked to project objectives

Objectives to Obtain Goals	Indicators/Data to Measure	Measurement Source/Data Collection Method
A.1: Increase student success and retention by developing 12 faculty-driven STEM gateway course-reform projects.	Three (3) gateway-STEM course reform projects initiated during each of Years 1-4. Students enrolled in reformed courses: Year 2: 1800; Year 3: 3600; Year 4: 5400; Year 5: 7200	Annual report of course-reform projects; registrar data
	Student-success measures for Hispanic and/or low income students completing each reformed course will improve Course completion: – 75%; 2nd semester of reform implementation – 80%; 3 rd semester. Grade of C or higher: – Increase by >10%; 2 nd semester of reform implementation – Increase by >20%; 3rd semester of reform implementation	Student ethnicity and grades accessed from registrar data each semester. Receipt of a Pell Grant (financial aid data base) will serve as proxy for low-income status. Grade improvement based on comparison to pre-reform statistics for the course.
A.2: Increase engaging, collaborative classroom learning through training and deployment of Peer-Learning Facilitators (PLFs) in large-enrollment STEM gateway courses.	Faculty in at least one gateway course in <i>each</i> of the departments that teach a gateway life/physical science or mathematics course will adopt a collaborative-learning pedagogy supported by PLFs by the end of the second project year.	Tracking of STEM faculty who complete collaborative-learning workshops, request and are assigned PLFs.
	Student-success measures for Hispanic and/or low income students completing each PLF-supported course section will improve. Grade of C or higher: – Increase by >10% by 2 nd semester of PLF deployment – Increase by >20% by 3rd semester	Student ethnicity and grades accessed from registrar data each semester. Grade improvement based on comparison to pre-reform statistics of the same course taught by the same instructor.
	Collaborative learning meets needs of $\geq 80\%$ of students in PLF-supported classes. PLFs, faculty, students, staff surveyed for quality of program & suggestions for PLF component improvement.	Anonymous surveys of students with likert-scale questions about perceived learning gains and helpfulness of PLFs to learning.
A.3: Increase student retention and success in STEM gateway courses by	<u>Year 1:</u> 5 sections, Aim for 60% target population and 100 students (attrition-based estimates), i.e. 60 Hispanic and/or	Registrar data

developing and piloting STEM Student Interest Groups (SSIGs) to shadow sections of at least four gateway courses (two courses during first year).	low-income students (of 100 total students) <u>Years 2-5</u> : 15 SSIG sections will be completed by ≥ 180 Hispanic and/or low-income students (300 total students). Students, leaders, instructors, staff surveyed on quality & suggestions.	
	By Year 4, $\geq 80\%$ of students enrolled in an SSIG complete companion gateway course with a grade of C or better.	Registrar data
	By Year 4, at least 80% of students enrolled in an SSIG enter or continue in a STEM field as their declared or aspired-to major.	Registrar data
	At least 80% of students identify SSIG experience as supportive to pursuing STEM degrees and course success	Anonymous surveys of students with likert-scale questions
A.4: The number of Hispanic and other low-income students receiving Bachelors degrees in life/physical sciences, engineering, and mathematics will increase.	Year-over-year increases in Hispanic and/or other low-income students obtaining STEM degrees will be apparent by the end of Year 3. By Year 4, the proportion of STEM graduates who are Hispanic will equal or exceed the proportion of Hispanic students among all graduates.	Registrar data; IPEDS graduation reports
A.5: Improvement of overall Hispanic student persistence and degree attainment	By Year 3: Increase by 5% full-time, degree-seeking Hispanic students who were in their first year of postsecondary enrollment in the previous year and enroll in the current year at the same institution. By Year 4: Increase by 10% first-time, full-time, degree-seeking Hispanic undergraduate students enrolled at UNM graduating within 6 years of enrollment	Registrar data
B.1: CNM and UNM departments will concur on learning outcomes and assessment for essential STEM-gateway courses in order to improve curriculum alignment and transfer.	Over grant period, and beginning no later than year 4, UNM and CNM will reach mutual agreement on measured learning outcomes, curricula, and assessments necessary for transfer of credits for at least 12 STEM-gateway courses.	Documentation of transfer agreements.
	Percentage of Hispanic students among total transfers from CNM to UNM will increase during the grant period from current level of 35% to more than 40%.	Registrar data

<p>C.1: To develop sustainable capacity to track student achievement, by race/ethnicity and income level through the STEM-majors curricula and based on courses taken at UNM or other institutions.</p>	<p>Year 1: Build query structures to build/analyze data sets for three prior years. Years 2-5: Update data sets. – Final-grade-achievement distribution of students in STEM gateway courses. – Course-by-course progress toward STEM degree or degree departure – Course-retaking patterns of students withdrawing or failing gateway courses along with prior course grades and entrance-exam scores –Success of declared or aspirant STEM majors among transfer students in subsequent UNM STEM courses (with focus on Hispanic, low-income and students transferring from CNM)</p>	<p>Registrar data</p>
	<p>By Year 5: establish plans to sustain the data-driven decision-making structure.</p>	<p>Complete data-access and analysis plan</p>

(ii) Methods of evaluation will provide performance feedback and periodic assessment of progress toward achieving intended outcomes.

As indicated in the Project Management Plan, evaluation measures will be included in Annual Reports designed to provide periodic assessment of each project component. Reports will contain evaluation data to permit efficient performance feedback from stakeholders and consolidate information for independent program evaluator review. Ongoing data collection and analysis will drive decision making and provide for empirically based continuous project improvement.

(iii) Methods of evaluation include the use of objective performance measures that are clearly related to the intended outcomes and will provide quantitative and qualitative data.

As shown in Table 12, each of the outcomes described in the Project Design is measured as part of the evaluation plan. Quantitative data are derived from objective data bases collected independently for various enrollment-management functions and institutional reporting requirements. Qualitative data are collected from surveys by (a) students in courses affected by project interventions, (b) staff, students, and faculty who implement the interventions, and (c) stakeholder administrators in the College of Arts and Sciences and School of Engineering.