



The Summer Undergraduate Research Bridge Experience for Community College Students: Providing Connections from Community College to the Four-Year Institution

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Introduction

The New Mexico Alliance for Minority Participation Summer Community College Opportunity for Research Experience (New Mexico AMP SCCORE), evolving in 2005 from a former New Mexico AMP program, assists community college students with their transition and acclimation to the culture and research of the university. The impressive outcomes of the former program, the Minority Engineering Transfer and Articulation (META) program (2001-2004), allowed us to take the successful components of the program, targeted only to pre-engineering students, and redesign the program, targeting more broadly to underrepresented students in all Science, Technology, Engineering, and Mathematic (STEM) disciplines.

The redesign has allowed SCCORE to become a sustainable and successful program, as evidenced by the number of students who have transferred and those who have enrolled in graduate school. The program started with all the alliance community colleges and one host university, New Mexico State University, located in the southern part of the state. The program has now been modified in structure to include all the universities as host institutions. We recognized that many students in the northern part of the state wanted to apply but did not feel comfortable staying for such a long time so far from their hometowns, and, most importantly, we acknowledged that some students preferred to transfer to a northern institution closer to home and family. Therefore, we offered to our other 4-year institutions the opportunity to host a SCCORE program, and we provided students the choice of attending SCCORE at the university at which they wanted to transfer. This change also gave our university Institutional Coordinators (ICs) more investment in our alliance activities, as they set up their own programs on campus and reached out to their own faculty to serve as research mentors for the students. In addition, community college ICs continue to be involved as recruiters for the program, and both the university and community college ICs collaborate with selection of participants. Through the years, our alliance activities have formed connections between universities and community colleges as they work toward the common goal of increasing retention in STEM by strengthening pathways and making them more accessible to students. In research experiences like SCCORE and others, Hunter, Larsen, and Seymour (2006) purport that experienced professionals in the disciplines of the students' interests model the "practices and habits of mind that contribute to successful engagement and discovery". . .and they teach students how to creatively problem solve, persist even in the face of failure, and learn methods and techniques of using highly technical equipment. They also state that "research experiences are viewed as important mechanisms for helping undergraduate transition into their professions because of the opportunity for cognitive apprenticeship and identity development."¹

Program Overview

The SCCORE initiative allows community college students to have an actual experience at the 4-year campus and to gain a network of faculty, New Mexico AMP staff, and university and community college students prior to transfer. SCCORE is one of the major components of the

New Mexico AMP program, a National Science Foundation (NSF)-funded statewide partnership of universities and community colleges that are more active partners. With a mission of increasing the enrollment, quality of education, and graduation rate of historically underrepresented minority students (URM) in STEM fields, New Mexico AMP was established in 1993. Since the program's inception, the number of baccalaureate degrees awarded to underrepresented minorities in STEM areas has more than doubled, from 253 in 1992-1993 to 665 in 2012-2013, with a total of 9,388 STEM degrees awarded over the life of the program. The program also provides direct student support to enable students to attend academic year and summer enrichment activities without unnecessary loss of income.

The New Mexico AMP SCCORE program benefits from the existing statewide network of New Mexico AMP universities and community colleges and offers opportunities that lead to transfer to community college students, many of whom are the first in their families to go to college. Given the challenge of New Mexico's population scattered over such a large area that often results in geographic isolation, the SCCORE program connects statewide students with two of the core components of the New Mexico AMP program, specifically SCCORE, held each summer and the New Mexico AMP Student Research Conference, held each fall, at which statewide students, including SCCORE participants, present their research and network with other students and faculty.

The SCCORE program targets students enrolled in community college and provides research opportunities, fosters student success, and assists students in articulation and transfer. This target was based on current studies that reveal that nearly half (45%) of all undergraduates in the U.S. in 2012 attended community college, and of these, 46% were minorities.² In New Mexico in 2013, 57% of all undergraduates in the state attended community college and of these, 64.9% were minority students.³ With its large network of community colleges and universities, New Mexico AMP's programs, like SCCORE, that target retention and transfer in STEM, have steadily improved the working relationships of instructors and administrators. SCCORE has also provided opportunities for students to broaden their perspectives and to recognize the possibilities that are available in the state outside of their communities.

The SCCORE program consists of a Summer Bridge Program for community college students in which students are housed on the host university or 4-year campus, attend a credit-bearing seminar, participate in research assistantships with faculty at the host campus in their discipline, and receive year-round advising support to help with transfer and articulation. Bridge programs like SCCORE and others that target students early and provide them with academic and social integration increase their potential for success in the transition from community college to university. In the program, students earn a stipend that helps to ease the burden of continuing their educations, and they earn university credit, providing them additional incentive to transfer after completing community college. Students are also offered carefully designed interventions that help to create a sense of belonging as students are immersed into the culture of the university and participate in the research of their discipline. In all of the host programs, students research each day, with a time allotted for attending a professional development seminar that includes presentation and scientific writing training, exposure to STEM professionals, student panels, lab tours, and orientations to resources on the host campus. The following seminar schedule

illustrates some of the daily activities and events that provide professional development to the SCCORE students:

Table 1: SCCORE Seminar Schedule

| Major Events | Workshops | Lab Tours/Field Trips | Panels/Speakers |
|-----------------------------|--|---|--|
| Orientation Dinner | Hazcom Training; Intros to: SCCORE, New Mexico AMP, and Research Methods | Tours of Biology Lab, Plant and Environmental Labs, Physics Lab, Astronomy Presentation and Tour of Observatory; Reduced-Gravity and Biomechanics Lab | Transfer Student Panel and Graduate Student Panel |
| Farewell Luncheon/Symposium | Creation/Dev. of Poster and Hands-on Poster Workshops | Field Trip: Tour of Research Projects in the Region | Combining Entrepreneurship with Engineering |
| | Purpose/ Significance of Research; IMRAD Method | | Importance of STEM and its Research (by Biology Dept.) |
| | Maximizing Transfer | | Speakers: STEM Professionals and Researchers (for example, one speaker was a former SCCORE Participant who works for the FDA.) |
| | Progress of Your Research (ongoing) | | University Resources: Financial Aid/Scholarships, Library Research Methods; Tutoring |

Students who have participated in SCCORE have come from many STEM disciplines, including engineering technology, biology, animal and range sciences, plant and environmental science, physics, astronomy, agronomy and horticulture, computer science, industrial engineering, mechanical engineering, electrical engineering, and civil engineering.

The SCCORE program was designed to meet the following goals: 1) To increase the transfer rate of minority students in STEM disciplines at community college level to bachelor degree programs in STEM disciplines at university level through active involvement in a summer bridge program that orients students to campus life; 2) To positively contribute to retention and transfer through active involvement in a research mentorship program at a baccalaureate-granting university, and 3) To provide academic and professional development to students through the

research experience and seminar to orient students to university life and to the culture of research in their disciplines.

With a transfer rate of 69.1%, the goals of the program are being realized, as reflected in the majority of the students who opt to enter a 4-year school the semester after SCCORE or who gain a committed intent to do so after they return to complete their community college programs. We attribute these decisions to having the opportunity to experience the culture of university life for 4-6 weeks, in addition to the diverse and rich experiences provided to explore their disciplines in a substantive way through professional development seminars and research assistantships. Most importantly, the SCCORE program helps students to collect and acquire information they need to successfully navigate the pathway or ‘bridge’ from community college to university life. Hirst, et al. discuss their own summer research experience in southeastern Massachusetts, the home of the two participating partnering institutions, asserting that “summer research experiences have been identified as important vehicles for fostering the learning, skill development, and retention of undergraduates in the sciences.” In these programs, transfer pathways are established, supporting the transfer of community college students in STEM and broadening students’ future aspirations for graduate school through an “expanded sense of science [and] lab experiences.”⁴

Background

The Need for Programs in New Mexico that Encourage and Facilitate Student Transfer

New Mexico, coined “The Land of Enchantment” perhaps as much for its diversity of cultures as for its distinguishing diverse terrain, has a high percentage of underrepresented minorities (47.3% Hispanic and 10.4% American Indian), reflecting a sizable available pool of underrepresented talent in the state. New Mexico’s population of 2.09 million people is scattered over an area equal to the combined land area of 10 eastern states, resulting in geographic isolation for many communities.⁵ The majority of New Mexico K-12 students are Hispanic and low-income. Many are also second language learners,⁶ with a language other than English used in 36% of New Mexico households.⁷ In national comparisons, New Mexico ranks near the bottom in several key indicators of well-being for children, ranking 48th for children under 18 living in poverty.⁸ Thus, the state’s low income levels and lack of opportunity resulting from other factors, such as language barriers, create the need for programs in the state that enable students to enroll in nearby schools, most often community colleges.⁹ The National Academies of Engineering (NAE) report, that more than 8 million students, who represent “the most diverse student body in the history of the United States,” enroll in community colleges each year, representing an enormous pool of talent available to help meet the nation’s STEM workforce needs.¹⁰ Fully one half of students receiving four-year degrees in the STEM disciplines attended community college at some point in their educational pathway. Community college students, in fact, represent a highly motivated pool of students. According to the College Board (2012), for all disciplines, as many as 80% of community college students identify transfer toward earning a four-year baccalaureate degree as an education goal.¹¹ Importantly, students who have been traditionally underrepresented in STEM are disproportionately enrolled in community colleges, with almost half (44%) of African American students and over half of Hispanic and American Indian students (52% and 55%, respectively) choosing community colleges as their institution of

higher education. Despite this large pool of a diverse and motivated students, Hoffman et al. report that an alarmingly low number of minority and female students complete two-year associate's degrees in STEM – only 11.08% of Hispanic community college students in 2006 (2010).¹² Clearly, it is crucial that we develop and support the talents and intentions of community college students. Citing the work of Alicia Dowd et al. at the Center for Urban Education at the University of Southern California, the NAE report (2012) goes on to state that transfer assistance in the form of scholarships, the availability of mentoring, and the “culture, values, and beliefs of faculty” increase the number of community college students transferring to four-year STEM degree programs. A number of additional issues critical in increasing STEM transfer rates are suggested by the report, including the transparency of information about STEM career paths and the availability of effective articulation agreements. The support provided to students is especially critical in states like New Mexico, where students face a number of educational and economic challenges previously pointed out in this paper.¹³

Community colleges lead the way to postsecondary education for many minority, low income, and first-generation students. Lieberman and Hungar highlight the fact that “while the nation’s community colleges serve high numbers of minority and low-income students, disappointingly, few students manage to make the leap to four-year institutions.”¹⁴ The authors assert that the reasons for students’ inability to transition to four-year institutions lie in the need for more flexible pathways and stronger academic support to compensate for any limitations in students’ readiness for college-level work.¹⁵ Horn and Skomvold (2011) and Shapiro et al. (2013) found that while 81% of entering community college students in the U.S. indicate they want to earn a bachelor’s degree or higher, only 25% of entering students actually transfer to a four-year institution within five years.¹⁶

Meeting the Challenges Associated with Low Transfer Rate

Many factors contribute to this low rate of transfer. For one, students who lack academic role models or who have low self-esteem issues and little confidence often have a difficult time seeing themselves as “university material” or academically successful. Renown author and Stanford University psychologist Carol Dweck highlights the power of mindset, explaining that abilities and talents are not what brings people to success, but, instead, it is whether goals are approached with a fixed or growth mindset. In her well known book, *Mindset*, Dweck proports, “Many minorities drop out of college and many women drop out of math and science because they just don’t feel they fit in.”¹⁷ Efforts like the SCCORE program broaden student perspectives and develop different ways of thinking about themselves and what often looms before them as mysterious and daunting. Dweck discusses how a fixed mindset, in which there is a belief that qualities are carved in stone “creates an urgency to prove oneself over and over,” which eventually can limit achievement by causing fear of the unknown and unfamiliar. On the other hand, an individual having a growth mindset can view that basic qualities like intelligence and skills can be cultivated through one’s efforts through application and new experience.¹⁸ The SCCORE program encourages the growth mindset by teaching students that they can venture out and leave their comfort zones to broaden their perspectives and try new experiences that will stretch and grow them. Many of the SCCORE participants have never left their small, rural hometowns, and have never visited a university campus. The SCCORE program provides students a sense of belonging in a community and builds their confidence level as they establish

a network of student peers and university faculty and graduate students who scaffold for them what needs to be learned. By providing a schema, or background of knowledge, these faculty provide students with lab and field experience and hands-on application. They also expose them to the rigors and techniques of research.

In addition, many students face the financial burden of working to support themselves and their families while concurrently attending school. Resources, like the financial aid ‘gauntlet,’ seem burdensome and difficult to navigate and scholarships are often a foreign concept and confusing to identify, and students do not see themselves as capable of winning the awards. Leaving home is often difficult because of their desire to stay by family and the culture in which they were raised. They also have responsibilities to contribute to the family’s financial needs. The SCCORE afternoon seminar includes presentations by representatives of the Office of Financial Aid and Scholarships to help students comprehend fund availability and procedures of access. In addition, we help students make one-on-one appointments with Financial Aid to go over specific issues, questions, and processes, if needed.

Students also do not always know the pathways from community college to university, nor do they know how to connect with the right advisors who are well informed about articulation and transfer, and the result is loss of money and time. Students, especially first-generation students, are often overwhelmed and immobilized by their inexperience with the bureaucracies of the system, and this leads to discouragement, confusion, and often, giving up on the notion of continuing on any educational pathway. In addition, some students also see college at any level as an exclusive community that serves only the highly gifted or elite.

To help students access the transfer and articulation pathway and to encourage a growth mindset regarding transfer, we invite the New Mexico AMP Community College Co-Director and IC at SFCC, to teach transfer workshops to our statewide students because of her involvement with the Higher Education Department’s (HED) Transfer Module Task Forces (Computer Science and General Engineering) and the HED General Articulation Advisory Committee. Assistant Professor of Engineering at SFCC, this IC has served as Visiting Faculty for the SCCORE program since the program’s inception and she provides transfer training annually at the Community College Professional Development Workshops at the New Mexico AMP Student Research Conference. The students are assigned to bring their transcripts and to review the requirements for their programs of interest at the institutions to which they want to transfer to find out any courses they are lacking and still need to take. They complete worksheets and walk away with a better idea of the transfer pathway. We also invite a representative from the Transfer Center, where one is available, who assists these students with understanding the pathways between their institutions and the receiving institutions. To help students even further, the SCCORE Coordinator helps with identification of faculty members at the host institution in the specific disciplines the students want to transfer, and the students make appointments with the identified faculty to go over their transcripts and discuss transfer. Sometimes, these appointments result in research assistantships or part-time work for the student in the academic year, and they always result in strengthening the network of community for the student upon transfer, providing one more advocate and friendly face for the student and helping with the often difficult transition of transfer.

Another obstacle is the traditionally-held view that community college students are not as academically capable as those who attend university, and often university faculty view community colleges as not offering the best education to students, and this stereotype affects their willingness to work with these students on their research projects. Further, community college and university faculty often do not have the opportunity to connect and have very little contact, even though both groups advise on articulation and transfer at one time or another. These were obstacles that had to be overcome the first years the program was offered, and finding research mentors was a huge challenge because the mentors had a fixed mindset that community college students did not have the necessary math or science background to participate as research assistants in their projects. One way we help faculty modify their own stereotypes of community college students is to invite them to review the students' transcripts and application packets, on which our staff has already noted the completed math and science courses. Often, the students have taken courses that provide an exposure to the discipline, providing more background than the mentors expected. Even in cases where math and science background was lacking, the mentors were able to review their transcripts and gain knowledge of work ethics, problem-solving abilities, and intellectual curiosity from the courses taken, GPA's, and grades. Some mentors, although not impressed particularly with the transcripts, wanted to provide the students an opportunity they may not otherwise be given to grow and gain knowledge because they believe in the fundamental concepts of our alliance and the SCCORE program, understanding what Grabowski, Heely, and Brindley call, "the value of early research for improved retention."¹⁹

Overcoming Obstacles Facing SCCORE

Resource for the Program

We learned very quickly that one of our greatest obstacles to overcome was the cost of the program. Students are paid a stipend for attending the program, and we pay for their stays in dorm residence halls, their meals, activity pass to the swimming pool and activity center, parking, activity fees, tuition for the one-credit hour course we provide, and new-student enrollment fees (if they are first-time attenders to the host institution), and any other fees associated with their stays, in addition to providing the mentors with supply money for the students' research supplies.

One way we have addressed the costs associated with the program is to seek out mentors who are willing to leverage their own grant funding to provide research assistantships for the community college students. Therefore, it has become less labor-intensive to find mentors because many grants now mandate that some of the funding is to go to community college research assistantships. For example, at NMSU, a Host Institution for the last SCCORE program, six of the students were funded by the NSF Engineering Research Center for Reinventing the Nations' Urban Water Infrastructure (ReNUWIt) that partners with NMSU, Stanford University, University of California-Berkeley, and Colorado School of Mines. This leverage turned out to be beneficial to both SCCORE and ReNUWIt, and we also invited the high school Young Scholars Program participants who were part of the ReNUWIt effort to join the afternoon seminar. The faculty often seek us out to find students to participate in their programs, instead of us having to seek them out, as before. The faculty has more confidence in the ability of the community

college students because they have had such positive outcomes from working with these students through the years. They have invited some of their students to present their research and to discuss their SCCORE experiences at some of their annual reporting meetings. Some mentors have hired these students as part-time researchers, and some have used these students as peer mentors for new students in their programs.

We also leveraged with another Louis Stokes Alliance for Minority Participation (LSAMP) program in South Carolina, the South Carolina Alliance Minority Participation (SCAMP) program at a small southern fully accredited all-Black Liberal Arts college. In 2011, two students from this institution participated in our SCCORE program, and in 2012, these students and two more participated. SCAMP was willing to pay all costs for the students. Because this institution in their alliance focuses more on teaching than research, the SCAMP Program saw the value of having some of their STEM students participate in our program. This was a wonderful experience for these students, and all of these former SCCORE participants have graduated and gone on to pursue graduate school in STEM fields.

Another cost-associated issue is the challenge of the SCCORE stipend not being as competitive as some of the internships offered in our state. For example, there are NSF internship programs and national lab internships offered that pay almost three times the amount we pay the students for a stipend. Therefore students, although interested in SCCORE, opt out to take other internships that pay more to offset the cost of their classes in the academic year. We continually look for funding and leveraging opportunities to increase the cost of the stipends and to offset other costs of SCCORE.

In addition, our faculty currently serve as volunteer mentors, and they depend upon their graduate and post-graduate students to assist them in the mentorship of the SCCORE students. We have been positively impacted by this volunteer service, but we continue to search for funding for SCCORE mentors or to increase other benefits to them, such as increased supplies funding for their participants.

Modeling Best Practices

The best way to ensure that these students complete bachelor's degrees in the STEM fields is to strengthen and increase transfer-focused interventions and opportunities with programs, such as community college bridge programs. The idea of bridge programs is not new; for example, the "Exploring Transfer" (ET) program at Vassar College for community college students, originally partnering thirty years ago with LaGuardia Community College, has served over 1,000 students from area community colleges, with over 80% transferring to four-year institutions.²⁰ This successful program and others served as Best Practice models for SCCORE for our alliance. In explaining the reasons for the success of such programs, Liebermann and Hungar discuss the "power of collaboration between institutions with significant differences but a common goal."²¹ La Guardia Community College is a City University of New York (CUNY) campus located in the borough of Queens in New York City, while Vassar is a private, prestigious liberal arts college, listed in 2014 annual ranking of U.S. News and World Report as "most selective," and the 11th best liberal arts college in the nation, with an acceptance rate of 24.16% and total number of students at 2,477.²² Likewise, New Mexico AMP's diverse 4-year and 2-year

institutions share the common goal of increasing B.S. degrees in STEM by encouraging active involvement in activities and events that lead to retention and transfer, like SCCORE.

Although the bridge programs in the literature reflect more programs for high school to university or high school to community college, there are other programs, like SCCORE, that provide residential bridge programs for community college students at the four-year institution. Although a majority of the programs seemed to have more of a focus on the development of skills to help students with coursework upon transition to the four-year institution, there are programs that have the research focus similar to SCCORE's. The following programs offer a research focus or a research component, serving as models of best practices for the SCCORE program and pointing to ways our alliance can improve SCCORE.

Two programs that offer research in the biomedical field to underrepresented students include the Bridge Summer Research Program at University of California at Los Angeles (UCLA) that provides students at eight (8) community colleges training in lab techniques, including biomedical instrumentation and research methods; an introduction to the UCLA campus and its biomedical and life and physical science academic programs; mentoring by UCLA science faculty; individual academic advising by a science counselor; and special academic and professional development workshops.²³ The Bridges to the Baccalaureate Program at the University of Massachusetts at Boston (UMB), and Bunker Hill and Roxbury Community Colleges also has the objective of advancing the careers of community college students who want to pursue a biomedical research career. The program provides community college students practical training in lab techniques, after which they are placed in supportive UMB and associated laboratory working environments where they establish peer/mentor relationships. Students receive a paid 2-week research skills workshop, followed by 8-10 weeks of research training as a full-time UMB employee during the summer.²⁴

Promoting early engagement for community college students in STEM research, the Internships in Nanosystems Science, Engineering, and Technology (INSET) program, is held at the University of California at Santa Barbara, a tier-one research university. Similar to the SCCORE program goals, INSET provides research opportunities to increase retention and degree completion. Unlike bridge programs that were researched, the INSET program involves community college faculty in all aspects of program planning and implementation of the program. The faculty from the four community colleges that participate in the program identify and recruit interns from the community college pool, and the lead community college faculty regularly visits the lab. Professional development workshops are provided in the program to provide training of presentation skills and more exposure to STEM disciplines and careers. The practice of involving the community college faculty in the research serves as a best practice model for the SCCORE program. In SCCORE, we have one community college faculty who has instructed the course and all the community college Institutional Coordinators of our alliance recruit and collaboratively select participants for the program, but the idea of involving more community college faculty to become involved in the research experience would strengthen the ties of community college faculty and students and community college and university faculty.²⁵

Rachel Hirst, et al, discuss a program at a four-year college for underrepresented community college students that has the goal of increasing retention and transfer and to expand the capacity

for research for community college faculty. Two of the authors are professors at Stonehill College and one of the professors is an associate professor at Massasoit Community College. The feature that stands out in this innovative program (unnamed in the article) is the collaboration of community college faculty and the private college faculty, who co-mentor the community college students. The community college faculty stayed involved in ongoing research at the 4-year college, and during the 3rd year of conducting research, each community college faculty member received \$15,000 in grant funds to begin their own research programs, and in the following year, they applied for external funding to support summer research at the community college. This program serves as a model for SCCORE, whose long-term goal has been to involve community college faculty from our alliance in research collaboration with faculty at our four-year institutions.²⁶

Many bridge programs introduce students to rigor of college coursework and study skills necessary to succeed. One such program is the Ohio State University STEP program (referred to as OSTEP), which focuses on first-generation students and underrepresented minorities in STEM. OSTEP is a six-week residential bridge program that, much like the SCCORE program, expanded the population from strictly engineering in a predecessor program to all STEM majors. The focused courses include communications, math, integrated science, and visualization and problem solving, in addition to a night professional development course. An interesting aspect of the integrated science course is the active learning research component in which students investigate STEM concepts regarding the dragonfly flight and habitat. They collect and analyze data with faculty from multiple disciplines, which helps them learn “the nature of science and the interconnectedness of concepts from multiple disciplines.”²⁷

Many summer bridge programs exist that provide transition between the senior year in high school and the freshman year in college. These programs benefit students by helping entering freshmen become acclimated to the world and culture of university life and receive academic support. These include such programs as the following: 1) a pre-college summer bridge program at Middle Tennessee State University (MTSU), which provides a program that is a component of a five-year NSF grant — FirstSTEP — that focuses on retention of STEM majors; 2) a summer bridge program at Anoka-Ramsey Community College, a component of the ASPIRE program; 3) the Bowling Green State University Academic Investment in Math and Science (BGSU AIMS), a summer bridge program; and others.

Program Assessment: SCCORE’s Transforming Impacts and Outcomes

Programs like SCCORE and others bridge the gap between community college and university and de-mystify the university and what it does and stands for. Through their participation in these programs, students experience positive outcomes, including what Sadler and McKinner note as “increased knowledge, competitiveness for graduate school, and commitment to the field.”²⁸ For many students, their experiences in bridge programs such as SCCORE are life changing.

SCCORE’s successful outcomes result from understanding the influence that community college has on students in New Mexico. The American Association of Community Colleges indicates

that community colleges are “powerful forces for transforming the scientific workforce because most college students from diverse backgrounds begin higher education there.” As stated previously, 57% of all undergraduates in New Mexico in 2013 attended community college and of these, 64.9% were minority students.²⁹ and many of these students planned to transfer to a 4-year institution. However, as Reyes stated regarding transfer in STEM, “more work is needed to strengthen 2- and 4-year collaborations.”³⁰ In our experience, the SCCORE program has served to strengthen ties between universities and community colleges in New Mexico, resulting in long-lasting impacts for our students.

Strengthened Ties Within the New Mexico AMP Partnership

Since New Mexico AMP was first established in 1993, one of the challenging goals of the organization has been to strengthen connections and ties between community colleges and 4-year institutions in the alliance. As the SCCORE program has evolved, we have seen more investment by the Institutional Coordinators (ICs) in our program than ever before, especially when we expanded the program to include all the 4-year institutions as host institutions for the program. Not only did this improvement provide students with attending a SCCORE program at the institution at which they planned to transfer that was closer to their home locations, but it also gave ICs an opportunity to work more directly with students and faculty, providing them a broader population of participants for their New Mexico AMP programs on their campuses and encouraging community colleges and universities to work together toward a common goal of increasing retention and transfer in STEM. A resulting benefit of this collaboration is the engagement in research and inquiry, contributing to the shift of the notion of students as a passive audience to students as “active stakeholders in a research community.”²⁸ According to Healey and Jenkins, this concept encourages “learning the epistemologies and forms of discipline-based inquiry; learning particular disciplinary research methodologies; linking the questions and forms of inquiry explicitly to academic staff research interests and current research foci in the disciplines; and producing work that mimics the forms of knowledge creation and dissemination in their disciplines and professional areas.”³¹ In this approach, students learn by doing, replacing individually competitive modes of inquiry with ones that focus on collaboration with teachers and students and students with other students. The SCCORE program supports this collaborative mode of inquiry by developing a broad community of researchers that crosses institutional boundaries. As the community college and university partnership has become more strongly connected, ties between the New Mexico AMP Administrative staff and the ICs have also strengthened. The collaboration of partners in the alliance has had a two-fold benefit: 1) ICs have become more invested by setting up their own programs, and 2) the ICs are being called on or are volunteering more frequently as speakers, trainers/ instructors, or coordinators for additional Alliance activities and events.

Strengthened Collaborations With Faculty and Complementary Programs

One of the goals for New Mexico AMP for this phase has been to make stronger the collaborations with our faculty and with other programs that would serve to benefit our students, i.e., the ReNUWI and EPSCoR programs. In addition, we wanted to strengthen collaborations with faculty that would lead to eventual leverage with their funded grants. So far, we have made headway, evidenced by the vested interest and commitment of the NMSU Campus Co-PI of the

ReNUWIt project, who serves as Community College Education Lead for the project. Sixteen (16) students have been funded by ReNUWIt for the NMSU 2012, 2013, and 2014 SCCORE programs, and this year, up to five (5) will be funded. Of these students, 13 have transferred to universities in New Mexico. Some of these students have been offered part-time research assistantships for the academic year by faculty who are associated with ReNUWIt and all have presented research at least one national conference to present their research. Others have earned scholarships and are New Mexico AMP Undergraduate Research Scholars at the receiving universities.

Another collaboration that has been strengthened that has had an impact on our SCCORE students is the Experimental Program to Stimulate Competitive Research (EPSCoR). In 2014, New Mexico AMP partnered with EPSCoR to provide the New Mexico Academy of Science 2014 Research Symposium on November 1, 2014 at the Albuquerque Hyatt Downtown. New Mexico AMP students from NMSU and other alliance partner institutions. The focus of the Research symposium was to encourage students to present research on Sustainable Energy Development in New Mexico and the Water-Energy-Environment Nexus. Forming the collaboration of partners was the New Mexico Academy of Science (NMAS), the New Mexico Partnership for Math and Science Education (NMPMSE), and New Mexico AMP, all of whom leveraged funding for the conference. The First-, Second-, and Third-Place awardees for Poster Presentations were all undergraduate students who participate in New Mexico AMP programs in statewide institutions. A 2014 UNM SCCORE participant from Central New Mexico Community College (CNM) was awarded First Place at the Conference, which is important to note because he was competing with students from community college and university. Also, a former SCCORE participant who is now about to finish her M.S. degree, presented graduate research at the conference. This collaboration has strengthened our working relationship with EPSCoR.

We have also leveraged with other faculty members' grant-funded projects, which has offset costs for the SCCORE program, and these faculty and others have approached us already for collaborating with us for Summer 2015's NMSU SCCORE, including a BRIGE Grant, whose P.I. has committed funding for two students and the ReNUWIt program has committed to leveraging funding for five students. As stated before, many grants require a community college component for either research or other participation, so SCCORE is a good match for leveraging with these programs.

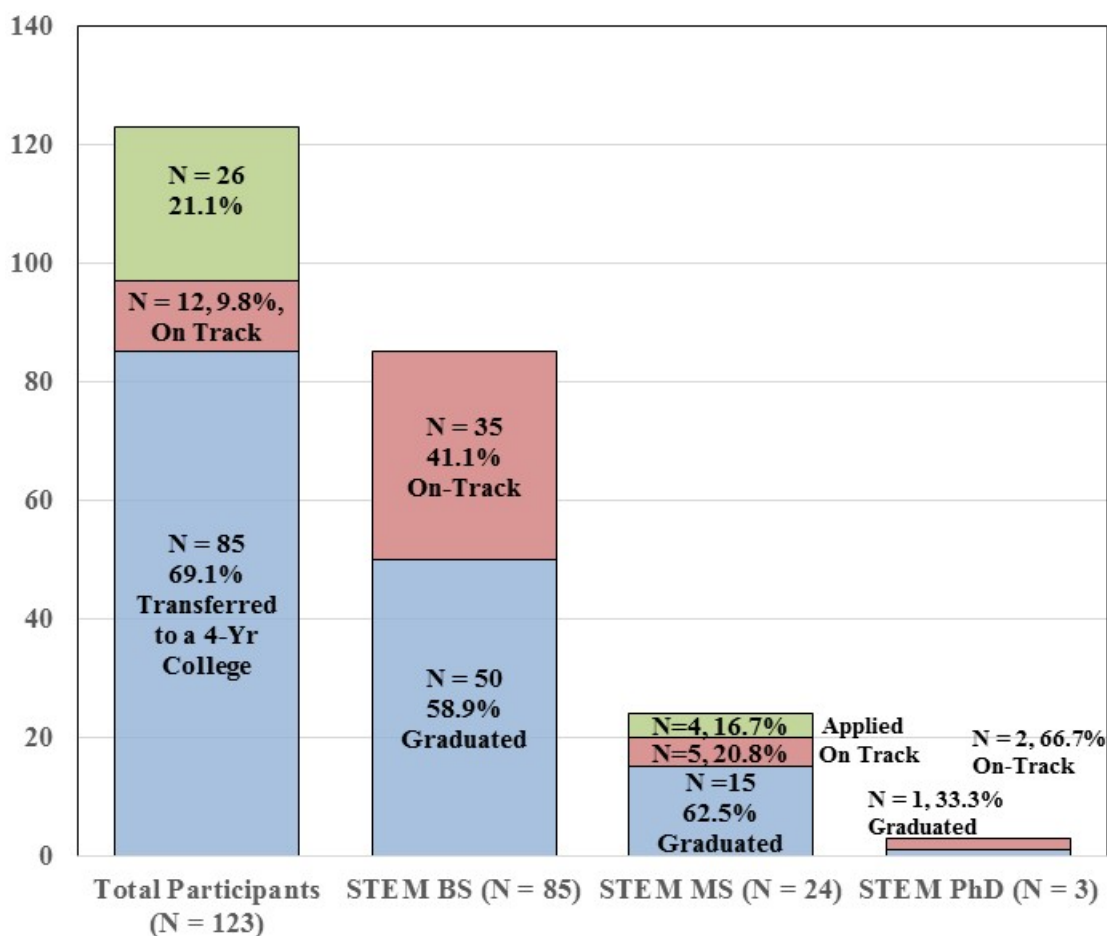
Positive Student Outcomes

Positive student outcomes of the SCCORE program include the development of long-lasting peer relationships among participants, the development and subsequent pursuit of strong educational pathways that have led to the B.S. degree and beyond for several participants, and strong outcomes for degree attainment. These, in addition to providing students with a sense of belonging, community, and a network of faculty members who become a touchstone or constant for the students, make this bridge experience notable in a student's academic career.

Degree Completion and Graduate School Enrollment: The development of strong educational goals leads directly to positive outcomes for degree completion. More than 120 students have

participated in the SCCORE program through 2013. At the conclusion of the Fall 2013 semester, 69.1% of the participants had transferred to a 4-year institution and of these, 58.9% had graduated with a Bachelor's degree. The remaining 41.1% of the transferred students were on track to complete their B.S. degree. In the program, between 2005 and 2013, 54% of the total participants were male, and 46% of the total participants were female. We expect the number of participants continuing their education beyond their Bachelor's degree to continue to grow. Since 2013, 24 SCCORE participants have completed or are pursuing a M.S. degree or were applying to graduate programs, as shown in the table below. One of the SCCORE students has graduated with a Ph.D. and two continue in their Doctoral programs and are expected to graduate soon (in May 2015).

Table 2: SCCORE Participants' Progress Through 2013



Development and Pursuit of Educational Pathways. Students come from many STEM majors and participate in research projects that are sometimes very complex and sophisticated. As a result of their participation in the project, many students are better able to articulate their long-term educational goals, sometimes extending and developing those plans as a directly result of their involvement in research. For some students, their goals stretch beyond the bachelor's degree, and they develop an interest in continuing their studies at the graduate level. Table 3 contains a representative sample of the complex research projects the students are able to engage in the SCCORE program, as well as the educational pathways pursued by participants.

Table 3: Sample of SCCORE Student Research Projects and Educational Pathways

| Student Ethnicity | CC | Univ. | Project Title | Degree Status |
|--------------------------|-----------------------------|---|---|---|
| Hispanic | Santa Fe CC (SFCC) | NMSU | Riparian Evapotranspiration Depletion of the Middle Rio Grande | B.S. and M.S., Civil Engineering (CE), NMSU. Ph.D., CE (CU-Boulder) |
| Hispanic | NMSU-Alamogordo (NMSU-A) | NMSU | Segregation of Mapping Population in Cotton Detected by AFLP Markers | B.S., Biology (NMSU). Ph.D. in progress, Mayo Graduate School |
| Hispanic | SFCC | NMSU | Water Quality in New Mexico's Colonias | B.S. and M.S., IE, NMSU |
| Pacific Islander (PI) | NMSU-A | NMSU-A | Impact of Discharge of Treated Wastewater on the Antibiotic Resistance of E. coli and Staphylococcus ssp. | B.S., Biology; M.S., CE-Environmental |
| Hispanic | Central New Mexico CC (CNM) | University of New Mexico (UNM) | Characterization of Transcription Factors in the Capsaicinoid Pathway | B.S., Biology, in progress |
| Hispanic | Luna XX | New Mexico Institute of Mining & Technology | Mechanization: Green Chile De-Stemming | B.S., Mechanical Engineering, in progress |
| Hispanic | NMSU-Carlsbad | Eastern New Mexico University | Polymorphic DNA Markers for Homologous Trichome Gene-TIGI in Cotton | B.S., Biology, in progress |

Development of Long-Lasting Peer Relationships: Students are expected to attend their research assignments every weekday morning of the program, and afternoons are devoted to attending a seminar that includes professional development training that focuses on creation and development of a research poster and presentation that includes an abstract and writing in the format of a scientific paper (Introduction, Methods/Materials, Results And Discussion, or IMRAD). Professionals speak on various STEM issues to help the students explore STEM professions; student panels are presented to help students understand transfer as well as pursuit of a graduate degree. Various faculty members offer lab tours or field trips of their research settings and sites, and many representatives from the host institutions resources offer workshops/seminars to our students to help with access of the resources offered at university. (See SCCORE Schedule Table 1). Students room together, eat together, work, and play together, forming and nurturing a development of community and network throughout the weeks of the

program. These students become best friends, lab colleagues, and future resources in the often difficult transition of transfer from community college to university.

Student Response to the Program: Program assessment strategies include exit surveys and informal interviews with the students at the end of every SCCORE program. The surveys and interviews reveal the significance and influence of the students' participation in research, as well as the associated seminar and other program activities. Moreover, student responses showed that they felt they belonged in this community of learners, especially the broader scientific community. Adding to this sense of belonging was their shared residences, mealtimes, and experiences in the labs with their professors and graduate students, which seemed to result in a sort of collegiality they had not experienced before. Students' survey responses are coded into broad categories, with the most significant of these falling into three general areas: Transfer of Knowledge, Benefits of SCCORE, and Modification of Students' Future Plans, including plans to pursue graduate school. (See Table 4 below: Selected Responses From Students' Exit Interviews):

Table 4. Selected Responses From Students' Exit Interviews

| Area | Student Response |
|------------------------------|---|
| Transfer of Knowledge | <ul style="list-style-type: none"> • "I learned that many different research projects can be related to each other because they all have an effect on what we collectively know about the world and how we experience it." • "Active engagement with research helped me to understand the discipline and research better." • "Working in a lab taught me to work better with others, and I gained communication skills I didn't have before." • "I learned how to create a professional poster and how to present research that addressed real world problems." |
| Benefits of SCCORE | <ul style="list-style-type: none"> • "To have lab experiences I wouldn't have had before." • "To become more familiar with the campus, which will be helpful once I transfer." • "During my time here, I was able to speak with the department of my interest and discovered many possibilities I can take." • "The engineering lab tours helped give me a better understanding of the type of research actually taking place." • "The workshops helped me become more comfortable with talking to a group of people and creation of a research poster." |

| | |
|---|--|
| <p><i>Table 4, Continued</i> Modification of Plans for the Future</p> | <ul style="list-style-type: none"> • “I learned graduate school is not for everyone, and that to get a graduate degree, I will have to be dedicated and motivated. I am willing to do this because I want to continue my passion for my major and learn as much as I can.” • “The scholarship opportunities and the research opportunities were helpful. The cost of graduate school was the one thing that I couldn’t go for. Now, I plan on going to school without collecting any debt and learned how to do that.” • “The most helpful discovery was how many professors and grad students wanted to be in their studies. This was contagious, and peaked my interest in grad school. • “When the grad student presented ‘Entrepreneurship in Engineering,’ I became really interested in ME/Robotics.” • “I worked on research related to environmental engineering that could change how we operate within the world with more efficiency. Now I know what I want to do in life.” |
|---|--|

Student Accomplishments and Achievements: Participating students have left the SCCORE program with renewed confidence in themselves, broader perspectives of the world and of university-level education, and have seemingly felt less limited to pursue that which they never thought they could. One student who came from a small community went on to spend two summers in undergraduate school after SCCORE at the Fred Hutchinson Cancer Research Center to work with Dr. Denise Galloway, who patented the Gardasil vaccine. The student is now about to receive the Ph.D. in Clinical and Translational Science at Mayo Graduate School in Scottsdale, AR. Another student went on to complete a M.S. in Industrial Engineering and is working for the Food and Drug Administration (FDA). Another student, who transferred recently to NMSU in CE from NMSU-Carlsbad, has worked part-time for her SCCORE Faculty Mentor as a research assistant in the ReNUWIt program since transfer, and she has presented her research poster as well as her SCCORE experience at Stanford University at the Annual ReNUWIt Meeting in 2014. Another past participant of SCCORE just received the Ph.D. at Colorado University-Boulder, and encouraged his brother to follow in his footsteps. His brother attended SCCORE and earned his B.S. and M.S. in Civil Engineering and is currently working on his Ph.D. Other students have gone on to statewide universities to become Undergraduate Research Assistants with university faculty members at their university of transfer and have presented their research at the New Mexico AMP Student Research Conference as well as other national conferences.

Plans for Continued Program Improvement

The New Mexico AMP SCCORE program has evolved over the course of 15 years. From the foundational experience of the ATE META program, through the 10 years of the SCCORE program, our commitment has been to support the academic and personal development of community college students and to assist them in creating personally relevant transfer pathways to pursue the B.S. degree. A well-structured program has emerged, including a specific curriculum and co-curricular activities that extend students’ experiences into the academic year. With the recent expansion of the program to additional university locations, new challenges and

opportunities have been identified. As we move forward to sustain the program, our efforts toward continuous improvement and adaptation to specific contexts include plans to improve pre-program preparation of students and establish additional relationships and connections with faculty and programs to expand student funding.

Pre-program Preparation of Students: Students are carefully selected for the program and multiple aspects of a student's background and preparation are considered, including the requirement for a direct recommendation from the New Mexico IC at the student's community college. Staff and faculty review student's transcripts, consider individual circumstances that impact course selection and credit hour completion, and give considerable weight to demonstrated willingness to work and learn. In these ways, we feel that students are appropriately evaluated and selected for participation in the program. We are less satisfied with the specific "pre-program" preparation that we are providing. In future iterations of the program, we plan to create a program handbook with checklists for students to reference as they prepare for their research experiences. Advance communication with their faculty mentors will be encouraged through email introductions, with faculty taking the initiative to reach out to students. These and other mechanisms for preparing students to feel comfortable with the program before they even arrive on campus will help students to transition to the research setting more quickly and to alleviate "pre-program jitters."

Relationships With Faculty and Programs: The program staff has collaborated with faculty to develop the SCCORE program; establish student selection criteria; and ensure that faculty perspectives, suggestions, and concerns are taken into consideration in the program's design and implementation. Over time, faculty have come to appreciate the unique contributions of community college students to the research team and the opportunity to recruit these students to their academic programs and research teams. These efforts have been highly successful, as the faculty are able to establish relationships in the pre-transfer stage and identify strengths and opportunities for students to develop as university undergraduates and potential graduate students. As the relationship between the program and participating faculty matured, faculty began to bring resource to the table, funding individual students—in one case, in groups of six or more each summer. Individual faculty have included support for SCCORE and other New Mexico AMP programs in their research grant proposals with funding committed to supporting 1-4 students. As we continue to develop the SCCORE program, we will work with our University ICs to encourage similar efforts to collaborate with participating faculty. Additionally, we will collaborate more directly with faculty to identify additional funding opportunities. We would like to involve our community college faculty in the research aspect of the program, as we seek funding for such an opportunity. It is our hope to provide an opportunity for community college faculty to work with university faculty, with the goal of collaboration as well as enabling the community college faculty to set up and conduct research at the community college through leveraged grant funding.

Conclusion

The SCCORE program has become the central component of New Mexico AMP's transfer programs. Through the SCCORE program, students have the opportunity to actively participate in university research, develop personally relevant academic plans, and establish meaningful and lasting relationships with peers, staff, and faculty. These critical experiences are positively

impacting students' long-term goals, helping them to determine the best pathway forward, refine their educational and professional interests, and giving them an expanded network of support. Participating faculty are also benefitting from the program. The opportunity to work with students early in their academic careers has enabled the faculty to recruit students and to groom them for active participation in their programs.

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