

## **EXECUTIVE SUMMARY**

In Year 1, Bakersfield College has been making strong progress towards achieving goals and measurable outcomes for our project, “Turning a Gateway into a Pathway to STEM Degrees for Hispanic and Low-Income Students in the Southern San Joaquin Valley.” Fruitful collaboration with four-year educational partner, California State University, Bakersfield, has set the stage to help students cross the bridge between remediation and transfer preparation at the community college, to entering a baccalaureate degree program in STEM at the four-year university. This is being achieved with development of several areas including pedagogies, enriched learning environments, support services and hands-on classroom resources. Moreover, as these areas continue to build, the project is bolstering institutional capacity to serve STEM students in the region for years to come.

Success of this project will impact the economy locally and nationally. The region is characterized by low educational attainment, and high rates of illiteracy, poverty, and unemployment. Bakersfield College (BC) and California State University, Bakersfield, (CSUB) are the only institutions of higher education within a 100-mile radius in the Southern San Joaquin Valley. BC serves approximately 19,000 students (53% Hispanic) and CSUB educates 6500 undergraduates (43% Hispanic). However, both institutions have significant challenges to address among its students. BC’s and CSUB’s student bodies exemplify the national crisis in Hispanic students’ underpreparedness and underrepresentation in STEM degree programs. Therefore, the vitality of a successful collaboration between BC and CSUB is amplified because it will combat the region’s problems by increasing the amount of educated professionals joining the STEM workforce and growing the local economy. This will, in turn, positively impact America’s competitiveness in the global STEM workforce.

At the heart of this mission, which mirrors the goals of HSI STEM and Articulation Grant Program, is a need to rectify Hispanic and low-income students’ underrepresentation in STEM, and open a pathway to success and transfer. In the San Joaquin Valley, students are typically low-income, first-in-family to attend college, and academically underprepared for college, especially in mathematics. Project efforts have paid special attention to increasing equity and access for such underrepresented students. Since metrics focus on improving enrollment and transfer rates, project activities address the fundamental connections to support services as well as classroom strategies. As success and retention in redesigned STEM courses increases over the course of the grant period, so will the transfer rates and educational attainment of low-income and Hispanic students in the region. Significant progress has been made in all three project goal areas in Year 1.

We are very pleased to report that the collaborative has expended more than two thirds of the allocated budget towards achieving our goals and objectives. Spending in Year 1 was initially slow as the grant commenced mid-semester in Fall 2011 which presented some logistical issues in establishing accounting relationships between the Bakersfield College campus and the district

office, as well as between the district and our partner institution, CSU Bakersfield. The savings were mainly due to delays in personnel hires and fulfilling some of the contractual obligations. Since the Spring of 2012, we were able to speed up our expenditures as originally planned. Despite the delays no changes have been made on our original goals and objectives. A substantial portion of the carryover has already been encumbered during the Fall 2012 semester, but since it falls in the second year of the grant internal regulations dictate that we include it in the second year's budget expenditures.

After the strong start in Year 1 detailed in this report, upcoming Year 2 plans include the development of a parent-orientation program in partnership with CSUB to promote college success and transfer. This should be especially helpful to BC's high population of first-generation college students and will be based on the PIQE model. In addition, not to take for granted the positive results on enrollment and transfer, continued efforts are underway to hone student programming for reinforced understanding of STEM educational and career goals. Fall 2012 will also debut the "Pathways" series among the Colloquia, which will introduce students to local professionals, the global impacts of STEM professions, and the schooling required to achieve them.

## **GOAL 1**

Joint efforts between Bakersfield College (BC) and four-year educational partner, California State University, Bakersfield (CSUB), have focused, firstly, on achieving substantial progress toward project goals within Year 1, and, secondly, laying the foundations for continued success in Years 2 through 5. All activities are pointed toward fulfilling the fundamental HSI STEM and Articulation Program objective of increasing educational attainment among Hispanic and low-income students while building long-term institutional capacity. At BC, this necessarily involves 1) increasing STEM success and transfer among all students with attention towards the needs of low-income and minority students, and, 2) eliminating the equity gap for Hispanic students. Therefore, efforts and metrics that will demonstrate progress and success revolve around numbers of students enrolled in STEM majors, retention and success in core STEM classes, basic skills math improvement rates, and transfer rates to four-year institutions.

Year 1 collaborative efforts between BC and CSUB are already demonstrating success in the areas of STEM enrollment (Performance Measure 1.1) and transfer rates (Performance Measure 1.4). Increased, targeted communications (electronic and print) are making positive inroads towards promoting collaborative efforts which support students. Promotion of these efforts has been cross-campus and in the community with educational and workforce partners. Interventions include implementing an email listserv disseminating workshops, speakers, scholarships, and internships; faculty disseminating information in their classes; sharing of industry partners' events; and even coverage in the campus newspaper and local print or television media.

The Project Team is building institutional capacity using student support services delivered one-on-one as well as for groups, and working hard to get knowledge of these resources to the students who will prosper from them. Examples of fruitful interventions impacting enrollment and transfer that have been supported by the HSI STEM and Articulation Program follow.

A “**CSUB-STEM Transfer Specialist**” serves students via appointments and walk-ins on the Bakersfield College campus to advise and admit students to STEM baccalaureate degree programs at our only local four-year institution. This personalized, accurate, and locally available support is helpful for students, who are often first-generation college students unfamiliar with transfer processes and transitions. It is also a “one-stop shop” where students get clear information on what major-related courses are required to enter CSUB in a timely fashion, do the necessary paperwork towards admission, and review scholarship options that can help them afford transfer. In Year 1, the CSUB-STEM Transfer Specialist assisted 502 STEM students.

Bakersfield College has also implemented several events to bring together faculty, students, and support staff across all seven BC STEM disciplines, and has included transfer partner CSUB. Three times in Year 1, “**STEM Colloquia**” presented academic success skills to be used now, transfer support to gear students towards transitioning to a four-year institution, and STEM professions to pinpoint a goal for the future. 214 students and faculty attended these presentations, which discussed study skills, overcoming math anxiety through “real-world” math, and engineering applications in medicine. 116 returned surveys displayed extremely positive feedback, such as students understanding the use of STEM skills in their everyday lives (92%), gaining information that was useful and interesting (Very useful: 77%), and feeling encouraged to pursue a STEM career (Very encouraged/Very likely: 76%).

“**On-Site Admission Days**” bring transfer counseling professionals from CSUB STEM to the BC campus to work with students one-on-one to review their progress towards transfer and, when appropriate, have them sign a Transfer Articulation Agreement and admit them to CSUB. At these events, which occur approximately five times per year, students may also **cross-enroll at CSUB** for STEM courses. In a time of state budget cuts and fewer class sections being offered, this is a timely offering made possible by the partnership of BC and CSUB. It allows students to avoid gaps in their course progression when classes are unavailable at Bakersfield College; to take courses at the university for the same fees as at the community college; and become acclimatized to the environment and expectations at the university. In Year 1, 55 BC students cross-enrolled at CSUB—this means 55 students who did not have to sit-out a semester waiting for their STEM class to open up. It is well-recognized that when community college students interrupt their enrollment for even a semester, most will not return and are lost from the educational system. Hence, the Project Team posits the cross-enrollment offering may impact retention and transfer rates at both institutions; further research is required.

The “**CSUB STEM Preview Day**” took place in April. BC students, faculty and student support professionals (over 60 attendees) went to the CSUB campus together to learn about transferring to STEM majors, financial aid and STEM scholarships, capstone projects, and research opportunities with faculty. Students came away with knowledge on the programs offered, connections to faculty, and the steps required to make transfer a reality.

Support services personnel are promoting the value of declaring one’s major and achieving particular educational milestones. When students declare a major early in their education, their persistence and completion rates increase. The BC MESA Program (serving underrepresented students and educationally and economically disadvantaged students), STEM and MESA Transfer Counselor, and Transfer Mentors (described further in Goal 2) share this knowledge with students. Their services also show them how to declare their major and complete a student educational plan (SEP).

All of the aforementioned activities led to extremely strong progress for Performance Measure 1.1 regarding increasing enrollment in STEM, as well as Performance Measure 1.4 regarding increasing transfer rates to CSUB. Notably, progress is being made in reducing the equity gap for Hispanic students. In Year 1, Bakersfield College has increased the number of enrolled STEM students overall to 1537 (up from the 2009 baseline of 1200), with 51.2% being Hispanic. Data from Fall 2010 on the number of Freshmen students (defined as having completed 24 or less units) enrolling in a STEM major shows a slight increase in number (502 in 2010, up to 535 in Fall 2012), but significantly more Hispanic students are represented (37.8% Hispanic Freshmen in 2010, increased to 55.1% in 2012). **Therefore, Year 1 experienced a boom of 28% growth in enrolled STEM students and increased Hispanic students’ participation in STEM majors.**

Transfer rates are showing similarly strong results from efforts thus far. Grant goals identify doubling the number of STEM transfers to CSUB by September 30, 2016. Already in Year 1, 98 students have transferred to this four-year educational partner (up from 57 in 2009). Of 92 who answered the ethnicity question, 39% identified as Hispanic. This is a solid step towards equitable representation of Hispanic students. Also, overall, 60% of the students transferring who answered the ethnicity question identified as minorities. These figures are essential harbingers of whether program activities are materializing into success because CSUB is the only transfer destination within 100 miles of the region, and is thus a primary educator of future generations of STEM professionals and minority students, especially Hispanics. **Thus, in Year 1, the project team is at 72% of its goal of 100%, which would represent doubling the number of students transferring.**

Best practices known to bolster underrepresented students’ success include pedagogies of engagement focusing on real-world problem-solving as well as using technology to effectively engage students, monitor progress, and facilitate “in-time” intervention to address bumps in student learning. These interventions are of utmost importance in addressing Hispanic students’

underpreparedness. Progress has been made towards performance measures 1.2 and 1.3 in the areas of basic skills math and transfer-level laboratory science courses. Over 30 faculty have been trained via on-campus workshops for NSF signature pedagogies and the use of technology to increase inquiry and engagement. Additional professional development has occurred off-campus including at area institutions serving similar student populations. These trainings acknowledged the value of supporting students with accurate information on transfer and career goals, and discussion on how to effectively measure outcomes. It is clear that much work remains to build institutional capacity using the faculty's knowledge of and ability to successfully implement such strategies. Thus, Year 2 will continue to build this foundation with additional on-campus learning opportunities and mobilization of techniques.

Two faculty are leading the redesign effort to be implemented in developmental courses. A challenge has been how to successfully transpose the scalability, self-pacing, and modularity allowed by technology (such as in emporium models) with the wider range of learning outcomes mandated by the State of California. Personnel and budget transitions at the college also impacted technology upgrades planned for Year 1 in classrooms needed to serve the redesign. Nonetheless, these have been overcome with the facilities and technology upgrade confirmed on the college's calendar and the pilot scheduled for developmental math for Year 2.

The developmental mathematics redesign pilot encompasses an approach that serves to increase first-time success in developmental mathematics using a high-touch approach facilitated by technology. Notably, one innovative learning outcome will be to facilitate students setting educational and career goals, which is recognized as a successful early strategy to cement college persistence and completion. Initiating this process in developmental mathematics is opportune as this is where more than 70% of incoming students begin their college journey at BC. **2011-12 data shows that developmental math success is 48.2% overall; White students' success is 50.3% and Hispanic students' success is 47.8%.** Achieving a 12% increase in success by September 30, 2016 (raising it to 60.2%), and ensuring Hispanic students succeed at a similar pace as non-Hispanic students, are the primary metrics the redesign will impact in Years 2-5 of the grant.

In the laboratory sciences, gatekeeper Chemistry courses are undergoing a transformation with the goal of increasing success and engagement. Process-Oriented Guided Inquiries in Learning (POGIL) has been implemented in the first transfer-level Chemistry course, with mixed results. POGIL is a pedagogical best practice that has been demonstrated to increase engagement and build long-term understanding. While BC faculty praised the inquiry-based method for its attention to developing students' minds, they have found execution to be difficult, time-consuming, and the results are highly individualized. Nonetheless, overall course success has shown progress after this initial pilot (58.3% before the intervention, compared to 65.4% now). Hispanic students' success shows an increase as well (from 51.3% to 57.3%) but is less marked than that of white students (from 59.7% to 79.3%). Consequently, the faculty are currently

exploring how to modify their intervention, and continue to integrate pedagogies of engagement into their classrooms.

Performance measure 1.3 pertaining to successful course completion in STEM courses is showing promising results. Success has increased nearly 6% (from a 2010 baseline of 42.8% to 48.5% in 2012), following initiatives previously described in the lab sciences, as well as Pre-Calculus bridge programs and technology usage. It also appears we are succeeding in closing the equity gap for Hispanic students. White students' success in 2012 was 51.5%, while Hispanics achieved 47.5%, representing a 4 point gap; in 2010 the gap was 5.7%. This data demonstrates positive progress towards attaining project goals of 10% over the course of the grant and closing the equity gap for Hispanic students.

Chemistry courses will pilot usage of technology in Year 2 that shifts the classroom dynamic from passive attendance to active learning. This includes chemical instrumentation, i-clickers, as well as the Nuclear Magnetic Resonance Spectrometer (NMR). The tools should open time for inquiry rather than "cookbook" experiment execution in the lab. In fact, the chemical instrumentation tools were used this summer in a small student research experience led by a faculty member. The students first learned to use these new tools and tested their limitations, and then delivered a series of student-designed experiments in the form of a lab manual. This manual will be used in the classroom in Year 2. It includes feedback from the student researchers directed at current students taking the class that will help them watch for pitfalls in their methodology, measure data correctly, and implement other success tips. The NMR is arriving this winter and will be put into use in the spring with student learning outcomes gauged. It is planned for this equipment to be used in a number of chemistry courses, including transfer-level and general education, and for a summer research experience to be rolled out in the summer.

## **GOAL 2**

BC and CSUB have collaborated for a productive start in Year 1 to create a seamless path for STEM transfer that can be continued and sustained while being fed by the alignment of student learning outcomes. The ultimate goal is to achieve second-level articulation with CSUB in all STEM disciplines. Progress towards achievement of Goal 2 Performance Measures has included 1) collaborative transfer activities to arm students with tools for transfer success, and, 2) curricular work between institutions to build academic and professional success.

By working cooperatively, several departments have made significant progress towards Student Learning Outcome (SLO) alignment, including Geology, Biology, and Engineering. This includes achievement of full articulation for Engineering with CSUB. The BC and CSUB faculties' work will continue in Year 2 with work sessions in fall 2012, which will facilitate remaining departments' (Math, Chemistry and Physics) progress towards alignment. This

productive curricular activity is the academic component of achieving successful transfer pathways.

Support services are the foundation for transfer success on the student side. In 2010, with an 1800:1 student to advisor ratio, it is unsurprising that over 13,000 students college-wide (53% Hispanic) did not participate in advisement services during the semester (per CCCCCO Data Mart). This hinders progress towards transfer. It is posited the interventions that bolster support services under the HSI STEM and Articulation Grant will combat the low participation in advisement within STEM and equitably serve Hispanic students. In addition to the STEM Transfer Specialist and activities implemented in Year 1 (as detailed in Goal 1), institutional capacity has been bolstered by the hiring of a dedicated “STEM and MESA Transfer Counselor” on the BC campus leading a team of near-peer “Transfer Mentors.”

The **STEM and MESA Transfer Counselor** provides individual and group counseling to students on academic pathways to careers and transfer processes. She also builds awareness among the students of how achievement of educational milestones (ex. declaring one’s major, completing a Student Educational Plan, or “SEP”), increases their likelihood of completion. The Counselor works with all STEM students with a special emphasis on MESA students. The College’s Math, Engineering, Science Achievement Program (MESA) serves underrepresented and educationally and economically disadvantaged students, particularly first-generation college students. **93 MESA students were served by the Counselor with an SEP or other academic support services since January 2012.** This is a positive step in their road to college completion.

Beginning in January 2012 and through September 30, 2012, the STEM and MESA Transfer Counselor provided 70 students overall (25% Hispanic) with SEPs, which include guidance on transfer and career goals. 40 more students also received group counseling to register for Fall 2012; additional sessions are planned for Spring registration to occur in Year 2. Also, this Counselor offered the first STEM Success Course in Fall 2012, serving 30 students with an educational plan and clear, specific advice to embark on their STEM educational journeys. 100% of the Student Learning Outcomes (SLOs) for the course were achieved by 100% of the participating students. These SLOs included knowing how to determine if a course is transferable or not, transfer requirements for both state university systems, and how to develop an SEP.

The **Transfer Mentor** initiative developed via the inter-institution partnership where BC alumni who have successfully transferred to CSUB STEM majors return to mentor current BC students. Their experience at both institutions serves as a means of sharing challenges, mentoring in applicable skills, and disseminating practical strategies of success. They provide one-on-one and group mentoring sessions to discuss how to apply for transfer, use of online resources, and how to be successful in current BC courses. In addition, Transfer Mentors provide supplemental instruction in much-needed advanced math and physics courses—this is value added, since

students with this knowledge have already usually moved on from BC. They further serve as an initial point of contact for students before visiting with the STEM and MESA Transfer Counselor, to provide information on campus resources, opportunities for involvement in research or clubs, and collect data for case management purposes. Thus, not only are the transfer mentors role models of STEM success, they also provide training on useful skills and serve as ambassadors for CSUB, the only local four-year institution. In addition, the successful relationship between the two institutions is demonstrated and solidified by this innovative initiative.

Through September 30, 2012, approximately 266 students are recorded in the database, and have received personal, accurate support from the Counselor and/or Transfer Mentors. 239 have identified ethnicity. Of those 239, 128 identify as Hispanic (53.6% Hispanic). This is positive progress towards remedying the problem of students not engaging in any advisement in the semester, and in bolstering usage of these services among Hispanic students.

Cross-campus efforts have also materialized for curriculum and the skills expected of students in the workplace. Both institutions' Engineering and Computer Science faculty met to discuss 21<sup>st</sup>-century workplace skills and the tools required to acquire them. **This led to Bakersfield College acquiring equipment and technology that will dovetail with those used in the courses and research experiences at CSUB.** For example, the Mojo Rapid Prototype facilitates projects combining physics, engineering design and robotics. This semester, engineering students are designing and creating a prototype of knee-replacement technology using this machine. For the first time, they can create an actual model of technology that can be used to help patients using interdisciplinary understanding of biology and engineering. These kinds of experiences are ones the Project Team will continue to support as they provide hands-on, authentic learning for students, which recognized best practice that increases Hispanic students' success.

The collaborative discussion that led to this equipment and real-world learning opportunity is being used as a model for the other STEM disciplines in Year 2 as a means not only of increasing academic success post-transfer, but also to strengthen critical thinking and workplace skills. The project team recognizes the value of authentic learning with an eye to the professional world in STEM students' development; it will form the basis to achieve 100% pathway articulation by September 30, 2016 across the STEM transfer programs.

### **GOAL 3**

Using data to make decisions regarding program progress and the success of interventions is crucial to achieving performance measures and effectively shaping how institutional capacity is built. Summative and formative evaluation, based on quantitative and qualitative feedback, are important elements in the project team's mission. Substantial progress has been made towards both performance measures comprising Goal 3.



In Year 1, a database was initiated that will track students receiving counseling services. It is based on a case management system to collect and make meaning of data. The database records demographics and majors. Educational milestones are also defined, and a **“progress rating” based upon them has been developed in consultation with partner, CSUB**. The milestones are drawn from national trends known to predict college completion rates: math placement and progress, major declaration, creating a Student Educational Plan (SEP), full-time enrollment status, number of units completed, and uninterrupted enrollment (especially in mathematics). The progress rating gives the Project Team and student support professionals information it can use to shape activities and further help students—especially underrepresented students. It will be useful in reaching out to students needing intervention, and understanding where gaps occur for students.

In late Fall 2012, the Research Analyst position will be filled and will manage a variety of data collection efforts. Importantly, this individual’s efforts will include and assessing—and improving—the quality and quantity of data collection in STEM, with the goal to eventually make a model available to other non-STEM disciplines at the college to track progress and completion. This individual will also spearhead the intersegmental tracking system with CSUB, an essential commitment of the Project Team within the opportunities provided by the HSI STEM and Articulation Program.

It is important to emphasize that steps have been taken to students actually *achieving* educational milestones, not just *recording* them in a database, via the work of the MESA Program, STEM and MESA Counselor, and Transfer Mentors. These support services use their case management approach to track students and let them know about the value of milestones such as composing an official student educational plan (SEP) or declaring a major. These actions are recognized as directly impacting student completion. The students, in turn, receive personal, accurate guidance, encouragement and support. To date, approximately 266 students are recorded in the database; 239 have identified ethnicity. Of those 239, 128 identify as Hispanic (53.6% Hispanic). They have all received support from the support professionals mentioned above. Of these recorded students, all 100% are being tracked and, when indicated, they will receive outreach and support.

Therefore, data collected will not only inform project activities, but also suggest when triage is required to help students succeed. This will impact the intersegmental tracking with CSUB as we will be able to monitor a students’ progress towards transfer, and initiate communications with them before transfer. It is hoped that this will facilitate tracking after transfer, especially to CSUB, where we seek to monitor their continued success in achieving a STEM baccalaureate degree. This is a positive feedback loop between the case management efforts and the database creation that was unanticipated at the start of the project but appears to have promising implications for the future.