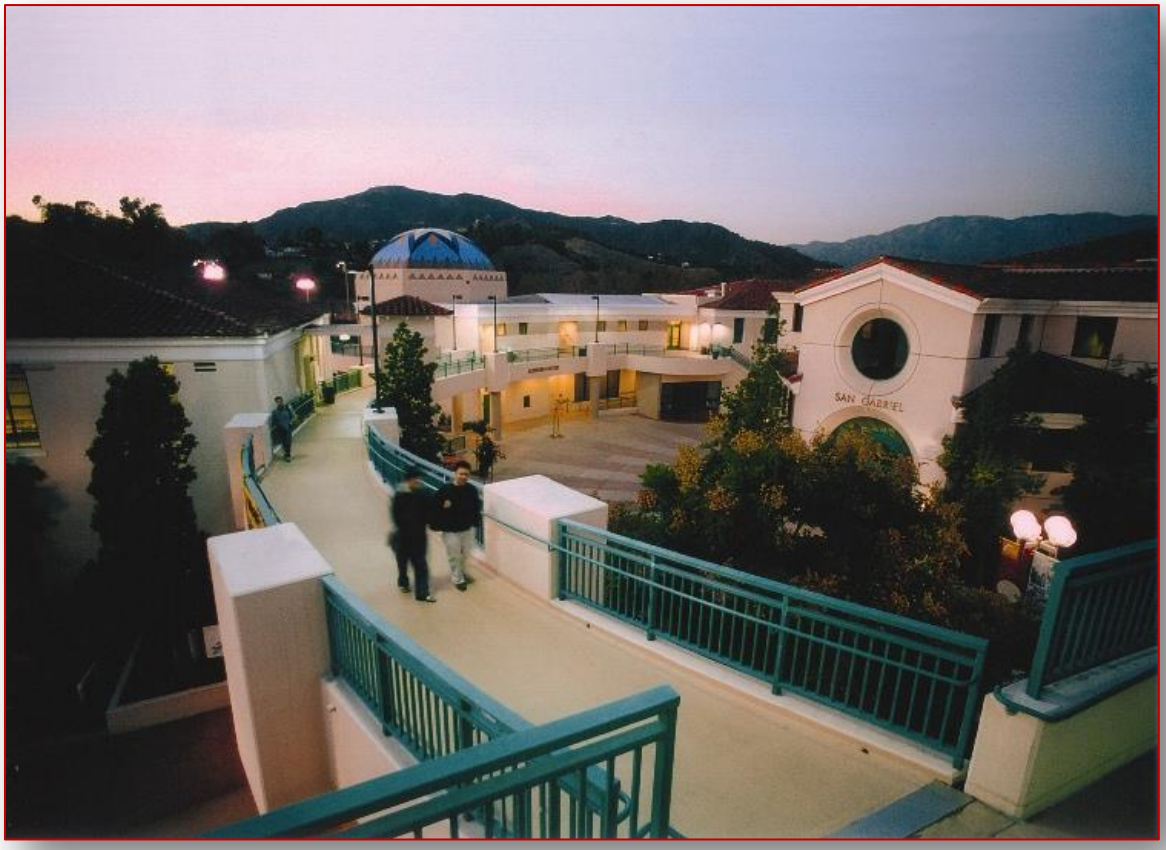
GLENDALE COMMUNITY COLLEGE

Title V HSI STEM and Articulation Cooperative Grant

External Evaluation Report, Year Three: 2013-2014

"GAUSS: GCC's Articulation with Universities for STEM Success"



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EXECUTIVE SUMMARY

Glendale Community College (GCC) is a large public institution serving more than 28,000 students annually, with more than 25% identifying as Hispanic. GCC has developed a reputation in the greater Los Angeles area as an exemplary institution committed to serving the needs of all students with special attention to socio-economically disadvantaged students. In recent years, GCC has refocused its mission to pay special attention in improving the transfer rate of STEM students in response to various local, state, and national calls for more graduates in this area. Recognizing the need for the importance of STEM for the local and state economy, in 2011 GCC was successful in securing a Title V HSI STEM and Articulation grant from the US Department of Education. The project, known to the GCC community as the "GAUSS Grant" (an acronym meaning, "GCC's Articulation with Universities for STEM Success"), aims to increase GCC's student engagement in STEM and build robust articulation processes with all local universities. The project has two overarching goals:

a. To develop a coordinated, integrated educational system and culture that support "structures of opportunity" so that underserved Hispanic students have access to STEM learning and degree completion; and,
b. To establish a model transfer and articulation agreement and Center for University Partnerships through collaboration with transfer institutions and Jet Propulsion Laboratory (JPL) to remedy obstacles (GCC, 2011).

The information used for this report was gathered during campus visits, emails and telephone conversations. In addition, relevant documents were reviewed. The report to follow summarizes the project; briefly discusses the evaluation methodology; details project activities and collected data; and concludes with reflections and recommendations. Notably, careful consideration has been paid to the data being collected in this program by the project team to ensure that it accurately reflects progress toward goals and is meaningful in shaping interventions.

The activities and interventions implemented during year three continue to propel the project forward, resulting in an overall assessment of the project's progress as extremely satisfactory. In January 2014, Dr. Tom Voden, math professor and former Co-Director, assumed responsibility as a full time project director. Dr. Durham, the project's former director still assists with the day-to-day operations. Together they form a very competent management team that skillfully leads the project and shape activities.

The project has made significant progress towards meeting its five-year timeline. Based on discussions, data and document review, the evaluation team is very satisfied with GCC's continued significant progress in achieving all of the project's proposed goals and objectives. The spending rate of federal funds has been similarly successful, with approximately 94% of funds being expended cumulatively in all three years.

In conclusion, although the project just passed midway of the five-year project timeline, GCC has demonstrated significant activity and progress in laying the pathway for success. The evaluation team includes recommendations to continue this positive trajectory. We look forward to returning to GCC next year to ascertain the project's fourth year of progress.

We would like to thank Drs. Voden and Durham, in addition to GCC leadership, faculty and staff contributing to the success of this project and creating successful pathways to support California's most needy students.

PROGRAM DESCRIPTION

Glendale Community College (GCC) has completed Year Three of a five-year Title V Hispanic Serving Institutions (HSI) STEM and Articulation Cooperative Grant, entitled, "Building a More Responsive STEM Success Environment at Glendale Community College for Underserved Hispanic and Other Low-Income Students." The goal of the HSI STEM and Articulation program is to provide grants to assist Hispanic-serving institutions to develop and implement activities which will edify and expand the institution's capacity to serve Hispanic and low-income students in the STEM fields. GCC is particularly qualified to fulfill this mission, as it serves a 25% Hispanic student population. In addition, as many as 75% of GCC's first-year students enter underprepared and leave without completing a STEM degree or transferring to a baccalaureate institution. GCC's

project activities are geared towards combating these issues to ultimately provide its service area with successful STEM graduates to fill workforce needs.

The GAUSS project focuses on infusing the educational environment with experiential learning and other best practices known to boost Hispanic and low-income students' success and completion in STEM.

GAUSS has defined four measurable objectives that address the needs of its students and support the goals of the HSI STEM and Articulation Program:

1. Increase overall student success rates in all GCC STEM classes and programs;
2. Increase the total number of STEM students who successfully pass through milestones to degree completion;
3. Increase success rates and learning incrementally in all new and redesigned courses;
4. Reduce the equity gap in learning and transfer outcomes for underrepresented Hispanic students (GCC, 2011).

METHODOLOGY

The evaluation team led by Christos Valiotis, based the findings in this report on information gathered during site visits over the project year, as well as information shared through phone, email and pertinent documentation from the

project team. Student achievement data has been retrieved from the 2013-2014 annual performance report (Durham and Voden, 2014).

FINDINGS

I. ACTIVITIES

The GAUSS project seeks to fulfill the mission of the Title V HSI STEM and Articulation Program while addressing gaps and serving the needs of its students, especially its Hispanic and low-income students. An overview of activities is provided below, which work synergistically to address project objectives of increasing student success and transfer, with particular attention to reducing the equity gap for Hispanic students. As project activities are necessarily working together to create a supportive STEM learning environment, this section will not separate activities into discrete entities, recognizing that the sum of the parts will equal the whole insofar as achieving objectives.

Robotics, Engineering Computer Science Initiatives

The robotics/engineering program at GCC has continued its strong presence on campus during year three of this project. The program is designed to help students learn through seeking solutions to real-world engineering problems. Three new courses in the Robotics/Engineering Academy were offered for the first time this year: Introduction to Robotics, a survey course that assumes no prior experience, puts students to work right away using actual robots. Robot Motion Planning, designed in partnership with faculty from Harvey Mudd

College, gives students a chance to work with robot sensors and actuators much earlier in their computer science education than is usually the case.

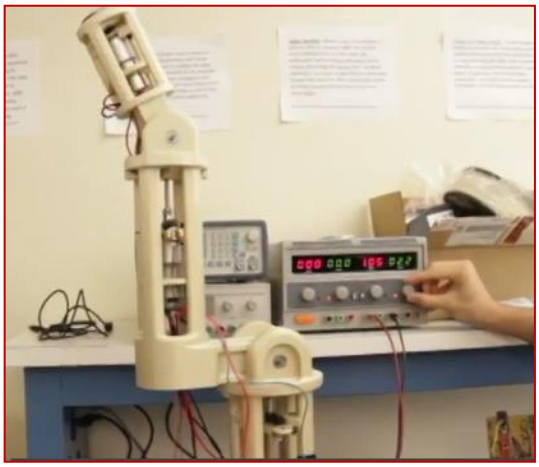

Figure 1: Robotics team members collaborate on hands on projects.

Electronics and Electrical Circuits, a no-experience-necessary introduction to analog circuits, forgoes a long list of prerequisites, which often turns students off from engineering. Rather, the course builds a math and physics foundation, as students need it for the electronics. As an early introduction to electrical engineering, the course helps students "catch the engineering bug" and see for themselves connections to their math and physics foundational courses.

Figure 2: Summer robotics academy.

The robotics/engineering program also ran pilot tests of its two-semester capstone experience this year. In fall 2013 the capstone was piloted as an independent study course, and in the winter and spring it was extracurricular. Students worked as a multidisciplinary team to build a robotic arm and a 3D printer under the guidance of three mentors--a mechanical engineer and an electrical engineer from Jet Propulsion Lab (JPL) and a software engineer/GCC instructor affiliated with IEEE. These pilots were an important precursor to the newly approved capstone courses, Undergraduate Research in Engineering I & II, which will be offered in Year 4.

In the computer science area, the grant supported the first phase of development of the CS/IS Sandbox Lab, which is reinventing an existing computer lab to support a total overhaul of the way Introduction to Computer Information Systems is taught. A great deal of work has gone into rethinking and testing the pedagogy in the introductory class to more deeply engage students, and students have given input regarding all aspects of the redesign. Though the lab is not finished, much of the pedagogical groundwork was laid and new equipment evaluated during Year 3. When completed next year, the Sandbox Lab will serve as a testing ground and demonstration site within the college for innovation in the design of learning spaces and use of technology in teaching.

Biology Initiatives

In Year 3, the grant supported significant advances in the Biology Division's capability to provide hands-on learning opportunities. Collaborating with partner institution Loyola Marymount University, the division further developed its student research program, and students presented their findings at SCCUR and the West Coast Biological Sciences Undergraduate Research Conferences. Also, the division gained approval for a new research course, Undergraduate Research in Microbiology, which will be offered for the first time in Year 4. Instituting the research course not only strengthens the program's sustainability but also enhances students' transfer prospects because research experience will now be indicated on transcripts. The grant also supported further development of an innovative apprenticeship program in biology, through which advanced students provide tutoring, create instructional videos, care for lab spaces, equipment, and specimens, and train the upcoming group of students who will follow them. Additionally, the grant purchased digital microscope cameras that allow students to view detailed, magnified, projected images of actual (and sometimes living) specimens during class discussions, which are engaging in ways textbook images rarely can be.

Physical Sciences Initiatives

Experiential learning in physics was fostered by a project that enables students to conduct introductory research using computer interfacing, which converts sensor

output into signals that can be entered into a computer and started, stopped, analyzed, and graphed. Using advanced hardware, software, and revised lab assignments, physics students now have access to a wider range of experimental possibilities than in the past. Another physics project involved enabling students to create and analyze slow-motion videos, a process that both concretizes concepts and develops skills with lab equipment. Also in physics/astronomy, and because of connections established through the grant, two students received internships at the Carnegie Observatory and later presented a poster on supernovae research at the Southern CA Conferences for Undergraduate Research (SCCUR).

The Chemistry Division also made advances in its program for student research. Student chemists in Year 3 presented their findings at SCCUR and also had the rare honor for community college students of presenting at a national meeting of the American Chemical Society. A new course, Undergraduate Research in Organic Chemistry, was also developed and will be approved in Year 4. Not only do student researchers benefit from developing knowledge, skills, and personal identities as scientists, but students in "regular" classes benefit also as the techniques and equipment used in research are introduced into their classes and they see role models from their peer group who inspire them to consider research as well.

Mathematics Initiatives

The grant supported the piloting of a new course, Algebra for Statistics, to give students alternative ways of preparing for college-level statistics. Another math project initiated the use of document cameras in math classrooms to reduce time spent copying problems onto the board, increase student-teacher interactivity, and permit live PenCasting during lectures. Math instructors using PenCasting save digital copies of lectures and post them online for review by students and "flip the classroom" to create a more active and experiential learning environment.

Student Support and Faculty Engagement

FACULTY INNOVATION

In addition to the efforts described above, the grant supported a wide range of activities to stimulate faculty innovation. An outside facilitator led a faculty group to design actionable solutions to the challenge, "How might we re-imagine the ways in which we collaborate with students to support inquiry driven learning?", and student evaluators critiqued faculty proposals. The STEM Courseware Initiative engaged faculty in a series of in-depth conversations on controversial topics in science. A Faculty Inquiry Group explored "Learning with Visual Representations," and STEM faculty developed strategies for using iClickers to invigorate class discussions and bring to light areas where students

need help. A guest expert led a workshop on "gamification" in education, and another presented creative ways of stimulating student engagement.

Finally, two instructors who participated in faculty externships at JPL were able to bring back to GCC new knowledge and a renewed passion for science.

STEM CONTEXTUALIZATION IN ENGLISH

To increase student awareness of STEM, the grant supported a project in which science was the semester-long focus of students' reading and writing in several English classes. Each English instructor collaborated with an instructor from a STEM discipline (e.g., astronomy or biology) who served as a discipline expert to ensure the accuracy and currency of the scientific content and the applicability of the assignments. Faculty and students in the pilot indicated a high level of engagement, and students both improved as writers and gained a degree of mastery in the subject area. As a result, instructors plan to continue using contextualization in future classes.

TRANSFER BRIDGE

Recognizing that the transition from community college to university is often difficult, we collaborated with partner California State University-Northridge (CSUN) to develop and pilot-test a groundbreaking transfer bridge program. The transfer bridge offers CSUN-bound students an upper division course, taught by a CSUN instructor, but held on the GCC campus during students' final semester

at GCC. It gives students a "jump start" into their university experience, three units of CSUN-required upper-division general education credit, and an introduction to the CSUN community through guest lectures, special events, and tours of the CSUN campus. The transfer bridge helps students feel at home at CSUN and facilitates a successful transition from GCC to university. Students, faculty, and counselors who participated in the pilot in spring 2014 were enthusiastic, and GCC and CSUN will join forces again in Year 4 to improve and expand the transfer bridge.

STEM OUTREACH

The grant also funded special outreach activities during Year 3. GCC co-hosted with CSUN "Latinas in STEM," an inspiring event for middle and high school girls led by a team of successful Latina engineers. GCC robotics students hosted an exciting VEX robotics competition for middle and high school students. At Welcome Day, GCC counselors discussed college success in English and Spanish with new students and their parents. At Counselor Day, counselors from local high schools learned about STEM programs at GCC. STEM Student Ambassadors worked at these and many other events to inform prospective and current GCC students about opportunities in STEM, and GCC digital media students gained professional experience producing outreach videos about several grant-funded projects.

Results

Following the tradition of GCC to make decisions based on student success data, the project has done an exemplary job in documenting progress in achieving goals objectives. The table below summarizes the various data metrics that the project tracks on an annual basis to evaluate progress:

Metric Description	Target (%)	Actual (%)
Student success rate for all GCC STEM courses	68	65
Completion rate for all STEM students	90	85
Persistence rate for all STEM students	91	87
30 unit completion milestone	97	96
Completion rate for career tech students	85	84
Success rate in Robotics/Engineering courses	78	70
Success rate for new Inter. Math for Stats course	50	53
Success rate for Latino students in STEM courses	58	53
Success rate for non-Latino students in STEM courses	71	69
Gap in the overall completion rate between Latino and non-Latino students	23	24

While many of the targets have not been met, significant progress towards them is evident from the table above. The new intermediate math for statistics course has shown significant gains in success rate, and warrants further study with

possible institutionalization in the near future. A huge accomplishment is the rate of students reaching the very important milestone of 30 units of completion. That is one of the main obstacles on the road to an associate degree completion or becoming transfer ready for all students and especially Hispanics. The management team is fully aware that a more orchestrated effort is needed to close some of the gaps that are shown in the table above. It is the evaluator's opinion that the targets set by GCC are extremely ambitious and the actual performance data are much higher than national or state averages. In other words, GCC is already serving students at a high level. Nevertheless, discussions about how to increase efforts to do even better are already under way.

II. PROJECT MANAGEMENT AND OPERATIONS

The project team consists of Title V Director, Dr. Tom Voden assisted by Dr. Cathy Durham, the former project director. Other support staff includes: Grant Specialist, Leticia Estrada; Research Analyst, Terrence Yu; and Garik Kirakosyan who works on an as-needed basis when additional administrative support is required such as for special events or projects. This team has been highly effective in engaging all constituent groups to support student success at GCC by changing institutional culture, and increasing service capacity. They are in close communication with personnel working on GCC's "Gateway" grant, which is a STEM and Articulation Solo grant project helping underprepared students succeed in developmental levels.

The project team has successfully managed activities, personnel and budget in Year Three. They spent over 94% of their budgeted amount for this period and also found they were able to effectively use student workers in capacities that allowed the latter to grow intellectually, academically and professionally, such as in the various science apprenticeships. The team prioritized faculty development and collaboration, innovative learning spaces, and inquiry-supportive technologies and equipment to enhance the student learning experience at GCC.

INTERPRETATION AND REFLECTION

GCC has been particularly effective in mobilizing NSF signature best practices that are recognized for promoting underrepresented students' success and engagement in STEM. As in previous years, the attention to data is particularly commendable as it provides hard evidence that practices are working and shapes future activities. GCC's work is producing measurable results for students as demonstrated by quantitative data and anecdotal feedback from students who are enjoying their experiences tremendously.

Moreover, the gains go beyond data collected to date. The capabilities instilled in students—such as complex reasoning, critical thinking, technical practice and research—will carry on with them as they move to their transfer destinations and will also open doors for them in the future educationally and professionally. In a parallel fashion, GCC faculty are working together in a vibrant interdisciplinary

collaborative to reflect upon their teaching methods and programs, paving the way for continuous improvement.

The evaluators note that this sharing among the faculty and reflection upon practice facilitated by the STEM and Articulation Cooperative Grant will have long-lasting effects in building institutional capacity. This is because it is helping shift institutional culture through practice, dialogue and dissemination towards one that is supportive of adopting and adapting new methods. While these methods are founded in evidence-based practices, their undertaking can nonetheless be intimidating. However, at GCC a sea change is occurring that is building an atmosphere that is student-centric, and encouraging faculty to see themselves as learners who are ameliorating their practice and adding to the campus' repository of success. In this kind of culture, the gains for faculty—and thus for students— are boundless.

RECOMMENDATIONS

GAUSS continues to make strong, productive progress in Year Three. Experiential, hands-on learning is taking root across the STEM disciplines. The project team is wisely creating ongoing, responsive professional development that will help faculty continue to refine their practices. Students are benefitting tremendously as they understand authentic STEM practice, research and the associated "soft skills" that will help them move successfully towards transfer

and become the much-coveted T-shaped professionals desired by industry. Recommendations to continue the positive trajectory demonstrated in Year Three are:

1) Investigate the reasons for the slight widening of the equity gap for Hispanic students, and carefully monitor the data. The cross-campus "think tank" with staff and faculty from various campus areas is a good start, as is continued dialogue with Institutional Research. IR may be able to suggest additional data collection tools or analysis that may help in this effort.
2) Examine additional venues where students can interact with STEM professionals as well as career environments. There may be opportunity in the labs (ex. the engineering technology lab) which, when opened up to industry professionals as a training site, may be an opportunity to engage students in dialogues on how the STEM workforce uses such technology on an everyday basis.
3) Consider primary transfer partners and the implementation of a Transfer Preview Day at one of the campuses, where GCC students spend a day seeing the labs, student facilities and resources available upon transfer. Such an event is very helpful in demystifying transfer by increasing familiarity with the four-year university.

4) The growth of additional partnerships for STEM transfer, research and careers has been considerable in Year Three. Continue to build these partnerships as they are already bearing fruit for the students.
5) Qualitative feedback from students—and, as the grant progresses, alumni—will provide an enriching perspective on the authentic learning experiences and insights into STEM careers they are currently enjoying at GCC.
6) Hold an annual campus-wide event, like Year One's STEM Expo, which can serve as an outreach event to raise STEM awareness for staff and students, as well as a dissemination event for reporting purposes. Include data and results but more importantly, showcase the students and hands-on experiential learning environments that have been developed. It will help inspire success in other areas of campus and add to transparency, institutional pride and buy-in.
7) Keep encouraging participation of non-STEM faculty and staff in STEM events, such as the Open Courseware Initiative and Faculty Innovation Center. This can help inspire and institutionalize the best practices being rolled out under the HSI STEM and Articulation grant program.
8) Establish an Advisory Board with educational, community and industry partners; this is an invaluable asset to any program. The work of the advisory board builds buy-in, and is another assessment of program

activities and outcomes. This is especially constructive when those outside the institution share their feedback.

9) Dissemination of this well-rounded program will help peer institutions across the country be inspired to build best practices in engagement and student learning into their programs. It is important for project leadership to share strategies, challenges and rewards with other institutions on the disciplinary, state and national stages.

REFERENCES

Durham, C. and Voden, T. (2014). 2013-2014 *Annual Performance Report*. Submitted to the US Department of Education for review.

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