STEM 2016 Proposal

Strengthening Hispanic STEM Students:
Comprehensive Support, Guided Pathways, Renewed Learning

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Project Design Addresses Each Absolute Priority and Competitive Priority 2

Gavilan's Project Meets Funding Priorities	
Priorities for Funding	**How the Project Meets Priorities**
Absolute Priority 1. An application that proposes to develop or enhance tutoring, counseling, and student service programs designed to improve academic success, including innovative and customized instruct-tion courses (which may include remedial education and English language instruction) designed to retain students and move them more rapidly into core courses and through program and degree completion.	**Part 1:** A STEM Support Center will provide centralized, comprehensive academic/ career advising, counseling and tutoring services that are proven support strategies and interventions based on extensive evidence in the literature on what works with Hispanic students. **Part 3: Renewed Teaching and Learning** will strengthen inclusiveness in "STEM culture," innovate in STEM courses with High-Impact Practices, customize **"**Accelerated" math & English pre-requisites to propel students more rapidly into gateway courses, develop Supplemental Instruction in STEM introductory core curricula and transfer to our partner, San Jose State University -- and other 4-year institutions.
Absolute Priority 2. An application that proposes activities to increase the number of Hispanic and other low-income students attaining degrees in the STEM fields and proposes to develop model transfer and articulation agreements between two-year HSIs and four-year institutions in STEM fields.	**Part 2: Guided Pathways** is our Articulation and Transfer model to streamline and expedite students' pathways to STEM degrees—designed with a panel of representatives from our students, Gavilan and SJSU STEM faculty, corporate leaders. *We will conduct a formal study based on ASAP/CUNY program replication in order to meet Competitive Priority 2. Using an RDD, we will analyze data from STEM cohorts above and below cut-off scores who use program services.*
Competitive Preference Priority 2. (Three additional points) Applica-tions supported by evidence of effectiveness that meets conditions set out in the definition of "moderate evidence of effectiveness."	The project's design was based heavily on **CUNY's ASAP study, approved by *WWC "Without Reservations***." Scrivener, et al. (2015). *Doubling graduation rates: Three-year effects of CUNY's Accelerated Study in Associate Programs (ASAP) for developmental education students.* New York: MDRC. http://www.mdrc.org/sites/default/files/doubling_graduation_rates_fr.pdf **AND** Hayward& Willett (2014). *Curricular Redesign and Gatekeeper Completion: A Multi-College Evaluation of California Acceleration Project.* http://cap.3csn.org/files/2014/04/RP-Evaluation-CAP.pdf **Gavilan Acceleration data were a part of the second study.**

Snap-Shot Profile: Gavilan Community College District [1]	
Control/Type	Public 2-Year Community College (WASC Accrediting Agency)
Location	Gilroy, CA: District: 2,700 square miles; southern Santa Clara & San Benito Counties
Programs	STEM: Division of Arts & Science: Math, Physical/Natural Sciences, AA/AS. Comprehensive AA/AS degrees, programs and CTE Certificates.
Students	**Headcount, Fall, 2015: 6,886**
	Race/Ethnicity: 4% Asian, 2% Black, **63% Hispanic**, 28% White, 1% Native Amer.
	Average Age: 25 **Gender:** 56% women, 44% men
Faculty	Full Time: 82; Adjunct 200 Faculty/Student Ratio: 1 to 33

[1] Office of Institutional Research: Gavilan College, GIDS Database, February, 2016.

Bridging Aspirations and Reality in STEM
…40% of all new entering students either express an interest in STEM degrees or actually choose a STEM program [and] … a majority of them switch out of STEM programs or drop out of school altogether. … The problem is more profound at 2-year colleges, where 58% of health science and 72% of computer science students leave the program without a credential. At the end of their post-graduate schooling, only 13% of today's students complete certifications or degrees in a STEM field. Even more unsettling, ***fewer than half of those students are women and minorities.*** What happens in the intervening years to discourage American students? Deborah Santiago, ***Excelencia*** [2]

Introduction **Gavilan is not unique in dealing with this STEM opportunity gap; it is nation-wide.** The national average STEM baccalaureate completion rate is alarming, only 38%.[3] A January 2015 report from Excelencia found that only 9% of STEM degrees and certificates went to Latinos in 2013. This disparity between Hispanics and other groups widens as higher levels of post-secondary education are achieved: only 4% of STEM masters degrees and 3% of STEM doctorates were achieved by Hispanics in 2013.[4] Latinos will soon total over 18% of the U.S. population; parity in STEM degree attainment is a key goal for the nation and for HSIs. Between 2011 and 2014, the percentage of Californians with a bachelor's degree or higher grew nearly 6%. Whites with a bachelor's or higher increased by 10.67%; Latinos' percentage grew a mere 1.37%. The attainment gap between Hispanics and whites is 30.33% in the State of California, 44.33% in Santa Clara County, and 36.85% in Monterey County.[5]

2014 Population 25 Years and Older with a Bachelor's Degree or Higher			
	All Persons 25 +	**Hispanic**	**White Non-Hispanic**
California	**8,136,670 (31.72%)**	**950,237 (11.37%)**	**4,685070 (41.67%)**
Santa Clara County	624,257 (48.36%)	41,766 (14.61%)	269,019 (55.94%)
Monterey County	62,638 (23.07%)	8,308 (6.26%)	44,873 (43.11%)
2014 American Community Survey Census Update: Tables B15002, B15002I & B15002H			

The Campaign for College Opportunity cites factors that impede Hispanic graduation rates: delays in developmental courses, insufficient funding, broken transfer pathways and inadequate

[2] Santiago, D. (2014) *Excelencia* Bridging Aspiration and Reality: Helping More Students Attain Post-Secondary STEM Certifications and Degrees. http://www.edexcelencia.org/events/bridging-aspiration-and-reality-post-secondary-stem#sthash.kSzbIoAE.dpuf
[3] National Math + Science Initiative, www.nms.org/AboutNMSI/TheSTEMCrisis/STEMEducationStatistics.aspx
[4] http://www.edexcelencia.org/sites/default/files/FindingYourWorkforce-STEM-2015.pdf
[5] *2014 American Community Survey Census Update: Tables B15002, B15002I & B15002H*

student support.[6] Our project design addresses all four. **We must improve our transfer rates and the percentage of transfers who are Hispanic.** Today only 45% of Gavilan transfers are Hispanic, but 63% of our students are Hispanic.[7] The transfer data must be in parity with our demographics. "We cannot rationalize unequal outcomes as inevitable because students suffer a long list of deficiencies: underprepared, lack study habits, do not seek help, at risk." [8] The Center for Urban Education asserts that we need to "frame unequal outcomes as a **problem of practice, rather than a problem of student deficiencies**." [9] We propose a three-part activity to improve student outcomes and equity -- by strengthening practices, particularly in STEM student support, articulation pathways and classroom learning.

Gavilan's Strengths in STEM Education: Building on Current Title III STEM Project

- **Excellent STEM Programs** Gavilan has an outstanding reputation in the fields of natural science and math education. Students majoring in science or math benefit from a strong curriculum in a wide range of programs.
- **Career and Technical Education (CTE)** includes flourishing digital media programs, computer science and nursing education—these have both certificate and degree-transfer programs.
- **University Partnership** includes most recently the current SJSU STEM project which began in 2011 and continues through September 2016. Our primary transfer-receiving institution is SJSU.
- **Undergraduate Research Opportunities** In order to involve science students in hands-on research, the faculty at our partner campus, San Jose State University, mentors and supervises student interns with their projects. A few students do projects in local corporations.
- **The ERC/Outdoor Classroom** a crowning achievement of our current STEM Coop project. We are currently working on integrating learning projects and assignments into the curriculum in Ecology, Geology, Geography, Biology, Chemistry and CTE's Water Quality Management.
- **Developmental Education Acceleration** We belong to the California Acceleration Project; we launched our own compressed math/English basic skills project in 2012 and participated in the 16-college project study.[10]
- **Summer Bridge programs for entering STEM students.** For pre freshmen, this intensive 3-week program provides math skills practice and college savvy – both for credit.
- **Engineering Cooperative with Foothill College:** engineering students are able to take courses interchangeably at either community college in order to strengthen their transfer readiness.
- **Outreach to Middle and High Schools** "Science Alive" takes Gavilan science faculty members to visit local middle schools and high schools for workshops with students and math teachers. The purpose is to show attendees the exciting options in STEM professions.
- **Outreach to STEM Students' Parents** Bi-lingual workshops for local parents of STEM majors and those taking STEM courses: the goal is to inform families of the varied and lucrative opportunities in STEM careers

[6] The Campaign for College Opportunity, (2015) http://collegecampaign.org/wp-content/uploads/2015/04/2015-State-of-Higher-Education_Latinos.pdf.
[7] *Chancellor's DataMart. http://datamart.cccco.edu/Students/Student/Term/Annual/Count.aspx 2-23-2016.*
[8] Rendon, l. & A. Nora, V. Kangala. (2014) Ventajas/Assets y Conocimientos/Knowledge: Leveraging Latin@ strengths to foster student success. San Antonio, TX: Center for research and Policy in Education, UT, San Antonio.
[9] Malcom-Piqueux, L. Bensimon, E. (2015) Policy Brief Series, Perspectivas: Issues in Higher Education Policy and Practice. AAHHE. *Design Principles for equity and excellence a Hispanic-Serving Institutions*, Issue 4.
[10] Hayward, C., Willett, T. (2014) *Curriculum Redesign & Gatekeeper Completion: a Multi-College Evaluation of the California Acceleration Project*. Research/Planning Group, California Community Colleges. **(WWC-approved)**

and to urge their support for their student who is in rigorous STEM courses. • **Supplemental Instruction** Originally we developed Supplemental Instruction in our basic skills English and math curricula, but we have more recently expanded this work to introductory STEM courses which can derail STEM students and serve as gatekeeper courses for STEM majors.

Our current STEM Title III project comes to an end this fall: we will build on the foundation of fine programs, strong student outcomes, and lessons learned in the five-year project. Our strengths, challenges and opportunities have been analyzed thoroughly by representatives from students, community and all levels of college personnel on the STEM Planning Group:

The STEM Planning Group
Staff: Steve Kinsella, President, Kathleen Rose, Executive Vice President and VP Instruction; Kathleen Moberg, VP of Student Services; Fran Lozano, Dean, Arts/ Science. Peter Wruck Research; Doug Achterman, Library; Kyle Billups, MIS; Blanca Arteaga, Counselor; Associate Dean Eduardo Cervantes, MESA; Esteban Talavera and Michele Cortes, Classified. ***Community:*** Mike Cox; Sokthea Mov, Karen Aitken. ***Faculty:*** Mary Ann Sanidad, ESL; Kimberly Smith, English; Karen Warren, English; Jennifer Nari, Ken Wagman, Math; Rob Overson, Disability Resource Center. ***Students:*** Marisol Arredondo, Engineering; Zulema Espinosa, Jennivi Zambrano, Biology.

This committee extensively reviewed current research in the literature and practice among campus models in California and the nation; they have met routinely since December, 2015.

Comprehensive Analysis of Major Issues and Documents
• We reviewed *internal and external research* on STEM student success, community needs, faculty development, basic skills, gateway course success, transfer barriers and evidence-based practices.
• We scoured our *Strategic Educational Plan* in order to synthesize our college-wide planning with our STEM project objectives and our Hispanic and first-generation students' needs.
• We reviewed recent state and national data on STEM issues*: National Academies' 2-Year and 4-Year Barriers and Opportunities in STEM, ACT's The Condition of STEM,* and Bailey, et al. *Redesigning Community Colleges*, NCES, What Works Clearinghouse, Census data and regional occupational trend analyses --knowing California's growing need for Hispanic STEM professionals.
• We reviewed data on transfer to Cal State Universities, and looked at successful practices we could adapt, especially for Hispanic and low-income. Our partners at SJSU agree with our concerns.
• We reviewed our WASC Accreditation Report (2011) and recent follow-up reports (2015-16) which suggest that we as a faculty need to be more engaged in student learning, its assessment and results.
• We reviewed recent California legislative agendas and policies to foresee regulations that could affect our program planning in the next five years--in all three major project initiatives.
• We listed STEM teaching and learning methods including high-impact practices and conducted a risk analysis of how adaptations would affect Hispanic student educational outcomes.

STEM Objectives: Relationship to Gavilan's Strategic Plan. The planning process was

further informed by our Strategic Plan, 2014-2019.[11] This alignment of strategic college goals and STEM project objectives will strengthen the project. We are fully prepared to do what it takes to achieve stronger student outcomes—especially for Hispanic and underserved students.

Goals & Project 5-Year Objectives	Strategies/Goals: Strategic Plan 2014-'19 [12]
Goal 1: Improve STEM Student Outcomes a. Increase # of STEM majors to 200 and % of those who are Hispanic/low-income. b. Increase STEM transfer rates by 10%; increase Hispanics % of transfers to 63%. c. Increase # of students who complete 30-unit and 60-unit milestones by 10%. d. Increase STEM completion of BA/BS degrees; long-term data from SJSU. e. Increase # of bilingual outreach workshops for families and schools in support of STEM student success. f. Increase Summer Bridge & Transition Academy student *completers* to 100%.	**Strategy 2: Improve student services and enhance curriculum and programs to help students meet their educational/career goals.** • Goal # 1: Increase the student success, completion, and transfer rates. **Strategy 1: Optimize enrollment, course offerings, and services to reflect community needs** • Goal # 1: Integrate student outreach activities with attention to under-represented students. • Goal # 4: Support professional development for staff to improve services that support success. **Strategy 7: Improve communication, coordination, collaboration to foster a culture of engagement.** • Goal # 5: Broaden contacts and communication with local schools, businesses and agencies.
GOAL 2: Increase STEM Pathway Success a. Increase # of Guided Pathway students who complete STEM programs in 3 years, by 10%. b. Increase # of students who complete Social Sci. pathway in 3 years, by 10%. c. Increase college success with student out-comes research on pathways & support.	**Strategy 1: (above)** • Goal # 1: …integrate student/faculty outreach activities with particular attention to under-represented students. • Goal # 3**:** Increase courses and programs…with particular emphasis on *transfer model curriculum.* **Strategy 7: (above)** • Goal # 5: (above)
GOAL 3: Strengthen STEM Teaching and Learning Opportunities a. Increase faculty project participation to 50: STEM Cultural changes, High-Impact Practices/STEM Curriculum. b. Increase *success* of cohorts in STEM introductory Math/ Natural Science courses, 10%. (Supplemental Instruction) c. Increase *success* in English & math gateway courses by 10% (Acceleration). **NOTE: Appropriate technology for STEM teaching and learning is budgeted for student and STEM program needs.**	**Strategy 2, (above)** • Goal # 1 (curriculum, above) **Strategy 7: (above)** • Goal # 5: Broaden contacts and communication with local schools, businesses and agencies. **Strategy 1 (above)** • Goal # 3: Support professional development for faculty in order to improve quality of teaching and curriculum for basic skills and transfer courses. • **Goal # 5: Provide appropriate technology and support for teaching and student success.**

Building Institutional Capacity to Achieve System Change. The STEM Planning Group has

[11] http://www.gavilan.edu/strategic_plans/Gavilan_StrategicPlan_2014_2019.pdf, pp.1-3, 3-15-16.
[12] http://www.gavilan.edu/strategic_plans/Gavilan_StrategicPlan_2014_2019.pdf, pp.1-3, 3-27-16.

studied obstacles and reforms in STEM education and we recognize the need for a comprehensive approach that will achieve broad system change, as opposed to piecemeal efforts. Gavilan's Hispanic and first generation STEM students need to complete their transfer requirements and move directly into STEM programs at San Jose State University. The three-pronged program weaves together three initiatives to strengthen the college.

A Comprehensive, Integrated Strategy: One Activity, in Three Parts
1. Strengthen STEM students by centralizing and broadening fragmented support services, 2. Develop and pilot Guided Pathways in order to streamline STEM degree requirements, and 3. Renew STEM Teaching and Learning opportunities for faculty and students.

San Jose State University (SJSU), our project partner, is our primary transfer-receiving institution. In the current STEM project, our collaboration has been especially productive: we have a higher percentage of STEM majors, more of them are Hispanics, and we have more Hispanic transfers than ever before. **The three roles of our partner** are 1) collaborate to build Guided STEM Pathways, 2) provide Transfer Tutors for community college students, and 3) contract with SJSU STEM faculty to supervise Gavilan student research internships.

Solid Reasons for Partnering with San Jose State University
• Gavilan and SJSU have a 5-year STEM partnership under HSI, Title III, ending 9/2016.
• Undergraduate Research for our STEM students with SJSU faculty has been very successful.
• SJSU is an "emerging Hispanic-Serving Institution" with 22% Hispanic students.
• SJSU's "University Center" on Gavilan's campus has offered upper-division courses since 2003.
• SJSU gives community college transfers many degree and credential options for STEM fields.
• SJSU produces more STEM professionals for the region than any other California university.
• Only 10% of SJSU's undergraduates, however, are STEM majors; about 12% of those are Hispanic. SJSU is concerned about increasing and retaining STEM majors, especially Gavilan's Hispanics.
• At least half of SJSU students are first-generation; many services are designed specifically for them.
• SJSU is 22% Hispanic: it has many initiatives such as Cesar Chavez Community Action Center.[13]
• For our transfers, the 32-mile commute to SJSU is shorter than to other CA state colleges.
• Many major educational initiatives have been shared with SJSU since 1995.

A year-by year Project Overview appears on the next page.

[13] Cesar Chavez Center. http://www.sjsu.edu/ccll/QuickLinks/ChavezCommunityActionCenter/.

CRITERION A 1. The QUALITY OF the PROJECT DESIGN: A Five-Year Overview					
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
1. Iincrease Student Outcomes	Centralize STEM/MESA Support Center, [14] Hire staff, equip space, train all peer tutors and Faculty Mentors	Develop Case Management, career/academic/ financial advising, assign faculty mentors; *130 STEM Majors*[15]	Refine, strengthen services based on student feedback & results; link tracking system to MIS *150 STEM Majors*	Launch institutionalization plan; budget accordingly for all services & systems *175 STEM Majors*	Complete development, finalize tracking, Institutionalize Final Evaluation *200 STEM Majors*
	• Build on strengths of bilingual outreach to STEM parents and middle school students, Science Alive *160 attendees per year.*				
	• Build on (MathJam) Summer Bridge *25 students a year*; Develop STEM Transition Academy [16] *25 transfer students a year.*				
2. Improve Pathways	Guided Pathway Panel: train, mine the data, find barriers in 2 STEM Degree Pathways.[17] *10 Representatives*	Plan/Align/Streamline Guided Pathways to 2 Math and Natural Science degrees. *10 Representatives*	Submit, review both Pathways, secure campus approvals on Math & Natural Science Paths. *10 Representatives*	*New Pathway Panel:* Train, develop 2 Social Science Degrees, Plan 2 Guided Pathways. *10 Representatives*	Submit, review 2 new Pathways, secure campus approvals on both Social Science degrees. *10 Representatives*
	• Guided Pathway Study. ASAP-CUNY model: full-time, accelerated, transfer-bound students, taking at least one remedial course. • Yr. 1: prep STEM-ASAP study,[18] conduct it Yrs. 2-5: 100 student per year, milestones: declared STEM major, 30, 60 units, transfer.				
3. Renew Teaching & Learning	Renew STEM Culture; Train faculty in High-Impact Practices, Prepare Pilots for Yr 2 *8 STEM faculty*	Pilot, assess new classroom/lab practices & technology in 8 Biology courses *8 faculty-240 students*	Design, refine pilots, assess new practices & technology in 8 Chem./Math courses *8 faculty-240 students*	Design, refine pilots, assess new practices & technology in 8 Geol./Botany courses *8 faculty-240 students*	Design, refine pilots, assess new practices in 3-4 Other Natural Science courses *8 faculty-240 students*
	• Customize, pilot Accelerated basic skills to STEM; extend, pilot Supplemental Instruction to STEM introductory curricula: *300 per yr.*				
	• Build on successful Student Research Interns with Partner SJSU Faculty Supervisors: *15-20 Interns and 1-1 supervisors per year.*				
LEARNING TOOLS: Provide student loaner calculators, books, laptops; update, equip STEM Support Center and classrooms/labs.					

[14] Our STEM-student services Part 1, and our formal study (Part 2) are based on Scrivener, S., Weiss, Ratledge, A., Rudd, T., Sommo, C. & Fresques, H. (2015) *Doubling graduation* rates: *Three-year effects of CUNY's Accelerated Study in Associate Programs (ASAP) for Developmental Education Students.* MDRC.
[15] Baseline # of STEM majors as of 2014-15: 116, counting Math, Natural Sciences, and Liberal Arts-Natural Sciences.
[16] Strengthen Summer Bridge (MathJam) to prepare STEM freshmen; develop and pilot Transition Academy to fortify second-year students.
[17] Gavilan's "Articulation and Transfer model" is a hybrid adapted from Bailey, T., Jaggars S., & Davis, J. (2015) Redesigning America's Community Colleges: A Clearer Path to Student Success. Cambridge: Harvard University Press.
[18] Our "STEM-ASAP" study will use the protocols of the What Works Clearinghouse, see Criterion E-3, pp. 46-55.

Criterion A. *Quality of the Project Design.*
1. The project addresses the needs of target population and other identified needs.

Part 1. Design of the STEM Support Center	***Hispanic, low-income student and system needs***
1. A centralized STEM Support Center will reduce fragmented STEM student services.	Fragmented services limit cohesive support; STEM/ MESA faculty & students need a shared space.
2. A suite of comprehensive support services: Case Management, dedicated 100% STEM counselor, tutors, academic/career/ financial advising, Faculty Mentors, tracking system.	Half-time Counselor not enough to increase/retain STEM majors; needs of Hispanic, low-income, first-generation students include help in rigorous STEM courses and lack contact with STEM faculty.
3. Bi-lingual outreach: parent workshops and school programs will mobilize STEM interest; Summer Bridge programs (for new and 2nd-year students) will fortify student transitions.	First-generation families & local school students unaware of lucrative and exciting STEM careers. Students lose momentum over summer, face tough transitions to rigorous college-level STEM courses.

1. The Project's STEM Center will centralize services in order to improve outcomes.

Gavilan's rate of transfer in 2014 overall was just 31%; only 22% of transfers were Hispanics. Of 6,298 entering students, only 12% officially declared a STEM major; only 7% transferred.[19]

Gavilan Transfers to all 4-Year Colleges by Cohorts & Ethnicity [20]						
	2006-2007		**2007-2008**		**2008-2009**	
	Cohort	**Transferred**	**Cohort**	**Transferred**	**Cohort**	**Transferred**
Total	485	142 or 29%	579	163 or 28%	714	220 or 31%
Hispanic	**228**	**44 or 19%**	**271**	**58 or 21%**	**311**	**69 or 22%**
White	199	68 or 34%	215	72 or 33%	262	93 or 35%

Our current support services for STEM students are too fragmented. We have three writing labs (one ESL) and two math labs which focus on discreet skills that are not tied directly to the STEM curriculum. The labs are spread out among isolated buildings on our hillside campus. The STEM Planning Group strongly recommended centralizing STEM support and customizing it to the STEM curricula. Our current labs are insufficient for STEM students' assignments. STEM students need a place to gather, with essential academic resources; many have no quiet place to study at home.[21]

[19] GIDS (Gavilan Information Data System) Transfer Reports, 12-2015.
[20] *Gavilan College Institutional Research. http://www.gavilan.edu/Research/ Run 3/22/2016.*
[21] Gavilan Report: Student Success, (Spring 2013) http://www.gavilan.edu/research/reports/documents.

2. The STEM Center will feature a suite of services: a full-time STEM bi-lingual counselor, Case Management of STEM students, academic, career and financial advising. We have learned in our current STEM project that a half-time STEM Counselor is simply not enough to address the needs of Hispanic, low-income, first-generation students. Most Gavilan students arrive with little appreciation of their own strengths – or how to build on those strengths in a supportive environment. About half have no college-going role models at home; many have family duties or very long work hours. **The fall to fall retention rate for the Fall 2013 entering cohort was 71% for full-time students, 35% for part-time.**[22] Studies of achievement milestones suggest that completing a minimum of 20 credits in a student's first year is a clear determiner of success, particularly for STEM majors.[23] Dipping below this level increases the probability of failing to earn a bachelor's degree by 30%.[24] **Financial advising** is also critical. In Fall 2015, about 49% of first-time, full-time students were on Pell grants and 67% get state or local government aid.[25] In the city of Gilroy, in Gavilan's central service area, income disparities are exacerbated by low-wage jobs, many in migrant agriculture.

Gilroy Residents Below Poverty Line—White vs Hispanic (2015) [26]				
	# Population	**% of total**	**# Poverty**	**% below Poverty**
Gilroy	51,701	100%	5377	10.4%
White	15,822	30.6%	634	4%
Hispanic	**30,756**	**59.5%**	**7222**	**23.5%**

Career advising will help Hispanic students gain equitable access to STEM professions. Hispanics are almost 15% of the US workforce, but command only 6.5% of STEM-related careers.

[22] NCES IPEDS data for Gavilan College, pulled 4-29-2016.
[23] Adelman, C. (2006). *The Toolbox Revisited.* Washington, D.C.: U.S. Dept. of Education, p. 86.
[24] Leinbach and Jenkins (2008). *Using Longitudinal Data to Increase Community College Student Success*. Community College Research Center, (CCRC) Teachers College, Columbia University.
[25] NCES IPEDS data for Gavilan College, pulled 4-15-2016.
[26] https://aspe.hhs.gov/computations-2015-poverty-guidelines#a.

STEM Workforce Participation 2011 (latest available by Ethnicity) [27]						
	Workforce	**%**	**STEM**	**%**	**STEM Related**	**%**
All Americans	116,445,308	100	7,277,620	100	7,829,769	100
White	77,920,908	66.9	5,113,563	70.8	5,689,948	72.7
Asian	6,404,993	5.5	1,047,444	14.5	678,210	8.7
Hispanic	**17,368,595**	**14.9**	**467,520**	**6.5**	**531,509**	**6.8**

Fastest Growing Jobs Needing STEM BA/BS Degrees in Santa Clara County [28]		
Job Title	**% Growth 2012-22**	**Median Annual: 1st Q. 2014**
Operations Research Analyst	64.9%	$115,042
Software Developers, Applications	42.8%	$128,680
Web Developers	42.0%	$103,347
Database Administrators	35.8%	$101,000
Biomedical Engineers	35.4%	$113,383
Computer Information Systems Managers	29.6%	$173,761
Computer Network Architects	28.5%	$138,140
Fastest Growing Jobs Needing STEM BA/BS Degrees in Monterey & San Benito Counties		
Registered Nurses	36.5%	$103,529
Computer Systems Analysts	36.4%	$83,062
Software Developers, Applications	34.8%	$108,122
Pharmacists	28.6%	$132,939

STEM Center services will include STEM Faculty Mentors and Peer Tutors. STEM majors will be assigned math or natural science Faculty Mentors to make routine contact and ensure that students stay on track to transfer. Researchers and practitioners agree that students with *intentional support* will reduce completion time while increasing completion rates.[29] Peer tutors will be trained with strategies linked specifically to STEM curricula, supervised by faculty.

3. Our STEM Support Center will hold outreach workshops for parents and middle school children. At quarterly bi-lingual workshops, students and their parents will learn what scientists do and how exciting STEM careers can be. Hispanic and low-income parents may not realize the rigorous demands of STEM courses on their students; parental encouragement has been shown to be one of the strongest influences on Hispanic students' aspirations.[30] We also plan quarterly,

[27] American Community Surveys, 2011. Combined data from Table S2401S (median earning).
[28] *California Employment Development Department, http://www.labormarketinfo.edd.ca.gov/.*
[29] Jacobson, L., Mokher, C. (2009). *Pathways to boosting the earnings of low-income students by increasing their educational attainment.* Hudson Institute Center for Employment Policy and CNA Analysis & Solutions; and Bailey, T., G. Kienzl, D. Marcotte. (2004). Washington D.C.: U.S. Department of Education.
[30] Arbona, C. Nora, A. (2007) The Influence of Academic and Environmental Factors on Hispanic Degree Attainment. *The Review of Higher Education*. Vol. 30, No. 3, String, 2007, p. 264.

middle-school "Science Alive" events, conducted by STEM faculty and designed to entice local middle-schoolers into STEM professions and to inform them about STEM programs at Gavilan and SJSU. These events develop motivation to identify as scientists.[31] Andrés Henríquez, a board member at Excelencia, noted the dearth in most laymen's perceptions of scientists:

> …one of the reasons why Latinos don't pursue careers in STEM is because they don't have a clear idea of what a job in STEM looks like—and neither do their parents. We know what a teacher is because we've gone through the K-12 system., but when we try to picture a scientist, it's very hard to think about what that looks like.[32]

4. The Center will coordinate a STEM summer "bridge" programs for entering students and second-year students. Jumpstart, our Summer Bridge for entering STEM students, is modeled on Pasadena City College's MathJam. Students earn 4 units for math and college savvy. We will build a summer bridge experience for second-year students. **The Transition Academy** will shore up STEM students' skills and motivation to prevent "the sophomore slump."

Part 2. Design of STEM Guided Pathways [33]	***Hispanic, low-income student and system needs***
1. **Years 1-3** Guided Pathways Panel with SJSU: find barriers in Math/Natural Science majors, design, map, approve majors.[34] **Years 4-5**: Scale Up to 2 non-STEM majors, (such as Social Sciences); draft 2 more streamlined Pathways, approve both.	Barriers delay progress, students waste time & $$; curricula misaligned, transitions awkward. A morass of requirements deters many, simpler maps needed. Our students need streamlined maps in all of our degree programs; they will be able to complete requirements and transfer much faster than currently.
2. A formal study of our students in services modeled on ASAP-CUNY's program for full-time, underserved students.	This study will serve our target population by confirming or rejecting our combination of support, pathway maps and linked summer bridges.

1. In Part 2, we will develop two sets of "Guided Pathways." In Years 1-3, an appointed STEM Pathway Panel will review pipeline data, find obstacles to transfer and baccalaureate degrees, and streamline pathway maps for each program. The Panel includes 2 Gavilan students,

[31] Graham, M. & Frederick, J., Byars-Winston, A., Hunter, A., & Handelsman, J. (2013). Increasing persistence of college students in STEM. In *Science*, 341, 1455-1456.
[32] Excelencia Webinar, June 17, 2015. *Finding Your Workforce: Latinos in STEM*.
[33] Bailey, T., Jaggars S., & Davis, J. (2015) *Redesigning America's Community Colleges: A Clearer Path to Student Success.* Cambridge: Harvard University Press.
[34] National Academy of Sciences, Engineering and Medicine (2016). *Barriers and Opportunities for 2-Year and 4-Year STEM Degrees*, Board on Science Education and Board on Higher Education and the Workforce. Washington, D.C.: (Pre-Publication Copy).

2 Gavilan STEM faculty, 2 Gavilan counselors, 2 SJSU faculty and 2 STEM industry professionals. They will be led by Hope Jukl, Activity Director. In Years 4-5, a new panel will use the model designed for STEM and apply it to the Social Sciences.

CCRC (Community College Research Center at Columbia University, New York) collects extensive case studies of community colleges that have moved toward "guided pathways" and have growing evidence of improved student outcomes. Their studies of barriers to faster degree completion suggest that many community colleges are what they call a "cafeteria" campus where students are stymied by too many choices and complicated requirements.

CRCC's "Cafeteria" Campus	vs. a "Guided Pathway" Campus
Students without advisors, too many try a curricular smorgasbord resulting in costly delays.	New students required to review career-related, structured planning maps with a trained advisor.
Decisions are based on fragmented advising and random notions about a professional goal.	Advisors offer simplified program maps and "no-fault" options related to key professions.
Courses are isolated chunks, not linked or sequential; skills and content built separately.	Foundational courses require critical thinking, and help students solidify a field of study.
Faculty tend to develop program pathways without student or professional input.	Guided Pathways are developed and reviewed with industry and student representatives.
Meta-cognitive learning is separated from learning in courses where content is king.	Critical thinking and meta-cognitive skills are intentionally embedded across coursework.
Faculty rarely engage directly with support services personnel when developing programs.	Faculty develop pathways with support personnel and review progress data together.
Curriculum development is course-based and isolated from program learning outcomes.	Curriculum development is based on links to and sequences in specific program outcomes.
Professional development relies on isolated workshops without coordinated applications.	Faculty apply training and test new practices with their students and share evaluations.
Classroom methods devolve into traditional knowledge transmission of facts and principles.	Collaborative practices engage faculty in new methods, shared inquiry, assessment strategies.
Adapted from Bailey, et al. (2015) Redesigning America's Community Colleges.	

Barriers in the curriculum can delay progress: Misaligned requirements and a quagmire of barriers face Gavilan's STEM transfer students. California State University (CSU) transfer patterns contain dozens of exceptions and variations for STEM majors at all nine campuses. Without clarity, these students face long, costly roads to graduation.[35] We need to expedite students' transfer trajectories. Students cannot afford to languish in complex transfer patterns,

[35] *Finding the 'Perfect 60" for Transfer,* Inside Higher Ed, 3/21/08.

and colleges can save millions by moving students to transfer more efficiently.[36]

2. Our project design includes a formal study of students in pathways and support services, modeled on the ASAP-CUNY program. The study will serve our target population by confirming or rejecting results of our combination of customized support, streamlined pathways and engaging teaching and learning practices. Our study will use a regression discontinuity design (RDD), with matched student groups and above and below cut-off scores. The support services and guided pathways intervention is based the ASAP-CUNY program; our study and comprehensive support services will benefit from the lessons learned in their initiative, below. [37]

Lessons for Designing and Implementing ASAP-Type Programs
• Require full-time enrollment and provide an array of on-going supports for students, such as career advisement and financial support that yield growth in enrollment and credit accumulation.
• Require students to participate in key program components, monitoring participation, and provide meaningful benefits to participant can markedly increase receipt of services.
• Monitor program operations, with a focus on ongoing improvement, for strong implementation.
• Encourage or require students to take developmental courses earlier to hasten and increase completion of those courses. Intersessions, especially summer, provide good opportunities to increase enrollment in college and credit accumulation.

A detailed discussion of the study, "STEM-ASAP," meets WWC protocol, see E 3, p. 51.

Part 3. Renew Teaching and Learning	***Hispanic, low-income student and system needs***
1. Transform "STEM culture" to be inclusive of ALL students; develop and test High-Impact Practices in STEM courses/get student input.	STEM culture limits success; we do not emphasize full-time enrollment. We must use more High-Impact Practices to engage STEM students.
2. Accelerated basic skills courses will expedite progress toward transfer; Supplemental Instruction will extend to intro STEM courses.	Second-language students and others are delayed in basic skills; most students need help with rigors of STEM courses and S.I. has promising results.
3. Build on success of Research Interns w/ SJSU supervisors and local STEM corporations.	Students need to experience what scientists do in labs at SJSU and in local STEM corporations.
Provide calculators, laptops, and textbooks; update labs and classroom with state of the art equipment.	

1. Transform "STEM culture" to be inclusive; develop and test High-Impact Practices in STEM courses with systematic student feedback. STEM culture can be unintentionally

[36] *Meeting Compliance, but Missing the Mark*, The Campaign for College Opportunity, 2012.
[37] Scrivener, S., Weiss, M. J., Ratledge, A., Rudd, T., Sommo, C., & Fresques, H. (2015). *Doubling graduation rates: Three-year effects of CUNY's Accelerated Study in Associate Programs (ASAP) for Developmental Education Students.* New York: MDRC. http://files.eric.ed.gov/fulltext/ED558511.pdf, p. 88.

"exclusive" when instructors believe that science education and professions are meant for the the few. This culture is a major barrier to students entering or continuing in STEM majors.[38] The STEM Planning Group agreed that we must change this culture and test new classroom practices directly with students. Training for math and natural science faculty will be followed by incentives to design and test High-Impact Practices in their STEM courses.[39] Students rarely benefit from stand-alone faculty workshops; instead, our plan to train, re-design, pilot and assess active learning methods in "real classes with real students" will ensure long-term change.

2. Expedite transfer with Accelerated remedial courses and Supplemental Instruction.

When most students arrive, the first thing we tell them is that their college trajectory will slow to a crawl: they are not only underprepared, they will have to "do time in remedial jail." Long basic skills sequences, especially math, detain students far too long.[40] STEM students will be served by "Accelerated" courses which "…reduce the amount of time students spend in remediation and allow them to enroll more quickly—or immediately—in courses leading to certificates or degrees." [41] We will also employ Supplemental Instruction for introductory science courses, often high-risk curricula. Hispanic students' success in Biology 1, (C or above), is a mere 25%.[42] Such low success rates in early in STEM cause too many to jump ship entirely. Between 2003 and 2009, ***48 percent of U.S. students in STEM bachelor's degree programs switched to another major or dropped out.***[43]

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[38] Malcolm, S., Feder, M., Ed. *Barriers and Opportunities for 2-year and 4-year STEM Degrees: Systemic Change to Support Students' Diverse Pathways,* (2016) Report by Committee Commissioned by the National Academies of Sciences, Engineering and Medicine, National Academies Press (Pre-Publication Copy)

[39] Kuh, G. (2008) *High-Impact Educational Practices: What they are, who has access to them, and why they matter.* Association of American Colleges and Universities. Washington, D.C.

[40] Hern, K. and M. Snell. (June, 2010) *Exponential Attrition and the Promise of Acceleration in Developmental English and Math.* Los Medanos College, Pittsburgh, CA.

[41] Nodine, T., Dadgar, M., Venezia, A., & Bracco, K. R. (2013). *Acceleration in developmental education*. San Francisco: WestEd.

[42] Gavilan Office of Research. GIDS data reports: 2-2016.

[43] National Academy of Sciences. (2016). *Barriers and Opportunities for 2-Year and 4-Year STEM Degrees.*

3. We will strengthen Student Research Interns, AKA "undergraduate research." Our partner faculty at SJSU and local STEM industry leaders will supervise our Interns. Gavilan has made STEM internships a priority for good reason: they have been highly successful in our current STEM project and are one of the most effective, evidence-based "High Impact Practices," particularly with under-served students. A study at CSU - Fullerton showed how undergraduate research maximized success in STEM programs (more than one-third of participants were Hispanics). These programs improve outcomes, including timely graduation, improved GPA and increased advanced degree candidates.[44]

Gavilan's STEM programs desperately need updated labs and classrooms and our low-income students need access to laptops, calculators and textbooks. Science and math curricula require modern facilities with current equipment; our under-served, low-income students deserve no less. Our STEM facilities have not been updated since 2012. To increase STEM majors and retain them, our labs must be more complete. About half of our students are from low-income families; income disparities diminish Hispanic students' access to learning technology. What is almost worse, many of them cannot afford a home wifi connection to get the Web-based resources required for research and learning projects. As a group, Hispanic families are less likely to own a computer and to have broadband access to the Internet. [45] Our under-served students need these resources.

Criterion A 2. A literature review supports implementation and appropriate methods.

The entire design is based upon the STEM Planning Group's broad review of recent research and practice, primarily in approaches and services for Hispanic STEM students.

Washington, D.C.: (Pre-Publication Copy).

[44] Moon, Hershey, J., & McMahan, (2012). A case study of evaluating undergraduate research courses as high-impact practices fostering student learning outcomes. Unpublished presentation, California State University, Fullerton. http://www.fullerton.edu/analyticalstudies/presentations/AIR_UndergResearch_HIPS_Sunny_vFinal.pdf.

[45] Rabinovitz, J, (April 8, 2015). https://ed.stanford.edu/news/studies-suggest-steps-bridge-digital-divide/hispanics.

Implementation Plan and Appropriate Methods	
1. Improve Outcomes	1. Establish, equip, maintain and centralize the STEM Support Center; the Center will strengthen and coalesce isolated services in current STEM/MESA initiatives. 2. Develop a Case Management System with 100% dedicated, bi-lingual, STEM Counselor; academic, career, financial advising, tutoring, STEM Faculty Mentors; Tracking System. 3. Offer bi-lingual outreach workshops for parents and middle-school students to inspire STEM interest; require Summer Bridge (pre-freshmen) & a Transition Academy (2nd yr).
2. Improve Pathways	1. Develop Guided Pathways with SJSU: review data, remove barriers in Math/Natural Science curricula, design structured program maps, campuses approve both. 2. Develop 2 Guided Pathways in Social Science programs based STEM model. 3. Conduct a formal study of students in services modeled on ASAP-CUNY program for Hispanic/underserved students--with budgeted Research Coordinator.
3. Renew Teaching & Learning	1. Transform "STEM Culture" from exclusive to inclusive; develop High-Impact Practices in the Natural Science/math curriculum; test and evaluate them with students. 2. Build on our Accelerated pre-college math and English curricula to improve pace and prep for gateway courses; build on strengths of Supplemental Instruction in gateway courses and expand S.I. into introductory STEM curricula. 3. Continue our successful Student Research Interns with SJSU Faculty and STEM industry Supervisors.

Gavilan's plan to improve STEM student persistence to transfer weaves well-researched strategies into a coherent program of student support, effective instruction, and system reforms. The STEM Planning Group divided into three sub-groups to investigate which studies and practices make a real difference with community college students. In the last two years we have visited other colleges in the northern California region, looking for methods that make sense.

Implementation/Appropriate Methods	Supported by a Review of the Literature
Part 1. Develop the STEM Support Center	
-Develop fully-equipped, centralized STEM center for STEM students and faculty. *-Develop suite of services: Case Management with bi-lingual STEM counselor, STEM career, academic and financial advising.* *-Faculty Mentors, Peer tutors.* *-Develop STEM Tracking System (GIDS and data analyst)* *-Conduct Summer Bridge (based on PCC's MathJam)* *-Develop and a Transition Academy (2nd-Yr)*	Tinto 2014; 2003; Kuh, 2001, 2014; Dowd, et al. 2009; Bensimon, et al., 2012; Santiago and Brown, 2008; Pascarella & Terenzini, 2005; Eagan, et al.2010; Einarson & Clarkberg, 2010; Perna, et al. 2010; Hurtado, et al. 2011-2015; Contreras, et al., 2008; Gore and Carter, 2011, Odon, 2005; Dowd & Bensimon, et al., 2010-2014; CUE, 2013-14; Hurtado, et al., 2008-15; Complete College America, 2011; Scott-Clayton, 2011; Pasadena City College, 2016; Nat. Ctr. for Research on Students in Transition, 2007-2016; Metro College at CCSF, 2015; Visher, Butcher, & Cerna, 2010; Scrivener & Weiss, 2013; Colvin & Ashman (2010); Steele & McDonald, 2008.

The STEM center will be the nexus for implementation of strategies and services across the project, linking students, faculty, support services, outreach, and bridge programs. Gavilan has designed benchmarking strategies to set equity goals, measure progress, evaluate current college

practices and set a course to implement and sustain new models of best practices. A tracking system will support monitoring major student milestones. These strategies are grounded in the best research on institutional change for Hispanic students (Dowd, Malcolm & Bensimon, 2009; Malcolm-Piqueux, Bensimon, 2015; Rendón, Nora, Kanagala, 2014). Co-locating services will also facilitate frequent, routine assessment of student progress along newly created pathways.

The Center will include interaction with Faculty Mentors in an informal setting. Advice and encouragement from faculty significantly increases student persistence and degree completion (Pascarella & Terenzini, 2005; Eagan, et al.2010; Einarson & Clarkberg, 2010; Perna, et al. 2010; Hurtado, et al. 2011 and Hurtado, 2015). Faculty Mentor training will focus on the strong influence faculty can have on the trajectories of Hispanic students. Faculty can become effective institutional agents, a central factor in transformation and in fostering student achievement and retention in STEM majors. **Ongoing advising will use Case Management model**. The path to a STEM degree is complex; students need guidance as they make educational decisions (Auguste, Cota, Jayaram, & Laboissiere, 2010; Complete College America, 2011; Scott-Clayton, 2011). Case management models are used to coordinate supports across college units and provide "enhanced" advising with mandatory meetings and an assigned advisor for the first year. Isolated interventions fail to produce long-term effects (Visher, Butcher, & Cerna, 2010; Scrivener & Weiss, 2013). Ongoing counseling and case management will reduce the "fade out effect" and help students weather complex challenges to persistence (Steele & McDonald, 2008).

Peer tutoring. We will train STEM majors as peer tutors in five specific roles: connecting link, peer leader, learning coach, student advocate and trusted friend (Colvin & Ashman, 2010). Ongoing training for peer tutors and faculty engagement in developing the peer tutor role will be enhanced within the structure of the STEM center. **Summer Bridge Programs.** In 2013,

CCRC studied high school transition curricula in several states to explore the factors that seem to lead to stronger outcomes for underprepared students. CCRC found that *summer transition* programs help most when students begin career exploration immediately, investigating degree programs in order to move quickly into a specific program of study.[46] Our Summer Bridge program (MathJam) offers 4 units for brush-up remedial math and "college savvy." Modeled after Pasadena City College's MathJam, the intensive one-week experience eases the transition to college for Hispanic STEM students. **The Transition Academy** will be developed to provide scaffolding for STEM students entering their second year--a critical summer juncture when students wind down from the first year and get discouraged by the challenges in STEM curricula. The Transition Academy will help students cope with new challenges such as more rigorous coursework and applying for internships.[47]

Implementation/Appropriate Methods	Supported by a Review of the Literature
Part 2. Develop Guided Pathways (Articulation-Transfer model).	
1.*-Train 10 Guided Pathway Panel reps: Consultant, Rob Johnstone, NCII.* *-Years 1-3, Panel develops 2 STEM Pathways* *- Years 4-5, Panel develops 2 Social Science Pathways to expedite transfer &completion, streamline curricula; align goals with professions and map clear degree programs through the baccalaureate.*	Bailey, et al., *Re-designing CCs.* 2015; Johnstone, *Pathways Demystified* 2015; National Academies, *2016*; National Resource Ctr., Students in Transition 2014-2016; CA, R-P Group, 2010-2014; AAC&U, "LEAP" 2014, 2015; AACC 2*1st C. Pathways* 2015; ACT's *Condition of STEM* 2015; Moore & Shulock, *Partnerships* 2009; RP Group, 2012; Monaghan & Atwell, 2014; Melguizo, Kienzl & Alfonso, 2011
2. *- Adapt, ASAP-CUNY's support model for a formal Study ("STEM-ASAP") of first-time, full-time STEM students, set minimum visits to advisors, mentors, counselors.* *- Set data elements with Research Office from GIDS system; Conduct training Year 1 and launch STEM-ASAP in Year 2.* *-Provide funds & other incentives to study participants, per ASAP model, E-3, p. 52.*	Scrivener, et al. ASAP/CUNY 2015; Pasadena City College Pathway model, 2015. Metro Academy: City College, San Francisco with CSU-SF; Long Beach City College Promise Pathways with CSU-LB: CEEE Study of Outcomes. National Academies, *Barriers/Opportunities,* 2016. Scrivener/Weiss (ASAP) participant incentives. See landscape STEM-ASAP Overview, E-3, p. 53)

1. Guided Pathways challenge colleges to tighten up how students enter programs. The best

[46] Barnett, E. *Validation Experiences and Persistence among Community College Students*. The Review of Higher Education, Volume 34, Number 2, Winter 2010, pp. 193-230, p. 141.

[47] Hunter, M., et al. (2009) *Helping Sophomores Succeed: Understanding and Improving the Second Year Experience.* San Francisco, Wiley-Bass.

methods used to achieve this change derive from a thorough study of Bailey's *Re-designing America's Community Colleges*. Admittedly, California Community Colleges are the "poster boy" of what Tom Bailey and colleagues call "a cafeteria college" or as Rob Johnstone, NCII, calls it, "the menu at the Cheesecake Factory." [48] Overcoming the cafeteria model is complex, but possible. Miami Dade College began by having faculty lay out required courses in five large program areas. When reviewing transcripts, not even "pathway skeptics" could tell if those given courses would permit students to transfer with junior standing. The exercise convinced them to support the guided pathways strategy (Rodicio, Mayer & Jenkins, 2014). *Our own STEM Planning Group tested this exercise and had to agree.* Recently, the California Chancellor's Office asked a handful of leaders and faculty to apply and matriculate at their own colleges; they found that more than half of them "tested into developmental education, claiming the math was not relevant to their real-world work, and calling into question why it should be relevant to students." [49] **Our typical focus on student outcomes has been on *discrete courses***, rather than a larger study of programs of study that facilitate timely completion to transfer. Scholars of pathways, based some of their work on behavioral economics and choice-making. The inference is that students do better with narrowed choices that still leave room for options. Judith-Scott-Clayton and others believe that our students are navigating a "shapeless river" of choices that limit their progress.[50] Developing Guided Pathways can also benefit taxpayers in the long run: "On average, taxpayers invest approximately $54,800 per associate degree resulting in total

[48] Johnstone, R. (2015) National Center for Inquiry and Improvement. Guided Pathways Demystified: Asking Questions about Implementing Pathways. http://www.inquiry2improvement.com/attachments/article/12/PWs-Demystified-Johnstone-110315.pdf. p. 14.
[49] Johnstone, R. (2015) p. 15.
[50] Scott-Clayton, J. (2011) *The Shapeless River: Does a lack of structure inhibit students' progress at community colleges?* CRCC Working paper, Number 25.

taxpayer returns over two and a half times greater than the initial investment.[51] Once our Guided Pathways are developed, high-school counselors can give these maps to college-bound seniors for a running start.[52]

2. We will conduct a four-year formal study, "STEM-ASAP," of students in new pathways with specified supports. The study of City University of New York's ASAP program meets What Works Clearinghouse's design standards without reservations, and has achieved statistically significant positive impacts in credit accumulation, remediation completion and degree attainment (Scrivener, et al., 2015). Gavilan's STEM comprehensive services in this project are modeled partly on ASAP-CUNY's program and Pasadena City College's (PCC) Pathways Project. Our first-generation students are quite similar; most of them need routine advising and well-structured choices. Brock Klein, PCC Pathways, says that their review of transcripts over three years showed that 65% had no noticeable goal or pattern.[53] (E-3, p. 52).

Sources for Implementing Gavilan's STEM-ASAP Study
• For math improvements in developmental courses, The California Basic Skills Initiative urges colleges to track the rates of student success and retention in subsequent course levels. [54]
• BEST Blue Ribbon Panel on Higher Education, 2002, recommends performance-based accountability, such as math skills growth, that relate to increasing the technical workforce. [55]
• NCES: National Center for Education Statistics. Department of Education evaluation resources. http://nces.ed.gov/surveys/SurveyGroups.asp?group=2.
• Ewell, P. (2008) *Community College Data and Performance Measurement Toolkit*. NCHEMS.
• Using milestones and momentum points: Leinbach and Jenkins (2008) *Using Longitudinal Data to Increase CC Student Success.* CCRC, Teachers College, Columbia University.
• NSF Science and Engineering Indicators, 2008, recommend measuring critical transitions: entering community college, transferring and completing the baccalaureate. [56]
• Excelencia, major Hispanic policy/data contributor, recommends sharing aggregated data with 1) internal stakeholders, and 2) external partners--used in project's continuous improvement. [57]
• US Dept. of Ed., Proposed Priority 10 "Enabling More Data-Based Decision Making" [58]

[51] Belfield, C. (2012). *Measuring efficiency in the community college*. CCRC Working Paper, No. 43. New York, Columbia University, Teachers College, Community College Research Center.
[52] Barnett, et al., 2010, p. 142.
[53] Klein, B. PCC Pathways Project Website, Pathways introductory video. http://pcc.edu/pathways. 4-16.
[54] Basic Skills, Part 2: Assessment Tool for Effective Practices in Basic Skills, Feb. 2007.
[55] *BEST Blue Ribbon Panel on Higher Ed., 2002.* A Bridge for All. www.bestworkforce.org
[56] Science and Engineering Indicators, 2008. http://nsf.gov/stistics/seind08/cl/cls6.htm
[57] *Successful Practices at 12 Top-Ranked Hispanic-Serving Institutions: Lessons On What U.S. Colleges... Can Do To Bolster Results for Latino Students*, Excelencia, June, 2008.

Implementation/Appropriate Methods	Supported by a Review of the Literature
Part 3. Renew Teaching and Learning	
1.-Renew STEM Culture as inclusive -Train faculty in High-Impact Practices, pilot test new active learning practices in STEM classes with student feedback.	Hurtado, 2015; Bensimon and Malcom, 2012; Carnevale and Strohl, 2010; Asera, 2009; Foster, 2007; RP Group, 2000-2014; Kuh & associates, 2007-2014; Sawatzky, 2015*…Minority Institutions: the Heart of the Matter.*
2. -Require Accelerated skills, 2 terms in 1. -Extend Supplemental Instruction to Natural Science introductory curricula.	Hayward & Willett, 2014; Hern & Snell, 2007-2015; Moore & Shulock, 2011; RP Group, 2014; Malcom & Feder, Ed. *Barriers*, 2016; AAC&U, 2014.
3. - Student Research Interns (undergraduate research with SJSU faculty or local STEM industry supervisors.	Kuh, 2007-15; *Barriers & Opportunities*, 2016; CCRC research, 2007-2015; ACT, *Condition of STEM*, 2015; Complete College America, 2014.

1. Shifting the culture of STEM to include ALL students. A staunch criticism of some science departments suggests they treat students as though the STEM field was an elite club. In fact, our STEM Planning Group was dismayed to discover this attitude was pervasive in four-year colleges.[59] We will work to undermine this elitism in our dealings with students. Dr. Misty Sawatzky, will do a training workshop: "Inclusive STEM Culture: A Radical Idea."

Implementing High-Impact Practices (HIPs). Not surprisingly, some of the best efforts in undergraduate education have been at the classroom level, particularly through more effective practices and a conceptual shift from teacher-centered to learner-centered.[60] The literature on teaching and learning in Pascarella & Terenzini [61] and Kuh, et al.[62] provides evidence that active and collaborative strategies are more effective than lectures.[63] Our HIPs consultant, Dr. Tom Voden, Glendale College, will present workshops on project-based learning.

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[58] US Dept. of Ed., Secretary's Priorities for Discretionary Grant Programs Comment Request, Federal Register, August 5, 2010, p. 9-11.
[59] National Academies of Science, 2016, *Barriers & Opportunities for2-Year and 4-Year …STEM,* www.nap.edu;
[60] Barr R., Tagg, J. *From Teaching to Learning: New Paradigm for Undergraduate Education*. Change Magazine, Dec. 1995.
[61] Pascarella, E. & Terenzini, P. (2005) *How College Affects Students, V. 2 A Third Decade of Research*, San Francisco, Jossey-Bass.
[62] Kuh, G. et al. (2005) *Unmasking the Effects of Student Engagement on College Grades and Persistence.* Center for Post-Secondary Research, Indiana University, Bloomington, IN.
[63] Brower, A., K. Inkelas (2007) Assessing learning community programs/partnerships. In Smith, B./Williams, L. Ed. Learning Communities/Student Affairs: Olympia: Evergreen State.

Accelerated Developmental Education Paradoxically, the more "remedial" courses students take, the less likely they are to complete college-level courses. At Chabot College, Katie Hern described "*exponential attrition*:" 23% students in lower levels completed College English versus 45% in the *accelerated track.*[64] At Los Medanos College, Myra Snell compressed two math levels into one; her students did far better than comparison groups placing two-levels below. In MathPath at Pasadena City College students complete two terms in one, with improved results in transfer.[65]

Research On Authentic Learning Experiences
• Research conducted across all disciplines, not just STEM, indicates that faculty behaviors and characteristics have a significant effect on student engagement: active learning techniques, communicating high expectations in student-faculty interaction (Umbach and Wawrzynski, 2005). • Authentic Learning Experiences. The President's Council of Advisors on Science and Technology (2012) and others (Kuh, 2008) have stressed that exposure to authentic STEM experiences, including research, is a key aspect in improving persistence and completion. • Undergraduate research internships may be particularly important for students from under-represented groups since they may facilitate students' identities as scientists and engineers (Eagan et al., 2013). The experience involves work on industry-related projects and academic research. • Authentic Disciplinary Experiences. As outlined by Estrada (2014), co-curricular supports, if done well, provide authentic learning experiences that influence students' engagement and persistence in the sciences and engineering (Chang et al., 2011; Kinkead, 2003; Lopatto, 2003, Eagan, 2013).

Criterion A 3. The project is supported by strong theory and a Logic Model.

The strong theories that undergird the project are the following:

1. *Under-served Hispanic students benefit by a supportive suite of co-curricular activities.*
2. *Guided Pathways reduce barriers, increase curricular clarity, improve degree completion.*
3. *Inclusive "STEM culture" and high-impact practices will increase and retain STEM majors.*

Primary Sources in Strong Theories for Planning
1. The ACT (American College Testing) 2015 Report: *The Condition of STEM.* National Academies' (2016) *Barriers and Opportunities in 2-Year and 4-Year STEM Degrees: Systemic Change to Support Students' Diverse Pathways.*

[64] Hern, K. Exponential Attrition & Promise of Acceleration in Developmental English and Math, June 2010, p. 6.
[65] *XL, MathJam, MathPath Survival Report, Executive Summary*, 2010, www.pasadena.edu/externalrelations/tlc/pdf

CEEE (Center for Evaluation and Educational Effectiveness). Cal-State University, Long Beach.
AAC&U's LEAP programs

2. Bensimon, E. et al., CUE: Center for Urban Education, USC. (Sawatzky, et al.)
Bailey, et al., (2015) *Re-designing America's Community Colleges, CCRC.*
H.S.I. & Articulation Programs Summative Evaluation, Proof of Concept Pilot, March 2016.
Weiss, M., et al. (2014) "The Platinum Bullet: An Experimental Evaluation of CUNY's Accelerated Study Associate Program) ASAP… *Society for Research on Educational Effectiveness.*

3. Hurtado, et.al, Hurtado, S., et al. (2009). Diversifying science: Underrepresented student experiences … research programs. *Research in Higher Education, 50*, 189-214; Estrada, 2014, Natl. Academy of Sciences; Espinoza, 2011, Harvard Ed. Review; Kuh, 2007-2014 (High-Impact Practices)
Completion by Design, (Gates Foundation Initiative)
Johnstone, R. Center for Inquiry and Improvement.

The well-founded theories underlying this project as a whole is that the proposed services, guided pathways and new teaching practices can make a long term, significant difference in the success of Hispanic students. The project as a whole and each design feature is grounded in the best available research, conclusions and recommendations of the most reputable education groups who advocate to improve the academic success of Hispanic students overall and in STEM particularly. These strategies cannot work unless they are part of an institutional transformation effort. There is clearly an imperative for HSIs like Gavilan to make transform-ative change because of the equity gaps in student outcomes. This project's Logic Model was designed by the STEM Planning Group, which looked to all sources **cited in this proposal** to plan alternatives, ideas and models. Strong theories ground all of this this project in evidence-based practices.

LOGIC MODEL [66] and [67] "Strengthening Hispanic STEM Students: Comprehensive Support, Guided Pathways, Renewed Learning"			
Resources	**Activities**	**5-Year Outputs**	**Short and Long-Term Outcomes**
People: • Students, Faculty • Staff, Counselor, • Trained Tutors/Mentor • Faculty Mentors • SJSU Supervisors **Fiscal:** • Basic Skills Initiative • Title V H.S.I. Grant • *(No indirect request)* • College Contributions: -Project Manager, S.I., Accel., Research, Case Manage., Counselors.	**1. STEM Support Center** ***Services to Students:*** • STEM Counselor (100%) • Case Management System • Career/Academic Planning • 2 types of Summer Bridge • Faculty Mentors, Tutors • Free calculator/laptop/texts ***Services to Families:*** • Bilingual Workshops • Bilingual STEM Events ***Services to Schools:*** • Science Alive workshops • Teacher/student workshops	• Hispanic outcomes improved • Customized STEM Support • Effective, centralized services • 500+ STEM Student Cases in Case Management System • Transition Academy established • Faculty Mentors: 100+ students • Support Center & labs equipped • 16 School or parent workshops • Embedded "Science Alive" • Embedded "Science Alive" • K-12 partnership sustained	• Stronger Hispanic outcomes: equity in outcomes: 60% transfer, 40% complete baccalaureate; STEM vital to all. • Customized, centralized STEM Support Center: model for other disciplines and program pathways. • Case Management System scaled up to other Programs • Summer Bridge and Transition Academy model for other regional community colleges • Faculty Mentors scaled up to other programs • Bilingual community programs and workshops for families will be routine and well respected. • Outreach to schools will be consistent across programs & mission to the community will be strengthened
Partnerships: • 4-Year Partner: SJSU • Pathway Panel: local professionals/students, SJSU/Gavilan faculty & counselors • ASAP Study Staff • PCC/Metro Staff	**2. Guided Pathways** ***Services to Students:*** • Clear Program Transfer & Degree Maps • STEM-ASAP Study ***Services to Pathway Panel:*** • Training: Guided Pathways • Community Contacts	• 2 STEM maps; 2 Social Science improved pace & transfer rates • ASAP/CUNY adapted study • Working Panel: concrete results • Strengthen community contacts	• Gavilan becomes a true "Guided Pathway College" with program maps in all major curriculum clusters. • ASAP-adapted research spreads to other supports systems • Success of Pathway panel morphs into other initiatives • Gavilan's role in community leadership becomes routine.
Facilities/Programs: • Skills centers isolated • Acceleration/S.I. • Student-centered • CTE thriving • STEM strengths from current project to build on for this one.	**3. Renewed Learning** ***Services to Students:*** • Inclusive STEM culture • Research Internships-SJSU • Pilots of new practices • Updated lab equipment • Accelerated basic skill; S.I. ***Services to Faculty:*** • Train, pilot new practices	• Hispanic students feel included in renewed Culture of STEM • STEM Internships successful • High-Impact Practices Engage • STEM equipment: state of art • Acceleration & S.I. embedded • Training, new STEM success; High-Impact Practices routine	• Changes in STEM culture expand to the Culture of Transfer, improving Hispanic outcomes in GPA, etc. • STEM Internships are model for broader professions-related internships across key Pathways & programs. • Acceleration and Supplemental Instruction throughout. • Respect for STEM programs will be strengthened by attention to state of the art resources and equipment devoted to a renewed, thriving STEM program.

[66] Kekahio, W., Cicchinelli, L., Lawton, B., & Brandon, P. R. (2014). *Logic models: A tool for effective program planning….* (REL 2014–025). Washington, DC: U.S. Dept. Education, Institute of Education Sciences, Regional Educational Laboratory Pacific. http://ies.ed.gov/ncee/edlabs.

[67] W.K. Kellogg Foundation. Using Logic Models to bring together planning, evaluation and action; Logic model development guide. 1998.

Criterion A 4. The project has an exceptional approach to competition priorities.

Absolute Priority 1: **Comprehensive Support, Accelerated Basic Skills Instruction**

Part 1, the STEM Support Center will build upon the current STEM five-year project, with centralized services and scaffolding Gavilan needs to serve the urgent needs of our STEM students. In the service of equity for our Hispanic, first-generation and low-income students, we will will work to improve key student outcomes, as outlined in the Hispanic-Serving Institutions program and as developed for this project. These outcomes will be analyzed by Gavilan's Office of Institutional Research. The STEM Support Center will increase the bi-lingual counselor assignment to strengthen comprehensive scaffolding for all students either taking STEM courses or who are already declared STEM majors. These include over 1500 students when remedial math and English enrollments are included. **Part 2, Guided Pathways** will serve to support students with faster routes to transfer degrees, helping them choose an appropriate track, and moving them through distinct programs and with default choices. **Part 3, Renewed Teaching and Learning** includes continuing the success of Gavilan's Accelerated basic skills program in the service of faster routes to transfer for STEM students. In both Developmental math and English, students can complete two terms in one.

Absolute Priority 2: **Increase STEM Degrees; Develop Transfer and Articulation Model**

The primary objective or outcome of the project is to increase the number of STEM degrees (AA/AS, transfer through BA/BS degrees) and the proportion of those who are Hispanic, first generation or low-income students. We propose an articulation and transfer model that has the potential to transform student degree pathways and the way we support student progress to transfer. California's "Transfer Model Curriculum," as it exists currently, is a listing of course outcomes and prerequisites for transfer that articulate with programs in the CSU (Cal State

University) baccalaureates. It can serve as a starting point for Part 2's Guided Pathways, but it really does not go far enough in terms of simplified program choices and paths for students.

Part 2: Guided STEM Pathways. Our STEM Guided Pathway will be a prototype to use for crafting similar program maps in other disciplines at Gavilan. **To develop the STEM model**, we will include a Guided Pathway Panel of ten appointed representatives: see Panel membership representatives in Management Key Personnel, p. 45. We have scheduled Dr. Rob Johnstone to speak at our August 2016 faculty development plenary to begin our work with Pathways. He will be the Pathway Panel trainer in Year 1 and Year 4. Dr. Johnstone has written extensively on ways to improve student pathways, especially as related to the model that Bailey and his colleagues at CCRC have proposed. However linear their approach appears, it draws on the research on choice management and asserts that students will make better choices and complete their goals more quickly with a simplified curriculum program map. This method is significant because few community colleges have taken up the challenge to reform the "cafeteria college."

COMPETITIVE PRIORITY

Competitive Priority 2: **Research Based on "Moderate Evidence of Effectiveness"**

Competitive Preference Priority 2 No WWC-approved studies relate to Hispanic students exclusively, but most most studies include Hispanics among first-generation, low income or under-represented students. **Part 1, the STEM Support Center** is built on the successes and lessons learned in our current STEM project, and on other proven best practices in the field. We will centralize and strengthen our support center services (see our STEM-ASAP study, E-3, p. 53) from CUNY's ASAP program. [68] **Part 3, Renewed Teaching and Learning** includes accelerated basic skills instruction in order to improve preparation for transfer-level courses in

[68] Scrivener, et al. (2015). *Doubling graduation rates: Three-year effects of CUNY's Accelerated Study in Associate Programs (ASAP) for developmental education students*. http://www.mdrc.org/

English and math. A second recently approved WWC study (with reservations) was done by Craig Hayward and Gavilan's former researcher, Terrence Willett, for California's Research and Planning Group. Gavilan participated in this study. At least 55% of students across the 16 colleges were Hispanic and a significant portion were developmental students.[69] Over half of the 112 California community colleges are now using Acceleration of course sequences to improve successful completion of transfer-level gateways, English and Math.

Criterion B. ***Quality of Project Services to Underrepresented Students***

B 1. Services reflect up-to-date current knowledge from research and effective practice.

Excelencia is a major resource center in Washington D.C. that focuses on Hispanic-Serving Institutions. The STEM Planning Group reviewed a number of their reports and listened to their 2015 Webinar on STEM renewal. Our project includes services they recommend:

Strategies	Excelencia's What Works in STEM [70]	Project
Counseling or Advising	Provide dedicated academic counseling for STEM pathways. Use case management & close follow-up for each student.	**Part 1**
Mentorship	Build networks of support with peer & faculty mentoring.	
Readiness & Outreach	Support policies that enhance STEM competencies & attract new talent to the pipeline; expose students to STEM careers.	
Education & Industry Partnerships	Develop partnerships that foster STEM pathways and strong strategies; invest in continuing work with four-year transfer colleges & regional industries to tie their needs to curricula.	**Part 2**
Faculty	Update curriculum and faculty engagement in new practices.	**Part 3**
Academic Support	Develop Supplemental Instruction and use other specific academic support for students in all levels of math and science.	
Research Opportunities	Provide engaging, supervised, credit-bearing research opportunities at all levels of STEM students' experience.	

Landscape pages to follow explicate major project services, current research and practice.

[69] Hayward, C., Willett, T. (2014) Curriculum Redesign & Gatekeeper Completion: a Multi-College Evaluation of the California Acceleration Project, the Research and Planning Group for California Community Colleges. http:/cap.3csn.org/files/2014/04/RP-Evaluation-CAP.pdf.

[70] Re-ordered, adapted from Webinar on STEM Pathways, Excelencia, Spring, 2015.

Part 1: The STEM Support Center	
Services to Hispanic & Under-Served Students	**Reflect Current Research & Effective Practice**
Nexus of Services: a centralized place, customized to STEM students' distinct needs, mutual support and encouragement. **Broad access** to bi-lingual STEM counselor to wrestle with personal identity issues; look for future goals, college resources. **Academic Planning:** goal setting for STEM degrees, EdPlan (4 x a year) DegreeWorks in Banner Student system's capability. **Career advising** (not job-posting) early-on interest inventories focused on STEM professions, also in Summer Bridge. The Holland Wheel still used; other tools narrow goals (2 x a year). **Financial Incentives** to low-income students, loaner laptops, textbooks, calculators, transportation (mileage reimbursement). **Option to join STEM-ASAP study**: participant incentives.	***Most support services*** were studied by CCRC colleagues at Columbia; Bailey, et al. *Redesigning CCs,* 2015; Eagan, Hurtado, Chang 2010 What Matters in STEM, www.heri.ucla.edu/nih/downloads/; Hurtado, S., et al. 2009, Diversifying science: Underrepresented student experiences in research…. *Research in Higher Education, 50*, 189-214; Natl. Academies 2016, *Barriers & Opportunities for…STEM*, www.nap.edu; Santiago, D. 2015, www.edexcelencia.org p 19; Scrivener, et al. 2015; *Doubling Graduate Rates*; ASAP-CUNY NY, MDRC; Morisano, et al. 2010, *Setting, elaborating and reflecting on… goals improves… performance*, Jour. Applied Psych., 95(2), 255–264; Carnevale, in Pappano, L. *Career Coaching for Playdate Generation*, www.nytimes.com/edlife 4-10-2016; Ruff, et al. 2008; National Career Development Assoc. 2008, *Holland's RIASEC Theory…*; Scrivener, et al. 2015 *(source of STEM-ASAP study).* Bettinger and Baker, 2011, *Effects of student coaching, mentoring;* Cannon, J. 2013, *Intrusive Advising 101; Academic Advising Today, 36 (1)* www.nacada.ksu.edu/
Web access to personal Case Management records that document plans, resources, options, interventions: Banner Student (quarterly logins to see their own progress).	Bailey, et al. (above) 2015 *Redesigning CCs*; Santiago, D. 2015, www.edexcelencia.org/research/2015-what-worksp/; Natl. Academies 2016, *Barriers & Opportunities for…STEM*, p. 101.
Peer Tutors: trained to link help to STEM curriculum, not only discreet skills; STEM faculty coach tutors on their assignments. SI tutors will be located in the Center as well, see Part 3, below. **Faculty Mentors**: improve STEM performance, help sustain momentum; connect to STEM advocates; many advocates of using this approach, especially with Hispanic & under-served students.	Kuh, G. 2008, *High Impact Practices*, www.aacu.org/leap/ (link tutoring to curriculum, not just isolated skills); Colvin & Ashman 2010, *Peer Mentoring…* Scrivener, et al. 2015; *Doubling Graduate Rates*; ASAP-CUNY program; Hurtado, S. 2015 *STEM Undergraduate Education: Increasing Diversity, etc.* Berkeley Presentation, Slide 18; Eagan, Herrera, Garibay, Hurtado, Chang 2011, *Becoming STEM Protégés*, www.heri.ucla.edu/nih/downloads/AIR2011-Becoming-STEM-Proteges.pdf.
Summer Bridge for entering students, 4 units for math skills & college savvy w/ interest testing; connects students to each other. **Transition Academy:** before 2nd year; critical juncture for STEM students, reinforces STEM transfer goals and major, keeps them "on course" and helps maintain skills.	Castleman, et al. 2014. *The forgotten summer*: *Journ. Policy Analysis & Mgmt., 33*(2), 320–344 (Boston); Natl. Academies 2016, *Barriers & Opportunities for…STEM*, p. 170; Pasadena's MathJam: www.pasadena.edu/MathJam; National Resource Ctr, Students in Transition, 2015, www.sc.edu/fye/research_presentations_files/2015/ ; Scrivener, et al. 2015; *Doubling Graduate Rates*; ASAP-CUNY *(WWC).*
Services to STEM Students' Families/Local School Children	**Reflect Current Research & Effective Practice**
STEM Parent workshops: Bi-lingual outreach informs parents and help families understand rigorous STEM & students' needs. **Middle School workshops** foster students' identity as scientists and acquaints them with STEM paths and opportunities. Faculty present "Science Alive" to inspire STEM.	Natl. Council of LaRaza Escalera STEM programs, http://blog.nclr.org/tag/stem-education/; Malcolm, Dowd & Yu 2010, *Tapping HSI Funds to Improve Latina and Latino Access to STEM Professions*, p. 15, https://cue.usc.edu/publications/ Hurtado, S., et al. 2009, Diversifying science: Underrepresented student experiences in research programs. *Research in Higher Education, 50*, 189-214. Santiago, D. 2014, www.edexcelencia.org/events/bridging-aspiration-and-reality

Part 2. Develop STEM Guided Pathways	
Services to Hispanic & Under-served Students	**Reflect Current Research & Effective Practice**
Streamlined STEM Pathways: clear, narrowed choices, visual maps of structured, streamlined programs for transfer and SJSU BA/BS degrees in STEM (Articulation/Transfer Model). **Culture of Transfer:** these program maps signal to STEM students repeatedly that the culture of transfer to 4-year colleges is back, if or not you have clarified goals by the end of first year. "All of this promise is cut off at the knees" (DeLuca, S.) **Pathway discussion** directly with students within weeks of first year will pay off long term, even in pre-freshman Summer Bridge. **Fewer obstacles** for degrees, reduced curricular redundancies; aligned requirements, clarified all for STEM degrees & other degrees as these are developed for other majors from STEM model. **Degrees linked directly to professions:** Pathway panel includes professionals who will help academic reps with linking all degrees and requirements to "real-world" expectations and needs. That link sustains students' momentum en route to transfer and completion. **Required minimum advising** and counselor visits; more strongly encourage full-time enrollment for faster pathways. We may find that intrusive advising is more effective; laissez-faire is passé. **High-school students** will have concrete maps (actual handouts) from their counselors to show parents when families are helping their students consider options for colleges and career goals.	Bailey, et al., 2015, *Re-Designing CCs*; Karp, M., 2013, *Entering a Program*, CCRC; Wyner, et al., 2016, *Pathways Demystified;* Scott-Clayton, J. 2011, *The Shapeless River*; Pasadena CC Pathways, http://www.pasadena.edu/pathways/; Long Beach City College & CSU-LB (2015) "Promise Pathways," CA Dept. Finance Innovation Award winner http://www.dof.ca.gov/innovation awards/; Grites, T. J., & Rondeau, S., 2011, *Creating Effective Transfer Initiative*s, Natl. Res. Ctr. Students in Transition; DeLuca, S. in Semuels, A. 4-2016 www.theatlantic.com/ /kids-poverty-baltimore/476808; Metro Academies, City College SF, CSU-SF http://metro.sfsu.edu/ ; Nunez, Hurtado, Galdeano, Ed. 2015, *Hispanic-Serving Institutions: Research & Practice*. NY, Routledge; *Completion by Design* 2015 (Pathway Analysis Toolkit) AACC, http://completionbydesign.org/; Natl. Academies,2016, *Barriers & Opportunities*; Achieving the Dream (Gates Foundation), 2014; Di Xu, Jaggars, & Fletcher (CAPSEE) 2-Yr *Entry/Labor Outcomes…*, Inside Higher Ed.com; Moore & Shulock 2011, *Sense of Direction: …Helping CC Students Select and Enter a Program of Study*, CA, IHELP. Scrivener, et al. 2015*;* Offenstein, Moore & Shulock, 2010, *Advancing by Degrees*, http://files.eric.ed.gov/fulltext/ED511863.pdf; Bailey, et al. 2015; *Meeting Compliance, but Missing the Mark*, The Campaign for College Opportunity, 2012; Bettinger & Baker, 2014, *Effects of Student Coaching*. Arbona, C., Nora, A. *Influence of Academic/Environ. Factors on Hispanic Degree Attainment.*, Review of Higher Ed, S-2007, pp. 247-269; Excelencia, 2015, *Finding Your Workforce: Latinos in STEM*.
Services to Faculty, Staff & Gavilan & High-School Counselors	**Reflect Current Research & Effective Practice**
Clear Program Maps to use when advising STEM students, helps staff help students, without overwhelming them. Maps also provide default choices and sub-majors if students need to change focus. **Direct Contact Opportunity** to reach underserved students at all levels to begin/sustain the conversation about going to college. **Updated Requirements:** Simplified program maps make updating easier too often faculty and staff try to help but do not have current information; all else is a morass of requirements for vast and numerous programs that even counselors find daunting to clarify.	Bailey, et al., 2015, *Re-Designing CCs*; Scrivener, et al. 2015; Natl. Academies, *Barriers & Opportunities*, 2016; Johnstone, 2015, *Guided Pathways Demystified*, Natl. Ctr. Inquiry & Improvement; Guided Pathways, strategylab.luminafoundation.org/. Natl. Academies, *Barriers & Opportunities*, 2016; Excelencia, What Works, Waukegan to College, http://www.edexcelencia.org/program/waukegan-college; Excelencia, 2015, *Finding Your Workforce: Latinos in STEM;* Wyner, et al. 2016, *The Transfer Playbook*, Aspen Inst. College Excellence Program, CCRC; Grites, T. J., & Rondeau, S., 2011, *Creating Effective Transfer Initiative*s, Natl. Res. Ctr. Students in Transition; Handel, 2011, *Improving Student Transfer from CCs to Four-Year Institutions*, College Board.

Part 3. Renew STEM Teaching and Learning	
Services to Hispanic & Under-served Students	**Reflect Current Research & Effective Practice**
1. For Hispanic/Underserved Students **Inclusive "STEM culture"** must be welcoming and exciting, not dull or elitist; SJSU faculty working on this to ameliorate this attitude in science departments, high schools -- 4-year campuses. **High–Impact Practices** are more engaging and increase/retain more STEM majors than traditional lectures. Students will test project-based learning and assess their uses of new faculty-designed methods. Flipped Classrooms/"Upside-down pedagogies" engage more students (SCALE-UP large-class format). **Personal contact:** HSI Statistics Instructor texts his students. **Focus on Learning:** not volume of information, relate coursework to problems that matter like public health, etc. **Validation as Learners:** students need academic, personal validation as powerful learners, rather than as "not meant to be here." **Pedagogical** STEM improvements: applied-learning and contextualized instruction; basic skills (Accelerated) use STEM-applicable, program-specific writing & math assignments. **Accelerated basic skills** expedite progress and improves success in math/English gateways and is merely the on-ramp (Bailey, p. 129). **Supplemental Instruction** will re-design customized S.I. tutoring for introductory STEM courses; course-relevant support **Research Interns** retains STEM majors, increases faculty contact with SJSU faculty and university environment. Among HIPs	Natl. Academies, 2016, *Barriers/Opportunities;* Malcolm-Piqueux & Bensimon, 2015, *Design Principles for Equity & Excellence at HSIs*, AAHHE; Nunez, Hurtado & Galdeano, 2015, *HSIs: Advancing Research & Transformative Practice*; AACU, 2015, *Committing to Equity & Inclusive Excellence*. Bensimon, et al. 2013, *Assessing Equity in High Impact Practices Toolkit*, AACU; Kuh, 2008, *High Impact Practices*…, AACU; Kuh, et al. 2013, *Ensuring Quality & Taking High Impact Practices to Scale*, AACU; Hurtado, 2015; Natl. Academies, 2016, *Barriers & Opportunities*; CCSSE, 2014, *A Matter of Degrees: High Impact Practices for CC Student Success*; No. Carolina State, 2016 SCALE-UP Project, www.ncsu.edu/per/scaleup.html. Bettinger & Baker, 2011, *The effects of student coaching in college*, NBER. Hurtado, et al., 2012, *Inclusive Learning Environments*: … Presentation, Association for Studies in Higher Ed; Barnett, E. *Validation Experiences and Persistence … CC Students*. The Review of Higher Ed., Volume 34, Number 2, Winter 2010, pp. 193-230; Villareal, et al., 2012, *Charting…Latino Student Success in STEM*, HACU; Eagan, K. 2013, *Understanding Undergrad. Interventions in STEM*…, National Academy of Sciences; Estrada, 2014, *Ingredients for Improving the Culture of STEM Degree Attainment*…, National Academy of Sciences. Scrivener, et al., 2015; Snell & Hern, *CA Acceleration Project* 2005-2009; Hayward & Willett, 2014 (WWC-Approved); Dawson, et al., 2014, *On the Effectiveness of SI*…, Review of Education Research; Hurtado, 2015, Slide 18 (S.I.); Hurtado, S., et al. (2009). Diversifying science: Underrepresented student experiences … research programs. *Research in Higher Education, 50*, 189-214; Estrada, 2014, Natl. Academy of Sciences; Espinoza, 2011, Harvard Ed. Review.
Services to STEM Faculty	**Reflect Current Research & Effective Practice**
2. For STEM Faculty **Faculty engagement:** need to stay engaged in their teaching practices, eschew lectures and test new strategies. Pilot training in project-based learning will strengthen teaching skills long term. **Re-Design Strategies Support** Collaboration and training in teaching/learning initiatives will increase professional success and teaching skills. STEM faculty incentives to test new practices will give them time to pilot new practices with their own students.	Natl. Academies, 2016, *Barriers & Opportunities*, 2016; Bailey, et al., 2015, *Re-Designing CCs*; Ferren & Paris, 2015, *Faculty Leadership for Integrative Liberal Learning*, AACU; Hurtado, et al., 2012. *Undergraduate Teaching Faculty…* HERI. UCLA. SCALE-UP Student-Centered Active Learning Environments…, North Carolina State University, www.scaleupserver/physics.ncsu.edu; Kezar & Gehrke, 2015, Scaling Up Undergraduate STEM Reform…, Los Angeles, Pulias Center; Austin, 2011, *Promoting Evidence-Based Change in…Science Ed.*, Natl. Acad.

Criterion B 2. Services are highly likely to have strong impact on intended recipients.

The intended recipients of the project's initiatives are primarily Hispanic and under-served students in STEM courses and programs; most of them reflect the majority of Gavilan students. CUE (Center for Urban Education, USC) studies and distributes practices that are known to narrow gaps in Hispanic graduation rates and to promote strong results for students of ALL backgrounds. These practices usually require a holistic approach that ensures **continuous support until degree completion**. We are well aware that we must replicate best practices of successful peer institutions and adopt proven practices, build on our students' strengths and intensify focus on **transfer as a college-wide eco-system**.[71]

1. The Intended Recipients of Part 1, the STEM Support Center Services: The Center's intended recipients are Hispanic and first-generation students who are poorly represented in STEM degrees and professions. This project is ambitious, but there are solid, research-based reasons that the particular *combination of services* will produce positive outcomes. STEM students will be expected to make minimum visits with the STEM Counselor, especially in the first year. This is not something that we have required before, but it may be worth the risk.

The project's services will empower staff, faculty and students. Our formal study of what really works in co-curricular services will contribute to the growing literature on Hispanics and other non-traditional student groups seeking degrees in community colleges. STEM students will have the opportunity to participate in the study. Their parents and local school children are also the intended recipients of our project's outreach programs, and our STEM students will be the beneficiaries of Summer bridge programs—as entering freshmen and sophomores.

[71] Witham, K, Malcom-Piqueux, L., Dowd, A., and Bensimon, E.M. (2015) *America's Unmet Promise: The Imperative for Equity in Higher Education*; LEAP, AAC&U. www. Accu.org

2. Intended recipients of the new Guided Pathways are all Gavilan students, if primarily Hispanic and Underserved Students Most community college students have only a general idea of their goals and interests and need help exploring and identifying their specific program of study in the first year. CCRC proposes that enrolling students in broad "meta-majors" or broad-category degree programs constitutes the most feasible way to accomplish this goal; Gavilan plans to start with two of the main STEM curriculum clusters: **Math and Natural Sciences**. Students will have maps of the curriculum requirements so that they can complete degrees or credentials as quickly as possible. The pathway tracking system, with its early alerts, will help staff and Faculty Mentors intervene if students stray "off-map." [72]

3. In Part 3, the recipients are both faculty *and* the students they serve in the classroom. We will move past traditional STEM classroom methods to increase and sustain STEM majors. Time and incentives for faculty to be trained, to re-design STEM pedagogies and to pilot them with students is a singular benefit to Gavilan STEM instructors. As with most California community colleges, our faculty typically teach 5 full classes plus labs, often serving over 200 students each term. Long-term benefits will accrue to faculty from a renewed engagement in teaching practices with the re-assigned time to work on shared pedagogies.

Among strategies to be tested are project-based learning, including contextual assignments, "Studio Classrooms" and the "SCALE-UP" model for large-format classes. The latter is known as "upside-down" pedagogy, likened to "flipped classrooms" where students do "homework" in class and listen to lectures online for homework.[73] In our last Title V, we equipped one classroom with the Studio/Scale-Up arrangement of learning-pod tables and chairs. This space has been used successfully by instructors inside and outside of science programs. STEM faculty

[72] Bailey, et al., (2015) *Redesigning America's Community Colleges*, p. 22.
[73] SCALE-UP Student-Centered Active Learning Environments with Upside-down Pedagogies. North Carolina State University,. www.scaleupserver/physics.ncsu.edu

are interested in adapting Studio spaces to the SCALE-UP approach. For students, a chance to test new STEM practices and provide feedback will connect them to the learning process in new and formative ways. Intentional efforts of all faculty and staff to communicate that science is for everyone will pay off in more STEM majors—and more who do not jump ship. Students are the real beneficiaries of all of the proposed strategies in the project.

Criterion C. *Significance*

1. The project will increase knowledge of educational problems, issues, strategies.

The coordinated suite of support structures, the guided pathways and the new classroom practices were designed deliberately to add to the foundation of evidence-based knowledge about what works in community colleges to increase the success of Hispanic students in STEM. From the lessons learned about what works best for Gavilan students, we will be ready to act on a college-wide imperative shaped by what we learn as the project evolves.

Results and outcomes of the project will be useful for community colleges in general and for California's colleges on matriculation issues, and first-year STEM students. The network of California community colleges is close enough through many state-wide initiatives to benefit from papers and presentations on project implementation and strategies that worked. The Articulation and Transfer model itself, in the form of Guided Pathways will show evidence of how these work in practice and how they benefit under-represented students. By reviving the culture of transfer, we will learn the value of strong messages combined with strong support.

The proposed project is significant in that it applies the lessons gleaned from a plethora of quality, current research evidence and expert analysis to the creation of STEM-customized services, including curriculum pathways that build directly on proven models in rigorous research, including cost analysis. This is particularly important for community colleges in

California that serve the majority of Hispanics and low income students, but have the least amount of funding per student in all three higher education systems. The three-pronged activity is also exceptional because the design is informed by CCRC (Columbia) research and analysis indicating the need for redesign based on evidence-based principles.

Because the project is closely modeled on successful strategies that work in other colleges with similar populations, it has significant potential to contribute to the growing literature on support systems and pathways for Hispanic students. These services will be evaluated more closely in our own "STEM-ASAP" study (E-3, p, 52). Our project evaluation and the formal study will be disseminated to the H.S.I. community leadership and AHSIE, in particular.

Criterion C 2. The project will result in Gavilan's system change and improvement.

> The definition of *structure* ... refers not only to explicit institutional policies and procedures, but also to "norms and nudges" that…influence individuals' decisions at a point of action. This broad definition…calls attention to the way that choices are structured and presented. *The Shapeless River.*

The project was planned collaboratively by a cross-section of Gavilan leaders, students and practitioners, and thoughtfully designed after wide-ranging study. This broad representation holds substantial potential to generate long-term systemic improvement. Our STEM Planning Group noted that in the The National Academies of Sciences review of STEM, the three primary strategies we have chosen are specifically recommended for long-range change in college systems and culture. The interaction of the three parts of the project will generate momentum of its own that permeates college operations, and moves Gavilan away from "business as usual." We are convinced from the evidence in student outcomes that the ASAP-CUNY program has something to teach us all. For example, we may have to push harder to encourage students to make full-time commitments, provide more intrusive advising, and require a specified number of visits to advisors and counselors.

Major Recommendations of the National Academies Committee on Barriers & Opportunities [74]
• There is now sufficient evidence to conclude that underrepresented students can succeed in STEM with **co-curricular support**, although more research is needed, especially by HSIs and community colleges which serve the majority of the fast growing and most underrepresented group – Hispanics. • The "pipeline" metaphor that describes the movement of students toward STEM degrees does not capture the complex reality. Colleges need to envision and **plan clear pathways** and strategies that address the needs of today's students, particularly those poorly served by traditional STEM academic culture and practices. • Adoption of promising, **evidence-based teaching practices** remains difficult; colleges ignore them ill advisedly. Continuing an exclusive STEM culture is a major barrier to improving STEM degree completion for Hispanics--even though their interest in STEM has increased. • **The failure of major but isolated initiatives indicates that systemic reforms are necessary to make STEM degree access a short and long-term reality for underrepresented groups.**

Part 1 STEM Support and Gavilan System Change. The STEM Planning Group was well aware that the project's design and initiatives had the potential to affect the college as a whole and other academic programs. By developing and strengthening the STEM prototypes--co-curricular supports co-located in a welcoming place for STEM students and faculty, Guided Pathways to accelerate progress, an inclusive STEM culture and High-Impact Practices--we know these changes could benefit other parts of the organization. This set of supports and improvements could be customized to other disciplines, certificates and degree programs.

If our STEM-ASAP study results are promising, Gavilan may need more support resources. The project could show STEM outcomes are improved enough that we will have to narrow student choices, encourage more full-time enrollment, and raise our counselor-to-student ratio. We may have to require more frequent visits to counselors, career advisors and mentors, especially in students' first year. We could also find that we need more intrusive, if caring, advising and Faculty Mentoring in every academic program. Many community colleges are finding that a culture of permissive advising is both passé and counter-productive.

The ASAP-CUNY program study readily admits that their complex services were more expensive per student than "business as usual." However, the long-term cost-effectiveness of

[74] Malcolm, S., Feder, M., Ed. (2016). *Barriers and Opportunities for 2-year and 4-year STEM Degrees: Systemic Change to Support Students' Diverse Pathways,* Report by Committee Commissioned by the National Academies of Sciences, Engineering and Medicine, National Academies Press (pre-publication copy).

increased persistence will improve the bottom line, *as well as* gains in student outcomes.[75] The Summer Bridge program's extension to a sophomore year Transition Academy will improve retention of STEM majors in their second year when they tend to waver in their STEM choices.

Part 2, Guided Pathways hold potential for the most transformation at Gavilan. Our "Articulation and transfer model" will remove key obstacles in both the STEM and Social Science curriculum patterns, and launch an acceleration of students' routes to transfer. Students in ALL programs could benefit from concise curricular structures and clear direction. Guided Pathways for STEM and Social Sciences will set the stage to reduce "cafeteria" sampling and give students narrower choices from the start. The Pathway Panels will mitigate the isolation of students from faculty, faculty from each other and STEM professionals from academics. Program pathways will expedite student transfer, the central focus of this project.

Part 3, renewing STEM teaching and learning will produce lasting benefits. More Hispanic and low-income students will be drawn to a college culture that communicates to all students that they belong in college and in STEM programs. Communicating inclusiveness matters to vulnerable students, especially in programs with a reputation for challenging curricula. Many studies provide clear evidence that students' perceptions of social belonging in a college setting is as important as anything else related to achievement. As more student cohorts try project-based learning and other active learning methods, their excitement and engagement in learning will spread. Student Research Internships will strengthen Gavilan's growing commitment to experiential learning, especially as it helps to hold on to science and math majors. Research experience early in their curriculum is known to help students identify as "scientists" and to sustain their interest. Faculty Mentors have a critical task as role models. Updating the labs with

[75] Scrivener, et al. (2015). *Doubling graduation rates: Three-year effects of CUNY's Accelerated Study in Associate Programs (ASAP) for developmental education students*. http://www.mdrc.org/

STEM industry leaders' recommendations will reduce the myth in the corporate world that students have not trained adequately with current, relevant equipment.

Synergy among the Three Project Parts The support systems in Part 1 will be ineffective without "intrusive" requirements in the newly-structured STEM pathways. Guided Pathways will be effective if classroom environments and pedagogies truly engage both students and faculty in the learning process. New teaching and learning approaches will be ineffective without the STEM Center's scaffolding for completing transfer and degrees. Our support services constellation, new Guided Pathways, and renewed teaching and learning really could be the winning combination in a turning point for Gavilan's system transformation.

Institutionalizing Practices and Improvements. Dr. Steve Kinsella, Gavilan's president, urged the STEM Planning Group to design a cost-effective project that changes the college in significant ways, but that fold seamlessly into existing operations. In order to assess when and how this will occur, we will use an assessment cycle to consider what strategies are ready to leverage and how. A visual of this cycle appears below. We know that some colleges wait to plan institutionalization until the third or fourth project year, but we will work toward spin-offs and scale up of the project from the onset.

Institutionalizing People, Practices and Supplies
Personnel and Practices: • ***Project Coordinator, Activity Director, and Administrative Assistant*** will have temporary re-assignments to support faculty/staff teams in the three Activity Parts, inclusive of the 5-year project. Afterwards, they will return to previous campus positions (Jukl to math; Lozano to Full-time Dean of Arts and Sciences, Assistant to the secretarial pool for another assignment). • ***Faculty Participants*** will continue on stipends, but they will train new colleagues on using High-Impact Practices; some incentives will be converted to Faculty Development FLEX hours; their initial work on the Activity is inclusive of the five years. • ***STEM Counselor*** **(100%)** will continue to serve STEM and other students in the new Pathways. The revenue from completion growth will add FTEs, allowing us to continue the co-curricular supports. • ***The Summer Bridge Programs: Summer Bridge (MathJam) and the Transition Academy*** will continue, under Arts and Sciences. Instructors will continue these critical supports. • ***Peer Tutors*** will be assigned to help with Supplemental Instruction, introductory STEM courses, the Summer Bridge and the Transition Academy -- as the District budget allows. • ***Faculty Mentors*** will continue, funds permitting. Development of experienced Mentors will be

complete, but will continue by stipend or converted to Staff Development FLEX hours by contract.

- ***RP Group Contract:*** (Research and Planning) The 5-year contract, donated by the college, will be up for renewal when the project is over; their continuing help with the ASAP-adapted study would be invaluable.
- ***Other contractual consultants,*** the ASAP Study Coordinator, Pathway/Faculty Trainer, Rob Johnstone and the External Evaluator will not continue beyond the project.

- ***Equipment and Supplies*** include student loaner laptops, calculators, textbooks, Support Center equipment and supplies, lab and classroom equipment for students in the activity. Equipment will be maintained in the MIS department operating budget, and additional printing and materials/supplies will be covered in the Vice President of Instruction's budget, as required. [76]

College leaders, faculty and staff are committed to continuing the services, products and methods we will develop in this project. We will scale up all of the best of our work with the following budget and cost-center plan:

Institutionalization and Scale-Up Plan			
STEM BUDGET ELEMENTS	**Office or Assignment**	**Annual $**	**Cost Center**
Part 1: STEM Support Center	***VP Student Services***		*Student Services*
• *Case Management System of a suite of services, advising*	• *Counseling & advising* • *MIS/GIDS (tracking system)*	---	*Instruction* *District MIS.*
• *Outreach: Parents, Middle Sch.*	• *Community Programs*	---	*Community Prog.*
Part 2: ***Guided Pathways***	***VP Services, VP Instruction***		
• *Continuing data collection*	• *Research Office*	---	*Research Office*
• *Continuing building Pathways*	• *Instruction/Student Services*	---	*By Program*
Part 3: Teaching & Learning	***VP Instruction***		*Instruction*
• *High Impact Practices*	• *FLEX credit, new practices*	---	*FTEs cover*
• *Accelerated Basic Skills*	• *Arts/Sciences Division*	---	*FTEs cover*
• *Supplemental Instruction*	• *Arts/Sciences Division*	---	*FTEs cover*
Personnel	***Across Divisions***		
• *Activity Director, H. Jukl*	• *Returns to classroom*	--	--
• *Activity Assistant, 100%*	• *Returns to classified pool*	--	--
• *STEM Counselor (100%)*	• *Continue, VP Student Serv.*	$90,041	*Student Services*
• *STEM Center Coordinator (.5)*	• *Lozano, Arts and Sciences*	$40,000	*Arts and Sciences*
• *STEM Center Peer Tutors*	• *Lozano, Arts and Sciences*	$20,000	*Instruction*
• *Summer Bridge Instructors*	• *Lozano, Arts and Sciences*	$40,000	*Instruction*
• *Faculty Mentors*	• *Lozano, Arts and Sciences*	$20,000	*Instruction*
• *Pathway Panel Reps 10 stipends*	• *Instruction/Student Services*	$30,000	*Instruction*
Equipment:			
Support Center, Labs and Classrooms, Labs, STEM	*MIS/Facilities Staff* *Arts/Sciences Division*	MIS Maintain	*MIS Dept. &* *Maintenance*
Students: *loaner laptops, textbook*	*VP Instruction*	$20,000	*Instruction*
INSTITUTIONALIZATION ESTIMATE: 2021-22		**$260,041**	

[76] As reviewed by Dr. Kinsella, President, Dr. Rose, VP Instruction, Dr. Moberg, VP of Student Services and Mimi Arvizu, Director, Management Information Systems.

Criterion D. *Quality of the Management Plan.*			
1. The plan will achieve timely objectives within budget with timeframes, milestones and tasks.			
Process Objectives, Tasks & Methods	**Key Personnel**	**Milestones/Outcomes within Budget**	**Timeline**
Year 1: 2016-2017			
1. Launch Project Offices/Personnel Set up Office, hire/appoint staff, set up budget; review objectives/outcomes. Advisory Group reviews roles & data. Hire & train tutors/contract SJSU Intern Supervisors; hire Research Coordinator.	Pres. Kinsella, VPs Rose & Moberg, Dean Lozano, Act. Dir. Jukl, faculty & staff, Advisory Committee, SJSU Dr. Collins & their faculty	ALL Staff re-assigned or hired; offices and budget set up, consultants, trainers, all staff committed to all objectives & CLU milestones; diverse Advisory Committee on board, clear role as liaison to all project stakeholders.	10-16 -- 2-17
2. Part 1: STEM Support Center: Train tutors & Faculty Mentors; set Case Management data, advising with bi-lingual STEM Counselor; prep, conduct outreach: parents and schools. Prepare, conduct Summer Bridge MathJam; design, prep, conduct Transition Academy for 2nd-Yr students.	VPs Rose & Moberg, Dean Lozano, Act.Dir. Jukl, STEM Counselor, Center Coordinator, gateway faculty, Summer Bridge Instructors, STEM Students	Objectives met on launch, remodel, equipment. Center tutors and Faculty Mentors fully trained & assigned, all staff hired and trained, Center coordinated, Center publicized: entering STEM students, fall semester, 2017; Summer bridges successfully completed, staff & ready for F2017.	10-16 -- 8-17
3. Part 2: Launch Guided Pathways: Panel: Dr. Johnstone, Consultant trains reps; set up tasks, meet quarterly, review data, identify barriers, review prerequisites, align outcomes, draft first set of program maps for Math & Natural Science.	VP Rose, Act. Dir. Jukl, SJSU Dr. Collins, Dean Lozano, 10 Pathway Panel representatives; Johnstone, Consultant	Goals and tasks of first-year Panel training and design are met in timely way: first drafts of both Pathways are completed, Advisory Committee and Gavilan Learning Council give go-ahead on next steps.	11-16 -- 6-17
4. Part 3: Launch Teaching & Learning: Train Faculty in STEM culture, High-Impact Practices; prep pilots for next year in one class each. Track Acceleration, design S.I. for introductory STEM courses, match students to SJSU faculty, conduct Research Internships, Summer, 2017.	Wagman, 6-8 STEM fac., Dean Lozano, Dr. Sawatzky Inclusive Culture trainer, Dr. Voden, High-Impact Trainer, S.I. trainer; SJSU Faculty, Student Interns	Faculty fully prepared on STEM inclusiveness and project-based learning, pilots ready in 6-8 courses. Acceleration students tracked; S.I. extended to Intro STEM courses; prep, training complete. Student/SJSU Research Internships successful, presentations at student conferences.	10-16 -- 9-17
5. Install, Equip Learning Spaces: Issue bids, equipment, supplies, remodel Support Center, coordinate low-income student equipment loans.	H. Jukl, F. Lozano, Business Office, Facilities Management, Students	STEM Support Center ready with all equipment & supplies; low-income STEM students receive loaner laptops, text books, calculators.	11-16 -- 8-17
6. Evaluation: Prepare evaluation processes, set up databases, milestones, outcomes; Evaluator reviews, conducts evaluation of all objectives. ***STEM-ASAP Study:*** *Prepare all elements and details of the study; hire staff, confirm group matching conditions, coordinate with Research Office, recruit participants, Aug, 2017.*	Dean Lozano, Act. Dir. Jukl, project staff, Project Evaluator, Dr. Halualani *Research Manager, Dr. Arnold, Study Staff, Act. Dir. Jukl, Dean Lozano; student participants.*	Project Evaluation completed: base-line data elements in place, Advisory Committee reviews reports, recommends; disseminate reports, APR. *STEM-ASAP Study preparation completed in line w/ WWC-standards; paid matched groups, intervention and comparison: 100 students total; STEM-ASAP study fully launched, 8-2017.*	11-16 -- 8-17

Years Two and Three: 2017-2019			
Process Objectives, Tasks & Methods	**Key Personnel**	**Milestones/Outcomes within Budget**	**Routines**
1. Manage Effectively: Align 3 budgets: G5, Business, project; Advisory Group liaison to all stakeholders & fends off obstacles; contract personnel changes, insure smooth operations.	VPs Rose & Moberg, Dean Lozano, Act. Dir. Jukl, Advisory Com.; SJSU Dr. Collins/faculty	Budgets rectified & pass audits; project operations smooth; all 3 Activity parts meeting short-term objectives; college leadership is proud of STEM project's success and its effective management.	Semi-annually 10-2017 -- 9-2019
2. Part 1: Strengthen Services: Review progress data; train & assess new tutors/Faculty Mentors; prepare, monitor STEM cohort services, re-vamp outreach workshops, Summer Bridge & Transition programs as feedback indicates.	Act.Dir. Jukl, STEM Ctr. Coordinator, Counselor, gateway faculty, Summer Instructors, all students in Part 1 services	Staff well trained and ready for STEM-ASAP cohorts; improved training per assessments; all services well coordinated, advisor visits/tutoring increase, satisfaction surveys rated highly in all programs, including outreach, Summer Transition.	Semi-annually 10-2017 -- 9-2019
3. Part 2: Complete First Set of Pathways: Increase cohesion/productivity; complete both STEM program maps, Fall Yr 3; review all data, negotiate new maps & implications for interven-tions w/ campus colleagues, Math/Nat. Science.	VP Rose, Panel Coord. Jukl, SJSU's Collins, VP Moberg, Lozano, Panel reps	Timely efficiency of Pathway Panel clear; both degree maps pass muster on both campuses & from industry reps, 2 STEM Pathways completed, campus counselors/leaders/faculty agree to set maps into operations and services to students.	Quarterly 10-2017 -- 9-2019
4. Part 3: Strengthen Teaching & Learning: Improve training/preparation for pilots of project-based learning; 16 pilots in 2 yrs; improve STEM Acceleration curricula with STEM-related appli-cations, improve S.I. uses in introductory STEM courses; review, strengthen Research Internships.	Wagman, STEM faculty, Lozano, Dr. Sawatzky: Inclus. Culture trainer; Dr. Voden, High-Impact Pilot/SI Trainer; SJSU Faculty/Collins, Students	Pilot prep stronger; faculty stronger at new STEM inclusiveness and project-based learning, 16 pilots show high ratings, Acceleration students moving thru gateways; S.I. showing higher success rates in Intro STEM courses; Research Internships, better rates, students do well at conferences.	Annually 9-2017 -- 10-2019
5. Improve Learning Spaces: increase/expedite equipment/supplies bids/installment, maintain all new equipment; improve low-income student loaner laptops, etc., process where needed.	Jukl, Dean Lozano, Business Office,Facilities Management, Students	Classroom/lab equipment & supplies more efficiently ordered and installed; loan-out process for laptops, etc., reducing snags and loss.	Semi-Annual 2017-19
6. Improve Evaluation & STEM-ASAP Study: Conduct evaluation smoothly, improve timely completion for college community/APR reports. ***STEM-ASAP Study:*** *launched Year 2: identify all staff and study cohorts, recruit matching groups, improve timely process over 2 yrs, Research Office supportive, reduce study snags by Year 3, reduce annual attrition below 100.*	Dean Lozano, all project staff, external Evaluator, Dr. Halualani *Research Manager, Dr. Arnold, Study Staff, Act. Dir. Jukl, Dean Lozano; study participants.*	Project Evaluation & all data analyses completed on time; Advisory Committee approves progress; APR timely; reports disseminated on time. *STEM-ASAP Study conducted both years in line w/ WWC-standards; paid matched groups in RDD process, 100 students remain; study processes considered by consultants to be effective; results appear to be promising by 8-2018.*	Annual 10-2017 -- 9-2019

Years Four and Five: 2019-2021			
Process Objectives, Tasks & Methods	**Key Personnel**	**Milestones/Outcomes within Budget**	**Routines**
1. Manage Effectively: Improve all processes; increase Advisory Group support--last 2 years; align all 3 budgets: G5, Business, project; reduce change resistance, finalize institutional-ization; operationalize systems, close G5.	VPs Rose & Moberg, Dean Lozano, Act. Dir. Jukl, Advisory Com.; SJSU Dr. Collins/faculty	All management processes clearly improved; institutionalization completed; processes fully integrated into college operations & budgets; all audits passed; staff returned to former positions as planned; offices closed.	Semi-annually 10-2019 -- 9-2021
2. Part 1: Strengthen Services: train, assess last sets of tutors/Faculty Mentors; monitor staff; finalize STEM Case Management system; make final adjustments to outreach and Summer Bridge programs; finalize all conversion to operations.	Act.Dir. Jukl, STEM Ctr. Coordinator, Counselor, gateway faculty, Summer Instructors, all students in Part 1 services	Staff finalized interventions and services for last two years, including new strategies for STEM-ASAP cohorts; all services deemed superior so that other departments/divisions consider a Support Center, institutionalization complete	Semi-annually 10-2019 -- 9-2021
3. Part 2: Complete Second Set of Pathways: Year 4: new Pathway Panel appointed, trained by consultant; Yrs 4/5 develop, complete two Social Sciences Pathways, negotiate new maps & impli-cations for services w/ colleagues; review results in Yr 5 of Pathway pilot students, Social Science.	VP Rose, Panel Leader Jukl, SJSU's Collins, VP Moberg, Lozano, Panel reps; (Yr 4) Dr. Johnstone, Consultant	New Pathway Panel is well trained & completes two degree pathways in the Social Sciences; the implications for early intrusive advising are confronted by college community. Counselors/ leaders/faculty agree to institutionalize Guided Pathways across all degrees and certificates.	Quarterly 10-2019 -- 9-2021
4. Part 3: Strengthen Teaching & Learning: Strengthen training/preparation for project-based learning in 16 more pilots; improve application for STEM in Acceleration and Supplemental Instruction for introductory STEM courses; review, strengthen Research Internships.	Wagman, STEM faculty, Lozano, Dr. Sawatzky: Inclus. Culture trainer; Dr. Voden, High-Impact Pilot/SI Trainer; SJSU Faculty/Collins, Students	Faculty prep & pilot testing fully embedded; STEM culture more inclusive; project-based learning is fully realized in math and Natural Science, 16 pilots show high ratings, Acceler-ation success shows in gateway success) S.I. & Research Internships institutionalized.	Annually 9-2019 -- 10-2021
5. Improve Learning Spaces: Complete all labs and classrooms of project facilities; turn over to Facilities Management.	Jukl, Dean Lozano, Business Office,Facilities Management, Students	All of center, labs and classrooms as planned are fully remodeled and equipped. Facilities Maintenance maintains all.	Semi-Annual 2019-21
6. Improve Evaluation & STEM-ASAP Study: By final evaluation, strengthen project evaluation to match processes and results with STEM-ASAP study itself. Prepare final APR reports for HSI. ***STEM-ASAP Study:*** *Year 4-5 cohorts will be more easily recruited and identified, complete all study analyses and submit to WWC for approval. Research Office and study staff reduce long-term attrition enough for results to be useful.*	Dean Lozano, all project staff, external Evaluator, Dr. Halualani *Research Manager, Dr. Arnold, Study Staff, Act. Dir. Jukl, Dean Lozano; study participants.*	Student equity and outcomes meet long/short term objectives; all APRs and final evaluation completed and submitted to HSI-STEM program officers and the college community. *STEM-ASAP Study conducted Yrs 4-5; all study processes completed and results submitted to WWC and approved! Study submitted to Inside Higher education journal considered by consultants to be effective; results by 8-2021.*	Annual 10-2017 -- 9-2019

Criterion D 1. Quality of Management Plan, continued. Gavilan has selected well-qualified internal staff with management experience to oversee implementation of the proposed project. The Project Manager, Dean Frances Lozano, and the Activity Director, Hope Jukl, will have clear access and be directly responsible to Gavilan's President, Dr. Steven Kinsella, for achieving all project objectives, and the absolute and competitive priorities.

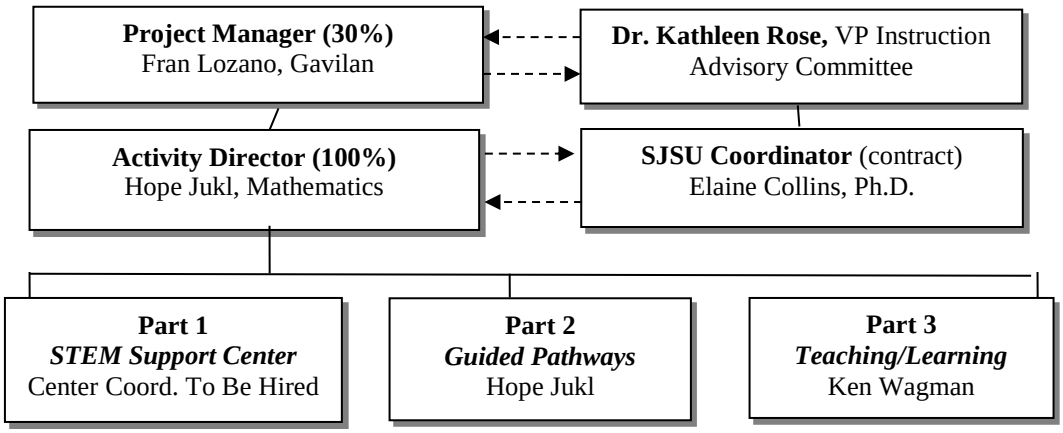
Management Strategies for Effective Implementation

Optimum Management Strategies	To Achieve Project Results
• **Integration** The project will be well integrated into Gavilan governance from the beginning.	• Dean Lozano and Ms. Jukl will assure that procedures fit ongoing college operations from the start.
• **Accountability** The project will meet or exceed all federal GPRA accountability standards, ensuring the HSI goals for achievement equity.	• Dean Lozano will oversee and manage project accountability. The project will meet or exceed all new federal UG accountability standards.
• **Compliance** The project will be in full compliance with federal regulations, internal monitoring and annual reporting of progress.	• Dean Lozano will see that all personnel remain thoroughly informed about Title V policies and grant terms/conditions, and in compliance with reporting.
• **Coordination** All personnel charged with project responsibilities will fulfill roles consistent with the Implementation Plan.	• Ms. Jukl will coordinate all three Activity Parts to optimize program resources and personnel. She will also coordinate the Guided Pathway Panel's work.
• **Management Procedures** will be followed by all staff and participants who will be fully and clearly informed of policies and procedures.	• Dean Lozano will develop a comprehensive project manual to specify policies, procedures, reporting responsibilities and clear lines of authority.
• **The Evaluation Plan** will be followed to achieve desired review, data elements and their thorough analysis so as to achieve objectives.	• Ms. Jukl and Dean Lozano will manage the Evaluation Plan, and work closely with the Gavilan Institutional Research office and the External Evaluator.

Strong Project Leadership The strength of the college leadership team will enhance the long-term success of the STEM project, during and after the funding period. Dr. Steven Kinsella, President since 2003, has streamlined college management and kept the college growing under daunting cutbacks. This prudent fiscal continuity assures that the Title V project will enjoy a timely launch, smooth development and thorough institutionalization. Gavilan's Executive Vice President, Chief Instructional Officer, Dr. Kathleen Rose, was the leader of the STEM Planning Group; her generous support for each of the three Parts of the activity was unwavering.

Authority to Conduct the Project Effectively The Project Coordinator, Fran Lozano, Dean of the Arts and Sciences Division, and will be contributed by Gavilan to coordinate project management. She will have direct access to and full authority from President Kinsella.

STEM Project Organizational Chart



Project Advisory Committee Members of the Advisory Committee will represent a broad spectrum of disciplines, experience and potential transfer students. Appointed by President Kinsella, the Advisory Committee will monitor all program development, review cohort data, recommend formative improvements, track fiscal activity, communicate with constituencies and generally keep their ears to the ground for barriers to progress or new opportunities.

The STEM Advisory Committee
Chair: Dr. K. Rose, Exec. VP/CIO (Hope Jukl, Activity Director and Elaine Collins, (ex officio) **College Leaders:** F. Lozano, Dean, Arts/Science; Kathleen Moberg, Dean, Student Services **Faculty:** M. Sanidad, ESL; Kimberly Smith, English; D. Achterman, Library; D. Klein, Anthropology; P. Wruck, Research; Rosa Sharboneau, Articulation Counselor. **Community Members**: Mike Cox; Sokthea Mov; Karen Aitken. **Students:** Marisol Arredondo, English; Zulema Espinosa, Jennivi Zambrano, Biology.

Criterion D 2. Time commitments of director and key personnel meet project objectives.

STEM Project Coordinator, Dean Fran Lozano, (30%, Gavilan Contributed)
Relevant Educational Background: • BA: University of California, Berkeley, With Distinction (English) 1970 • MA: California State University, Fresno (English) 1977 • General Secondary Teaching Credential, U. C. Berkeley 1971 • Cerro Coso Online Teaching certificate, 2001
Relevant Leadership Experience

- Project Manager of current H.S.I. STEM Cooperative Project: 2011-2016
- Project Manager of Individual H.S.I. Title V Part A Project, 2010-2015 (Gavilan contributed)
- Dean of Humanities, Arts and Sciences: 2002 to Present (Basic Skills Supervisor)
- English Professor and Chair 1995-2002; Chair, STEM Grant; Chair Basic Skills Committee
- Chair, Campus Compact (Service Learning); Chair, Technology Committee, Learning Council and Grants Subcommittee: 2001-present

Project Coordinator's Roles and Responsibilities

- Provide leadership for and direct all aspects of the STEM partnership, working closely with the Activity Director, SJSU Coordinator and project staff to develop and implement all strategies.
- Supervise and collaborate with STEM project staff, Advisory Committee, faculty participants, Pathway Panel representatives, consultants and internal/external evaluators of the project.
- Supervise fiscal management of the project, ensuring that Federal and Gavilan fiscal policies and procedures are followed. Oversee evaluation; disseminate results and findings; submit all federal reports, as required.
- Submit periodic reports to Gavilan's Board of Trustees, Executive Committee, the Academic Senate on the project as it addresses Gavilan's strategic planning goals and needs.

STEM Activity Director, Hope Jukl, M.S., 100% Re-assigned

Responsibilities:

- Manage all aspects of activity development and monitor all activity objectives & evaluation.
- Supervise and evaluate all activity staff and all reporting per federal regulations and UG.
- Coordinate all aspects of the major parts of the activity and its multi-level evaluation.
- Coordinate the complex work of the Guided Pathway Panel of representatives from industry, Gavilan, and SJSU. Negotiate support of stakeholders on both campuses and in industry.
- Work closely with Project Manager, Fran Lozano to benefit the activity and its progress.
- Report to the Project Advisory Committee routinely on all aspects of the STEM activity.

Relevant Educational Background Qualifications:

- MS: Mathematics 1977
- BA Mathematics 1974 Queens College, CUNY
- 20 Years experience teaching math and statistics at the community college level.

Relevant Special Project Leadership Experience:

- Activity Director, current STEM Coop Project, 2011-2015, Gavilan College
- Director, STEM Project, 2008-2011, Gavilan College
- Coordinator, Outreach community activities for STEM Middle School Teacher Conferences
- Coordinator, Outreach community activities for STEM Middle School Students: "Science Alive"

Gavilan: Bi-lingual STEM Dedicated Counselor (100% To Be Hired)

Education and Qualifications:

- BA/BS; MA/MS
- License for California Community College Counselors
- Conversational bi-lingual skills: Spanish and English
- Experience with STEM students and knowledge of STEM baccalaureate requirements.
- Demonstrated awareness and knowledge of STEM industry needs.
- Broad community college experience with under-represented students and services that fit their needs, as planned and developed in the project.

STEM Counselor Duties:

- Develop full Case-Management System for all STEM students and majors.
- Develop routines with MIS staff for a tracking system for the Case Management database.
- Develop and coordinate the comprehensive, STEM Student Support Center, orientations, workshops, career/academic planning and advising, parent workshops, summer transition programs, degree audits, full STEM student and majors' tracking system, and the STEM-ASAP study.
- Coordinate training of faculty in STEM culture and in High-Impact Practices; manage Research Internships
- Lead and Coordinate the work of the Guided Pathway Panel representatives.

Part 2: STEM Guided Pathway Panel:	
Years 1-3: Ten representatives will develop 2 STEM Guided Pathways for Natural Science & math degrees. **Years 4-5:** A new 10-rep panel will develop 2 Pathways for Social Sciences.	
2 Gavilan STEM Students: Zulema Espinosa, Marisol Arredondo	**2 STEM Professionals:** Michelle Mostajo Chen: Associate Scientist, Genentech; Ryan Schindler, Manufacturing Technical Specialist, Genentech
2 Gavilan Counselors: Rosa Sharboneau, Transfer/Articulation Counselor; Bilingual STEM Counselor (To Be Hired)	**2 SJSU Faculty**: Elaine Collins, Chemistry, SJSU Susan Lambrecht, Biology, SJSU
2 Gavilan Faculty: Rey Morales, Biology, Marla Dresch, Math	**Panel Leader:** Act. Director, Hope Jukl, Math

Stipends and Re-assigned time for training, mentoring and using High-Impact Practices

- 24-40 Faculty will receive training from consultants in student mentoring support and STEM pedagogical practices in both individual and group sessions. Substantial hours are needed to develop new curriculum and instructional designs to pilot with first-generation students. Pilots will be in High-Impact Practices (project-based learning).
- 10 STEM Faculty per year will mentor 2 students each. A consistent mentoring approach, using evidence-based practices, will be developed by the mentors and reviewed and/or revised each year.

Faculty Mentors:
Elena Dachkova, Erik Medina, Math; Rey Morales, Biology; Dale Clark, Chemistry, Russell Lee, Engineering
High-Impact Practices: (YEAR 1: Training) Years 2 and 3, STEM faculty**:** Ken Wagman, Marla Dresch, Jennifer Nari, *Math;* Rey Morales, Patrick Yuh: *Biology;* Daune Willahan: *Geology;* Jon Hubbard, *Environmental Science;* Russell Lee: *Engineering;* Dale Clark, *Chemistry.*
Part-Time Faculty among Mentors and pilot projects: Jennifer Kurushima: *Biology;* Svetlana Tyuleneva, Lynn Lockhart: *Math;* Michael Masuda: *Physics:* Paria Bakhtar, *Chemistry*.

SJSU Faculty Supervisors for Student Research Internships

SJSU Faculty will receive stipends ($ 2000 per student intern) by contract to supervise Gavilan Student Research Interns on specified projects to enhance engagement and support their progress to transfer and degree completion.

Laura Miller Conrad, Assistant Professor of Chemistry; Wasin So, Professor of Mathematics and Statistics
Cleber Ouverney, Associate Professor of Biological Sciences; Jeffrey Honda, Professor of Biological Sciences
Aaron Romanowsky, Associate Professor of Physics and Astronomy; Industry: Matthew Salem, Market Development Manager at SCIEX; Ryan Schindler, Manufacturing Technical Specialist, Genentech
Michelle Mostajo Chen: Associate Scientist, Genentech

SJSU Partner Coordinator: Elaine Collins, Ph.D., Chemistry

Education:
1981, BS Biochemistry, University of California, Riverside
1983, MS Biochemistry, University of California, Riverside
1994, PhD Biochemistry, University of California, Riverside

Related Professional Experience:
2011-present, Associate Dean, College of Science, San José State University
2010-present, Professor of Chemistry, San José State University
2006-2007, Visiting Professor, University of Waterloo, Canada (Sabbatical Leave)
2004-2010, Associate Professor of Chemistry, San José State University
1998-2004, Assistant Professor of Chemistry, San José State University

External Project Evaluator: Rona Halualani, Ph.D.

Education

- **Ph.D.** June 1998, ***Arizona State University,*** Intercultural Communication and Assessment
- **M.A**. May 1995, ***California State University, Sacramento***: Intercultural Communication
- **B.A.** Sept. 1992, ***University of California, Davis,*** Rhetoric and Communication

Related Professional Experience

- 2011-Present, Gavilan Title V H.S.I. STEM Coop Project External Evaluator, Gavilan and SJSU.
- Spring 2008 – 2010: Program Evaluator, Dept of Ed Title V STEM Grant, Gavilan College/SJSU.
- Spring 2010 – Present: Program Evaluator, National Science Foundation, "Electronic Learning..."

NOTE: see STEM-ASAP Research Manager, Carolyn Arnold's qualifications, E-3, p. 55.

Criterion E. ***Quality of the Project Evaluation.***

1. Project goals, objectives and outcomes are clearly specified and measurable.

To ensure that evaluation methodology is both comprehensive and efficient, Gavilan has divided evaluation into two separate but related methodologies: the project's **overall performance evaluation** (measuring project outcomes – addressed in E-1 and E-2, below) and **a research study** (meeting WWC evidence standards). Performance evaluation will involve meeting program and project objectives, improving outcomes for Hispanic and low income students through well-designed initiatives and a cycle of continuous improvement. Through a five-year process guided by evidence-based benchmarking, Gavilan's evaluation of project goals and objectives aligns closely with purposes of the HSI STEM program, as indicated below.

Gavilan STEM GPRA-Adapted Long-Term Measurable Objectives and Baselines

1. **Increase STEM Majors.** Gavilan will increase the number of Hispanic and low-income full-time STEM degree-seeking students by 10 percent over the 2015-2016 baseline, with data first submitted in the 2016-2017 Annual Performance Report or APR (GPRA a).
2. **Participation in STEM Support Services.** At least 500 Hispanic and/or low-income students will have participated in grant-funded student support programs or services, data first submitted in the 2016-2017 APR (GPRA f).
3. **First to Second Year Retention in a STEM Program**. Gavilan will increase the percentage of Hispanic and low-income first-time, full-time degree-seeking students who were in their first year of college enrollment and remain enrolled in a STEM Program the following year by 10 points above our 2015-2016 baseline, with data first submitted in the 2018-2019 APR (GPRA b).
4. **Gateway Completion.** Gavilan will increase the percentage of Hispanic and/or low-income students in English and math college-level gateways by 10 points over the 2015-2016 baseline, with data submitted in the 2017-2018 APR (GPRA g).
5. **Developmental Education Accelerated.** Gavilan will increase the percentage of Hispanic and/or low-income students in STEM degree programs who successfully complete developmental education sequences in one term for each two terms recommended at 10 points over the 2015-2016 baseline, with data first submitted in the 2018-2019 APR.
6. **Introductory STEM Course Completion.** Gavilan will increase the percentage of Hispanic and/or low-income students in STEM degree programs who successfully complete introductory, freshman-level STEM courses by 10 percentage points over the 2015-2016 baseline, with data first submitted in the 2018-2019 APR.
7. **30 and 60-Units Milestones**.[77] Gavilan will increase the percentage of Hispanic and/or low-income students in the STEM degree programs who complete **30 transfer-level units** within 3 years by 10 points over the 2015-2016 baseline, with incremental increases reported beginning 2017-2018. Gavilan will increase the percentage of Hispanic and low-income students in STEM Programs who complete **60 units** and/or transfer to a four-year institution in a STEM field by 10

[77] Leinbach and Jenkins (2008). *Using Longitudinal Data to Increase CC Student Success.* CCRC, Teachers College, Columbia University.

points over the 2015-2016 baseline (GPRA e).

8. **Timely Completion/Transfer Rate.** (GPRA (d)). Gavilan will increase the percentage of Hispanic and low-income first-time, full-time degree-seeking students graduating or transferring within three years of enrollment with a STEM degree by 8 points over the 2016-2017 baseline, with data first submitted in the 2018-2019 APR (GPRA d).
9. **STEM Baccalaureate Degree Completion.** Gavilan will increase the percentage of Hispanic and low-income students in STEM Pathways who have completed a baccalaureate degree by 10 points over the 2016-2017 baseline, with data first submitted in the 2018-2019 APR (GPRA j).
10. **Measures of Equity. By September 30, 2021, Gavilan will reduce equity gaps between Hispanic and "mainstream population" students in all of the above measures by at least 50%, with data first submitted in the 2018-19 APR.**

*** Our partner, SJSU**, will provide data on our STEM transfer students' baccalaureate completion w/in 6 years. The CSU system provides data on community college transfers to all CSU campuses.

The three levels of project objectives will combine to benefit the college, the HSI-STEM program and the broader community college field.

1) This STEM project's long and mid-term objectives, above, mirror those of the HSI-STEM Performance Objectives with Gavilan's baselines. The 5-year targets apply to this project in Gavilan's specific setting, and involved thoughtful review with research advisors.

2) The STEM project's short-term objectives focus on program outcomes and services to its participants: STEM students, STEM faculty at Gavilan and its partner campus, SJSU, the Arts and Science Division as a whole, and the STEM project leaders.

3) Gavilan's formal study, STEM-ASAP, based on WWC standards, bears its own objectives, outlined more specifically in section E-3 of the Evaluation, p. 52.

The second level of objectives appears below.

Goals & Project 5-Year Objectives	Measures/Methods/Timelines [78]
Goal 1: Improve STEM Student Outcomes a. Increase # of STEM majors to 200 and % of those who are Hispanic/low-income. b. Increase STEM transfer rates by 10%; increase Hispanics % of transfers to 63%. c. Increase # of students who complete 30-unit and 60-unit milestones by 10%. d. *Increase STEM completion of BA/BS degrees; long-term data from SJSU.* e. Increase # of bilingual outreach workshops for families and schools (STEM success). f. Increase Summer Bridge & Transition Academy student *completers* to 100%.	**ALL reports reviewed by project/college leaders.** a. MIS/GIDS: # of STEM majors; % Hispanic, by **semi-annual** run/report. b. MIS/GIDS: STEM majors' transfer & % Hispanic; by **annual** run/reports (incremental improvement). c. MIS/GIDS 30-unit & 60-unit completed, **annual** run/report. d. *Increase STEM completion of BA/BS degrees; **annual from Year 3** onward, data from SJSU.* e. Bilingual outreach workshops, families/schools, 6 per year, attendees/workshop count, **annual** report. f. GIDS grade rosters for Summer Bridge; attendees' roster Transition Academy: increase 5% **Annual.**
Qualitative: Increase Hispanic student satisfaction incrementally w/ Center Services.	**Self Report: surveys** to monitor uses & benefits; get input: access/value in support services. **Annual.**
Goal 2: Increase STEM Pathway Success a. Increase # of Guided Pathway students who complete STEM in 3 years, by 10%. b. Increase # of students who complete Social Sci. pathway in 3 years, by 10%. c. Increase college success with student outcomes research on pathways & support.	a. Guided Pathway roster, Banner Student, MIS, # of completers in 3 years, **annual, start Year 4.** b. Guided Pathway roster of completers in Social Sci. degree/transfer in 3 years, **annual, start Year 5.** c. Report GIDS-data for QED ASAP study results to project staff; submit to WWC and HACU, **annual.**
Qualitative: Increase discussion/interest using Guided Pathways model in <u>*other*</u> academic programs.	**Survey deans/faculty** about the awareness & interest in using pathways model in o<u>*ther*</u> academic programs. **Annual, Year 3 +.**
Goal 3: Strengthen Teaching/ Learning a. Increase faculty project participation to 50: STEM Cultural changes, High-Impact Practices (HIPs) /STEM Curriculum. b. Increase *success* of cohorts in STEM introductory Math/ Natural Science courses, 10%. (Supplemental Instruction) c. Increase *success* in English & math gateway courses by 10% (Acceleration).	a. Train/pilot rosters: poll students' perceptions of STEM culture; compare cohorts using HIPs with those not; 3% increase per yr in faculty. **Annual.** b. GIDS grades database, success rates of introductory STEM courses using S.I. compared to those not using S.I. **Annual starting Year 3.** c. GIDS grades data, transfer English/math gateways, compare Accel. to non-Accel. cohorts. **Annual.**
Qualitative: Increase student satisfaction w/ changes in STEM culture, and the uses of HIPs incrementally each year (start Year 2).	Survey STEM HIPs pilot cohorts to calibrate success rates and learning engagement; incorporate student feedback into training and methods. **Annual, Year 2+**

[78] GIDS: the acronym for the Gavilan Information & Data System.

Quantitative trends over time along with survey analysis provides insights into why specific expectations are being met or how their delivery might be improved. Our previously presented logic model (theory of action) concisely visualizes our conceptual framework, identifying key active "ingredients" that are critical to achieving relevant outcomes, and describes the relationships among the key components and outcomes. Formative evaluation methods will provide performance feedback and permit periodic assessment during the grant period. **Benchmarking targets** have been established to provide extensive data and information for formative project assessment and improvement. This project is expected to achieve strong outcomes during the grant period and for the long-term. This will be especially true as effective strategies, validated by WWC, are replicated in other settings. This is what CUE (Center for Urban Education) means by "research that matters" for Hispanic-Serving Institutions.[79]

Criterion E 2. Evaluation methods are thorough, feasible & fit goals, objectives, outcomes.

The goals of this project are to increase the number of Hispanic students obtaining a STEM degree or certificate, and who transfer into a 4-year institution in a STEM-related field. As such, the primary objective of this evaluation is to determine whether Gavilan's combination of the student supports, Guided Pathways, and renewed classroom methods contributes to higher levels of completion of STEM degrees and transfers among Hispanics. The evaluation will collect and analyze data for all students, not just Hispanics, so that subgroup program effect differences can be examined: Hispanics, other minorities, Whites, low-income, first generation, and so forth. To learn how the project is evolving, the following questions will be on our evaluation agenda.

[79] Bensimon, M.E. et. al., "Doing Research That Makes a Difference," *The Journal of Higher Education*, Jan./Feb. 2004: vol. 75, no. 1.

Critical Questions About Project Processes
1. To what extent are STEM support services reaching their target population (Hispanic students, faculty, families, local school students)?
2. Are services implemented as planned (advising, peer tutoring, Faculty Mentoring, Summer Bridge and Transition Academy)? How can they be strengthened?
3. To what degree do the STEM Guided Pathways (our Articulation/Transfer Model) support higher persistence and at what junctures are there still leaks in the pipeline to transfer?
4. How well are the Guided Pathway Panel representatives working together and meeting their deadlines? Are there junctures where project staff need to offer more help?
5. How many STEM instructors have received training, re-designed curriculum and tested High-Impact Practices and completed their assessment in the chosen STEM course? How have they and their students responded to the new approaches?
6. How are Research Interns and their SJSU Supervisors managing the various demands of the assignments? Are there mid-term corrections due in any of their projects?

These evaluation questions will keep the three parts moving forward in concert with each other. Results of these programs and their objectives will be assessed in two ways: ***formatively,*** which identifies barriers to success that can be addressed along the way***,*** *and* ***summatively,*** which documents annual and final-year growth. Both ***quantitative*** and ***qualitative*** data will support this evaluation. These measures and methods in combination use both hard outcomes AND human factors that contribute to sustained improvement. The evaluation team includes Gavilan's new Director of Research, Peter Wruck, our new Research Analyst, Wenliang He, and the RP Group (California Research and Planning Group). They will work with Rona Halualani, Ph.D., (SJSU) the project's External Evaluator, to set up data collection protocols.

Project evaluation and data reviews will take into account the systematic routine gathering of feedback from project staff, key college leaders, faculty groups, and especially Gavilan students. We know that "Data can tell us which students are on track to college preparedness and which need additional support; [monitoring these data] are *essential to the continuous improvement of educational results."* [80]

[80] US Dept. of Ed., Secretary's Priorities for Discretionary Grant Programs Comment Request, Federal Register, August 5, 2010, p. 11.

Criterion E 3. Methods of a formal study to evaluate outcomes meet WWC Protocols.

Gavilan will conduct a formal study of the impact of specified STEM Center services student outcomes. It will complement the annual project evaluation with its more specific analysis of services in Part 1: the STEM Support Center. This formal study will be coordinated by Carolyn Arnold, Ph.D., through a contract with California's RP Group (Research and Planning) with the full cooperation of Gavilan's Research Office. We have recently hired Dr. Arnold through the RP Group to support evaluation of our Title V project, begun in fall, 2015.

The intervention methodology we found most compelling was described by WWC (2015) as meeting evidence standards without reservations, and demonstrating statistically significant favorable impact: *Doubling Graduation Rates: Three-Year Effects of CUNY's Accelerated Study in Associate Programs (ASAP) for Developmental Education Students: http://ies.gov/ncee/wwc/quickreview.aspx?sid=20155 . Given the size of our campus, a randomized control trials design was not viewed as feasible. Instead,* we plan to apply CUNY's ASAP design to potential STEM students to evaluate the impact our services and pathways have on increasing success in STEM fields while incorporating a regression discontinuity design (RDD). For these purposes, prior achievement will be used as the forcing variable in our analysis with the annual cohort's median score utilized as the cut-off score. In preparation, the STEM Planning Group reviewed six WWC-approved studies and thoroughly discussed their implications. Based on this inquiry, Gavilan chose the ASAP study as the most relevant and useful model to replicate with Gavilan's particular group of students. Our "STEM-ASAP" study design takes the essential aspects of CUNY's study and replicates it with the added value of its application to STEM students and the context of a non-urban setting.

The overview of Gavilan's purposes in the STEM-ASAP study match those of the CUNY study. The setting and population differ somewhat making this study potentially a valuable test of the generalizability of CUNY's findings.

Gavilan's Proposed STEM-ASAP Study Using the Language of CUNY Objectives.
Purpose, Objective, Study Questions, Focus: The primary objectives of Gavilan's STEM-ASAP study are to determine: • **What is the effect of the ASAP (STEM services) program on students' academic outcomes?** Are these services effective compared with the current services offered at the college? • **How is the STEM-ASAP program to be implemented and put into practice?** Will it provide information valuable to Gavilan and other Hispanic-Serving Institutions? • **How do the *planned* program services compare with the *offered* program services?** To what degree is there fidelity to the program model? As with the original ASAP program, this is an ambitious intervention for Gavilan, consisting of many components. • **How are the services *received* by intervention students different from those services *received* by the control group members (to what degree is there a *treatment contrast*)?** The "treatment contrast" represents the likely cause(s) of any program's effect on student outcomes, such as differences between intervention and comparison groups on frequency of visits to the STEM counselor and Faculty Mentors. What effect does that have on student outcomes? • **Will STEM services cost more than "business as usual?" How will additional program costs affect how we change these services?** The original ASAP's services were greater than typical CUNY services. Some of our new level of service will be funded by the STEM project itself. The long-term implications of positive outcomes could involve a re-configuration of cost per student outcome vs. cost of increased support.
Setting: The site of the original ASAP study was CUNY's 6 community colleges, that enrolled in F2010, 91,264 students: 65 percent of whom were Pell-eligible; 48 percent first generation (CUNY, 2011). By contrast, Gavilan is a one-college district with 6,886 students (F-2015); Gavilan students' average age is 25, 56% are women, 63% are Hispanic, 48% Pell eligible, 53% first generation. About 34% of our Hispanic students are from first or second-generation immigrant families; about a third of these are in migrant worker families .
Population, Participants, Subjects: In the original study, students were low-income, in need of one or two developmental courses, full-time students (new or continuing) who had earned 12 or fewer credits; they were 44% identified as Hispanic, 10% as White and 34% as African American. **Gavilan's STEM-ASAP population**, matched groups will be first-time, full-time students taking STEM courses including introductory requirements, close to 63% Hispanic, first generation (by survey), age 18 to 24.

On the following page, a table compares key components of the comprehensive acceleration model to 1) current Gavilan services with 2) the ASAP-CUNY study and 3) Gavilan's proposed STEM-ASAP study: requirements and messages, enrollment expectations and financial incentives for participants.

Comparison of Gavilan Services, the ASAP/CUNY Study and Gavilan's Proposed STEM-ASAP Study		
Requirements and Messages		
Current Services	**The ASAP/CUNY Study [81]**	**Gavilan's STEM-ASAP Study**
• **Full-time enrollment** not required. About 22% of first-year students are full time. • **Developmental courses often delayed**, but encouraged, if at all advised, to take early. • **Graduate/transfer**: students rarely pressured to finish in a given timeframe.	• **Full-time enrollment required** (eligible for Developmental Education). • **Taking Developmental courses early**: encouraged consistently and strongly. • **Graduate/transfer within 3 years**: encouraged consistently and strongly.	• **Full-time enrollment** (12 units) required; eligible for Developmental Education. • **Taking Developmental courses early. [82]** encouraged consistently and strongly. • **Graduate/transfer in 3 years in STEM**: encouraged consistently and strongly.
• **Advising:** 65% of students visit counselor 3 times in their first year. • **Career Services:** about 25% use career or employment services in first year; counselors recommend these services. • **Tutoring:** 50% are in course-specific tutoring or Supplemental Instruction.	• **Advising:** Comprehensive, at least 2x/month • **Career Services:** at least 1x/semester. • **Tutoring:** required to attend tutoring during their developmental courses and any semesters they were on academic probation.	• **Advising:** Intervention cohorts: required to meet with their counselors, advisors, mentors 2x/month • **Career Services:** at least 1x/sem. • **Tutoring:** required to attend tutoring during developmental courses and when they were on academic probation.
Course Enrollment Expectations		
• **Blocked Courses:** no students are now in a blocked enrollment framework. • **ASAP-type Seminars:** Summer Bridges: one for math skills (MathJam) & college savvy.	• **Blocked or Linked Courses:** No curriculum changes, able to enroll in blocked courses; encouraged to complete Devel. Ed. early. • **ASAP Seminar: "student success" type** seminar offered during the semesters.	• **Blocked Courses:** can enroll in blocked courses; encouraged early Devel. Ed. • **ASAP-type Seminars:** Summer Bridge or Transition Academy: summers at critical transition points, program continuity.
Financial Incentives		
• **Low tuition:** low-income fee wavers. • **Free laptops:** for a few STEM majors. • **Textbooks:** free to STEM majors.	• **Tuition waivers:** 3-11 % got waivers. • **Free Metro Cards:** on public metro. • **Free use of textbooks:** nearly all in ASAP.	• **Tuition waivers:** FAFSA. • **Free laptops**: low-income participants. • **Textbooks:** nearly all in study.

On the next page, we make a comparison between the CUNY ASAP design/analysis/data collection, and Gavilan STEM-ASAP study.

[81] Scrivener, S., et al. (2015). *Doubling graduation rates: Three-year effects of CUNY's Accelerated Study in Associate Programs (ASAP) for developmental education students.* New York: MDRC: adapted from Chapter 3 descriptions pp 21-44.

[82] Study treatment groups will be eligible for Gavilan's "Accelerated" developmental math or English courses.

FROM CUNY ASAP Study	Gavilan STEM-ASAP Study
Research Design and Analyses:	
This study is a randomized field trial. Participating students were assigned, at random, either to the program group, whose members have the opportunity to participate in ASAP, or to the control group, whose members receive the college's standard services. The random assignment procedure and process was designed and controlled by the researchers.	This study is a quasi-experimental design using an RDD analysis. Given the number of students involved, study participants in the treatment group, chosen for falling below the benchmark criterion and invited from all first time, full time students in any STEM class (math, mostly developmental) will be compared with those not selected (falling above criterion). The forcing variable for primary analysis will be previous achievement as measured by students' global Acuplacer score.
Data Collection: The following data sources will be used in the preliminary, primary, and secondary analyses:	
Random sampling (no benchmark criterion).	**RDD Benchmark Criterion:** Median Acuplacer score as determined by the annual distribution of scores for each year's cohort. Students falling above the median will be placed in the control group with those falling below placed in the treatment groups. Preliminary statistical checks and adjustments will be made according to this variable's distribution prior to the discontinuity analysis as outlined in the Procedures and Standards Handbook Section 111.3; and 5.
Baseline data: After students agreed to be a part of the study and prior to being randomly assigned, students filled out a Baseline Information Form (BIF) and baseline survey.	**Baseline data**: Students are invited during the first 2 weeks of the term: during registration, counselor visits, appropriate classes. After they agree, prior to random assignment, students fill out Baseline Information Form, survey in exchange for $25. Prior semester comparison group is compared on available data from their records.
Field Research: The researchers conduct periodic interviews with ASAP staff members, including directors, advisers, career specialists, and tutors.	**Field Research**: Researchers conduct periodic interviews with ASAP staff members, directors, advisers, career and employment specialists, and tutors.
Student 12-month Survey: Covers topics including sample members' (program and control) use of program services, and measures of mediating variables (e.g., reduced hours working/increased time studying). The response rate for the survey was around 80 percent.	**Student 12-month Survey; Service Log Analysis**: Topics include sample members' (both intervention/comparison) use of program services, measures of mediating variables (reduced hours working and increased time studying). Logs are electronically available to assess actual service use.
Transcript data: These records include the following from all CUNY colleges: transcript data--course, credits and grades; basic skills assessment test: test type, score, date, and sites); degree data: type, major, date, college. These data provided by CUNY's IRDB.	**Transcript data:** These records include the following: transcript data (e.g. course name, credits and grades); basic skills assessment test data (e.g. test type, score, date); and degree data (e.g. type, major, date).
National Student Clearinghouse: These records include enrollment and degree attainment from over 95 percent of the nation's colleges.	**National Student Clearinghouse**: These records include enrollment and degree attainment from over 95 percent of the nation's colleges.
Cost data: The CUNY Central ASAP office provided study expenditures from three colleges. To estimate control group costs, MDRC obtained operating costs/annual credits attempted: IPEDs.	**Cost data:** Expenditure data for the program will be used for the treatment group. To estimate control group costs, operating budgets and annual credit hours attempted from IPEDS.

Gavilan's STEM-ASAP study falls under WWC's Postsecondary Education category. It will address the study review protocols as summarized below.

Research Study Review Protocol for Postsecondary Education	
WWC Criteria	***Gavilan "STEM-ASAP" Study Methodology***
Study Type	This study is primarily a Quasi-Experimental Design using a Regression Discontinuity Design analysis.
Population	Our study's population involves postsecondary students in California, it will meet this criterion. We will report results to WWC: Hispanic, first-generation, underserved, low-income, testing into at least one remedial course, community college students.
Timeframe	Years 2-5. Although measures will be collected and analyzed in alignment with academic terms as part of the project formative evaluation process, annual and final (2021) data collection for "STEM-ASAP" will be analyzed for submission to WWC.
Relevant Outcomes	This study will measure milestones to include: # of STEM majors, % of Hispanics among majors, units earned (30 & 60) toward transfer, continuous enrollment, GPA and attainment (transfer and degree completion).
Review & Distribution	The study will be a rigorous quasi-experimental design; if thorough and credible, it is expected to generate valid evidence of causal relationships. Gavilan will submit a request for a single-study review to IES and submit report to HSI-STEM Program Officers.

Gavilan will ask critical questions about the study's goals and its implementation; the college Institutional Review Board will review all aspects of the study, especially survey and interview protocols, to protect students as subjects and ensure confidentiality. **The STEM-ASAP study's manager** will be Dr. Carolyn Arnold, Chabot College, as contracted with the RP Group (Research and Planning Group for California Community Colleges). Her qualifications follow.

Carolyn L. Arnold, Ph.D. Special STEM-ASAP Research Manager (Contractual)
EDUCATION Stanford University, Stanford, California, Ph.D. in Sociology of Education, Stanford University, Stanford, California, M.S. in Statistics, 1985. San Francisco State University, San Francisco, California, M.A. in Women's Studies, 1979. Smith College, Northampton, Massachusetts, B.A. in Education, 1973.
RESEARCH and ADMINISTRATIVE EXPERIENCE *Board Member*, Research and Planning Group (RP Group) of the California Community Colleges. *Coordinator, Institutional Research,* Chabot College, Hayward, CA. (2011-present). *Coordinator, Institutional Research and Grants,* Chabot College, Hayward, CA. Coordinated the Offices of Institutional Research and Grant Development. (2000-2011). *Institutional Researcher*, Chabot College, Hayward, CA. Multiple research projects including internal evaluation of Title III Grant and other studies (1993-2000). *Project Director*, Research Grant: Why Underrepresented Students Stay in Community College and Why They Leave, a 2-year grant from California Community Colleges, a quantitative and qualitative study of major factors influencing underrepresented students to persist. (1998-2000) *Principal Investigator,* Research Grant: Using National Data Sets to Create Comparable National Statistics for the Student Characteristics and Outcomes in Community Colleges. AIR and NCES, final report as guidebook for researchers (1996-1997).