INCREASING THE STEM PIPELINE: A COMMUNITY COLLEGE/CSUN PARTNERSHIP

Dr. Robert Ryan, CSU Northridge
Dr. Nathan Durdella, CSU Northridge
Dr. Richard Cortes, Glendale Community College

6th Annual HSI/Title V Best Practices Conference
March 18, 2014
Attract, Inspire, Mentor, and Support Students (AIMS$^2$)

- Faculty Mentors, Chairs, and Dean

- 2012-2013 Cohort 2
Program Goals

• To increase the number of Hispanic and low-income students who transfer from the community college partner institutions to pursue STEM degrees at CSU Northridge
• To assist these students to successfully graduate with a STEM degree in a timely manner
• To streamline the transfer process between the community college partners to our institution by expanding existing articulation agreements
Program Structure

- Funded by $5.5 Million HSI-STEM Grant from the Department of Education
- PI is S.K. Ramesh, Dean of the College of Engineering & Computer Science at CSUN
- Co-PI’s include additional academic personnel from CSUN, Glendale Community College, and College of the Canyons
- Monthly meetings are held at CSUN to discuss program activities, articulation agreements, program assessment, etc.
Program Structure

- Glendale Community College
- CSUN College of Engineering & Computer Science
- College of the Canyons

- HSI-STEM Advisory Board
- Program Assessment and Evaluation Committee

- Civil Engineering and Construction Management
- Computer Science
- Electrical and Computer Engineering
- Manufacturing Systems Engineering and Management
- Mechanical Engineering
Advisory Board

- Mr. Rich Alvidrez, JPL
  Community College Initiatives
  NASA/JPL Education Office

- Dr. Vaughn Cable, JPL
  Spacecraft Antenna Research Group
  Caltech-JPL
  College Industry Advisory Board (Chair)
  Electrical and Computer Engineering Department Liaison Council

- Mr. Luis Carbajo,
  ECE Program Alumnus
  IEEE SFV Section Chair
  Membership Development Chair, IEEE Region 6
  Vice Chair, IEEE Los Angeles Council
  Treasurer, IEEE San Fernando Valley Section

- Ms. Linda Friedman, Northrop Grumman, Woodland Hills
  Manager, Engineering Excellence
  Northrop Grumman Corporation Electronic Systems
  Computer Science Department Liaison Council

- Mr. Neal Gaborno,
  Senior Manager, Raytheon
  SAS Systems Verification Center
  Raytheon, Space and Airborne Systems
  College Industry Advisory Board
  Computer Science Department Liaison Council

- Mr. Bill James,
  Managing Director,
  Avery James, Inc.

- Prof. Miguel Macias,
  Emeritus faculty, Civil Engineering and Applied Mechanics
  CSUN

- Mr. Tony Magee,
  Member of the Technical Staff, Materials Design
  producibility
  Aerojet Rocketdyne
  Manufacturing Systems Engineering & Management
  Department Liaison Council

- Mr. Michael Medina, Hill International, San Diego
  CMT Program Alumnus
  Analyst
  Consulting and Claims Services
  San Diego

- Mr. David Naiditch
  Senior Engineering Specialist
  The Aerospace Corporation
  El Segundo, CA

- Dr. Rick Ratcliffe
  Dean Emeritus, College of Engineering and Computer Science
  CSUN
Student Recruitment

• Program began in AY 11-12
• Students must be an individual who has faced or faces social, cultural, educational, or economic barriers to a career in a STEM field (U.S. Citizen or Permanent Resident)
• Each year the target is to have a cohort of 30 students at CSUN, and 15 each at CoC and GCC
• CSUN students receive a stipend of $2400 per year, CoC and GCC students receive $1200 per year
Student Benefits and Expectations

• Must successfully complete 24 units per year
• Access to faculty mentors, student mentors, and tutors
• Free iPad
• Opportunities for program engagement (e.g. volunteer on senior design projects, involvement in professional societies, attendance at conferences)
• Opportunities for summer employment as research assistants working with faculty mentors
Summer 13 Research Projects

- Professor Bob Ryan:
  "Wind Tunnel Testing Summer Research"
  "Human Powered Vehicle (HPV) project with 5 CSUN students and 2 GCC students"

- Professor Behzad Bavarian:
  “Alternative Battery-BioTech Project” with 6 CSUN students, 1 GCC student, 1 COC student

- Professor Bruno Osorno and Professor Kourosh Sedghisigarchi:
  "SMART GRID project” with 2 CSUN students, 1 GCC student, 1 COC, and 1 Mission Community College student

- Professor Gloria Melara:
  “Collaborating and Modeling Android computer game Summer Project” with 2 students from CSUN students and 4 GCC students
Sample of Student Accomplishments

• Yassamah Tarazkar, “Mechanical Engineering Design Experience for Hispanic and Low Income Students”, paper presented at 2013 ASEE Annual Conference

• Travis Van Leeuwen and Mr. Kevin Miranda, “Rechargeable Metal-Ion Batteries for Energy Storage”, presentation at November 2013 meeting of the SFV ASM/SAMPE chapter

• Melissa Flores, Alliance of HSI Educators Scholarship (Tier # 1: conference travel, registration and iPad)

• Stephanie Medina, Noe Hernandez, Juan Zepeda, attended the HACU 27th Annual Conference in October, 2013
GLENDALE COMMUNITY COLLEGE
ASPIRE, INITIATE, AND MASTER (AIM) PROGRAM
• Three Cohorts of 13-15 participants (n= 44)

**Majors:**

2 Aerospace Engineering, 2 Architecture, 1 Biotechnical Engineering, 6 Civil Engineering, 3 Computer Engineering, 2 Computer Information Technology, 12 Computer Science, 5 Electrical Engineering, 3 Engineering (undecided on option), 7 Mechanical Engineering, & 1 Physics
## Academic Performance (GCC)

<table>
<thead>
<tr>
<th></th>
<th>Spring 2012</th>
<th></th>
<th>Fall 2012</th>
<th></th>
<th>Spring 2013</th>
<th></th>
</tr>
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<tbody>
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<td>mean</td>
<td>n</td>
<td>mean</td>
<td>n</td>
<td>mean</td>
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<tr>
<td>Cohort 1</td>
<td>13</td>
<td>2.81</td>
<td>12</td>
<td>3.05</td>
<td>10</td>
<td>2.95</td>
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<td>Cohort 2</td>
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<td>14</td>
<td>2.7</td>
<td>14</td>
<td>2.7</td>
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<tr>
<td>Cohort 3</td>
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<td></td>
<td></td>
<td>7</td>
<td>3.1</td>
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<tr>
<td>Comparison (Cohort 1)</td>
<td>14,823</td>
<td>2.58</td>
<td>14,962</td>
<td>2.57</td>
<td>15,036</td>
<td>2.59</td>
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<tr>
<td>Comparison (Cohort 2)</td>
<td>14,962</td>
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<td>Comparison (Cohort 3)</td>
<td></td>
<td></td>
<td>15,036</td>
<td>2.59</td>
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Transfer Trends

- Cohort 1: A total of 6 transferred to CSUN & 1 to Cal Poly Pomona for Fall 2013.
- Cohort 2: A total of 2 transferred to CSUN & 1 to CSULA for Fall 2013. The majority have applied for Fall 2014.
- Cohort 3: The majority will apply for Spring 2015 (if CSUN is open).
Program Benefits

- Personalized Academic & Career Counseling
- Individualized Tutoring
- GCC Faculty Mentoring
- CSUN Summer Research Internship Opportunities
- $1200 Annual Scholarships
- STEM-related Co-curricular Activities
- K-12 Outreach Opportunities
- Bi-monthly workshops
- FREE iPAD & training
Enhance GCC/CSUN Articulation Agreements

- Upon grant submission, 15 lower division Engineering and Computer Science major courses lacked course to course articulation agreements
- As of March 2014, GCC and CSUN have successfully articulated 6 & 2 course currently in the pipeline
### GCC – New Course Articulations

<table>
<thead>
<tr>
<th>CSUN Course Name/#</th>
<th>Course Title</th>
<th>GCC Course Name/#</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIT 101/L</td>
<td>CIT Fundamentals w/lab</td>
<td>CS/IS 101</td>
<td>Intro to Computer Info Systems</td>
</tr>
<tr>
<td>CIT 160/L</td>
<td>Internet Technologies w/lab</td>
<td>CS/IS 260</td>
<td>Intro to Website Development</td>
</tr>
<tr>
<td>COMP 108</td>
<td>Orientation to Computer Science</td>
<td>CS/IS 112</td>
<td>Intro to Programming using JAVA</td>
</tr>
<tr>
<td>COMP 122/L</td>
<td>Computer Architecture &amp; Assembly Language</td>
<td>CS/IS 165</td>
<td>Computer Architecture &amp; Assembly Language</td>
</tr>
<tr>
<td>ME 186/L</td>
<td>Computer-Aided Design w/lab</td>
<td>ENGR 111</td>
<td>Solid Works Applications</td>
</tr>
<tr>
<td>CE 240/L</td>
<td>Engineering Statics</td>
<td>ENGR 152</td>
<td>Engineering Mechanics-Statics</td>
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<tr>
<td>ECE 240/L</td>
<td>Electrical Engineering Fundamentals</td>
<td>ENGR 140</td>
<td>Electrical Engineering Fundamentals (pending)</td>
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<tr>
<td>MSE 227/L</td>
<td>Engineering Materials w/lab</td>
<td>ENGR 146</td>
<td>Engineering Materials (pending)</td>
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</table>
AIM Counseling/Workshops

- Over 50 counseling sessions made since the start of the Fall 2013 (n=27)
- On average, 23 participants attended our bi-monthly AIM meetings/workshops
- On average, 15 participants receive peer tutoring services (over 66 hours of tutoring last Fall)
Professional Development

Exposing more students, counselors, and instructors to professional engineering conferences
Co-Curricular Activities

- Jet Propulsion Laboratory (JPL)
- JBL/Harman
- North Island Naval Base (San Diego)
- Burbank Water and Power
- California State University, Northridge
- Speed Mentoring (WISE)
- California Science Center
- Golden Road Brewery
- HEENAC 2013 Conference (New Orleans)
- SHPE 2013 Conference (Indianapolis)
- VivaTech events (GMIS)
AIM Outreach/Mentoring

- AIM participants/mentors pay weekly visits to Roosevelt Middle School (Glendale)
- Mentors serve as co-facilitators, tutors, and robotics coaches
- Mentors are paid for their trainings and visits
AIM Mentoring in Action
Challenges

• Finding committed GCC faculty mentors
• Student psychosocial issues (e.g., low self-esteem/self-efficacy, lack of assertiveness)
• Minimal counseling training in STEM-related work
• Financial aid bureaucracy
• Not having a centralized location
Exploring Project Performance

• Evaluation framework
• Research design and procedures
• Overall findings and patterns
• Next steps
Evaluation Framework

• Project objectives guided the evaluation as an embedded mixed methods case study design
  • Merriam (2009) and Stake (1995): cross case comparison, use of diverse procedures
  • Unique needs across sites: CSUN, GCC, COC
    • Student and faculty/staff needs and project objectives at each campus direct approaches
Diverse Data Sources

- Diverse data sources
  - Cohort participants (students), mentors (faculty), staff, and institutional data
- Mixed sampling/recruitment
  - Criterion sampling and email invitations to for questionnaire, journals, interviews
  - Miles and Huberman (1994): stratified purposeful sampling strategy
A Collection of Procedures

- Questionnaires
  - Entry (baseline) and annual (assessment) instruments for students tied to measures at GCC
  - Entry (baseline) instrument: CSUN applicant interview
- Structured journaling
  - Monthly journal guides for students to record participation in project activities
- Personal and group interviews
  - Annual student interviews (GCC and CSUN)
A Mix of Analytical Approaches

- Descriptive statistical analysis
  - Frequency analysis with institutional data (COC/CSUN), questionnaire (GCC)/journal (CSUN) data
- Thematic data analysis
  - Segmenting, coding, clustering, and thematizing textual data from personal (CSUN) and group (GCC) interviews
Measuring Project Performance

- 12 objectives shape 35 performance measures
- 35 performance measures guide assessment tasks
- 28 quantitative, 7 qualitative measures shape data
  - Quantitative measures: transfer, completion, articulation, advisors, advising, courses/labs, tutoring, mentoring
  - Qualitative measures: student-faculty, peer-peer, research
- Types: project (4), non-cohort (3), cohort (28)
Challenges of a Cohort Model

• A cohort model required a unique approach
  • With the formation of the second cohort, we needed to assess cohort measures by cohort
    • Baseline data and actual performance data collected by cohort, analyzed by cohort
  • This approach applied the 28 cohort measures to each cohort for the performance period
Success: Transfer and Completion

- Transfer achievement exceeded target
  - 44 new CSUN transfer students entered in 2012-13 from COC/GCC in a field housed in CECS
    - 122% increase over the project target (n=36) and 210% increase over baseline figure (n=21) from 2010-11
- Program completion exceeded target
  - 40% (25/63) completed a degree program for the most recent period vs. 31% (21/68) project target
Strengths in Cohort Measures

- GCC/COC counselor STEM PD
- COC academic advising frequency, quality of GCC student-faculty interaction improved
- Student-faculty interaction campuses dramatically increased during the period
  - CSUN academic advising/workshops, supplemental labs, faculty research increased
Interpreting Quantitative Measures

- Faculty work with cohort participants—advising, mentoring, supervising research
- Project faculty/staff efforts with academic workshops, events, activities pays off
- Lower peer tutoring/mentoring rates = greater percentage ➔ senior standing
Faculty Research: Student Learning

- Faculty research presented students with typical problems in the field, concepts in class
  - “I was learning techniques used in the field.”
  - “Working on the [redacted] helps me to learn concepts.”
  - “After participating in the research projects, I felt better about my classes; I understood material.”
  - “Attending a national conference gave me confidence. I felt better about myself.”
Research: Career Preparation

- Research participation builds career capital, skills
  - “The [redacted] competition was really exciting. I met people in the industry…good for me and my future.”
  - “I was presenting my research to other people across the country [and] accomplished something really big.”
  - “Research experience helps with career and my individual work presentations.”
  - “[Redacted] has made me look differently at my self, what I can do and where I can go.”
  - “Being able to work in a group teaches me skills for later on, like work plans…[as] part of a group.”
Student-Faculty Interaction

- Overall, students reported meaningful, fulfilling interactions with supportive faculty
  - “My faculty mentor is very helpful...willing to listen” and “is friendly...we just talk”
  - “My faculty mentor is very helpful and is always willing to listen.”
  - “[I] find the instructors very approachable” and “friendly,” including times “when I have a question, they answer them and help me.”
Faculty Interaction as Advising

- "The face-to-face meetings with my faculty mentor has been great. I get my questions answered."
- "The interaction with the professors help me to augment what I am learning in class. They have been great to me."
- "My interactions with faculty mentors help me to learn a lot of new stuff [and have] given me some ideas towards a career and also helped me in classes."
- "My interactions with faculty mentors help me to learn a lot of new stuff and they just help a lot."
Peer Effects: Transitions/Learning

• “My peer mentor helped me to navigate things”
• “I still see my friends from GCC and we have some classes together.”
• “I like working with the same students in my [redacted] group and research group.”
• “They helped me to study for this one class I was having problems with.”
• “The peer tutors are good, they know the subject matter and help me especially before tests.”
• “I meet with my peer tutor and mentor [for] tips on the program, classes.”
Interpreting Qualitative Measures

- What appears to affect student learning and career development is consistent, frequent interaction with faculty mentors.
  - The activities that facilitate interaction matter if meaningfully connected to coursework and career.
- Peer tutors/mentors tend to enhance student academic/social experiences, support learning.
Recap

• In general, advising, workshops, labs, and faculty research are project strengths
• Overall, student-faculty interaction have the strongest effects on student development
• Finally, peer interaction via peer mentoring and tutoring appear to have strong, positive effects on student transitions, learning
Next Steps

- Update program monitoring tools
- Inferential statistical analyses to examine program participation and outcomes at CSUN
- Exploratory studies on effects of faculty contact with transfer students of color, focusing on gender and race/ethnicity
QUESTIONS?

http://www.ecs.csun.edu/aims2/