Engineering Educators Bringing the World Together
2025 ASEE Annual Conference & Exposition
Palais des congrès de Montréal, Montréal, QC • June 22–25, 2025 ASEE
Paper ID #48907

NSF EEC: Establishing UTRGV's Center for Broadening Participation in Engineering: Engage, Educate, Enrich

Dr. Ala Qubbaj, The University of Texas Rio Grande Valley

Ala Qubbaj, Ph.D. Dean of the College of Engineering & Computer Scienceâ€¯ The University of Texas Rio Grande Valley â€¯ Dr. Ala Qubbaj is the Dean for the College of Engineering and Computer Science at the University of Texas Rio Grande Valley (UTRGV

Laura Benitez, The University of Texas Rio Grande Valley

Dr. Laura Benitez serves as Associate Dean for Outreach and Student Engagement in the College of Engineering and Computer Science (CECS) and is also a faculty in the Electrical and Computer Engineering Department. Dr. Benitez is the Associate Director and co-PI for the National Science Foundation-funded Center for Equity in Engineering (CEE). She has also engaged and led several STEM outreach and equity initiatives at UTRGV. Prior to joining UTRGV, Dr. Benitez was a Product Engineer at Texas Instruments Inc. and earned her Ph.D. degree from Texas A&M University.

Dr. Noe Vargas Hernandez, The University of Texas Rio Grande Valley

Noe Vargas Hernandez researches creativity and innovation in engineering design. He studies ideation methods, journaling, smartpens, and other methods and technology to aid designers improve their creativity levels. He also applies his research to the des

Prof. Constantine Tarawneh, The University of Texas Rio Grande Valley

Dr. Tarawneh is a Professor of Mechanical Engineering at the University of Texas Rio Grande Valley (UTRGV) where he worked since 2003. He obtained his MS and Ph.D. degrees from the University of Nebraska-Lincoln (UNL) in 1999 and 2003, respectively. He fo

Dr. Arturo A Fuentes, The University of Texas Rio Grande Valley

Arturo Alejandro Fuentes is a Professor of Mechanical Engineering at the University of Texas Rio Grande Valley. He holds a Ph.D. and an M.S. in Mechanical Engineering from Rice University. His research interests include engineering education.

Dr. Nazmul Islam, The University of Texas Rio Grande Valley
Edna orozco-leonhardt, The University of Texas Rio Grande Valley

Edna Orozco, MSE, EdD is currently a Lecturer II, and undergraduate coordinator, for the Department of Manufacturing & Industrial Engineering. Edna has been key for the Department of Manufacturing & Industrial Engineering in many facets. The department opened in the year of 1993 and since then the department has hired only two faculty women, Dr. Karen Lozano, who currently works in the mechanical engineering department, and Edna Orozco, who is the female who has been working the longest at the department despite of being the only female. This is important to mention because she has been able to collaborate with all tenure, tenure track, and lecturers at the department. She has led the accreditation process and undergraduate curriculum of the department and has been greatly involved in outreach not only for the department but also for the College of Engineering & Computer Science. Her contribution to the engineering college was to bring the Girl Day in Engineering, a national celebration that focuses only on female students. She is also currently the chair-elect for the UTRGV Women Faculty Network. Edna Orozco is a former Specialist in the Texas Army National Guard and worked as an administrator in secondary education K-12 for 7 years.

Thuy Vu, The University of Texas Rio Grande Valley
Angela Chapman, The University of Texas Rio Grande Valley

NSF EEC: Establishing UTRGV's Center for Broadening Participation in Engineering: Engage, Educate, Enrich

Hispanics are one of the fastest growing populations in the US, yet they are underrepresented in engineering. University of Texas Rio Grande Valley (UTRGV), a major Hispanic Serving Institution (HSI) with a student population over 95% Hispanic, is well-positioned to address this disparity. UTRGV established a Center for Broadening Participation in Engineering: Engage, Educate, Enrich (CBPE-E3) to enhance Hispanic participation in engineering from early awareness through professional employment. The CBPE -E3 aims to increase enrollment, retention, and advancement rates of Hispanic students in higher education engineering, especially Latinas facing intersectional barriers of race and gender. The CBPE -E3 envisions becoming the leading national model for inclusion, professional preparation, and successful advancement of Hispanic engineers. Drawing on the community wealth asset framework, the CBPE -E3 is grounded in culturally relevant programming and pedagogy. It encompasses three objectives and related focus areas: 1) ENGAGE (K-12 Outreach): Provide early exposure to engineering content and role models for students, their families and communities, and teachers and counselors; 2) EDUCATE (Education & Training): Create an inclusive college experience that promotes students' success through curricular reform and trainings for faculty and students; and 3) ENRICH (Professional & Research Experiences): Provide the next generation of engineers with critical professional, leadership, and research development opportunities. The CBPE -E3 builds on UTRGV's long-standing commitment to supporting Latinx students, as recognized with a 2021 Seal of Excelencia, and in broadening participation through successful NSF ADVANCE IT, INCLUDES, and ECR grants. It also leverages partnerships with 14 entities, including major universities, engineering professional societies, community colleges, K-12 systems, non-profits, and engineering employers and alumni. The CBPE -E3 expands UTRGV's student educational opportunities through an R1 institution collaboration to create the Alliance for Student Participation in Research Experiences for Hispanics (ASPIRE Hispanics). It also introduces students to role models, professional networks, and ongoing personal and career development through professional society partners. Finally, the CBPE -E3 shares promising practices with institutions serving largely Hispanic populations so that they can replicate or adapt best practices at their home campuses through an "Equity in Engineering Education Summit." Infrastructure in phase I will be expanded for national scale-up in phase II. The authors will present the work in progress and preliminary results from a pilot implementation. This project is funded by NSF EEC award 2217780.

Introduction

Need for National Engagement of Hispanic Students in Engineering

The 2019 report, Minority-Serving Institutions: America's Underutilized Resource for Strengthening the STEM Workforce, by the National Academies of Sciences, Engineering and Medicine highlights the critical role of MSIs in serving U.S. minoritized populations. The recent US Census Bureau report (2017) indicates that "minorities" are projected to account for 56% of the U.S. population by 2060. Further, the Hispanic population has grown by 23% since the last census [1]. Despite this growth, Hispanics remain among the least employed racial/ethnic groups in STEM after graduation [2]. There are also discrepancies in STEM workforces, where women, particularly from a Mexican or Latinx background, comprise less than 7% of the STEM

workforce in science and engineering. Only a small fraction of this number is specifically in professional engineering fields [2]. One reason for the low numbers of Hispanics in engineering may be that 37% of Latinos, compared to 29% of White students, switch out of their major as undergraduates [3]. Therefore, it is critical to improve the educational experience in engineering for Hispanics to develop a future engineering workforce that reflects the diversity of the nation.

UTRGV's Center for Broadening Participation (CBP)

UTRGV established the Center for Broadening Participation in Engineering (CBP) in Fall 2022, guided by the principle of "servingness" to empower Latinx students pursuing engineering careers [4,5]. The CBP aims to increase Hispanic participation in engineering by developing and sharing successful strategies for their acculturation and advancement, especially Mexican-Americans. This will be achieved through educational supports that consider biculturalism [6] and culturally relevant pedagogy [7]. One key approach involves integrating Hispanic cultural values into science and engineering education [8]. Additionally, the CBP draws upon Yosso's [9-10] asset-based framework, recognizing the strengths inherent in the cultural wealth of Hispanic families and communities. This perspective fosters cross-community support for engaging Hispanics, particularly Latinas, in engineering. UTRGV's CBP also leverages partnerships with 14 entities, including major universities, engineering professional societies, community colleges, K-12 systems, non-profits, and engineering employers and alumni. It also introduces students to role models, professional networks, and ongoing personal and career development through professional society partners. Finally, the CBP shares promising practices with institutions serving largely Hispanic populations so that they can replicate or adapt best practices at their home campuses through an "Equity in Engineering Education Summit." The CBP focuses on addressing inequities in three key systems along the engineering career continuum: (1) Social/Family Systema, (2) Education System, and (3) Professionalization System. To achieve the mission to increase the representation of Hispanics in the engineering workforce, CBP is mitigating and addressing inequities for the largest US minority population, Hispanics, throughout the engineering career continuum. To that end, we have ongoing initiatives to transform the education and preparation of the next generation of engineers in the following areas: (1) ENGAGE (K-12 Outreach) – conducting outreach to broaden the pipeline by providing early exposure to culturally relevant content focused on family-systems and role models, (2) EDUCATE (Education & Training) – creating an inclusive college educational experience that promotes students' success and development of technical skills, and (3) ENRICH (Professional & Research Experiences) – providing the next generation of engineers with professional/career, leadership, and research development opportunities.

Key CBP's ENGAGE (K-12 Outreach) Initiatives

Familia ENGAGE: Empowering the Next Generation of Hispanic Engineers :Familia ENGAGE empowers high school students and their families to explore the exciting world of engineering. Through interactive activities, hands-on demonstrations, and inspiring stories from real-life engineers, especially Latina role models, families discover the diverse applications of engineering and its power to solve societal problems relevant to their communities. To take

advantage of large groups of families attending the University, the event took place during the Rio Grande Valley Science and Engineering Fairs hosted by UTRGV in February 2023 and 2024. The program consisted of different talks and guided tours with lab visits with faculty and student presentations throughout the College of Engineering and Computer Science (CECS) facilities. The program tackled head-on: (1) Breaking stereotypes and misconceptions, (2) Navigating career paths, and (3) Smoothing the transition. By igniting early interest and equipping families with knowledge and resources, Familia ENGAGE paved the way for the next generation of Hispanic engineers to make a lasting impact on our world. In 2024, 25 students with their families attended.

Latina Summer Camps: Building the Future Engineers of Tomorrow: This one-week summer camp ignites the passion for engineering in 8th & 9th-grade Latinas in the summer of 2023 and 2024. Through immersive cultural scripts, they explored diverse engineering disciplines by tackling fun and interactive activities that bring fundamental concepts to life. These camps included: (1) Engaging workshops and hands-on projects: Build, experiment, and discover the magic of engineering! (2) Inspiring guest speakers: Hear from real-life Latina engineers about their exciting careers and journeys. (3) Immersive local field trips: See engineering in action and its impact on communities. (4) Connecting with role models: Find your community and gain invaluable mentorship from Latina engineers. This dynamic program went beyond lectures and worksheets. It was about hands-on learning, building confidence, and discovering the power of engineering to shape the world. In 2023, 40 Latina students participated and 51 in 2024.

Additional Sample Initiatives :In addition, the CBP successfully implemented the following ENGAGE initiatives: (1) Community College ENGAGE: Community College students participated in the "Student Engagement Day" during UTRGV's Engineers Week 2024. Additionally, PIs also connected with South Texas College faculty to discuss specific initiatives to ease the transition of community college students to our university. Among other things, we developed and deployed a weeklong boost-camp for Transfer Student; 16 students participated in 2023 and 18 in 2024. (2) Teachers and Counselors Forum: 22 invited high school teachers, principals, and counselors to our 2nd Annual Broadening Participation in Engineering Summit in 2024. (3) High School Engineering Scholars Program (HSESP): Our center placed 4 high school students in UTRGV CECS research centers during summer 2024.

Key CBP's EDUCATE (Education & Training) Initiatives

Curriculum Revisions to CECS courses: CBP's lower-level curriculum interventions represented a valuable opportunity to increase engineering and computer science students' salience for identities as professional engineers. The revisions assisted students to set appropriate academic and career goals. The revisions during Spring 2024 focused on the "Introduction to Engineering" course impacting over 800 freshman students and involved five faculty members across the different departments in the College of Engineering and Computer Science.

Faculty Training on "Inclusive Teaching and Learning": In these CBP workshops with an external consultant, 20+ faculty members reflected on and identified a plan to enact equity-minded and inclusive teaching and learning practices. Specifically, they identified deficit-minded and equity-minded statements on teaching documents, self-assessed their teaching philosophy statement and course syllabus, and designed a feedback/assessment component.

Jumpstart boostcamp & Facilitator Training: The Jumpstart Boostcamp is a one-week long onboarding experience for incoming freshman CECS students. This program ameliorated the

lack of high school rigor that inhibits academic success for some of our students, many of whom are first-generation college students. Jumpstart Bootcamps were offered right before the Fall semesters. CBP also started a Facilitator Training Academy, which is preparing faculty and graduate students to successfully adapt and run similar Jumpstart Bootcamps in their departments. Specifically, four boost camps and one transfer student boost camp were implemented in 2024, benefiting more than 150 students. Based on the survey results, the participants showed changes in functional skills after their camps.
Equity in Engineering Education Summit : CBP had an Equity in Engineering Education Summit with the theme of "Broadening the Participation of Hispanics in Engineering" that looked at how to recruit, retain and prepare Hispanics into and for the engineering workforce. This summit drew upon all three focus areas to act as a clearinghouse for the sharing of best practices in the outreach, education and professional development of Hispanics in engineering. Approximately 140 industry, K-12, Community College, University faculty and students' representatives participated in the Spring 2024 summit.

Key CBP's ENRICH (Professional & Research Experiences) Initiatives

Leadership development & Soft-Skills "Engineering Student Leadership conference":
Approximately 50 student leaders from CECS participated in a 2-day leadership conference/bootcamp designed to provide them with the "soft skills" overlooked in engineering education programs that are still necessary to succeed in their careers. By focusing on how to engage their peers in their student organizations, student leaders learned from each other through interactive leadership workshops on goal setting, teamwork, community service, effective communication, and professional integrity. The results included a significant number of internship offerings at the SWE and SHPE conferences.
Professional & Career Development: During the 2024 E-Week, more than 125 students participated in CBP provided alumni panels, networking opportunities, and career fairs. Through our Career Center, we provided resume and job search workshops, mock interviews, and an "imposter syndrome" workshop. We also invited/leveraged our industry partners/alums to participate in the career panels, workshops and networking, and served as mentors and role models for our students.
Alliance for Student Participation in Research Experiences for Hispanics (ASPIRE Hispanics) – REU: The CBP expanded UTRGV's student educational opportunities through Research Centers collaboration to create the Alliance for Student Participation in Research Experiences for Hispanics (ASPIRE Hispanics).

Conclusions

While the Hispanic population represents a rapidly growing demographic in the U.S., it remains significantly underrepresented in engineering fields. To address this disparity, UTRGV, a major Hispanic Serving Institution (HSI) with a student body exceeding 95% Hispanic, established the Center for Broadening Participation (CBP). To bridge the gap in Hispanic representation within engineering, UTRGV's CBP took a holistic approach. Our ENGAGE initiative sparked early interest by exposing K-12 students, families, and communities to inspiring engineering content and role models, empowering teachers and counselors with resources to guide students towards

these pathways. Then, EDUCATE initiatives fostered an inclusive college experience through curricular reform and tailored support programs, while equipping faculty with the skills to mentor all students effectively. Finally, ENRICH initiatives shaped future leaders by providing crucial professional development, leadership training, and research immersion opportunities, preparing them for successful careers. This comprehensive approach, targeting enrollment, retention, and advancement, empowers the next generation of Hispanic engineers, especially Latinas, to contribute their unique perspectives and talents to the field.

Acknowledgments

The authors express their gratitude to the CBP students, staff and faculty involved in this project. Funding for this project was provided by NSF EEC award 2217780.

References

[1] Jones, N., Marks, R., Ramirez, R. & Rios-Vargas, M. (2021). 2020 census illuminates racial and ethnic composition of the country. US Census Bureau. https://www.census.gov/library/stories/2021/08/improved-race-ethnicity-measures-reveal-united-states-population-much-more-multiracial.html

[2] Landivar, C.L. (2013). Disparities in STEM employment by sex, race, and Hispanic origin, (American Community Surveys Reports, ACS-24). U.S. Census Bureau.

[3] Riegle-Crumb, C. King, B. & Irizarry, Y (2019). Does STEM stand out? Examining racial/ethnic gaps in persistence across postsecondary fields. Educational Researcher, 48, 133-144.

[4] Excelencia in Education (2021). 10 trendsetting institutions certified with Seal of Excelencia for intentionally serving Latino Students. https://www.edexcelencia.org/press-releases/10-trendsetting-instiutions-certified-seal-excelencia-intentionally-serving-latino

[5] Garcia, G.A., Nunez, A.-M., & Sansone, V.A. (2019). Toward a multidimensional conceptual framework for understanding "servingness" in Hispanic-Serving Institutions: A synthesis of the research. Review of Educational Research 89(5), 745-784. https://doi.org/10.3102/0034654319864591

[6] Cruz, J. L., & Blancero, D. M. (2017). Latina/o Professionals' Career Success: Bridging the Corporate American Divide. Journal of Career Development, 44(6), 485-501. https://doi.org/10.1177/0894845316664414

[7] Ladon-Billings, G. (2014). Culturally Relevant Pedagogy 2.0:a.k.a. the Remix. Harvard Educational Review, 84(1), 74-84. https://doi.org/10.17763/haer.84.1.p2rj131485484751

[8] Hernandez, C.M., Morales, A.R., & Shroyer, M.G. (2013) Cultural Studies of Science Education 8 (2013), pp 803–820. DOI 10.1007/s11422-013-9544-1

[9] Yosso, T.J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. Race Ethnicity and Education, 8(1), 69-91.

[10] Yoss, T. J., & Burciaga, R. (2016). Reclaiming our histories, recovering community cultural wealth. (Research Brief, 5), Center for Critical Race Studies. University of California, Los Angeles.