Advancing Student Success Through Integrated Sociocultural and Academic Intervention Strategies

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Introduction

The demographic shifts since the 1970s witnessed considerable growth in the Hispanic population in the State of California. Currently, Hispanics/Latinos are the largest ethnic group accounting for 39% of the state's total population (Johnson et al., 2022). Given these demographic shifts and accumulated years of experience in serving Hispanic students, California State University, Fullerton (CSUF), one of the largest Hispanic Serving Institute in California, is strategically poised to address many of the challenges faced by these students. As of July 2021, the demographic profile of California shows that of the total population, the Hispanic population accounts for 39%, closely followed by the white non-Hispanic population, 38%. The demographic shift makes California one of the largest states without a white non-Hispanic majority (Johnson et al., 2022). Given this demographic profile, CSUF appears to be uniquely poised to serve underrepresented minority student (URM) populations. CSUF is among the largest universities in the United States, with a fall 2021 enrollment of 40,087. In terms of enrollment, it is one of the largest campuses of all 23 campuses in the California State University System. Of the enrolled students, females constitute 59.2% of the student population. The ethnic distribution for the fall 2021 semester shows that Hispanic students alone account for 47.3% of the total student population (CSUF, 2021a). The data obtained from the Instructional Research and Analytical Studies suggest that in 2020-2021 CSUF awarded 207 undergraduate degrees (28.79 %) to Hispanic students in all engineering disciplines, while 148 (38.14%) degrees were awarded to Hispanic students during the same period in all science discipline. CSUF ranks third in the entire United States for undergraduate degrees awarded to underrepresented minority students. In terms of undergraduate degrees awarded to the URM, CSUF ranks fifth in the nation (CSUF, 2021b).
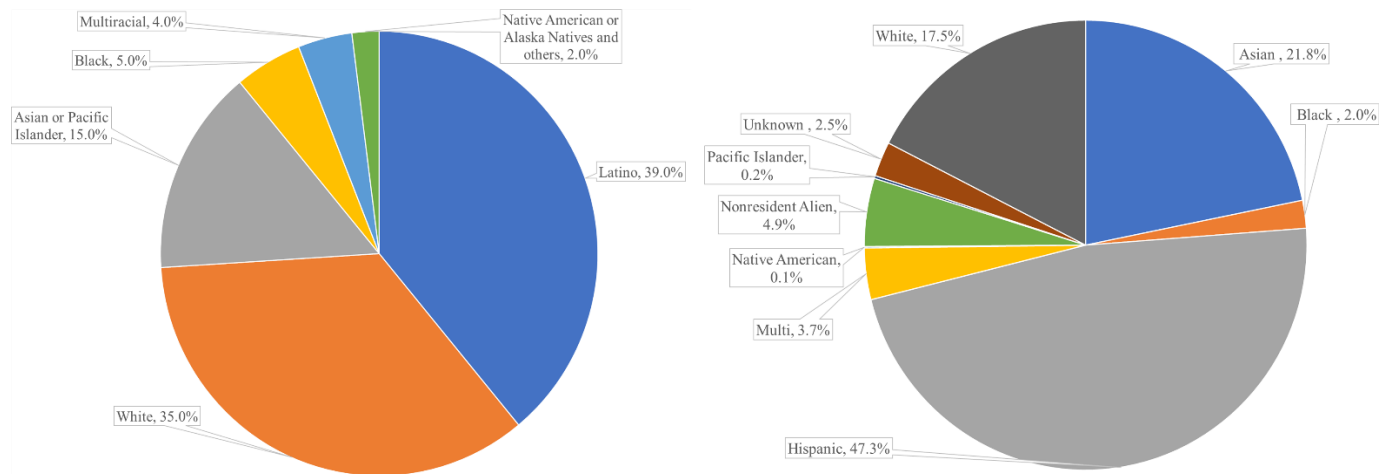

Figure 1. Population demographics of the State of California (left) and the student demographics at CSUF (right)

The graduation rates, as discussed above, do not correlate well with the enrollment numbers. This glaring discrepancy points to the fact that many Hispanic students may not be graduating on time or maybe disengaged early on without completing their degrees in sciences and engineering. A closer look at the systemic problems that explicitly affect the URM students at CSUF is the relatively higher repetition in lower-division math courses. In general, 2-10% of URM student

repeats lower-division math courses (Math-150A and Math-150B) compared to the non-URM students (Figure 2). Several factors affect the achievement gap between URM and non-URM students, including their prior academic preparation, sociocultural background, and economic pull factors. The National Science Foundation (NSF)-funded "*Advancing Student Success by Utilizing Relevant Social-Cultural and Academic Experiences for Undergraduate Engineering, Computer Science Students (ASSURE-US).*" This is a five-year project at CSUF that seeks to address the challenges faced by URM students. The project aims to achieve this objective by integrating sociocultural and academic intervention strategies targeted toward URM students through gateway course redesign, expanded student co-curricular experiences, and student and family engagement strategies.
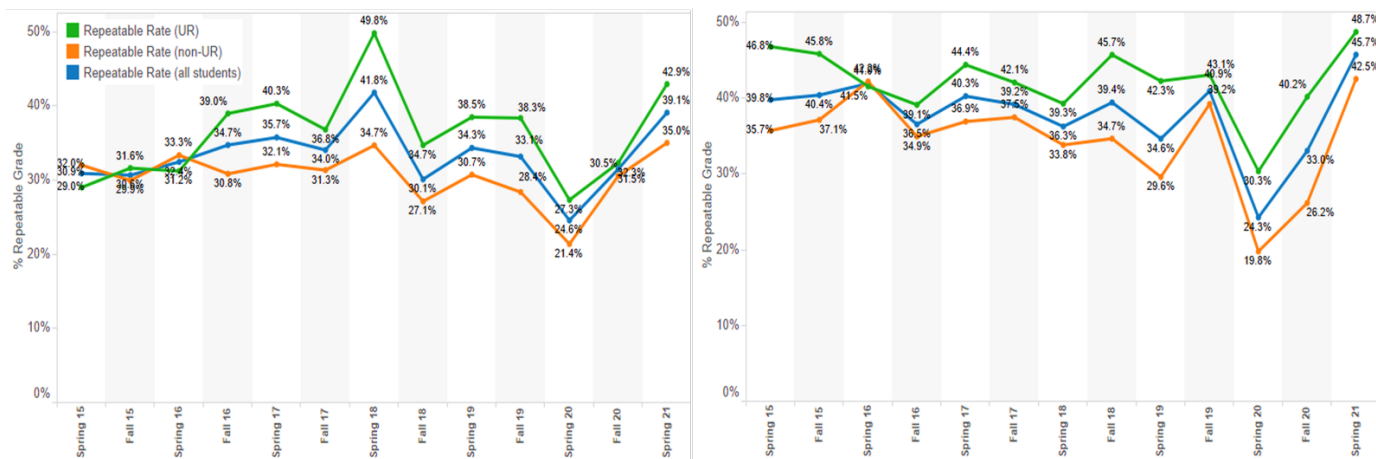

Figure 2. Repeatable grade rates for URM and non-URM students in lower division Math 150-A (left) and Math 150-B (right) courses (CSUF, 2021c)

Here we document the twin strategies comprising academic and sociocultural interventions to address URM students' retention, graduation, and overall meaningful learning experience. Despite the challenges posed by the ongoing COVID-19 pandemic, the project team reimagined and redesigned the planned activities and continues to provide enhanced learning experiences and equitable educational opportunities to URM students.

Student Recruitment for ASSURE-US Project

ASSURE-US project primarily targets the freshman and sophomore students in the College of Engineering and Computer Science (ECS). Pre-pandemic recruitment was accomplished during the freshman orientation, followed by classroom visitation and in-person recruitment. However, during the pandemic, the ASSURE-US project team recruited students through email outreach, social media posts, and online classroom presentations. During the 2020-2021 academic year, the team recruited 198 students. The ASSURE-US project team also conducted various orientation presentations for the newly recruited students. The objectives of these orientation meetings were to make students aware of the various ASSURE-US project activities and opportunities for academic and sociocultural support. The majority of the student participants were from computer science majors, with 33% female, 66% male, and 1% non-binary students.

Academic Intervention Strategies

Academic intervention strategies were mainly geared towards lower-division math courses, specifically Math-150A and Math-150B. The objective of the academic intervention strategies is to redesign the courses, emphasizing the design using real-world examples and the application of engineering design. Instead of traditional math courses, the redesigned courses require students to apply mathematical concepts to various engineering design problems. Mid-term surveys conducted in the Math-150A course show that 36% of students felt that the academic redesigned math course helped them better grasp the learning material, while 38% remained neutral. Students find it difficult to relate the project to the mathematical concepts being taught. Additionally, some students reported that the intervention projects were too long. Please note that the objective of teaching application-based math was not restricted to learning mathematical concepts limited to their coursework, but how they can continue to use these concepts in their advanced courses in their senior years. Furthermore, students also expressed difficulty learning in a virtual environment. The team observed that application-based learning might be advantageous for traditional instructional modalities but may not for the virtual modality. Solutions to the challenges reported by students include targeted professional development for the instructors and streamlining the interventions to focus on one round of engineering design.

Sociocultural Intervention Strategies

The project team organized sociocultural intervention strategies primarily to create an inclusive learning environment through a series of student-teacher interaction council activities. These intervention strategies were holistic, for they promote students' well-being and help students better seek help from available campus resources. The ASSURE-US project team organized various activities throughout the academic year. These activities include a financial planning workshop, exam preparation & stress relief workshop, a "keeping your motivation intact" workshop, and virtual coffee sessions. Given the ongoing pandemic, besides peer mentors, the project team also invited Counseling and Psychological Services (CAPS) personnel to share tips on exam preparation and coping strategies. The campus resources workshop was organized by inviting various experts, including Library Services, the Office of Financial Aid, the Engineering and Computer Science Advising Center, and the Career Center. They shared information about critical resources available to CSUF students. The project team offered peer advising through discipline-specific peer mentors. Summer research activities were also organized using virtual tools such as Zoom and Microsoft Teams. Four faculty mentors recruited 42 students during the 2021 Summer Research Experience. Overall, students expressed a positive opinion about the ASSURE-US project. Some students genuinely appreciated the opportunity to connect with faculty members and peers and benefit from the support for their STEM education.

COVID-19 Pandemic: Instructional Modality and Challenges

The Covid-19 pandemic affects student performance due to the sudden shift from traditional face-to-face instructional delivery to remote virtual delivery. The ASSURE-US project team redesigned the activities for virtual mode. Besides emails and Zoom, the team utilized various social media tools (discord and Instagram) to keep the students informed and engaged. Throughout the remote learning during the pandemic, the ASSURE-US project supported students through various activities, including addressing mental health issues (through

workshops and impersonal coffee sessions), financial education, research opportunities, scholarship, and textbook support. Despite these supports, students reported several challenges due to the virtual instruction. Specifically, students reported low motivation, difficulty maintaining focus, technical difficulties, and lower participation. They also noted that emphasis on pre-recorded videos resulted in less material being covered, and most of the instruction was activity-based.

Conclusion

Early results from the implementation of academic and sociocultural intervention strategies show that students persevered despite less-than-ideal circumstances. Despite not fully grasping the scope of ASSURE-US project activities, they responded by actively taking advantage by participating in many of the project activities. They genuinely appreciated being connected with their peer and faculty and obtained academic, financial, and personal support. Students' feedback reflects their appreciation for the ASSURE-US project activities. For example, most students reported high awareness of campus resources for mental health and academic support. For example, 89% of participating students reported they are somewhat or fully aware of the mental resources available on-campus, while 90% reported full awareness of academic support resources available. A survey of the ASSURE-US project participants shows that of the students surveyed, 39% said that the project helped them identify role models in their field, while 34% reported that the project helped them identify and connect to a mentor. The ASSURE-US project was conceived as an in-person, hands-on, activity-based, and family-involved project. Despite the challenges brought about by the pandemic, the project team quickly reimagined the project and implemented the activities in a virtual setting. The quick adaption of project activities for virtual mode and implementation of the same ideas shows the resiliency of the strategies for student success. The project activities were implemented in less-than-ideal circumstances, yet preliminary results show promising results. Given the challenging circumstances created by the COVID-19 pandemic, students genuinely appreciated the opportunities afforded by the ASSURE-US project to meet and interact with others. The academic and sociocultural strategies developed over the last three years have led to new knowledge that could benefit various minority-serving institutes in the California University System.

Future Work

The ASSURE-US project team will extend the implementation of intervention strategies to include lower-division engineering and computer science courses such as Computer Science (CS 120) and Statics (EGCE/EGME 201). The faculty in charge of CS 120 redesigned the course in fall 2021, and the implementation of the redesigned course is tentatively scheduled for spring 2022. In Fall 2022, 7 sections of CS 120 are planned for academic intervention. Instead of designing the intervention modules for lower-division engineering courses, the project team will continue to implement intervention modules in lower-division math courses and develop a better insight into what worked and evaluate the need for further improvement.

In Summer 2022, the ASSURE-US intends to host an in-person undergraduate research symposium for students and their families. The project team has recruited nearly fifty students to participate in summer research activities. The symposium will showcase the research conducted by ASSURE-US students over the summer. ASSURE-US will continue to offer sociocultural

intervention strategies, workshops, panel discussions, and family field trips in fall 2022. Due to the ongoing pandemic, the team implemented sociocultural interventions primarily in virtual mode. The ASSURE-US team will plan for in-person events post-pandemic academic season. In addition to these, future work will also involve extensive data gathering, especially pre-survey data, to accurately assess the impact of intervention strategies.

Acknowledgements

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