

Improving Inclusive Excellence in STEM Through Place-Based Learning Communities

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Background and Significance

Humboldt State University is the most remote and geographically isolated campus of the California State University (CSU) system. It is located in Humboldt County, which is both predominantly non-Hispanic White (~75%; U.S. Census Bureau 2010) and home to nine federally recognized American Indian tribes. Reflecting the national trend in higher education, the number of HSU students who are from a cultural or economic background traditionally underrepresented on college campuses and/or are first in their family to attend college has been steadily increasing. These students, now referred to as the New Majority (Schneider, C.G. 2005), have increased from 19% of the HSU 2009 student body (n = 7954) to 40% of the HSU 2017 undergraduate student body (n = 7774). Many arrive from distant urban centers in Southern California (40%, 700-800 miles away) and the San Francisco Bay Area (17%, 300-400 miles away), places that are environmentally, economically, and culturally quite different than Humboldt County.



Figure 1: The majority of HSU undergraduates arrive from distant urban centers, places that are environmentally, economically, and culturally quite different than Humboldt County. 2017 Enrollment Data CSU Data Dashboard

Despite multiple institutional initiatives, data from our campus indicates that we still struggle to cultivate the self-efficacy, academic behaviors, and the sense of belonging necessary for academic achievement, particularly for students of color in the disciplines of science, technology, engineering and math (STEM). As of 2018, HSU's 4-year graduation rate for incoming STEM freshmen was 20% overall, 13% for students from traditionally underrepresented ethnicities, and 11% for first-generation students. Though improved, the 6-year graduation rates are still unsatisfactory and opportunity gaps persist (43% URM vs. 54% overall).

The HSU College of Natural Resources and Sciences (CNRS) is trying to help first year STEM students develop a sense of belonging to our unique campus and the greater Humboldt community, overcome barriers to academic success, and cultivate intercultural knowledge through the implementation of place-based learning communities (PBL). Our PBLs are comprised of five High Impact Practices (HIPs) shown to be effective in increasing diversity in STEM. Woven throughout each is an integrative assignment that links a hands-on research experience that explores scientific, cultural, and environmental themes of our unique location, with a particular emphasis on their impact on local Native American people.

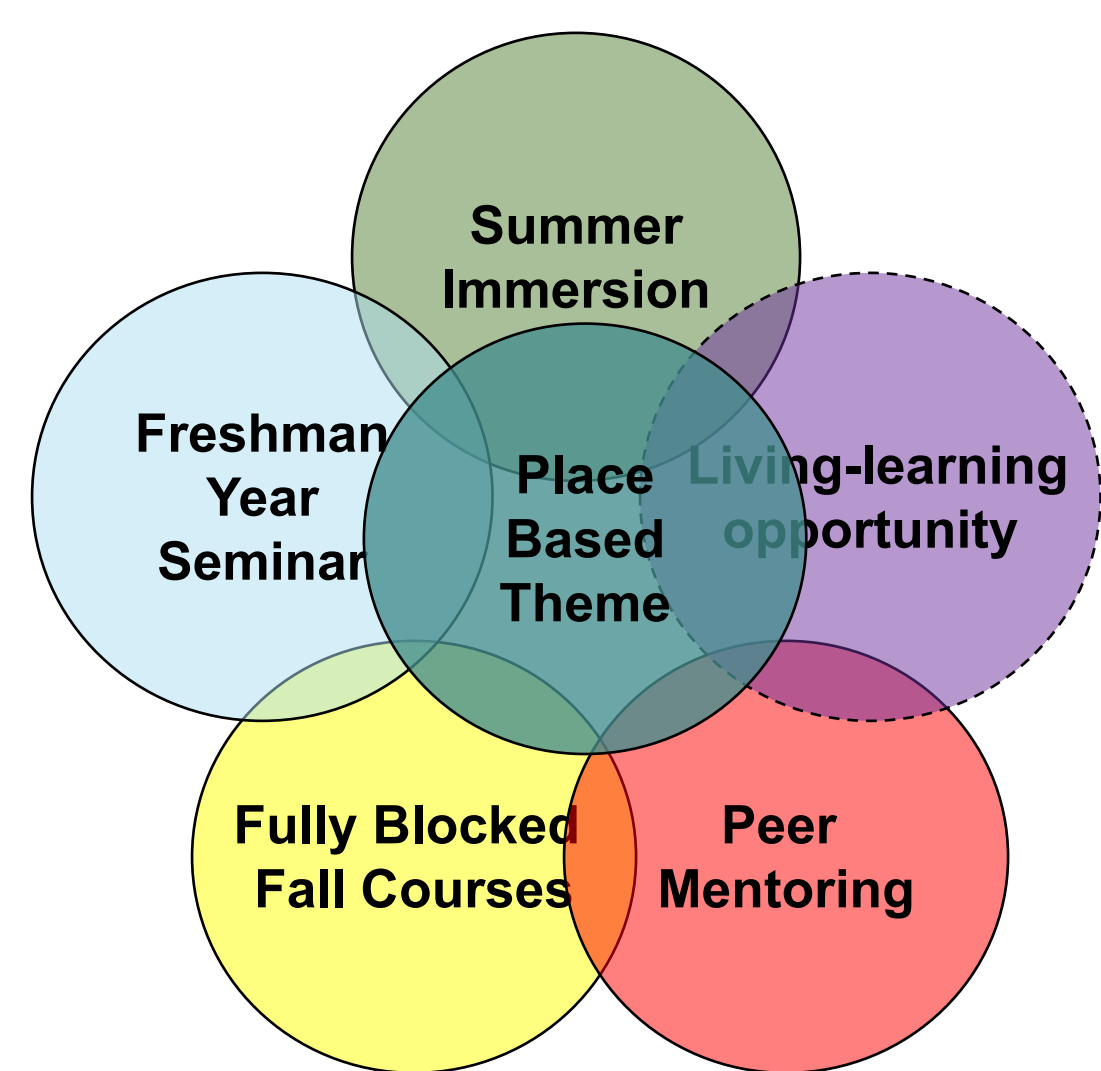


Figure 2: Our place-based learning communities link five high-impact practices around themes unique to the geography and cultures of our region.

Our hypothesis is that our PBLs will foster a deeper sense of belonging, study skills and attitudes that will ultimately lead to improved academic achievement and increased retention and graduation rates. An additional goal is that these curricular reforms will result in meaningful personal, academic and professional cross-cultural engagement that will assist participating students in developing an intercultural knowledge of indigenous environmental, scientific and cultural issues.



Figure 3: Our hypothesized model that place-based learning communities can foster the sense of belonging, skills, and habits that favor academic success and increased graduation.

Evidence of Effectiveness

The first HSU place-based learning community launched in fall 2015. Called *Klamath Connection*, it is designed around themes of the Klamath River Basin for first-time students entering a declared major of Biology, Botany, Environmental Science, Environmental Engineering, Fisheries, Wildlife or Zoology. The following data summarize the impact of our PBL programming on the first three cohorts of Klamath Connection (KC) students when compared to non-KC students propensity score matched (PSM) for STEM major, gender, ethnicity, low-income (Pell-eligible), first-gen, and high school G.P.A. * indicates $P < 0.05$, ** indicates $P < 0.01$ based on t-tests (surveys), ANOVA (GPAs), or log linear models (pass rates and retention)

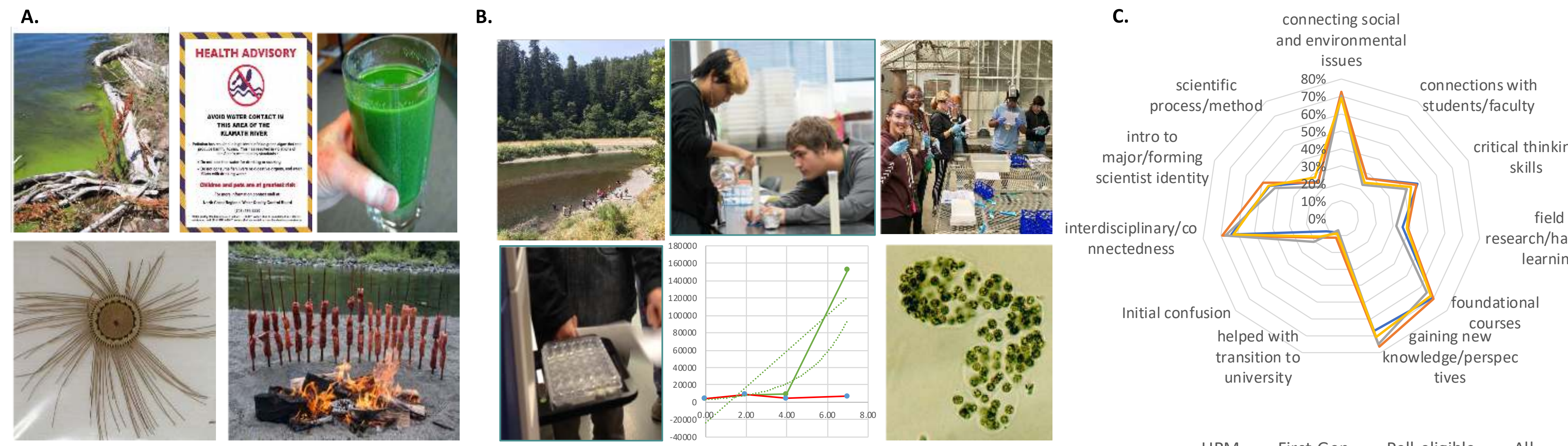


Figure 4: Studying harmful algal blooms of the Klamath River increase student competencies in integrative learning, global and civic learning, and intercultural knowledge. A. In 2002, water quality scientists of the Karuk Tribe discovered levels of *Microcystis aeruginosa* in the reservoirs behind the Klamath Dams nearly 100x > than the recommended levels. These blooms occur during the time of year that Karuk people are in and around the river gathering food, basketry materials, and performing ceremonies. B. Klamath Connection students conduct a basic eutrophication experiment to see if nitrogen is the factor limiting harmful algal blooms downstream of the dams. During the summer immersion, they sample water, add ammonium nitrate, incubate one week and measures the relative fluorescence units (RFUs) of their cultures. The lab is integrated into all of the of the first year STEM courses. The cultures are examined in Introductory Botany, RFUs are graphed in Math, phosphorus levels measured in Chemistry, and data analyzed in the Critical Thinking course. C. Students from each KC cohort submitted reflections on the integrative assignment at the end of their fall semester. The coding of the essays (n=242) revealed the students attained aspects of many of the LEAP competencies including increased awareness of the interconnectedness of disciplines, connections between social and environmental issues, connectedness of foundational STEM courses, and the gain of new knowledge and perspectives, especially regarding Native American issues (survey data not shown).

	Average		t-test
	KC	Non-KC	p-value
Commitment to the Institution	6.54	6.46	0.52
Peer Connections	5.63	4.95	<0.01**
Homesickness: Separation	3.21	2.98	0.19
Homesickness: Distressed	5.34	5.07	0.16
Academic Integration	5.76	5.66	0.45
Social Integration	5.45	5.07	0.02*
Satisfaction with Institution	5.99	5.55	<0.01**
On-Campus Living: Social	5.2	4.55	<0.01**
On-Campus Living: Environmental	5.5	5.18	0.071
On-Campus Living: Roommate	5.8	5.32	0.03*

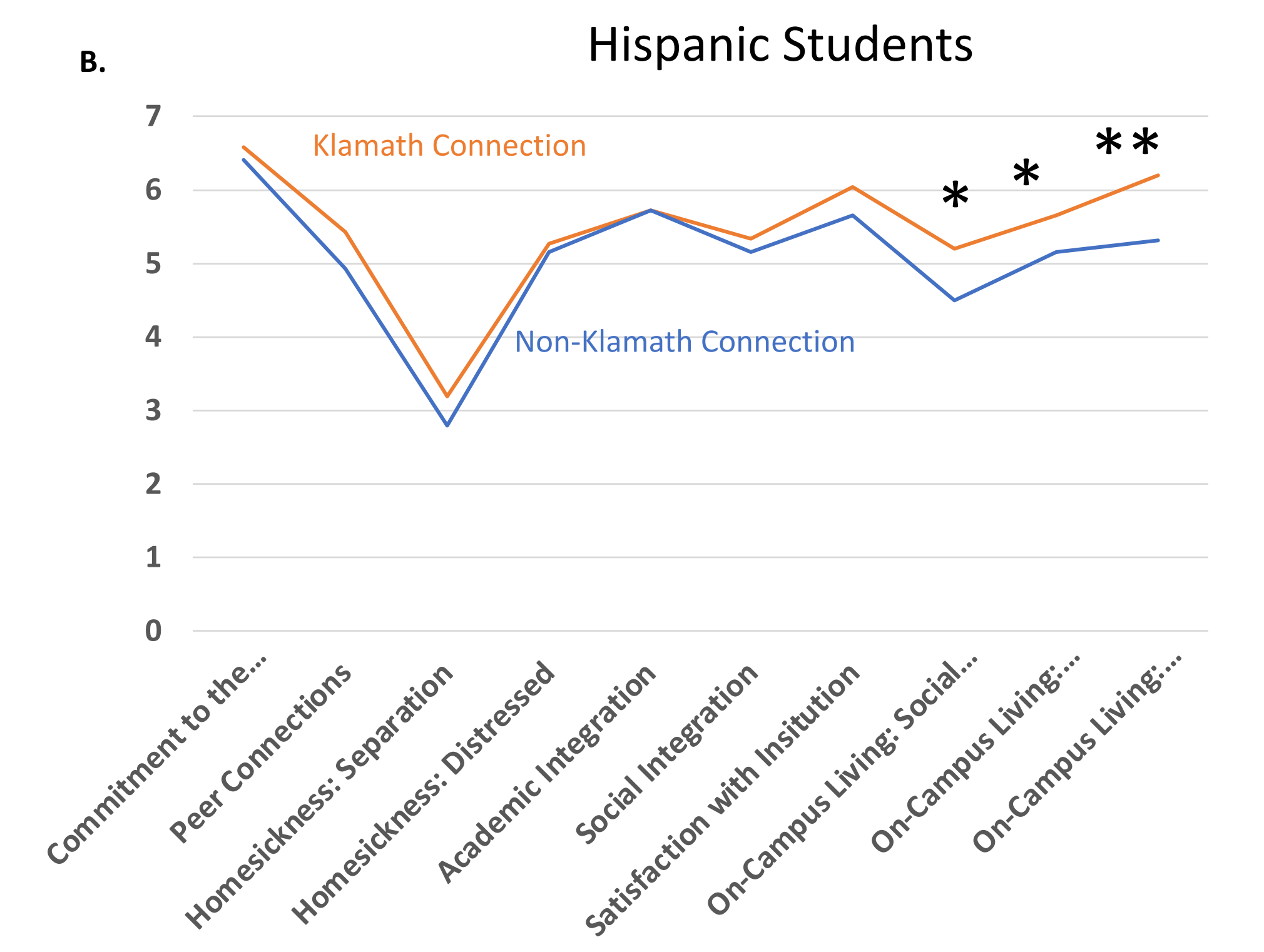


Figure 5: Participation in Klamath Connection Improve some factors of belonging for Hispanic students. All first year students take the Skyfactor Mapworks survey within the first 6 weeks of the fall semester. A. KC participants show significant improvements in five factors: peer connections, social integration, satisfaction with the institution, and two aspects of on-campus living. B. Higher self reported belonging and community for Hispanic students in Klamath Connection than for non-Klamath Hispanic students, especially in social/living factors.

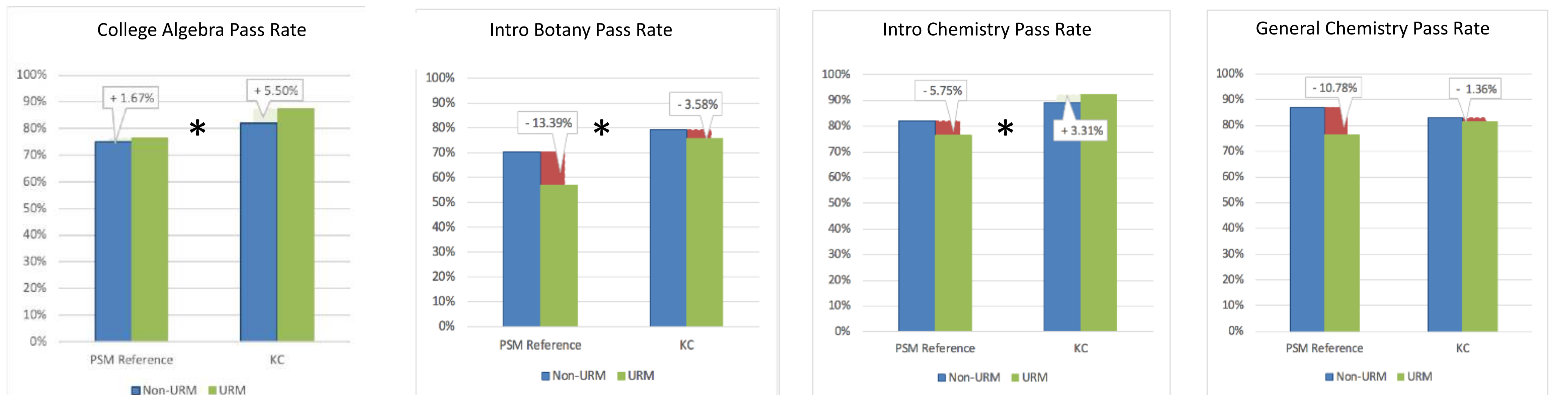


Figure 6: Opportunity gaps in first year math and science laboratory courses close for Klamath Connection participants. Klamath Connection students are block enrolled in Math of the appropriate level and Introduction to Botany in the fall semester. In the spring they are blocked into Introduction to Chemistry or General Chemistry, depending on their major.

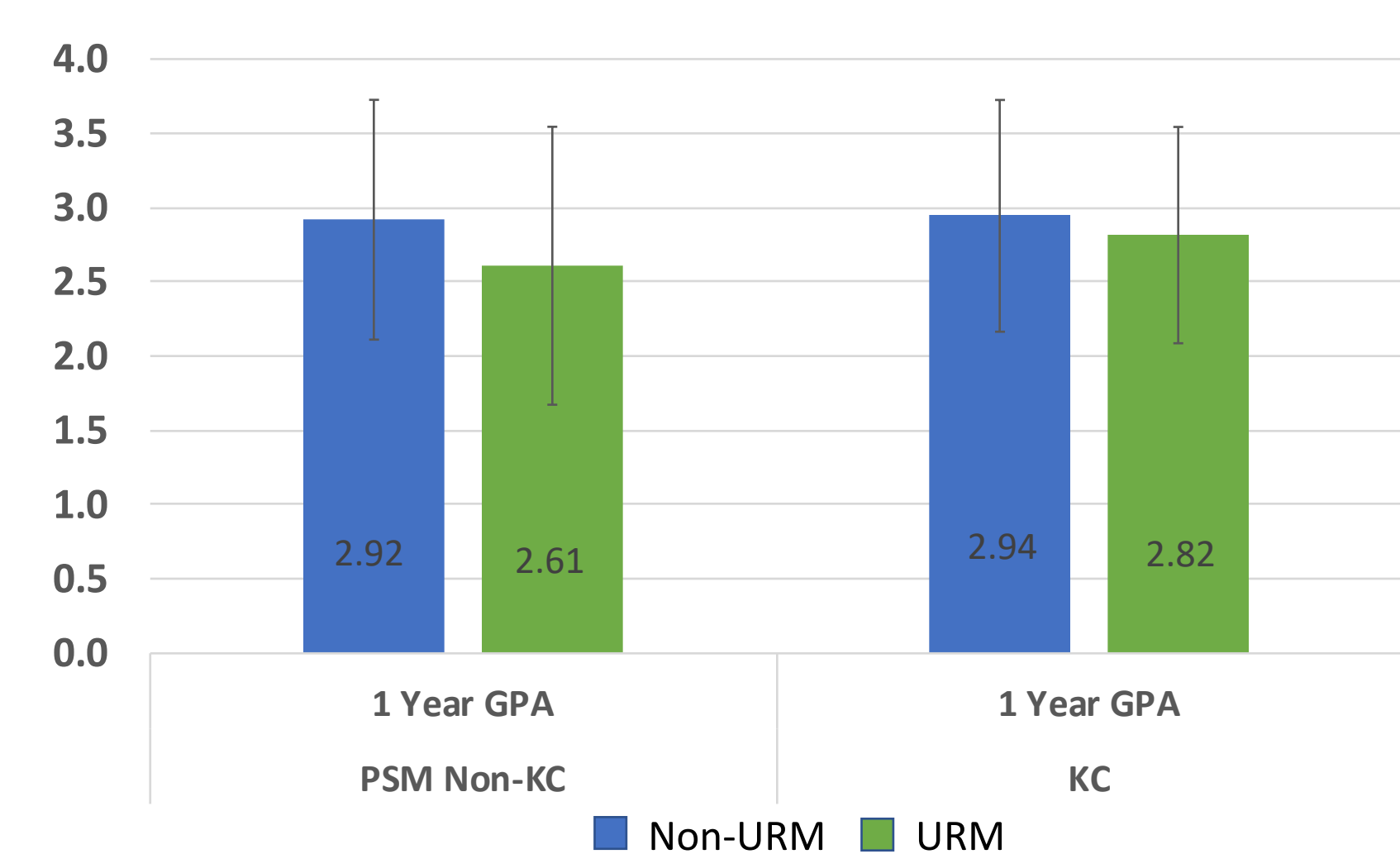


Figure 7: Opportunity Gaps in first year GPA close for Klamath Connection students. Average +/- S.D..

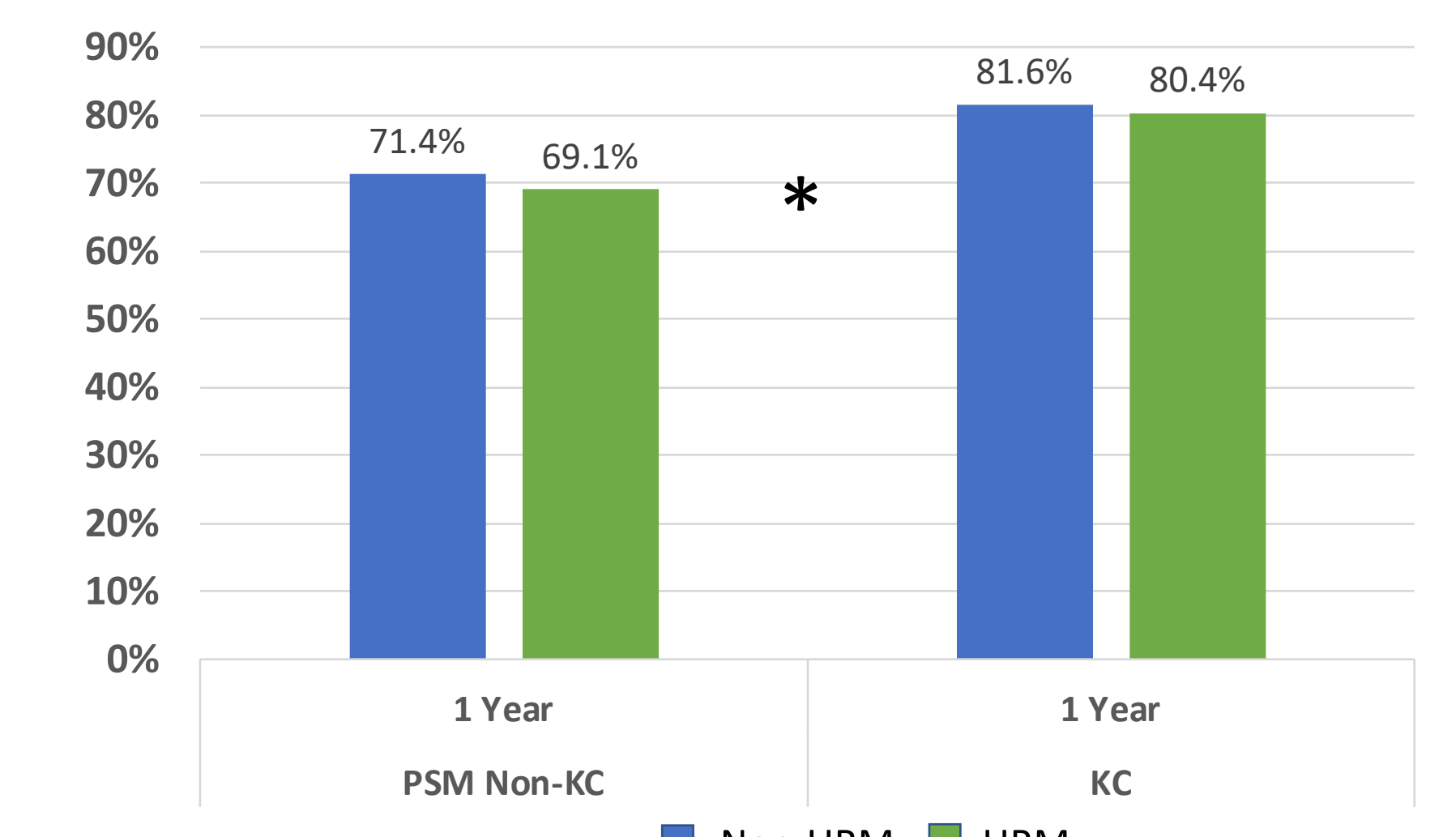


Figure 8: First year retention Improves and opportunity gaps close for Klamath Connection students.

Next Steps

Data from three cohorts of Klamath Connection students suggest that the high impact practices embedded in our place-based learning communities are improving student success in STEM and university retention into the second year. HSU HSI STEM and HHMI IE'17 funding is supporting the launching of new PBLs for all entering STEM first-year students and their institutionalization by AY'20/21.

Acknowledgements



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