ASEE 2022 ANNUAL CONFERENCE Excellence Through Diversity MINNEAPOLIS, MINNESOTA, JUNE 26TH-29TH, 2022 SASEE

Paper ID #38399

Impact of Three Years of Intervention in Culturally Adaptive Pathway to Success on S-STEM Scholars

Eun-young Kang (Chair and Professor)

Dr. Kang has served as PI/Co-PI on several educational and research grants sponsored by NSF programs and local industries such as Lockheed, Northrop Grumman, JPL, and LA County CIO. Dr. Kang has a particular commitment to broadening participation of underrepresented faculty and student groups in computing.

Matthew Jackson (Assistant Professor) (California State University, Los Angeles)

© American Society for Engineering Education, 2022 Powered by www.slayte.com

Impact of Three Years of Intervention in Culturally Adaptive Pathway to Success on S-STEM Scholars

1. Introduction

With a mission to increase the number of academically talented low-income students entering the STEM workforce, the NSF S-STEM program has granted awards to various type of institutions in order to advance our understanding of how "evidence-based curricular and co-curricular activities affect the success, retention, transfer, academic and career pathways, and graduation in STEM of low-income students [1]." To date there are a number of publications that document effective practices and strategies to help talented low-income students succeed in different institutional and disciplinary contexts [2][3]. Our project builds on this literature by providing a combination of an academic scholarship and culturally competent mentorship for students at a Very High-enrolled Hispanic Serving institution (VH-HSI).

Designated as a Title III minority-serving institution, the College of Engineering, Computer Science, and Technology (ECST) at California State University Los Angeles (Cal State LA) has nearly 3,200 student enrolled in Fall 2021, a diverse student body of which 67% are underrepresented minority (URM) students; 56% are first-generation college students; 60% of the students are Pell grant eligible; and 78.3% need to work for more than 20 hours per week to support themselves. In addition to financial disadvantage, many students – including those who are academically talented - have inadequate preparation for the increased rigors of college education through their K-12 education and limited family guidance due to the fact that most students are first generation college students. With support from NSF Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM), the Culturally Adaptive Pathway to Success (CAPS) program aims to build an inclusive pathway to accelerate the graduation for academically talented, low-income students in Engineering (Civil Engineering, Electrical Engineering, and Mechanical Engineering) and Computer Science majors at Cal State LA, which traditionally serves the underrepresented and educationally disadvantaged minority students in the Los Angeles area.

CAPS program aims to build a pathway progressively developing social and career competence in our students via three integrated interventions: (1) Mentor+, a relationally informed advising strategy that encourages students to see their academic work in relation to their families and communities; (2) peer cohorts, providing social support structure for students and enhancing their sense of belonging in engineering and computer science classrooms and beyond; and (3) professional development from faculty who have been trained in difference-education theory, so that they can support students with varying levels of understanding of the antecedents of college success. To ensure success of these interventions, the CAPS program places great emphasis on developing culturally responsive advisement methods and training faculty mentors to facilitate creating a culture of culturally adaptive advising. More details of CAPS interventions can be found in [4][19].

CAPS program is a 5-year project that has started from Fall 2018. The program was designed originally to support two cohorts of 14 scholars from their sophomore to senior years. This paper

presents CAPS program implementation progress during the first three project years (Fall 2018 – Spring/Fall 2021) and major impacts of the program on CAPS scholars. We will also report findings of the following CAPS research questions: (a) how did CAPS interventions affect the development of social belonging and engineering identity of CAPS scholars, and (b) what was the impact of Mentor+ on academic resilience and progress to degree.

2. Three Year Implementations of CAPS Program

Recruitment

The program has established a structured process [4][19] and successfully recruited two cohorts – Cohort 1 of 12 students in Fall 2018 and Cohort 2 of 16 students in Fall 2019. The process highly utilizes several online tools that includes a dedicated web portal to advertise the program and a secure online application platform. While establishing the recruitment process, one concentrated effort was to develop a collaboration with other campus programs and create an efficient way to fill the applicant pool with highly eligible candidates. For Cohort 2 recruitment, the program strengthened the process by actively involving Cohort 1 scholars in reaching out to students. This resulted in recruiting more scholars for Cohort 2 (16 scholars) than Cohort 1 (12 scholars). In Fall 2020, one more scholar, EE Major, was recruited and added to Cohort 2 to fill a vacant space caused by one Cohort 1 scholar transferred to another school. Table 1 shows the distribution of students in the two CAPS cohorts. 27 of 29 recruited scholars (93%) are either URM and/or woman students.

Mentor+: Mentor Training

As indicated by many studies, advisor training is key to successful mentoring programs [5][6]. Our previous work has shown that engineering faculty advisors can learn to provide more holistic advising, with the right professional development program [7][8]. The CAPS program has worked on establishing professional development sessions for Mentor+ advisors, aiming to offer a session per term and disseminate through the college's Advising Council [9] and the college's Teaching and Learning Academy where 10-30 faculty and staff advisors meet 4-5 time per term [10].

Led by Dr. Jackson, social psychologist who is also a Co-PI on the project, the training for faculty mentors focuses on increasing the awareness of the benefits of holding growth mindsets [11][12][13] and developing a culturally responsive mentoring procedure [14]. Each year, the program has provided one or two mentor training sessions following the culturally responsive mentoring strategy. A list of provided mentor trainings is below. The detail mentor training descriptions can be found at [4][19].

Training Term	Торіс
Summer 2018	Growth mindset, Purpose and Value, and Social Belonging
Fall 2018	How to have effective one-on-one meetings with a mentee.
Spring 2019	Leadership
Fall 2019	Intersectionality of various social identities
Spring 2020	Online training: Growth Mindset Revisited
Fall 2020	Peer Mentorship

Fall 2021	Understanding the university/college resources as a part of essential success
	strategies

Mentor+: Scholar Mentoring

All CAPS scholars are paired with trained Mentor+ advisors from sophomore year until graduation. Mentor+ advisors consist of faculty mentors, a Professional Advisor from the college student advising center, and the CAPS PI. Scholars must meet Mentor+ advisor individually at least twice per semester to talk about their educational, personal and professional progress. Upon requests, frequency can increase. In every term, each scholar met a Mentor+ advisor more than once, the CAPS PI, and/or their academic advisors. Mentor+ mentors conducted their individual meetings based on the guideline given through the training session. Scholars also met the professional advisor and the PI to review and plan their academic work, extra-curricular activities, fellowship opportunities, and discuss multi-tasking and time management. On average, each scholar had 4 contact points (for mentor and advisement only). This is significantly higher than the average number of contact points (0 through 2 times) experienced by all other engineering sophomore students.

Other Activities

In addition to core Mentor+ activities, the program provides activities for cohort building and professional development of scholars.

Inspired by prior research on cohort building [15] and peer mentoring [16][17], the program has adapted collaborative cohort activities promoting personal, professional development and strengthening cohort relationship across disciplines. This intervention provides social, academic, and informational support (i.e. how to navigate bureaucracy, how & why to use campus resources). Major cohort gatherings are arranged at least twice per term – one with the designated faculty advisor. The scholar-led peer mentoring meetings have been arranged to build a supportive community focused on leadership development and academic, professional, and personal growth. For example, scholars within the same major have met to study together, review resumes, and share internship information. As for cohort gatherings, the program hosted two gatherings (the orientation and cohort gathering) in each semester, focusing on icebreaker activities, getting to know each other, and sharing coursework information and their personal experiences. As the program progresses, scholars began to build closer relationships with others to some degree, but we have noticed that their cohort building could not mature as scholars were not actively meeting due to the pandemic.

The Difference-Education Intervention is a program model working to overcome the socialclass achievement gap in higher education by introducing background specific dialogue to programming offered incoming first generation undergraduates [20]. Our difference education intervention focuses on preparing scholars to adapt themselves to new challenges. This is an important professional preparation for future career development. Our program embeds this within multiple activities like research activities, professional conference or seminar and field trips, where students are exposed to and experiences in working with a variety of people with different backgrounds and expectations. In addition, the program has provided abundant information for scholars about a series of seminars providing opportunities for discussion and presentations related to student success (e.g., time management, effective communication), research topics, and more from various campus student support centers, engineering research and design team projects (students and faculty), and industry. Students participate in a wide range of activities, including seminars designed to build their portfolio, review students' resume, and enhance required skills such as research, presentation, and interview skills.

3. Program Impact on Scholars and Mentors

Scholar Accomplishments

The program recruited 12 students for Cohort 1 and 17 students for Cohort 2. As of Spring 2022, the program retained 7 out of 12 Cohort 1 scholars and 15 of 17 Cohort 2 scholars. As for Cohort 1, the program lost two scholars during the first project year and three scholars during the second project year. At the beginning of the third project year, the program retained all the scholars. However, two scholars of the second cohort were not retained after Fall 2021 due to their low academic performance. These two students reported that they struggled to adapt to online learning fast and had bad time management partly during the pandemic. Currently, the program supports 22 (=7 + 15) scholars. Table 1 shows the retained number of students by major, gender, and URM.

Table 1. CAPS Cohorts Demographics										
	CAPS Cohorts (as of Spring 2022)									
		Number of Scholars								
		Male			Female					
Cohort	Major	URM		Non-URM		URM		Non-URM		
		Recruited	Retained	Recruited	Retained	Recruite d	Retained	Recruited	Retained	Total
	Civil Engineering							2	1	
	Computer Science	2				1	1	2	2	
1	Electrical Engineering	2	1							
(Fall	Mechanical Engineering	1		1	1			1	1	
2018)	SubTotal (Recruited)	5		1		1		5		12
	SubTotal (Retained or									
	Graduated)								4	7
	Civil Engineering	3	3							
(Eall	Computer Science	4	4			1	1			
2010 &	Electrical Engineering	5	5			1	1			
Fall 2020)	Mechanical Engineering	2	0			1	1			
	SubTotal (Recruited)	14				3				17
	SubTotal (Retained)		12				3		0	15
Total (Re	Total (Recruited)			1		4		5		29
Total (Re	tained or Graduated)		13		1		4		4	22

CAPS students are progressing faster than non-CAPS students academically. Some key outcomes are below:

- 100% of retained scholars are expected to achieve 5-year graduation.
- 5 of 7 Cohort 1 scholars (70%) graduated in 4 years. 1 of 7 graduated in 4.5 years.
- At least 50% scholars of Cohort 2 are on track to graduate in 4 years. This is significant, compared to average graduation rates of 4% achieving 4-year graduation and 23% achieving 5-year graduation (Years: 2015-2020).
- 5 of 6 graduated scholars found their jobs during their senior years or immediately after their graduation; one pursued an MS degree.

Research Findings

The research activities in our program aimed at enhancing the current understanding of four research questions outlined below (R.1 - R.4). To begin answering these questions, both qualitative and quantitative data collections occurred each year. An online survey was administered to the cohort of CAPS scholars after completion of each program's year, assessing the impact of the CAPS program, engineering/computer science identity, and career plans. We also conducted a survey with a matched group of non-CAPS students as well. The match criteria were fulfilling the recruitment requirements for the SSTEM scholarship group. Specifically, we recruited students of the same class standing to our two cohorts in identical majors with a minimum Term GPA of 3.0 in both fall and spring of their freshman year. Matched students also had completed the prerequisite math and physics-related courses required of CAPS scholars.

As for focus group meetings, the scholar focus groups consisted of a semi-structured discussion with a moderator, held at the end of each semester. The number of participants ranged from 9-18 within each group meeting. The focus groups were moderated by co-PI Jackson, and attended by at least one external evaluator. The questions answered converged around four themes: *the financial impact of the scholarship, the students' relationships with their mentors*, the students' *perceptions of the CAPS program*, and the students' *recommendations for future program events*. CAPS mentor focus groups have also been conducted in the form of a semi-structured discussion with a moderator. The questions answered converged around three themes: the mentors' relationships with their mentors is the mentors' perceptions of the caps program events. The findings of the scholarship and the mentors' relationships with their mentors are reported below, as they relate to each research question.

(R.1a) What are students' perceptions of the obstacles they face and the resources available to them? A primary early concern among scholars was juggling financial and academic concerns. This concern, a consistent theme in scholar interviews, was expressed by both cohorts in the first year of the scholarship (i.e. Cohort 1: Winter 2018; Cohort 2 Winter 2019). The scholarship was immediately helpful in addressing these concerns, as multiple scholars reported being able to quit extra jobs, or work fewer hours. One scholar reported that their parents could work fewer hours, alleviating stress for the entire family. Beyond financial concerns, early during the scholarship CAPS scholars expressed moderate confidence in professional and social skills. Professionally, scholars requested better training on how to prepare their CV to later be competitive in the job market. Further, scholars were unsure on how to develop relationships with mentors, and what questions to ask to further their development. One scholar expressed the desire to develop deeper relationships with mentors so they could get "non sugar-coated advice." Similarly, multiple scholars reported a lack of ability to connect with other students and the hope that CAPS would help them and form supportive relationships. Overall, the early concerns demonstrated that scholars felt a lack of clarity on how to be successful was a major obstacle. Importantly, while resources such as mentors are available, scholars felt low confidence in their knowledge of how and when to access those resources. Scholars benefited from support in understanding how to appropriately seek information and build relationships. By the third year of the scholarship (i.e. Cohort 1: Summer 2020; Cohort 2 Summer 2021), when scholars were entering their senior year of their academic careers, Scholars perceived that obstacles had shifted to preparing for and

mastering the job market. Scholars expressed fewer concerns about how to be successful or build relationships. Now, lacking specific professional skills became seen as the biggest obstacle, and particularly skills that related to thriving during COVID (e.g. How does one focus when taking classes in a busy home context? What are the norms of online interviews?) Because of the impact of COVID forcing scholars to contend with new learning and communication styles, scholars consistently listed time management as an obstacle, across early and later years. Scholars reported a wide variety of resources used to address these challenges, including support from loved ones, peer support, study groups, calendars/schedules, and tutors. However, as the obstacles became less generic (e.g., how to be a good student) and more specific to particular career paths (how do I get a job at company X?), the needed resources narrowed to those with expertise in professional engineering and Computer science.

(R.1b) <u>What are their perceptions of social belonging and their identity as engineers?</u> As part of the annual online survey administered to CAPS scholars, participants were asked to self-report their professional identity. On a Likert scale of 1 to 5 (1=None at all; 5=A great deal), participants were asked how much they identify with being an engineer or computer scientist as a part of who they are. Trends across the first three years of survey data consistently reveal modestly higher engineering identity for CAPS scholars relative to their matched peers (Table 2).

Table 2. The professional identity of CAPS scholars vs. a	CAPS	NON-CAPS	
matched comparison group of scholars			
Professional Identity: e.g., "I have come to think of	(1 = not at all, 5 = a great deal)		
myself as an 'engineer' or 'computer scientist' "			
<u>2021:</u>	4.02	3.97	
2020:	4.10	3.83	
2019:	3.90	3.87	

(R.2) <u>How does participating in CAPS mentoring affect their academic achievement and their preferences for pursuing challenging occupations and research</u>? We compared the GPA's of CAPS scholars to peers who were matched on specific academic accomplishments (i.e. course progression). However, due to privacy concerns, we were not able to obtain financial need information from the matched group. Thus, whereas 100% of CAPS scholars have demonstrated financial hardship, the same cannot be said of their otherwise matched peers. As reflected in Table 3, the GPA of CAPS scholars began slightly below their matched peers after one year in the CAPS program, but by the second year of the CAPS program, CAPS scholars had surpassed their peers in GPA. This trend continued in the third year of the program, with CAPS scholars having a higher GPA than their peers. Further, CAPS scholars reported a higher commitment to careers associated with their academic major relative to their matched peers at the end of their third year in the scholarship (i.e. the end of senior year), despite a lower intention to attend graduate school (Table 4).

Table 3. The GPA of CAPS scholars vs. the comparison group of scholars	CAPS	NON CAPS
Spring 2018 GPA	3.44	3.52
Spring 2019 GPA	3.31	3.45
Spring 2020 GPA	3.45	3.38

Spring 2021 GPA	3.44	3.34

Table 4. The career plans of CAPS scholars vs. the comparison group of scholars after Year 3	CAPS	NON CAPS
Career plans	(1 = not at all, 5 =	= a great deal)
Intend an E/CS career	4.83	4.5
Committed to E/CS career	4.83	4.25
Intend to apply to Grad school	3.5	4.0
Interest in Grad school	4.0	4.0

(R.3) What is the relationship, if any, between their perceptions and academic outcomes? Partial correlations predicting scholars' end-of-year GPA from the amount of quality feedback from mentors, while controlling for start-of-year GPA were not significant (r = -.14, p = .547). The same is true of partial correlations predicting end-of-year GPA from engineering identity, while controlling for start-of-year GPA trend in the predicted direction, but do not approach significance (r = .33, p = .168). In our attempts to understand the mechanisms of the striking improvements in student success of CAPS scholars relative to their peers, no single predictor theorized to be a mechanism was statistically significant. This suggests that the CAPS program may provide a holistic experience that does not disproportionately rely on a main driver. It may be that the totality of experiences is what is providing the demonstrated benefits. Planned interviews with CAPS alumni are being developed to either support this holistic interpretation, or further disentangle the primary drivers of greater success.

(R.4) What is the impact on the trained advisors? Our research mentors demonstrated growth in their ability to engage with students due to their participation in CAPS. During early focus groups, mentors reported a benefit of having dedicated time to discuss the mentorship with their peers and borrow best practices from each other. For example, 2 out of 4 mentors reported immediate success in establishing relationships with their mentees, building on their expertise developed in roles as mentors in previous programs (Winter 2018 focus group). However, the other two mentors mentioned initial struggles connecting with students. These latter mentors cited discomfort around discussing the personal lives of their students, fearing the student's perception that they were overstepping their mentorship role. The two mentors that had early success building relationships then shared specific examples of their success with the group, focused on revealing one's own background (i.e., sharing stories of one's own immigration, revealing one's own college journey and struggles) as a means of building rapport with mentees. One mentor explained his strategy of building trust by only talking about family, and not academics, when first meeting mentees. This exchange of experiences between mentors provided an important benefit of intra-group training in mentorship for the two remaining mentors - an opportunity that may not have taken place outside of the scholarship context.

Further, mentors developed higher standards for CAPS scholars as compared to non-CAPS mentees. "*We* have higher expectations...," one mentor noted about the scholars, adding that the mentors "challenge them more, because of course, their performance." Mentors reported that CAPS scholars are more engaged during meetings, noting "lots of questions about internships and resume-building," and observing that scholars were more likely to talk about internships than

other students who are not scholars in the CAPS program. Such increased expectation for students has been previously shown to be an indicator of student success [18].

Mentors also reported increased skill in developing peer mentors. Mentors reported positioning the first cohort of scholars to help mentor the second cohort when they first joined. The CAPS cohort structure provided an opportunity that may not have otherwise presented itself to practice directly connecting more experienced and less experienced students.

Early Longitudinal Analyses

Examining the academic progress of CAPS students as compared to their peers, CAPS students performed better and graduated within 4.5 years, as compared to the institutional average of 21.1% and the College of ECST average of 11.4%.

CAPS students earned a mean GPA of 3.375 over the term of this project, compared to 3.425 for the control group. However, comparing 4-year graduation rates, 60% of Cohort 1 graduated in 4.5 years, while only 43% of the control group for that cohort graduated in the same time frame. Thus, while the CAPS students may have earned a slightly lower GPA, they graduated at a faster rate than the non-CAPS students. Early indicators show that 50% of CAPS Cohort 2 scholars are on track to graduate in 4 years.

4. Assessment and Evaluation

This section focuses on results of formative evaluation performed since Fall 2021. Formative evaluation data was gathered by monitoring the implementation of the CAPS program activities conducted to achieve the program goals and by monitoring the implementation of the Mentor+ advisement and mentoring to participating scholars, and other student support activities. Due to the Covid-19 pandemic shut down and later shift to virtual classes, many activities normally held were not scheduled. Between August 2021 and December 2021, three main CAPS activities were conducted. These activities included CAPS Graduation Recognition event (virtual), CAPS Orientation for Students and Faculty Mentors, CAPS Mentor Focus Group, and the CAPS student focus group.

CAPS Graduation Recognition events was held virtually on September 10, 2021. Fifteen CAPS scholars and seven faculty/staff attended and celebrated achievements of Cohort 1 scholars who graduated in Spring/Summer 2021. Four of six graduated scholars attended the event and were individually recognized by their mentors. These scholars shared their experience with the CAPS program and unanimously commented that scholarships helped them graduate faster and enabled them to focus on study without worrying (less worrying) about financial problems.

During the Fall CAPS Orientation held virtually on October 29, 2021, sixteen CAPS students attended and 89% completed a post-event survey.

Eleven students completed the survey. All students (100%) rated the orientation as "good", "very good", or "excellent". Overall, the students felt the event was helpful or extremely helpful. They felt comfortable talking with peers or mentors about how they were feeling, especially after the shutdown. Only one student said that he was neutral about feeling

comfortable sharing. The most interesting results emerged from the qualitative responses. 100% of the student participants said they were experiencing a lack of motivation, 75% stated that they felt isolated, 58% felt distracted and most stated that they had little to no personal space. Because of the composition of our cohorts, due to limitations in their homes, students did not have a dedicated quiet space to work. One student commented that it would be nice to have a room allocated for the CAPS students to use to meet with peers, study, or just collaborate. Finally, 25% of the student respondents stated that they had feelings of depression. 100% of the student participants mentioned in their comments that they wished for more collaboration and interaction with their peers; possibly due to the long period of inaction during the shutdown. All of the students noted that they would love to see more activities related to professional development and what to expect after graduation.

Focus groups were held to gather qualitative data. Faculty mentors participated in a focus group held on December 10, 2021. 50% of the faculty mentors participating in CAPS attended the focus group. Mentors described the challenges faced during the return to classes, albeit virtually, and how they had far fewer meetings with scholars than in past semesters. One mentor noted that because most of the students are graduating in Spring 2022, their focus was on Senior Design and post-graduation plans instead of advising, as that work "is already done." Job placement was the primary conversation between mentors and students during this term.

At the end of the fall semester 2021, a student focus group was also conducted to collect student feedback on their experiences during the fall semester and post-pandemic shutdown. Nine CAPS students participated in the focus group. Students reported overall good relationships with faculty mentors; they felt comfortable reaching out and discussing academic and non-academic subjects with their mentors. However, due to Covid-19, interaction between mentors and students was virtual and two students reported infrequent to no contact with mentors.

Students were also asked about their aspects of the program that need more improvement and an overall consensus by participants was the desire for more in-person programming. The pandemic shutdown reduced the number of program activities; students commented that this lack of programming was a detriment. Several scholars from Cohort 2, who are graduating in Spring 2022, requested programming that linked students to post-college experiences, either graduate school opportunities or career. Students wished to see an expansion of activities to include presentations or discussions about what comes next after graduation, how to handle graduate school rejections, or generally how to prepare for life after college.

5. Conclusions and future work

This paper focused on describing research findings after three years of the program. In summary, the research analysis reported that the program made a consistently positive impact on students to have strong engineering identity, sense of social belonging, and career interest in Engineering and Computer Science. Also, the data show that while performing competitively, CAPS scholars graduated faster than control group students who are also academically talented. As mentioned, in our attempts to identify salient factors enabled success of CAPS scholars relative to their

peers, no single factor was statistically significant. We postulate that the CAPS program may provide a holistic experience that does not disproportionately rely on a main driver. It may be that the totality of experiences is what is providing the demonstrated benefits. As we continue to conduct longitudinal research, we hope to produce findings to either support this holistic interpretation, or further disentangle the primary drivers of greater success. Our findings will help enhance the CAPS program and establish a sustainable Scholars Support Program at the university, which can be implemented with scholarships funded by other sources, and which can be transferred to similar culturally diverse institutions to increase success for students who have socio-economic challenges.

Acknowledgement

This material is based upon work supported by the National Science Foundation under Grant No. 1742614.

References

[1] NSF Scholarships in Science, Technology, Engineering, and Mathematics Program (S-STEM), <u>https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5257.</u>

[2] Scott Steinbrink, Karinna M. Vernaza, Barry J. Brinkman, and Lin Zhao, "A Rolling Stone: Evaluation of one NSF S-STEM Program through Successive Grant Periods," In Proc. ASEE Annual Conference, June 2018.

[3] Chip W Ferguson, Paul M Yanik, Yanjun Yan and Sudhir Kaul, "NSF S-STEM Scholarship Program Initiative via Recruitment, Innovation, and Transformation: SPIRIT Program Year-One Results," In Proc. ASEE Annual Conference, June 2016.

[4] Eun-Young Kang, Jane Dong, Mathew Jackson, and Emily Allen, "Developing a Culturally Adaptive Pathway to Success," ASEE Annual Conference, June 2019.

[5] Shultz, E., Colton, G., Colton, C., "The Adventor Program: Advisement and Mentoring for Students of Color in Higher Education," Journal of Humanistic Counseling, Education and Development, v40 n2 p208-18, 2001.

[6] Rodgers, K. et al., "A Real PLUSS: An Intrusive Advising Program for Underprepared STEM Students," NACADA Journal Volume 34(1), 2014.

[7] Allen, E., Castillo F., Schiorring, E. "Starting a New Conversation: An Engineering Faculty Advisor Development Program," Procs. Frontiers in Education Conference, Seattle, WA, 2012.

[8] Allen, E., Castillo F., Schiorring, E. "The Reflective Engineering Advisor: a Paradigm for Learning-Centered Student Advising," Procs. American Society for Engineering Education Annual Conf., Atlanta, GA, 2013.

[9] Dong, J., Kang, E., & Hidalgo, F., "Building a Collaborative Advising Structure through ECST Advising Council," presented at ASEE PSW 2019 Conference, Poster Symposium, Los Angeles, USA, 2019.

[10] Dong, J., & Allen, E., "Work-in-Progress: Building an Inclusive Faculty Community Through the ECST Teaching and Learning Academy," ASEE Annual Conference, Florida, June 2019.

[11] Aronson, J., Fried, C. B., & Good, C. (2002). "Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence," Journal of Experimental Social Psychology, 38(2), 113-125.

[12] Dweck, C.S. (2006). Mindset: The new psychology of success. New York: Ballantine.

[13] Rattan, A., Good, C., & Dweck, C. S. (2012). "It's ok—Not everyone can be good at math: Instructors with an entity theory comfort (and demotivate) students," Journal of Experimental Social Psychology, 48, 731-737.

[14] 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.

[15] Tuberty, J., Anagnos, T., and Allen, E.L., "Leveraging Scholarships to Advance Student Success," Proceedings ASEE Zone IV Conference, Long Beach, CA, 2014.

[16] Rosenthal, K. I., & Shinebarger, S. H., "Peer Mentors: Helping Bridge the Advising Gap," About Campus, 15.1 (2012): 24-27.

[17] Heirdsfield, A. M., Walker, S., Walsh, K., & Wilss, L., "Peer mentoring for first-year teacher education students: The mentors' experience," Mentoring & Tutoring: Partnership in Learning, 16.2 (2008):109–124.

[18] Rosenthal, R., & Jacobson, L. (1968). Pygmalion in the classroom. *The urban review*, *3*(1), 16-20.

[19] E. Kang, Dong, J., M. Jackson, E. Allen, and D. Galvan. (2020). Developing a Culturally Adaptive Pathway to Success: Implementation Progress and Project Findings. ASEE's Virtual Conference.

[20] Stephens, N.M., Hamedani, M. H., & Destin, M. (2014). Closing the social-class achievement gap: A difference-education intervention improves first-generation students' academic performance and all students' college transition. Psychological Science, 25(4), 943-953. doi: 10.1177/0956797613518349.