Design, Development, and Impact of Educational Modules to Broaden Academic Research Cultures (EMBARC) for STEMM Career Development: A Pilot Project

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Abstract: Though historically marginalized and first-generation college students aspire to attend college, educational equity gaps remain in transfer and pursuit of graduate degrees of science, technology, engineering, math, and medicine (STEMM). The purpose of this paper is to describe the process and impact of the Educational Modules to Broaden Academic Research Cultures (EMBARC) to leverage students' community cultural wealth (CCW) and address cultural mismatch (CM) – the misalignment between the interdependent values shaped by one's family or culture and the independent values emphasized in Western post-secondary institutions and STEMM fields. Findings from evaluation of the program suggests that leveraging CCW and CM in developing educational modules can contribute to historically marginalized students' education, career and persistence in STEMM. Findings also illustrated that the modules connect students to resources as well as their cultural wealth and ancestral strength.

Keywords: cultural mismatch, community cultural wealth, module development, community college students, STEMM education

Introduction

College enrollment of historically marginalized students (including students from African American/Black, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander, and Latinx backgrounds) has nearly doubled in the last 30 years [1], [2] and roughly half of historically marginalized students begin their post-secondary education at a community college [3]. However, historically marginalized community college students often lag behind their non- historically marginalized community college peers in transfer from 2- to 4-year institutions [1], [4], [5]. For example, nationally, of Latinx students who graduate from high school and pursue postsecondary education, 41% will enroll in an associate degree program, compared to 31% white and 30% Asian students; and only 1 in 10 Latinx

student who started at a community college will complete their degree after transferring to a 4-year institution, compared to 1 in 4 Asian and 1 in 5 white students [3], [6], [7]. Additionally, historically marginalized students who do transfer are less likely to pursue a science, technology, engineering, math, and medicine (STEMM) science major or career [8], [9], [10]. These general patterns suggest that, though historically marginalized students aspire to attend college, there are challenges in connecting them to a 4-year college environment and STEMM fields of study. This is often because the majority of historically marginalized students are first-generation college students whose parents had limited exposure to college [11], making them more likely to experience cultural mismatch (CM). CM refers to the misalignment between the interdependent values shaped by one's family or culture (e.g., "work together") and the independent values emphasized in Western post-secondary institutions and STEMM fields (e.g., "do your own thing") [12], which contribute to educational disparities [13], [14], [15]. It can be experienced broadly [12] or in specific contexts (e.g., home-school cultural value mismatch – a mismatch between interdependent family obligations and independent academic obligations; peer-peer cultural value mismatch – a mismatch between interdependent and independent oriented peers) [14], [16], and can cause discomfort, negatively impacting students' health and academic development, thereby contributing to educational disparities [12], [13], [14], [15], [17]. CM is particularly relevant at the community college (CC) level and among STEMM majors, which are often perceived as individualistic and competitive [18], [19].

In seeking to ameliorate CM, it is important to recognize the strengths of historically marginalized students. Community Cultural Wealth (CCW) [20] highlights several forms of capital (aspirational, linguistic, familial, social, navigational, resistant) that historically marginalized students bring from their families and communities, often overlooked in higher education, but linked in empirical work to a range of cognitive, social, and emotional skills, as well as academic success [20], [21], [22], [23], [24]. Thus, the purpose of the Educational Modules to Broaden Academic Research Cultures (EMBARC) program was to invite, retain, and support historically marginalized community college students in STEMM through innovative, culturally-informed educational modules. These modules were delivered as in-person or online synchronous workshops, and leveraged Cultural Mismatch Theory (CMT) [12], [15], [18] and Community Cultural Wealth (CCW) [19]. By embedding CMT and CCW into the modules, historically marginalized students recognize cultural barriers and their strengths in higher education through interactive discussions, while also gaining strategies to harmonize home and academic cultures and draw on the assets they bring from their families, communities, and ancestors.

Drawing on these frameworks, the EMBARC team developed modules to form an integrated learning experience for historically marginalized community college students and by community college students. These modules provide students with knowledge, skills, resources, and role models for developing meaningful connections between home, academic, and science contexts. Similar to previous work on the development and evaluation of professional development modules [25]. [26], [27], [28], learning is understood as social and cultural acts situated in contexts where meaning is constructed and negotiated. That is, learners draw on their backgrounds and experiences to make sense of new information while shaping their understanding in dialogue with others. The goal of this report is to discuss the module development process through three stages: module conceptualization (Stage 1), revision (Stage 2), and evaluation (Stage 3). Stage 3 incorporates collaboration with community college students, making the modules ecologically connected to the intended population.

It is important to mention that there are existing CM and CCW interventions that have set foundations for our work. In tackling CM at a broader level, Stephens and colleagues' [12] work at private and research centered institutions have demonstrated that receiving an admissions letter embedded with interdependent messages ("we") rather than independent messages ("you"), fosters positive health and academic

outcomes [12], [13]. The first two authors of this paper piloted the effectiveness of a 10-minute intervention among historically marginalized students aimed at addressing cultural value mismatches between home and academic cultures, ultimately increasing science self-efficacy [16]. The results showed that the cultural mismatch theory intervention improved students' science self-efficacy compared to a control group, which only provided general strategies for navigating educational resources like student support programs and offices. More recently, researchers have used implicit means to make historically marginalized students aware of their social and navigational capital (components of CCW) in higher education by providing a list of resources (social capital) and visual, instructional tools for exercising them (navigational capital) [29], [30]. They discovered that receiving this information versus not receiving the information yielded higher grade point average and lower drop rates. At a broader level, Building Infrastructure Leading to Diversity (BUILD) Promoting Opportunities for Diversity in Education and Research (PODER), an Undergraduate Research Experience Program with foundations in Critical Race Theory (CRT), provided an array of resources, along with research and professional development training to historically marginalized students [31]. One aspect of their training involved making students aware of the experiential knowledge (familial capital) derived from their families and communities back at home. Latinx students in their program demonstrated a strong sense of science identity [31], [32]. Taken together, these interventions are fruitful in setting the stage for the power of cultivating a cultural "match" and fostering awareness of one's CCW. EMBARC extends the work by providing students with a toolkit for STEMM success that (a) makes CM and CCW explicit to students, (b) provides an array of resources and "how-to" guides relevant to navigating the culture of science contexts, (c) incorporates live discussions of students' lived experiences, and (d) provides one-on-one mentorship.

Methods

Stage 1: Module Conceptualization (Format: Summer-Intensive [SI] 2023)

In summer 2023, EMBARC leadership team, staff, partners, and six university faculty mentors from historically marginalized backgrounds and/or with a history of successful mentoring historically marginalized students in navigating successful STEMM educations and careers co-developed the original 12 modules to be delivered in a one-week summer-intensive (SI) format (Table 1). Partners who informed EMBARC included the Health Equity Research & Education (HERE) Center STEM Transfer and Research Training (START) Badge Project and Building Infrastructure Leading to Diversity (BUILD) Promoting Opportunities for Diversity in Education and Research (PODER), which had developed modules for historically marginalized STEMM undergraduates informed by Critical Race Theory (CRT). CCW reexamines traditional views of cultural capital through a CRT lens [19]. EMBARC aims to further sustain and expand these opportunities by inviting, retaining, and supporting community college students through culturally-informed, accessible, and rigorously tested educational modules. By learning the scripts and "rules" of scientific social systems, we expect EMBARC students to more strongly internalize the values of the scientific community, identify as a scientist, and persist in a scientific career [33].

Table 1. Module Descriptions and Developer Information from Stage 1

Module Type	Module Titles
Cultural Framework Modules	• Module 1: Cultural Mismatch (Dr. Yolanda Vasquez-Salgado, Psychology) • Module 2: Community Cultural Wealth (Dr. Yolanda Vasquez-Salgado, Psychology)
Science Exploration and Ancestral Strength Motivation	• Module 3: Biobehavioral Research Careers 101 (Amber Bui & Veronica Villaseñor, HERE START Office) • Module 4: Research Opportunities and Programs: What is Right for You? (Amber Bui & Veronica Villaseñor, HERE START Office) • Module 5: Recognizing Strength of our Ancestors to Fuel Achievement in STEMM (Dr. Yolanda Vasquez-Salgado, Psychology)

Professional Development Modules	• Module 6: Discovering Your Inner Scientist (Dr. Heidi Schumacher, Gender and Women's Studies & Division of Academic Affairs) • Module 7: Communicating with Faculty and Science Networking (Dr. Scott Plunkett, Psychology) • Module 8: Organizing Your Path to STEMM Success (Dr. Shu-Sha Angie Guan, Child and Adolescent Development in collaboration with Dr. Gabriela Chavira, Psychology)
Research Skills Modules	• Module 9: Exercising the Scientific Method to Investigate and Resolve Issues in one's Community: Design, Rigor and Reproducibility (Dr. Mariano Loza Coll, Biology) • Module 10: Team Science: Working with Multidisciplinary and Multicultural Groups (Dr. Claudia Toledo-Corral, Health Sciences • Module 11: Visual Presentation of a Community Partnered Participatory Research Project (Dr. Kacie Blackman, Health Sciences)
Transfer Logistics Modules	• Module 12: Transfer Process and Transition to New Contexts (Dr. Dimpal Jain, Educational Leadership and Policy Studies)

Stage 2: Module Revision (Format: Across-Year [AY] Spring 2024)

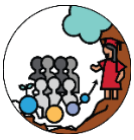
SI 2023 modules were revised in consultation with community college students trained during SI 2023, our larger leadership team (Co-Investigators Dr. Jared Ashcroft, American Psychological Association [APA] leads Dr. Kelley Haynes-Mendez and Rhonda Swales-Jefferson, Los Angeles Community College District [LACCD] representatives from Educational Programs and Institutional Effectiveness [EPIE]), and with university partners (e.g., HERE Center, START Office, Office of Undergraduate Research [OUR]). For example, in consultation with the LACCD, the EMBARC team made adjustments to the original 12 modules from summer for delivery to community college students on their home campuses across the academic year (AY) in spring 2024. The original 12 developed modules were redeveloped into 8 modules for greater feasibility. In addition, the American Psychological Association (APA) and LACCD recommended greater incorporation of student mental health resources and information about addressing microaggressions, which were subsequently incorporated into Module 1 and 7, respectively. AY modules were delivered in-person as well as online synchronous via Zoom, as we found the latter provided greater accessibility. Below are the descriptions and student learning objectives for the 8 modules from Stage 2, along with their corresponding module badges.

Cultural Framework Modules

Module 1: Cultural Barriers & Strengths in Higher Education

- Understand cultural mismatch (a barrier) & community cultural wealth (a strength) in the context of higher education
- Define different types of cultural mismatch & wealth
- Identify & practice strategies for overcoming mismatch
- Identify & practice strategies for exercising one's cultural wealth

Module 2: Ancestral Strength as Fuel for Achievement in STEMM



- Recognize that our ancestors were trailblazers
- Understand that being in STEMM makes you a trailblazer too
- Analyze and contextualize strength of our ancestors in navigating as trailblazers via lived experiences (students, faculty)
- Recognize the impact you are making by pursuing a STEMM education and career

STEMM Transfer and Exploration Modules

Module 3: Planning Your Path to STEMM Success

- Describe the importance of academic organization and planning
- Define an individual development plan and practice developing SMART goals
- Explore how cultural backgrounds and perspectives influence career development
- Discuss how to incorporate CM and CCW in career planning

Module 4: Your Guide to the Transfer Process & What to Expect After

- Understand the transfer function in California higher education
- Compare the application process to CSU, UC, and private institutions
- Unpack the "hidden curriculum"
- Discuss community success strategies and ways to leverage EMBARC community

Professional Development Modules

Module 5: How to Build a Resume and CV for STEMM Success

- Define a resume and curriculum vitae (CV) and the structures of each
- Identify tips and best practices to creating your own resume/CV
- Describe how cultural biases can shape resume review and hiring
- Apply culturally-informed approaches for tailoring resumes/CVs to diverse audiences

Module 6: How to Present Yourself and Your Research Professionally

- Make your authentic self shine
- Devise a research question
- Devise an elevator pitch
- Explore strategies for cultural connection and networking

Research Skills & Careers Modules

Module 7: Team Science: Succeeding in Diverse Groups and Labs

- Define team science and why diversity of perspectives is important to innovation
- Identify types of teams and effective practices
- Describe microaggressions and their impact on team dynamics and individual well-being
- Reflect on how to create inclusive and respectful team environments

Module 8: How to Secure Research Opportunities & Careers

- Define "STEMM" and identify STEMM majors and careers
- Compare STEMM graduate degrees and educational options
- Describe steps to getting involved in research
- Define "culture of science" and discuss strategies to navigate

Stage 3: Module Evaluation (SI 2023 and AY 2024)

Summer-Intensive (SI) 2023 Modules. Pre- and post-program test surveys were completed by the first cohort of EMBARC peer mentors (n = 8) recruited from community colleges, as part of the summer program held in July—August of 2023. The peer mentors self-identified as African American, Asian American, Latinx, and Middle Eastern/North African. Participants' (M_{age} = 22, SD = 5.63) pre-test responses (start of Week 1) were matched with their post-test responses (end of Week 1). The average time taken to complete the survey was 30-minutes. Full measures from previous research included global self-efficacy (e.g., "I can always manage to solve difficult problems," "I can remain calm when facing difficulties because I can rely on my coping abilities") [34], research self-efficacy (e.g., "How much confidence do you have in your ability to..." "explain your research topic to other scientists," "pursue a graduate degree in science") [35], science identity (e.g., "felt like a scientists," "interacted with scientists from outside my school," "felt part of a scientific community"), science career intention (i.e., "How likely do you think you are to pursue a career in science, technology, engineering or math [STEM])".

Recruitment efforts started with reaching out to staff, administrators, and faculty from various student services programs, who would then support with distributing and sharing recruitment flyers to their students via email broadcast, social media, and word of mouth. The first author also presented in classrooms. Selected peer mentors had been recipients of each of the modules in Week 1 of summer training. In Weeks 2 and 3, they were trained to deliver one of the modules across the following academic year. Across Week 1, approximately two of the one-hour 12 modules were presented each day between organized community building, movement, and reflection activities (e.g., lab tours, lunch with socializing). After the post-test in Week 1, the students received an EMBARC T-Shirt, ranked the modules and identified strengths and suggestions for improvement for each module. At the start of Week 2, students were informed about the module they would deliver throughout the academic year. Across Weeks 2 and 3, students reviewed, revised and practiced their assigned module individually and in groups between continued community building and introduction to peer mentor training (e.g., coordinated Badge Project Peer Mentor activities, supporting students in crisis presentation from University Counseling Services) as well as module development resources (e.g., meeting the first two authors and module developers). Each student received a stipend for completion of the summer training, paid stipends payments across the academic year for their participation as EMBARC peer mentors, and received a graduation stole and 8 workshop badges at a culmination event.

Academic-Year (AY) 2024 Modules. Pre- and post-program test surveys were completed by EMBARC workshop attendees (n = 52) from April – May 2024. At the behest of the LACCD, the surveys were redeveloped to be brief (5-10 minutes) and included an open-ended question at the end for feedback. Measures include items such as “This workshop will support my future career development” and “This workshop will support my future educational development” (1 = *Strongly Disagree*; 5 = *Strongly Agree*). Recruitment included distributing an invitation email and flyer to faculty at a pilot community college through our LACCD liaisons and direct recruitment via student clubs and organizations (supported by the community college EMBARC Fellows). A participation incentive system was modeled after the HERE Center START Badge Project. For completing each workshop, students received an iron-on badge and were entered into a raffle for a $25 Amazon or Target gift card. Participants who completed at least 3 workshops received an additional tier 2 prize item (i.e., EMBARC t-shirt), and those who completed at least 6 workshops received tier 3 prize item (i.e., EMBARC tote bag). For completing the entire module series, students were eligible for $1,200 in conference travel that expires 1 year after workshop series completion. All survey materials and procedures were approved by the Institutional Review Board (IRB) at the lead author’s institution, in an approved protocol and reliance agreement with LACCD.

Results

Summer-Intensive (SI) 2023 Modules. Peer mentors experienced the full series of workshops over a one-week summer intensive. Because of the small sample size and non-normal distribution of data, a non-parametric statistical analysis (Wilcoxon signed-rank test) was conducted to compare pre- and post-survey results. Results suggest significant and trending changes in global self-efficacy, research self-efficacy, science identity, and science career intention. Though changes in the composite global self-efficacy was not significant with just 8 participants, as shown in Figure 1, there was a significant increase in students’ abilities to remain calm when facing difficulties because they can rely on their coping abilities (M_{pre} =2.38 SD =1.06 vs. M_{post} =3.13, SD =.99, p =.034). Similarly, though the composite research self-efficacy scale was not significant (M_{pre} =5.13, SD =3.69 vs. M_{post} =6.36, SD =1.18, p =.397), there were general increases across all items and a significant increase in confidence in explaining one’s research to others from pre- to post-test (M_{pre} =5.13 SD =2.36 vs. M_{post} =6.63, SD =1.77, p =.042), respectively. Additionally, there were marginally significant increases in science identity and community items like "I interacted with scientists from outside my school” (M_{pre} =3.25, SD =1.67 vs. M_{post} = 4.13, SD =1.73, p =.066) and “I felt part of a scientific community” (M_{pre} =4.13, SD =1.64 vs. M_{post} = 5.13, SD =.84, p =.096). The likelihood of students to pursue a career in STEMM marginally increased from pre- to post-test (M_{pre} =3.25, SD =1.75 vs. M_{post} =4.38, SD =.74, p =.066). Vitally important was also the fact that 100% of EMBARC peer mentors transferred (comparable to BUILD PODER rates) and 100% continued

in research opportunities (e.g., Georgia Tech Mechanical Engineering SROP, UALR Summer REU, APS San Francisco 2024, CSUNposium 2024).

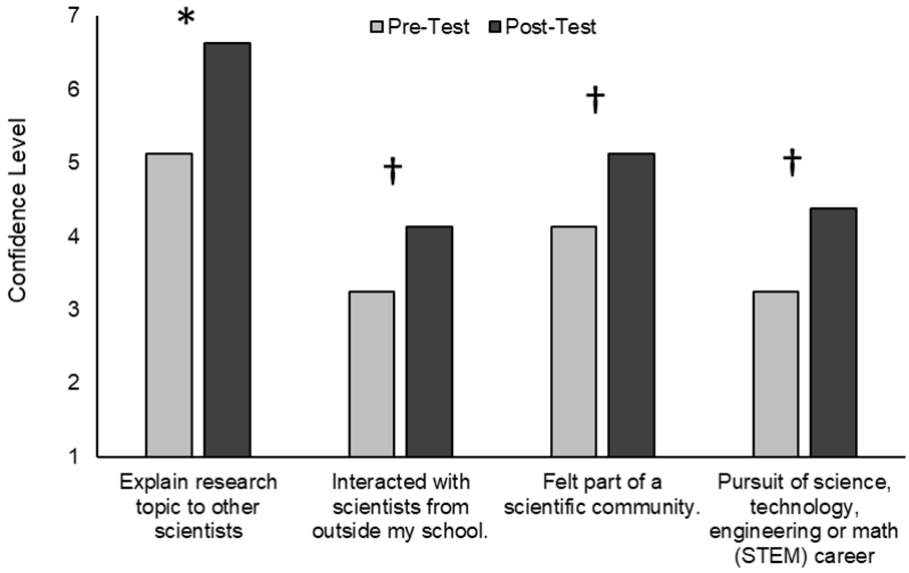


Fig. 1. Pre and Post Survey Responses for EMBARC Summer-Intensive Workshop Recipients (n=8)

Academic-Year (AY) 2024 Modules. Across the year, we assessed changes in educational and career development for each module at a more granular level. Of the 19 unduplicated students who completed both pre- and post-tests, two self-identified as African American, four as Asian, ten as Latinx, two as Middle Eastern/North African, and one as white, with ultimately 63% from historically marginalized backgrounds. Pre-test responses were matched with post-test responses to assess changes after module exposure. As shown in Table 2, results highlight high interest in the majority of workshop topics, with students indicating that they "agree" (4) or "strongly agree" (5) these workshops would support their future educational and career development at the initial outset (pre-test). These high rankings continued at the post-test, with most students noting that they "agree" or "strongly agree" on the usefulness of the workshops. In reviewing the open-ended feedback (Table 2), the modules appeared to have provided practical skills and cultural scripts that supported career and educational development. The evaluation data suggest that modules that integrated CMT/CCW/CRT topics (CM, cultural wealth, and hidden curriculum) were particularly effective in building knowledge and persistence.

Table 2. Summary of Evaluation Results

Module		Pre-test			Post-test			%Change
		M	SD	N	M	SD	N	
Module 1 (Cultural Barriers & Strengths in Higher Education)	Future Educational Development	4.33	0.82	6	4.50	0.84	6	3.93
	Future Career Development	4.17	0.75	6	4.50	0.84	6	7.91
Module 2 (Ancestral Strength)	Future Educational Development	4.75	0.50	4	5.00	0.00	4	5.26
	Future Career Development	4.75	0.50	4	5.00	0.00	4	5.26
Module 3 (Planning Your Path to STEMM Success)	Future Educational Development	4.50	0.71	2	4.50	0.71	2	0.00
	Future Career Development	4.50	0.71	2	4.50	0.71	2	0.00
Module 4 (Transfer Process)	Future Educational Development	4.89	0.32	10	5.00	0.00	10	2.25
	Future Career Development	4.78	0.44	10	4.90	0.32	10	2.51

Module 5 (Resume vs. CV)	Future Educational Development	4.33	1.15	3	5.00	0.00	3	15.47
	Future Career Development	4.67	0.58	3	5.00	0.00	3	7.07
Module 6 (Professional Presentation)	Future Educational Development	5.00	0.00	1	5.00	0.00	1	0.00
	Future Career Development	5.00	0.00	1	5.00	0.00	1	0.00
Module 7 (Team Science)	Future Educational Development	4.00	0.00	2	4.00	1.41	2	0.00
	Future Career Development	4.00	0.00	2	4.50	0.71	2	12.50
Module 8 (STEMM Research Opportunities)	Future Educational Development	4.50	0.71	2	4.50	0.71	2	0.00
	Future Career Development	4.50	0.71	2	5.00	0.00	2	11.11

Note. The sample sizes (Ns) for each module reflects only students who completed the pre-test and the post-test rather than attendance.

Due to limited space, we highlight three qualitative themes derived from the open-ended survey responses across modules, focusing on cultural awareness, transfer resources, and career preparation.

Cultural Assets, Awareness and Connection: Participants appreciated learning about how to apply CCW and CM to their everyday lives, as well as how cultural perspectives and ancestral strength can shape one's "academic journey" and "bring resilience."

Demystifying the Transfer Process: Participants found value in learning about the transfer process and statistics, scholarship opportunities, and the hidden curriculum. The modules provided essential resources and practical advice for navigating the transfer journey, which participants found both "helpful" and informative.

Career Exploration and Preparation: Students appreciated the practical knowledge gained from workshops on preparing for future careers, which covered career skills such as research, scholarship applications, resume and CV writing, and elevator pitches. They also valued the discovery of new opportunities and that there was "more versatility in majors than expected."

Discussion

CM between historically marginalized students and their colleges and universities can be mitigated by recentering higher education values and practices to realize the talents of our current student body. The EMBARC modules discussed here can be a tool for educators who strive to invite and retain historically marginalized and first-generation college students, especially in STEMM fields, by directly addressing CM and the challenges it poses as well as drawing out students' community cultural wealth (CCW). The modules are designed to reveal the hidden curriculum of higher education, the community college to university transfer, as well as to support students' understanding of their own strengths and contributions that motivate them to persevere.

Here, we provide two sources of evidence: (1) detailed information about 8 peer mentors trained in module delivery, peer mentoring, resource utilization and coordination with similar University programs (e.g., HERE START Badge Project), and (2) workshop participants' view of the utility of the workshops. These data suggest that high impact practices like participating in the EMBARC program affirmed EMBARC mentors' science network and community as well as their intention to pursue a STEMM career (vis a vis their post-test survey responses, engagement in science activities across the year, and transfer to four-year institutions as STEMM majors one-year later). The EMBARC modules themselves were also seen as useful for students' educational and career advancement, with each module generating high ratings and open-ended responses reflecting cultural awareness and connection, transfer resources, and STEMM career skills building.

Similar to other programs that provide early career exposure and access to mentors among 4-year university and community college students [31], [32], [36], [37], [38], the EMBARC summer intensive strengthened students' science belonging and career intention. Additionally, presentation on resumes/CVs

(Module 5) and ancestral strength (Module 2) in workshops across the year appeared to have the most impact on students' future educational development. In terms of positively affecting future career development, presentations on cultural barriers and strengths (Module 1), team science that included a discussion about microaggressions (Module 7), and STEMM research opportunities (Module 8) produced the greatest change. This is in line with previous research suggesting that a strengths-based approach and exposing students to information about resources can support student success, particularly among first-generation college students [29], [30]. Notably, though we focus on change scores, modules that did not show change were already rated high at pre-test (e.g., Module 3 STEMM Planning; Module 6 Professional Presentation) suggesting high student interest in general professional develop at the outset. However, EMBARC differs from previous programs in explicitly discussing cultural frameworks throughout all the modules. As one participant in the transfer module noted, these are topics and elements "that other workshops do not highlight."

While promising, these findings are limited by sample size due to barriers in recruiting students to multiple workshops, which is a challenge echoed by our community college as well as campus partners. For educators and administrators interested in similar work, we recommend integration with institutional initiatives [30] and identifying a campus insider who can advocate for the program through on-campus networking, advertising, and coordinating to support sustainability of the program. Each college and university has its own culture, demographics, and processes [39]; customization may be required and is encouraged. As mentioned, sample size and pretest ceiling effects also made achieving significance for some pre- and post-test changes difficult. Additionally, program participants were not randomly sampled from LACCD students and peer mentors were not randomly assigned to facilitate a module. Therefore, we cannot eliminate selection effects or presenter effects.

Although we aimed to centralize student voices here, including data from faculty, administrators, staff, and students' families has the potential to support the development of modules for larger scale change. Relatedly, this project builds on a 10 minute cultural value mismatch intervention developed by the first two authors [18] and future directions include the possibility of encapsulating each module into shorter interventions that can be used in classes, student organization meetings, dormitory meetings, and other places where students can become interested in a deeper dive into the full content. Given the sample sizes, qualitative inquiry and analysis of longer-term outcomes, including whether or not students persevere in STEMM fields, join a research lab, and move on to a graduate program or STEMM career, can address gaps in the research methods and contribute to better understanding of the impact of EMBARC. An additional goal of the EMBARC program is to leverage this iterative process to re-develop the modules into self-paced, fully online asynchronous educational modules to be evaluated in the next phase. Ultimately, findings from this EMBARC pilot highlight how strengths-based modules steeped in cultural and theoretical frameworks can generate a safe space for students to explore their STEMM interests and has implications for research and practice alike.

Conclusion

Most U.S. institutions of higher education were built on principles consistent with middle-class values, practices, and assumptions. While institutional change is slow, EMBARC modules provide a current solution to making STEMM education and careers welcoming to historically marginalized students. The modules are unique in directly addressing cultural mismatch and community cultural wealth and in developing skills, knowledge, and relationships that welcome students into and support them in persisting in STEMM fields. Ultimately, building on a brief, online CM-informed intervention [18], this study examining how CM and CCW can be integrated into student training programs and contributes to the growing evidence that awareness of community cultural wealth and broader critical race theory perspectives positively shape historically marginalized STEMM students' science identities across higher education [17], [31], [32].

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Disclosures The authors declare no conflicts of interest.

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