

NSF IUSE HSI Hub : Developing a Community-Grounded STEM Identity Scale for Students at HSIs

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Blanca E. Rincón is an associate professor of STEM Equity and Education at the University of California Riverside. She received her Ph.D. in education policy studies from the University of Illinois at Urbana-Champaign. She identifies as a proud Mexicana/Latina, a daughter of immigrants, and is the first in her family to attend college. Her research agenda aims to advance educational equity for historically underserved and marginalized college students in STEM, and specifically Latina/o/x college students. With support from the National Science Foundation, her research investigates three interrelated lines of inquiry: 1) The origins, sustainability, and impact of STEM enrichment programs, 2) The institutional environments that shape college student experiences and outcomes, and 3) The culturally derived assets that college Students of Color mobilize to navigate and persist in STEM

Vanessa Vongkulluksn, University of Nevada - Las Vegas

Dr. Vanessa W. Vongkulluksn is an Associate Professor in the College of Education at the University of Nevada, Las Vegas. She earned her Ph.D. in Education from the University of Southern California. As a first-generation immigrant, she understands how the intentional facilitation of motivationally supportive learning spaces is crucial for student success – especially those whose cultural assets may not be recognized by our educational system. Her research centers on contextually-specific motivation and engagement in technology-integrated STEM learning contexts. A central focus of this work is to design innovative learning environments and teacher resources for supporting equitable motivation and engagement, particularly for historically underserved students.

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Dr. Juanita K. Hinojosa is a Research Associate in the Department of Educational Psychology, Leadership, and Higher Education at the University of Nevada, Las Vegas. Dr. Hinojosa received her Ph.D. in higher education from the University of Nevada, Las Vegas, and proudly identifies as a first-generation college graduate and immigrant scholar. Hinojosa's lived experiences inform her work and research, and she is passionate about researching and developing inclusive practices and policies that advocate for and support students pursuing a postsecondary degree.

Eduardo Robleto

Eduardo A. Robleto is a Latino professor at the University of Nevada, Las Vegas School of Life Sciences. Dr. Robleto is a native of Nicaragua and got his BSc in 1986 from the Escuela Agrícola Panamericana in Honduras. He earned his M.Sc. in 1994 and Ph.D. in 1998 from the University of Wisconsin-Madison. Also, he was a Postdoctoral fellow at UW Madison and Tufts School of Medicine during 1998-2002. Dr. Robleto is the Program Coordinator of Nevada-INBRE, which is designed to improve the biomedical research infrastructure and diversify the STEM workforce in Nevada. The Robleto lab studies DNA repair, mutagenesis, and gene expression in cells experiencing stress. Dr. Robleto believes that strong and committed mentoring empowers students to meet their potential in research and academic development. Providing role models for diverse students fosters a learning and inclusive environment that promotes innovation and creativity at UNLV and consequently improves the nation's workforce.

Melissa Morales Ambriz, University of Nevada - Las Vegas

Melissa Morales is a graduate student in the Higher Education M.Ed. program at the University of Nevada, Las Vegas, with an expected graduation in Spring 2026. Melissa Morales Ambriz is a graduate student in Higher Education at the University of Nevada, Las Vegas. She earned her bachelor's degree in Secondary Education with a concentration in Mathematics from the University of Nevada, Las Vegas. As a proud Mexicana and first-generation college graduate, her experiences inform her commitment to supporting underrepresented students. She currently serves as a Graduate Research Assistant and Academic Advising

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Dulshi Fernando is a doctoral student in Educational Psychology at the University of Nevada, Las Vegas. She earned her bachelor's degree in Psychology from the University of Nevada, Las Vegas, and her master's degree in Psychological Sciences from California State University, Chico. Her research and advocacy are strongly shaped by her experiences navigating cultural expectations, academic pathways, and the evolving meanings of education passed down across generations. As the daughter of two Sri Lankan immigrants, Dulshi is passionate about understanding how social, cultural, and structural forces shape students' motivation, identity development, and educational opportunity, particularly for students from historically marginalized communities. As a researcher, mentor, and advocate, she is dedicated to producing scholarship that amplifies marginalized voices and informs more equitable practices in education.

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The HSI Resource Hub (NSF #2311181) aims to cultivate a community of STEM scholars who implement and advance evidence-based practices in STEM education at HSIs and is supported by the National Science Foundation's Improving Undergraduate STEM Education: Hispanic-Serving Institutions (NSF IUSE: HSI) program. The HSI Resource Hub prioritizes three interconnected areas. First, it promotes synergistic knowledge-building to foster collaboration and networking among STEM faculty at HSIs. Second, it enhances institutional capacity by offering professional development that supports faculty in adopting and refining best practices in STEM education within HSI contexts. Third, it seeks to establish a sustainable community of practice by actively generating, supporting, and disseminating scholarly work by and about HSIs. Next, we share how the HSI Hub is actively working on the latter by developing empirical research that advances our collective understanding of STEM identity development. The following describes the steps taken to date to develop a community-grounded STEM identity scale and initial piloting of the scale.

STEM identity (SI) development has recently been studied with students who are historically underserved in STEM fields. This work revealed that it is informed by several interconnected dimensions: *interest*, *competence*, *performance*, and *recognition* (Dou & Cian, 2021; Carlone & Johnson, 2007; Hazari et al., 2010). Research increasingly supports the idea that developing and sustaining a STEM identity is important for persistence in STEM, particularly for historically underrepresented students who constitute a critical mass at Hispanic-Serving Institutions (Camacho & Lord, 2013; Rodriguez & Lehman, 2019). These students often lack the opportunities to participate in STEM activities, engage with STEM mentors, or see themselves represented in STEM fields, which may make it difficult for them to develop and maintain STEM identities (Carlone & Johnson 2007; Rodriguez, 2015) and/or result in disrupted STEM identities (Camacho & Lord, 2013; Carlone & Johnson, 2007).

Dou and Cian (2021) found that a STEM identity scale representing interest, recognition, and performance-competence showed strong construct validity, with indices showing that the data satisfactorily fit the theorized model (CFI = 0.97, TLI = 0.98, RMSEA = 0.05, SRMR = 0.03) and high internal reliability (Cronbach's α =0.85-0.90). Yet, while this scale presents empirical evidence for the underlying components of STEM identity, scholars suggest that a more collectivist-oriented approach to studying SI is warranted when considering a more diverse group of STEM learners (Rincon & Rodriguez, 2021). Herrera and Sanchez's (2022) community-centered SI model is the first to recognize the role of community-based assets in STEM identity development for historically underserved students. To date, however, there are no existing scales that incorporate the role of community-derived assets in how we measure STEM identity at Hispanic-Serving Institutions (HSIs). Opportunities exist for understanding how HSIs, through organizational structures for serving, provide opportunities to develop STEM competencies, perform roles of a STEM person that are responsive to local community needs, and receive recognition from a more diverse group of important others.

Community Grounded STEM Identity Scale

With this in mind, the HSI Hub team developed a STEM identity scale grounded in community. Scale development followed established procedures for instrument construction and validation in educational and psychological research, emphasizing iterative refinement and evidence of content validity. Item development began with a review of relevant theory and empirical literature, with particular emphasis on existing STEM identity measures and qualitative studies of how diverse students conceptualize their relationship with STEM fields. Items were generated by members of the research team with expertise in educational psychology, higher education, and STEM education. They were theoretically grounded on three empirically established subcomponents of science identity (interest, self-recognition, and performance-competence) advanced by Hazari and associates (2021) and Dou and Cain (2021), and expanded to include features of how students may conceive their STEM identity in relation to their community. The initial scale included 41 items, with three subcomponents encompassing several related aspects: a) *interest* included feeling and value towards STEM, as well as interest development; b) *recognition* included self- and other-recognition; and c) *performance-competence* included connection between STEM and community, helping others in STEM, and resilience.

To evaluate item clarity and content validity, the initial item pool was pilot tested with a small sample of undergraduate STEM students ($n = 9$). Following survey completion, participants engaged in individual cognitive interviews focused on how they interpreted each item, the clarity of item wording, and the extent to which response options aligned with their intended judgments. Castillo-Diaz and Padilla (2012) find that cognitive interviews provide important evidence for assessing the validity of participant item response processes. In other words, these data can reveal how individuals interpret and respond to particular survey items. Item response processes have been identified as one of the five “sources of validity evidence” by AERA et al.’s (1999) Standards for Educational and Psychological Testing. In the case of this research, a particular focus of the cognitive interview was on how students conceived of the idea of “community” and how community-based assets informed survey responses related to RI (see Table 1). Interviews were conducted via Zoom and consisted of read-aloud exercises with follow-up probes, such as *When you hear the word 'community', what does that bring up for you? Who do you think of when you hear the word 'community'?*

Table 1. Sample Student Responses Related to Community

Community as Academic Community	Community as Family	Community as Society
“I do see that more or less as, like scientific community, because I feel like that's what a lot of people try to outreach when they talk about STEM, so I'm not thinking my community as [City], or my community as us as students.	“The first thing that comes to mind is family first, and then people that look like my family, and then from then on, it's neighbors, you know, neighbors of the neighbors, and then I guess counties, and they're just... I guess [City] is	"Community is a broad group... I guess what counts as community is either maybe something like... maybe neighborhood, or city, or even school itself" B1 "My community is everyone

I think about it as the science community, as scientists.” A3	not that big, in a way that we're all kind of one community.” A2 “What does community mean? ... My immediate family, so my dad, my brothers, and sisters, and then on the backside I thought of my grandma, because my grandma's part of that community.” B2	and anyone.” A1 “ I am very biased, thinking my community, like, specifically lower-income type of communities. It's sort of where I came from, like, I came from a low-income community that wasn't very heavy in STEM, like, the closest experiences that I have with computer science was a typing class in 6th grade, which is really mandatory for every school at that point.” A4 “I would say people in my family or people I go to church with. Or people who knew me since I was a kid. Just those type of people.” B4
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Interview transcripts were analyzed using a thematic coding approach. A team of six researchers independently reviewed the transcripts and coded student feedback related to item comprehension, relevance, and potential sources of misinterpretation. The research team then met to discuss emergent themes and reach consensus on patterns across participants. These discussions focused on identifying items that were unclear, redundant, or misaligned with the intended construct definition.

Findings from the cognitive interviews informed systematic item revision. Items were refined, reworded, or removed based on converging evidence from student feedback and team discussion, with the goal of improving clarity, reflecting students’ community-based assets, and strengthening alignment with the underlying theoretical framework. The revised set of 34 items constitutes the version of the instrument to be implemented in a large-scale administration during Spring 2026. Data from this administration will be used to examine the factor structure, reliability, and construct validity of the scale, using a combination of confirmatory factor analysis, classical test theory, and item response theory (Vongkulluksn et al., 2022).

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