

Urban Latina/o Undergraduate Students’ Negotiations of Identities and Participation in an Emerging Scholars Calculus I Workshop

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In this article, the author presents a qualitative multiple case study that explored how two urban Latina/o undergraduate students’ emerging mathematical and racial identity constructions influenced their participation in a culturally diverse, Emerging Scholars Program, Calculus I workshop at a predominately White urban university. Drawing on critical race theory and Latina/o critical theory, cross-case analysis illustrates that participants’ emerging mathematical and racial identities—co-constructed with their other salient identities—contributed to positively shifting their participation by: (a) changing their perceptions of their and peers’ mathematics abilities, (b) allowing them to challenge racialized mathematical experiences, and (c) strengthening their comfort levels in the workshop environment. The Latina/o participants’ counter-stories support that the sociopolitical nature of identity development and participation in mathematical learning contexts should be embraced because it provides additional knowledge regarding how and why Latina/o students attain mathematical success.

KEYWORDS: collaborative learning, identity, Latina/o students, mathematics education, race

Vanessa and Immanuel¹ were Latina/o freshman² enrolled in an Emerging Scholars Program (ESP) Calculus I workshop at Hall University. In this optional mathematics workshop, which ran parallel to Vanessa’s and Immanuel’s required Calculus I course, culturally diverse peer groups collaboratively solved challenging Calculus I problems. This workshop consisted of 27 students: approx-

¹ Vanessa, Immanuel, and the names of all people and places used in this article are pseudonyms.

² The classifications *freshman*, *sophomore*, *junior*, and *senior* refer to describing participants (and workshop students they interacted with) as first, second, third, and fourth year students, respectively, at Hall University. These classifications are also used to describe participants’ year in high school.

imately 41% Latina/o (4 women and 7 men), 30% Asian (5 women and 3 men), 22% White (2 women and 4 men), and 7% African American (1 woman and 1 man), and 44% women. I was not only the researcher but also the instructor of the Calculus I workshop.

In her interviews, Vanessa revealed that her interactions with Ms. Johnson, an African American woman, her sophomore (geometry) and senior (precalculus) high school mathematics teacher, were relevant to understanding her participation in the Calculus I workshop at Hall University. Vanessa believed her Latina status contributed to the low mathematical expectations and negative treatment she received from Ms. Johnson. Such treatment included having her preferred problem-solving strategies (e.g., translating mathematical symbolic notation into words) criticized: “I have a tendency of writing a lot. I write words and sentences and with that teacher she’s like, ‘No, no, no. Math is all about no words’” (Interview 1, January 25, 2008). Because of such interactions, Vanessa believed it was inappropriate for her to apply some of her preferred problem-solving strategies to learn workshop material. However, as Vanessa participated in the workshop she realized that such strategies were appropriate: “I use words to read math and read math by using words [laughs], so that helped a lot too. We would do that a lot in the workshop” (Interview 4, May 28, 2008). Vanessa’s workshop experiences, which included encountering opportunities to resist negative high school mathematics experiences, aided her in constructing a strengthened self-perception as a Latina mathematics learner:

I was like, wow! I guess it’s good to see how other Hispanic people are so good at doing math.... It’s not what people usually think of. I think it makes me proud that there’s a chunk of us, I’ll put myself in that group, that are willing to do whatever to be good at math or to excel in math. (Interview 3, May 12, 2008)

Vanessa’s and Immanuel’s stories, which the readers will learn more about in the findings section, provide examples of not only how aspects of Latina/o students’ *mathematical* and *racial* identities can shape participation in a collaborative mathematics learning context but also how elements of these identities can positively merge as a result of this participation. For example, on one hand, Vanessa’s negotiations of Ms. Johnson’s perceptions of her mathematics ability initially contributed to limiting her workshop participation. On the other hand, however, her participation in the workshop’s mathematical practices allowed her to develop tools to resist harmful racialized mathematics experiences³ (e.g., chal-

³ In this article, *racialized mathematics experiences* refer to participants’ mathematics experiences that are structured by societal meanings for race, racial identity, or racial stereotypes (Martin, 2009). In this article, I also refer to mathematics learning contexts as racialized (Martin, 2009) given that I perceive students’ racialized mathematics experiences as influencing how they participate in and learn mathematics within such settings.

lenging Ms. Johnson's negative ascriptions to her mathematical and racial identities), to build on positive aspects of her Latina and mathematical identities, and to positively merge her Latina and mathematical identities. As revealed in the findings section, positive mergings of Vanessa's and Immanuel's mathematical and racial identities, including their connection to other salient identities and broader contexts in which meanings for these identities became relevant, contributed to positive convergences among the various strains of their identity development and participation.

Such stories about Latina/o students are rare despite evidence that students' practice-linked identities—"identities that people come to take on, construct, and embrace that are linked to participation in particular social and cultural practices" (Nasir & Hand, 2008, p. 147)—inform, and are informed by, intersecting aspects of their identities in mathematics learning contexts (Esmonde, Brodie, Dookie, & Takeuchi, 2009). The ways in which Latina/o students' identities and participation can positively influence one another over time as they engage in collaborative mathematics learning contexts leads one to question (a) what additional knowledge has yet to be uncovered about these relationships and (b) how such knowledge can contribute to understanding their mathematical success. Because mathematics classrooms are racialized (Martin, 2009), it is also important to understand how Latina/o students make sense of, narrate, perform, and negotiate mathematical and racial identities, and to understand how these identities inform how they make sense of, narrate, perform, and negotiate practice-linked (or disciplinary) identities in collaborative mathematics learning contexts. Here I illustrate how two urban Latina/o (and Mexican American⁴) undergraduate students negotiated ways of more productively participating in the workshop via their emerging mathematical and racial identity (re)constructions.

This study occurred in an ESP mathematics workshop: a collaborative mathematics learning environment that has been nationally recognized for effectively supporting underrepresented students in succeeding in mathematics. While the majority of research conducted on ESP mathematics settings has focused on participants' static achievement outcomes instead of forces that influence these outcomes (an exception includes Asera, 1988), this study uses an identity lens to examine Latina/o students' perceptions of their participation within an ESP Cal-

⁴ In the United States, Mexican Americans constitute approximately 65% of the Latina/o population (Motel & Patten, 2012). Due to the essentialization of Latinas/os' experiences, aspects of Mexican Americans' histories, culture, and immigration experiences that differ from those of other Latina/o cultural subgroups are often disregarded (Telles & Ortiz, 2008). Historically, Mexican Americans have experienced significant obstacles linked to colonization, immigration, segregation, and discrimination, including within educational contexts (Rodriguez, 2000). Given Mexican Americans' unique histories and experiences in the United States, it is critical that mathematics education scholars take into consideration the sociopolitical nature of Mexican American students' mathematical lives.

culus I workshop. A Calculus I workshop was selected because calculus functions as a gateway course for STEM⁵ majors, making it an interesting setting to explore the role of identity, power, and broader contextual experiences. I focus on how urban Latina/o students constructed their identities in relation to their participation in this environment with the aim of deepening the mathematics education community's understanding of how identity development contributes to underrepresented (and represented) students' mathematical success.

Drawing from a larger study on Latina/o students' identity construction and participation in an ESP Calculus I workshop (Oppland, 2010), this study addresses the following questions:

1. How did participants negotiate their emerging mathematical and racial identities over time as they participated in the Calculus I workshop?
2. What changes, if any, occurred in how participants' negotiations of their emerging mathematical and racial identities influenced their participation over time in the Calculus I workshop?

Identity, Race, and Mathematics Learning

Social identities are constructed as individuals engage in social interactions tied to societal norms (Johnson, 2001). There are numerous social identities that Latina/o individuals may construct at any given moment (e.g., racial, gender, class). Because all Latina/o Americans are exposed to racial socialization (Helms, 1994), this study aims to examine how urban Latina/o students construct their emerging mathematical and racial identities. In this study, *emerging mathematical and racial identity constructions* (EMRICs) refers to participants' negotiations of privately and socially constructed meanings of the terms Latina/o, race, racism, and racial inequality in relation to their workshop participation. *Privately constructed meanings* refer to meanings for such terms that are developed within the individual, while *socially constructed meanings* refer to meanings for such terms that are developed jointly with other individuals. Because such meanings are (re)constructed through social interactions, I consider participants' self-perceptions, their perceptions of others, and perceptions they believe others impose on them. I also take an intersectional approach (Crenshaw, 1991) by exploring how their EMRICs intersect with their other salient identities (e.g., gender, class). I aim to gain a deeper understanding of Latina/o students' perspectives of how they negotiated their EMRICs as they participated in the workshop and how such negotiations might have caused changes in their participation. Because this study aims to capture Latina/o students' perceptions of the historical, sociopoliti-

⁵ STEM is an acronym for science, technology, engineering, and mathematics.

cal, and situational nature of how their EMRICs influenced their participation, I draw on both sociocultural and sociopolitical perspectives of learning.

Sociocultural and Sociopolitical Learning Theories

From a sociocultural theoretical standpoint, learning refers to becoming more central and competent participants in the valued practices of communities of practice (CoP), including by adopting trajectories of participation and constructing identities that contribute to this convergence (Lave & Wenger, 1991; Rogoff, 2003; Wenger, 1998). As individuals engage in a CoP, which is “a history collapsed into a present that invites engagement” (Wenger, 1998, p. 156), they continuously negotiate their identities, identities belonging to others, and meanings projected onto their identities by others (Rogoff, 2003; Wenger, 1998). As individuals’ identity constructions and participation continuously inform one another, these dialectics can support or impede the creation of opportunities that allow them to participate in CoPs’ valued practices. It is in this sense that identity, participation, and learning are inextricably linked. Drawing on this theory, the present study viewed participants’ EMRICs as strengthening their participation if these constructions contributed to their convergence towards becoming more central and competent participants in the workshop’s valued practices (e.g., strengthened engagement in mathematical group work with a culturally diverse student population).

Wenger (1998) describes the complexity associated with becoming a more central and competent participant in the valued practices of CoPs. As individuals engage in such practices, this process can involve transformations in how identities are (re)negotiated, how various degrees of participation and non-participation are adopted, and how identity constructions and participation relate amid broader social structures involving power relations. Drawing on this perspective, I anticipated that examining participants’ EMRICs in relation to their participation might involve changes in how they constructed these particular identities, how they adopted ways of participating and not participating, how their identities and participation related over time, and how such changes were connected to power relations and identity constructions linked to broader contexts. Although participants’ various forms of identification became salient as they described their workshop experience, this study focused on relationships between their EMRICs and participation. By analyzing the Latina/o participants’ perspectives of these relationships, I illustrate how ESP-type environments can “hold the key to real transformation” in terms of possibly helping students negotiate what it means for them to be mathematics learners of a particular cultural group in ways that support them in becoming more central participants in valued mathematical practices (Wenger, 1998, p. 85).

Mathematics education research studies have drawn on sociocultural learning theories to explore students' mathematics participation and learning processes in CoPs (e.g., Boaler, 2002; Boaler & Greeno, 2000; Gresalfi & Cobb, 2006; Martin, 2000, 2006). Collectively, this body of research asserts that using an identity analytic lens provides an effective way to capture how students construct identities and participate in the practices of mathematical CoPs. This research also indicates that dialectics exist between how students construct identities as mathematics learners and participate in the practices of mathematics learning communities. On one hand, students' participation in mathematical practices influences aspects of their mathematics identity constructions (Boaler, 2002; Boaler & Greeno, 2000; Martin, 2000, 2006). These constructions include how students negotiate sociohistorical forces (i.e., lived experiences tied to broader communities and schools) and their agency as they engage in mathematics classroom practices (Martin, 2000, 2006). On the other hand, however, aspects of students' mathematics identity constructions shape how they engage in mathematical practices (Gresalfi & Cobb, 2006).

Mathematics education research that has drawn on sociocultural theories indicates how students' identities as mathematics learners are constructed in social interactions (i.e., practice-based interactions). However, mathematics education scholars have indicated that a weakness of sociocultural research is its tendency to adopt color-blind paradigms (Esmonde et al., 2009; Gutiérrez, 2013). That is, this research often ignores the intersectional nature of identity development and its influence on practice-linked identity constructions (Esmonde et al., 2009), the voices of marginalized students (Gutiérrez, 2013), and the roles of politics and power relations (Gutiérrez, 2013). Color-blind approaches are particularly damaging to underrepresented students (Martin, 2009) because they mask how inequities functioning in their histories, experiences, and mathematical lives impact how they negotiate identities in relation to their participation in mathematical CoPs. In the case of Latinas/os (and, in particular, Mexican Americans), it is imperative that the "social, political, and historical patterns of exclusion, degradation, and racism" they have experienced in education (Gutiérrez, Willey, & Khisty, 2011, p. 28) be recognized when investigating how their identities and participation inform one another in mathematical learning contexts.

Critical race theory and Latina/o critical theory. Because of the limitations associated with sociocultural mathematics education research, I also draw on sociopolitical perspectives of learning (Gutiérrez, 2013). Sociopolitical perspectives of learning view "knowledge, power, and identity as interwoven and arising from (and constituted within) social discourses" (Gutiérrez, 2013, p. 40). From this scholarship, I draw on the theoretical frameworks critical race theory (CRT) and Latina/o critical theory (LatCrit). CRT in education refers to a "set of basic insights, perspectives, methods, and pedagogy that seeks to identify, analyze, and

transform those structural and cultural aspects of education that maintain subordinate and dominant racial positions in and out of the classroom” (Solórzano & Yosso, 2002, p. 25). CRT emphasizes the centrality of race and racism and their intersectionality with other forms of subordination. LatCrit complements CRT, while also offering an important lens to discuss transformational resistance specifically for Latinas/os (Solórzano & Bernal, 2001). LatCrit emphasizes that Latinas/os’ identities are multidimensional and addresses “the intersectionality of racism, sexism, classism, and other forms of oppression” that may impact Latinas/os specifically, such as language, ethnicity, and culture (Bernal, 2002, p. 108). CRT and LatCrit also both emphasize the centrality of marginalized students’ experiential knowledge (Solórzano & Bernal, 2001). CRT and LatCrit also encourage examining marginalized students’ experiences through *counter-stories* (Bernal, 2002; Solórzano & Yosso, 2002), which, in this study, refer to participants’ stories that challenged dominant ideologies that disregard how social constructions of Latina/o, race, and racism shape their mathematical experiences.

This study contributes to mathematics education equity scholarship embracing the sociopolitical turn in mathematics education (Gutiérrez, 2013). Applying both sociocultural and sociopolitical perspectives to examine bidirectional relationships between Latina/o students’ EMRICs and participation allows for viewing identity development complexly—as involving multiple perceptions (self-perceptions, perceptions of others, imposed perceptions); as (re)constructed in relation to engagement in social practices within local contexts situated in broader sociohistorical and sociopolitical contexts; as being intersectional in nature; and as connected to complex issues, such as race, class, gender, language, agency, hegemony in society, and power dynamics. From CRT, I emphasize the centrality of race and racism in participants’ mathematical experiences and how such meanings intersect with other forms of oppression (e.g., gender, class). From LatCrit, I emphasize what it means for participants to be Latina/o mathematics learners, including how they manage forms of oppression that may be particularly relevant for Latinas/os (e.g., language). From both CRT and LatCrit, I stress the intersectional nature of participants’ EMRICs, the centrality of their experiential knowledge, and the importance of capturing their counter-stories. Drawing on both sociocultural and sociopolitical theoretical frameworks allows for examining what it means for participants to be Latina/o mathematics learners and how their negotiations of such meanings related to their workshop participation.

Methods

In this study, I applied qualitative multiple-case study methodology (Miles & Huberman, 1994; Yin, 2009) to holistically explore Latina/o students’ perspectives of their EMRICs as they engaged in the workshop. Here multiple-case study

refers to the fact that I address the research questions for two cases. My goal was to provide thick descriptions (Geertz, 1973) of each case and to identify emergent themes (Miles & Huberman, 1994) across both cases. Thick descriptions refer to rich, detailed portrayals of participants' experiences situated within broader sociopolitical contextual layers related to the phenomena investigated. Therefore, I used multiple data sources, including interviews, a questionnaire, reflections, and direct classroom observations, to construct an in-depth case study for each participant that described their perspectives of how their transforming EMRICs impacted their participation. I sought to capture participants' perceptions of significant avenues they experienced, obstacles they faced, and critical transformations that occurred as they engaged in the workshop, specifically related to their negotiations of privately and socially constructed meanings of Latina/o, race, racism, and racial inequality. The units of analysis for each of the two in-depth case studies were the individual students; each case presents an inimitable description of how a Latina/o participant's negotiations of their EMRICs informed (or did not inform) their participation. The subsequent sections (i.e. research context, participants, data collection, and data analysis) provide detailed descriptions of the methods.

Research Context

This study is part of a larger study on Latina/o students' identity constructions and participation in an ESP Calculus I workshop at Hall University, a predominately White, 4-year research university in Chicago, Illinois (Oppland, 2010). The university's socioeconomically diverse undergraduate student population (~16,000 students) included approximately 45% Caucasians, 23% Asians, 16% Latinas/os, 9% African Americans, <1% Native American, 2% international students, and an approximately equivalent number of male and female students. Latinas/os were significantly underrepresented within Hall's undergraduate student population (16%); a claim supported by the fact that Latinas/os represent approximately 45% of the Chicago Public Schools (CPS) student population ("Stats and Facts," 2014). Historically, a significant percentage of Latina/o students also have struggled to successfully complete their mathematics requirements at Hall University, challenging their efforts to obtain STEM degrees.

Emerging Scholars Program. Prior to Fall 1989, data collected at Hall University confirmed that a considerable number of Latina/o and African American students were failing precalculus and calculus (Brugueras, Hernández-González, & Libgober, 2005). For example, it was discovered that over 55% of Latina/o and African American students were failing precalculus (Brugueras et al., 2005). To improve Latinas/os' and African Americans' precalculus and calculus achievement levels, Hall's mathematics department initiated ESP math workshops in Fall 1989. ESP at Hall aims to increase the number of underrepresented students who

successfully complete introductory mathematics and physics courses. At the time of this study, ESP mathematics workshops were offered for precalculus, Calculus I, Calculus II, Calculus III, and Introduction to Advanced Mathematics. These optional workshops ran parallel to students' required mathematics courses, encouraged culturally diverse peer groups to collaboratively solve challenging worksheet problems, were held for 2 hours either once or twice per week, and were worth one credit hour (graded as satisfactory or unsatisfactory). While all students were encouraged to participate, underrepresented students were recruited more heavily.

Hall University's mathematics workshops are modeled after Uri Treisman's doctoral dissertation work (Treisman, 1985), which aimed to discover explanations for why African American students were struggling to learn calculus at the University of California (UC), Berkeley in the mid-1970s. Treisman analyzed differences between twenty African American and twenty Chinese students' study habits for their calculus courses. While both groups practiced the mathematics study habits advised by their institution's study skill courses (e.g., studying individually for several hours each week), several Chinese students' study habits differed from the African American students (e.g., discussing problem solutions with peers) (Treisman, 1992). These findings led to the implementation of the Mathematics Workshop Program at UC Berkeley in 1978, which offered "minority" students enrolled in first-year calculus the opportunity to collaboratively solve challenging mathematics problems with peers (Asera, 1988). The program received national recognition as participants exceeded non-participants in mathematics achievement and persistence levels (Fullilove & Treisman, 1990). The workshops have proliferated in universities across the United States where they continue to be recognized for assisting students in attaining mathematical success.

To gain in-depth information about how Latina/o students' identities and participation can positively inform one another as they engage in mathematical learning contexts, I argue it is important to study this development in mathematical learning contexts that have been recognized as effective. This study occurs in an ESP mathematics workshop because ESP environments have been recognized as effective. First, ESP's implementation of group work has been nationally identified as a powerful pedagogical tool for increasing marginalized students' mathematics achievement levels (Hsu, Murphy, & Treisman, 2008). Second, ESP workshops typically incorporate practices recognized in mathematics education literature as effectively supporting Latina/o students in improving their mathematics achievement levels, such as "math-based enculturation and socialization experiences" (Martin, 2004, p. 11). Third, as an ESP precalculus workshop instructor prior to this study taking place, I was inspired by positive changes I witnessed related to how culturally diverse workshop participants embraced mathematics as the semester advanced, including students who had expressed skepticism about

the workshop's benefits earlier in the semester. For these reasons, I argue that ESP mathematics workshops provided an appropriate setting for investigating positive relationships among Latina/o students' identity development, mathematics participation and learning, and success.

Calculus I ESP workshop and course. In this study's Calculus I workshop, students solved worksheet problems within peer groups. Worksheet problems were related to, but often more challenging than homework problems assigned in students' required Calculus I course. Examples of acceptable social norms within peer groups included discussing problem-solving processes, supporting peers in understanding mathematical explanations, and presenting alternative strategies. Students were also encouraged to present their strategies and solutions on chalkboards, which sparked whole class discussions.

Calculus I workshop students were simultaneously enrolled in a required Calculus I class, which consisted of a lecture and discussion section. During lectures, students listened to an instructor present the material in a large lecture hall. During discussion sections, a graduate teaching assistant guided students in understanding homework problems and students completed quizzes. All Calculus I sections followed a common schedule that was posted on a main course webpage. The course covered chapters 2 through 5 of *Calculus, Early Transcendentals* by Jon Rogawski (2008). The required Calculus I course grade was based on the total points earned from two hourly exams, homework, quizzes, and a final exam.

With respect to identity issues, the ESP mathematics workshops' unique features may have affected marginalized students' identity development differently than experiences they negotiated in Hall University's required mathematics classes. For example, while ESP mathematics workshop facilitators aim to support culturally diverse student populations in attaining mathematical success, instructors of required mathematics courses may or may not have had this goal in mind. Although all mathematics learning contexts are racialized (Martin, 2009), meanings for race may become more salient for underrepresented students in an ESP mathematics workshop through their consistent interactions with a culturally diverse student population and an instructor aware of equity and diversity mathematics education issues.

Researcher identity and positionality. Conducting this research involved carefully balancing my roles as workshop facilitator and researcher of Vanessa and Immanuel workshop experiences. As the facilitator, I influenced workshop students' engagement. For example, my identity development as a mathematics learner (e.g., challenges I faced as a female student) prompted me to encourage students to incorporate their strengths (e.g., mathematical, cultural, linguistic) while engaging in problem-solving practices. However, to observe how students' participation progressed "naturally," I avoided interfering with their engagement,

when possible. My responsibilities and goals included: crafting worksheets that contained challenging Calculus I problems that could be solved with minimal instructor guidance, motivating students to engage in mathematical discourses with peers, addressing students' mathematical inquiries without providing complete solutions (i.e. Socratic methods), and urging students to validate students' preferred strategies and ways of engaging with mathematics. As the facilitator, I often played a supportive, behind-the-scenes role as students primarily constructed solutions with peers; this role provided ample opportunities for me to observe students.

As a White middle-class woman investigating Latina/o students' mathematics experiences, this research involved entering into unfamiliar territory in many respects. Although I may relate on some level to Latinas who face mathematical boundaries related to their gendered identities, my race grants me advantages that individuals from other cultural backgrounds, such as this study's participants, may not experience. Although my identities, including my White background, informed all facets of this study, I used strategies to attempt to mitigate the effect of my race on influencing the study's construction in ways that would "reproduce White privilege"⁶ or take away from participants' perspectives of their experiences (Gordon, 2005, p. 300). Such strategies included bringing up race directly during interviews, seeking to capture participants' counter-stories, and member checking. While the former two provided participants with a forum to challenge dominant perspectives that disregard the role of race, racism, and Whiteness in Latina/o students' mathematics learning, the latter provided participants with the opportunity to critique, confirm, or challenge my interpretations of their mathematical lives.

Participants

The participants are Vanessa, an 18-year-old, female, second-generation Mexican American immigrant, and Immanuel, a 19-year-old, male, first-generation Mexican American immigrant. The majority of K–12 schools the participants attended were public schools located in Chicago, Illinois with predominately Latina/o and/or African American student populations. Vanessa, a chemistry major, graduated salutatorian from a third-ranked, public high school in Chicago, Illinois. Immanuel, who intended to major in computer engineering,⁷ graduated from a public high school in a small suburb near Chicago, Illinois. Both

⁶ *White privilege* is "a system of opportunities and benefits conferred upon people simply because they are White" (Solórzano & Yosso, 2002, p. 27).

⁷ At the time of this study, Immanuel had not declared his major. However, in his interviews, he indicated that he planned to major in computer engineering.

participants were collegiate freshmen, middle class, and bilingual (English and Spanish). Table 1 summarizes participant background information taken from questionnaire and interview data.

The larger study in which these two case studies were situated (Oppland, 2010) was started by inviting all 27 students in my spring 2008 Calculus I workshop to participate. After completing data collection with nine Latina/o students, I selected Vanessa and Immanuel for case study analysis because they provided powerful, yet *different*, accounts of how their EMRICs and participation informed one another.⁸ I also selected a Latino and a Latina for this study to explore similarities and differences in how their other salient identities (e.g., gender) might intersect (or not intersect) with their EMRICs.

Table 1
Background Information for Case Study Participants

Background	Vanessa	Immanuel
University classification	Freshman	Freshman
Age	18	19
Gender	Female	Male
Race	Hispanic, Latino, or Latino-American; Mexican-American	Hispanic, Latino, or Latino-American; Mexican-American
SES	Middle	Middle
Language	Bilingual (English and Spanish)	Bilingual (English and Spanish)
Birth country	United States	Mexico
Major or intended major	Chemistry (major)	Computer engineering (intended major)

Data Collection

Multiple data collection strategies were used to understand how participants negotiated their EMRICs and how these negotiations related to their participation. In-depth interviews were the primary data source; a questionnaire, four reflections, and direct observations were secondary data sources.

Interviews. Three individual interviews were designed to capture participants' perceptions of their mathematics experiences and histories (including retrospective accounts), how their participation developed, and how their

⁸ Providing diverse accounts of how Latina/o students' identities and participation inform one another is critical because mathematics education research too often essentializes Latina/o students' mathematics experiences.

EMRICs shaped their participation. Interview 1 focused on the first category; interviews 2 and 3 focused on the latter two. The semi-structured interviews were conducted at the beginning, middle, and end of the semester. Participants were asked directly about race, gender, and class issues related to their mathematical trajectories and to elaborate on these phenomena (e.g., Do you feel that race/ethnicity plays a role in achieving in math? Why or why not? Describe any experiences where your race/ethnicity played a role in the workshop). After completing individual case study drafts, each participant participated in a follow-up interview to provide feedback on their case studies, which were then edited based on their comments (eight total interviews; average 1.6 hours each for Vanessa; 2 hours each for Immanuel). Interviews were audio-recorded and promptly transcribed to allow for any necessary modifications to the interview protocols.

Questionnaire and reflections. The purpose of the questionnaire was to collect personal background information (e.g., racial/ethnic affiliation), perceptions of collegiate mathematics experiences prior to participating in Calculus I (e.g., mathematics coursework completed), and perceptions of the Calculus I course and workshop (e.g., motivation for participating in the workshop) for each of the 27 workshop students, including Vanessa and Immanuel. Four written reflections were used to capture participants' more immediate perceptions of their workshop experience, including how they perceived their participation as developing over time.

Direct observation. Direct observations of Vanessa and Immanuel in the workshop also were collected. During each of the 28 workshop sessions, I used observation protocols to record detailed fieldnotes about each participant; a videocamera to record participants' engagement; two audiorecorders located in the classroom to capture participants' conversations; another audiorecorder located in my pocket to capture my interactions with participants; and photographs of participants' board work to capture another aspect of their engagement. Special attention was paid to how participants engaged with the environment, the instructor (me), peers, and the mathematics, and comments they made that shed light on their EMRICs. This analysis used audio and video data from three class periods—one each at the beginning, middle, and end of the semester—as time markers to capture how participants' identities and participation changed during the semester. As a teacher-researcher, I had an insider perspective, including an understanding of the general nature of the workshop context, participants' inter-actional tendencies with students and me, and participants' behaviors that they may not have described in interviews and reflections.

Data was organized in a case study database that contained notes, documentation, tabular materials, and narratives (Yin, 2009). Classroom observations were

gathered in one file; separate files, one for each participant, included the questionnaire, reflections, and interview protocols. A primary computer file contained a spreadsheet with organized questionnaire data and separate secondary files for each of the following: photographs of boardwork, audio files, typed classroom observations, and interview data. The interview data file contained separate files for each participant, each of which contained transcripts, interview data tables, and narratives. I also converted all videotape data onto cds (videotapes were not transcribed). Table 2 illustrates the data collection methods.

Table 2
Summary of Database

Methods	January 2008–May 2008	Data Collected
Interviews*	<ul style="list-style-type: none"> • Interview 1: Beginning of semester • Interview 2: Middle of semester • Interview 3: End of semester • Interview 4: Follow-up interview after the semester ended 	<ul style="list-style-type: none"> • Audiotaped and transcribed interviews • 8 total interviews • Average 1.6 hours each (Vanessa) • Average 2 hours each (Immanuel)
Questionnaire	<ul style="list-style-type: none"> • One time at the beginning of semester 	<ul style="list-style-type: none"> • Hard copy of questionnaire
Reflections	<ul style="list-style-type: none"> • Four times during the semester; once per month 	<ul style="list-style-type: none"> • Hard copies of four reflections
Classroom Observations	<ul style="list-style-type: none"> • Each workshop meeting throughout the semester • This study uses data collected during three class periods-one at the beginning, middle, and end of the semester 	<ul style="list-style-type: none"> • Field notes on 28 workshop meetings (roughly 56 hours of observation) • Audiotape and videotape of 28 workshop sessions (roughly 56 hours) • Photographs of boardwork

*Some interviews were conducted on different days.

Data Analysis

Data collection and case study analyses occurred simultaneously. The goal was to identify emergent themes related to how Vanessa's and Immanuel's management of their EMRICs related to their participation. Keeping this goal in mind, the initial codes described in Table 3 were used to analyze interview transcripts.

Table 3
Codes for Interview Analysis

Code	Description
Background information	Evidence that revealed information about participants' mathematics experiences in various contexts throughout their lives (e.g., societal, community, family, and school contexts)
Broader mathematical and racial identity constructions	Evidence that revealed how participants constructed their mathematical and racial identities in relation to broader contexts (e.g., societal, community, family, and school contexts)
Workshop mathematical and racial identity constructions	Evidence that revealed how participants simultaneously constructed their mathematics and racial identities in relation to the workshop
Workshop participation	Evidence that revealed information about how participants' participated in the workshop context

After completing data collection, interview data for each participant was categorized by the initial codes into data tables. An iterative coding scheme (Miles & Huberman, 1994) was then applied to carefully scrutinize interview data within the data tables, which involved developing and refining codes. For the second and third codes in Table 3, I identified (as best I could) identities that intersected with participants' mathematical and racial identity constructions (e.g., gender). After completing this iterative coding process, the interview text placed under the third and fourth codes in Table 3 in the data tables were put in chronological order according to interview dates to help recognize any changes that occurred over time.

Next, I meticulously analyzed and compared all data sources multiple times. Through this review and comparison, themes emerged for each participant regarding (a) how they negotiated their EMRICs (e.g., negotiated racialized experiences); (b) changes that occurred in how they negotiated their EMRICs (e.g., challenged racialized experiences they had managed earlier); and (c) how their participation evolved (e.g., became stronger participants in the workshop's valued practices). After identifying these themes, I investigated relationships between changes that occurred in how they negotiated their EMRICs and how their participation evolved. To understand these connections, in addition to drawing on CRT and LatCrit to capture participants' perspectives of meanings for the terms Latina/o, race, racism, and their possible intersection with other forms of oppression, I used a grounded theory approach (Corbin & Strauss, 2008), allowing relevant themes to emerge in the data. To gain a deeper understanding of students' EMRICs (including how this development transformed), I also drew on interview data to compare how they negotiated these identities in the workshop versus within and across broader contexts (e.g., societal, community).

Next, while keeping the research questions in mind, I conducted case analysis using three stages recommended by Miles and Huberman (1994): within-case analysis, data reduction, and cross-case analysis. First, within-case analysis involved developing theories about how each participant's EMRICs related to their participation, testing these theories against evidence collected for that particular student from various data sources, and deciding whether to accept, modify, or discard the theories. Second, data reduction involved constructing a case study narrative for each student. As the instructor of the workshop, my knowledge of the classroom and the participants aided me in constructing detailed contextualized narratives. Additionally, each participant also confirmed that the final version of their case study accurately portrayed their experiences. Third, after this member checking occurred, the final step of the data analysis involved conducting a cross-case analysis on the two in-depth case studies. That is, after identifying themes for each participant, I compared the two case study narratives to identify similar themes across the participants.

Participants did not always talk explicitly about meanings related to Latina/o membership, race, and racism as mathematics learners. Therefore, I took into consideration when they spoke about issues that might be relevant for understanding their EMRICs (e.g., diversity issues related to their mathematical experiences). As mentioned above, I also took into account how these meanings intersected with other social categories, such as gender. Although the social categories addressed in the interview questions were limited to race, gender, and class, I did not assume that gender and class identities were the only identities that might intersect with participants' EMRICs. Instead, I aimed to capture the complex social categories that were relevant for understanding what it means for participants to be Latina/o mathematics learners participating in the workshop.

Case Study Findings

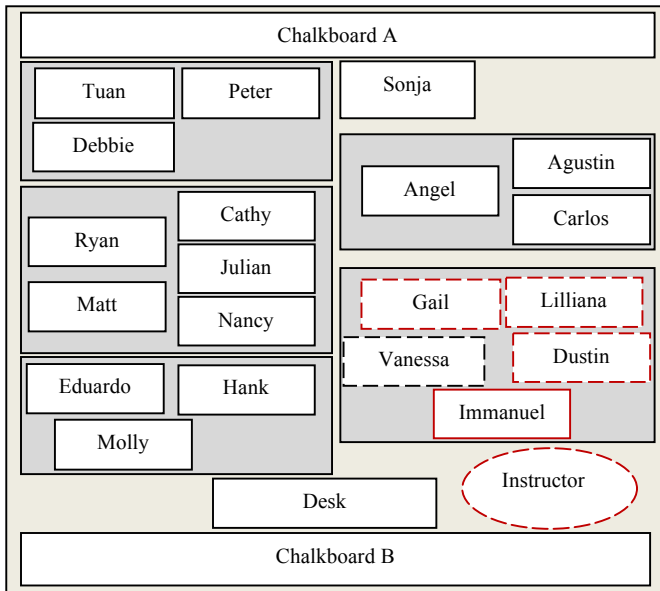
In this section, I first provide a detailed description of Vanessa's and Immanuel's case studies. Each case study illustrates how a Latina/o participant's EMRICs and participation informed one another over time. When describing each case, I attempt to highlight how the identity constructions examined intersected with participants' other salient identities, how such constructions were related to their negotiations of experiences in broader sociopolitical contexts, and how their workshop experiences influenced their negotiations of their identities and participation. After presenting the two case summaries, I present a cross-case comparison that reveals common themes, and also some variations, in how aspects of participants' EMRICs shifted their participation. Although the findings presented within each case study are based on the unique experiences of a particular Latina/o participant, the main themes reported in the cross-case comparison were similar across both cases.

When presenting each case summary, I refer to Table 4 and Figure 1. Table 4 contains background information for all students in Figure 1. Figure 1 provides snapshots of the workshop during three meetings—at the beginning (January 15, 2008), middle (March 20, 2008), and end (April 10, 2008) of the semester. The workshop met in three different classrooms during the semester. From January 15, 2008 until February 26, 2008, the workshop met in classroom 1, a small classroom that included several small desks, a large desk, and boards along the front and back walls. Because classroom 1 felt cramped and provided limited board space, I relocated the workshop to classroom 2. From February 28, 2008 until the end of the semester (except on April 1, 2008), the workshop met in classroom 2, a spacious meeting room that included several small desks, a large table, a free-standing board positioned in a private location, a significant amount of board space along two walls, and additional space for peer groups to spread out in the room. Due to a university activity occurring in classroom 2 on April 1, 2008, the workshop met in classroom 3, which was similar to classroom 1. During each meeting, students had the freedom to self-select into peer groups, change peer groups, interact with students in multiple groups, and move desks and the free-standing board. In addition, the workshop student population did not always remain consistent during each meeting.

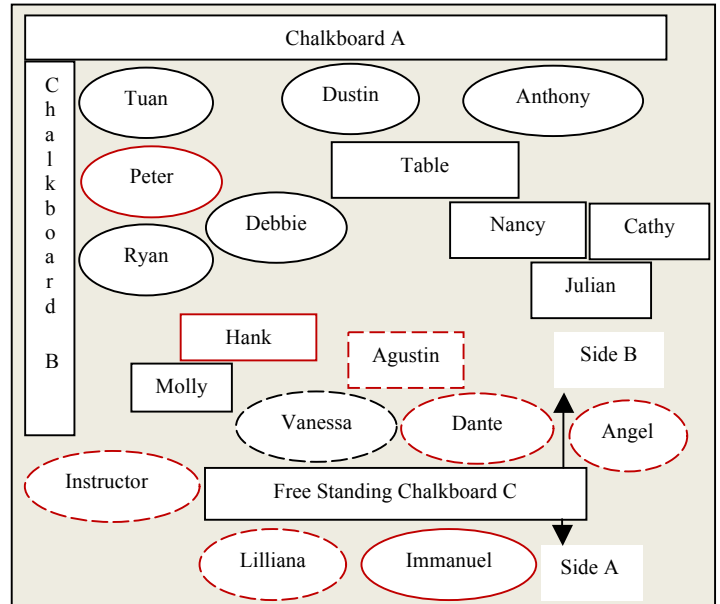
Table 4
Name, Year, and Race/Ethnicity of Students Identified in Figure 1

Name	Year	Race/Ethnicity
Agustin	Freshman	Latino
Angel	Freshman	Latino
Anthony	Freshman	African American
Carlos	Freshman	Latino
Cathy	Freshman	White
Dante	Freshman	Latino
Debbie	Freshman	Asian
Dustin	Junior	White
Eduardo	Freshman	Latino
Gail	Freshman	Asian
Hank	Freshman	Asian
Immanuel	Freshman	Latino
Julian	Freshman	Latino
Lala	Freshman	Latina
Lilliana	Sophomore	Latina
Matt	Freshman	White
Molly	Freshman	Asian
Nancy	Freshman	Asian
Peter	Freshman	White
Ryan	Freshman	White
Sonja	Freshman	African American
Tuan	Freshman	Asian
Vanessa	Freshman	Latina

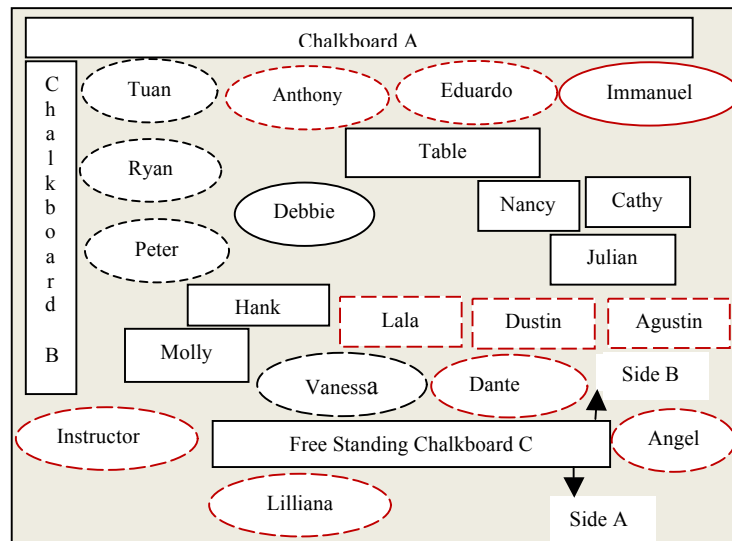
Snapshot of Classroom 1 on January 15, 2008



Snapshot of Classroom 2 on March 20, 2008



Snapshot of Classroom 2 on April 10, 2008



- Indicates the individual mainly sat at a desk during this meeting
- Indicates the individual mainly stood during this meeting
- Indicates individuals Vanessa interacted with during this meeting
- Indicates individuals Immanuel interacted with during this meeting
- Indicates individuals both participants interacted with during this meeting

Figure 1: Snapshots of the workshop context during three workshop meetings.

What It Means For Vanessa to Be an Urban Latina Workshop Student

Vanessa is an outgoing, first-generation, Latina freshman with long brown hair, brown skin, and a contagious smile. Although Vanessa had confidence in her mathematics ability throughout her academic development, she experienced a decrease in her mathematical confidence in high school and college. Vanessa revealed complex experiences she negotiated as a Latina that acted as avenues and barriers for her mathematical success, including those involving race, gender, culture, language, and power. As the following discussion illustrates, Vanessa's history as a Latina significantly impacted how her EMRICs influenced, and were influenced by, her participation over time.

Negotiating mathematical and racial identities: Avenues and barriers for participation. When the workshop relocated from classroom 1 to classroom 2 (see Figure 1), Vanessa's participation shifted in some critical ways. For example, she shifted from solving problems mainly with her initial group in classroom 1 while seated to solving problems with predominately Latina/o peer groups at board C in classroom 2 while standing. Vanessa revealed how her EMRICs supported this shift. Vanessa indicated that her preference for working with Latinas/os in "segregated" classroom 2 was tied to her perception that she shared "culture" and "language" backgrounds with Latina/o peers. For instance, encountering opportunities to occasionally speak "math in Spanish" while engaging with Latina/o peers made her feel comfortable:⁹

It's funny how we are all *segregated*. I think it's just nature. Everywhere I've been in school the Mexicans or the Hispanics will always be together no matter what. It's just the fact that you see similar things between each *culture*, like the *language* especially. We talk sometimes *math in Spanish*, so it's just like you can really tell them a little bit more than the other people. (Interview 2, March 11, 2008)

Vanessa also indicated that she felt comfortable working with Latina peers because of their shared gender backgrounds. Although her EMRICs contributed to creating these avenues, she also revealed several barriers that limited her participation, including three that I identified as related to her EMRICs: (a) perceiving differences between her and peers' cultural and language backgrounds; (b) peers' cultural and gender backgrounds contributing to her perceiving differences between her and peers' mathematical abilities; and (c) negotiating racialized and gendered experiences.

First, Vanessa's awareness of differences between her and peers' cultural and language backgrounds alienated her from some classmates. For example, in

⁹ Although Vanessa did not believe practicing mathematics in Spanish strengthened her comprehension of mathematics, she did believe that, for other Latinas/os, "language can be a barrier" for understanding mathematics.

the last sentence of the previous excerpt, she revealed that speaking mathematics in Spanish allowed her to “tell” Latina/o peers “a little bit more” than “other” students (who were predominately Asian and White). She also believed peers who shared culture and language backgrounds could comfortably practice mathematics together. This shared background made it “awkward” for her to join groups where members possessed cultural and language backgrounds that differed from her own because she did not want to “break something that’s out of the norm” and “mess everything up” (Interview 3, May 28, 2008). In fact, during much of the semester, Vanessa rarely interacted with students who typically participated in predominately Asian and White peer groups (e.g., Molly, Peter, Anthony). The ways in which peers’ cultural and language backgrounds both encouraged and limited Vanessa’s participation may have been related to her prior experiences, which included forming her closest friendships with Latinas/os and experiencing a lack of exposure to cultural diversity throughout her life.

Second, peers’ cultural and gender backgrounds contributed to Vanessa perceiving differences between her and peers’ mathematical abilities. For example, Vanessa viewed Asian and White students as mathematically superior because of their racial/ethnic backgrounds. The last sentence of the following quotation reveals Vanessa’s perception that Asian students possessed stronger mathematical abilities “because they’re Asian.” She also expressed a desire to interact with Asian students (including over Mexican students) because she viewed them as “smarter” and “wittier”:

Vanessa: You right away see who has more capacity for understanding sort of things and you just go to them. I don’t know. Maybe their race like maybe ‘cause they’re Asian they’re *smarter* and they’re *wittier*...if I were to go to the classroom and I would have to choose one partner that I think would help me understand a math problem I would definitely go to an Asian person. I wouldn’t go to a person that’s Mexican as much as I would feel a comfort zone with them.

Sarah: Can you say more about that? Why?

Vanessa: Why? I think that people look up to the Asian countries.... That’s sad to say I wouldn’t go to one of the people that are Mexican. I’m not saying that they’re dumb or anything. I mean I’m Mexican too, but it’s just like you tend to go to someone that has more of a reputation. Yeah.

Sarah: So would you have to know that they’re smart before you go to them or would you just kind of assume that because they’re Asian...

Vanessa: *Because they’re Asian they’re smart.* (Interview 3, May 12, 2008)

Even though Vanessa expressed this viewpoint, she rarely interacted with Asians, due to cultural and language differences that limited her interactions with them (as previously mentioned).

Students' genders may have also impacted how Vanessa assessed peers' mathematical abilities. She tended to perceive men as mathematically superior: "Males have a tendency of knowing more about math" (Interview 1, January 25, 2008). Blending this belief with her perceptions of how peers' cultural backgrounds related to their mathematics abilities may have made her more prone to develop an identity of marginalization in relation to students positioned externally to her peer groups who possessed both the cultural and gender statuses she associated with mathematical superiority. For example, she described White male peers positioned externally to her peer groups (such as Peter in the following quote) as "intimidating" due to their strong mathematics abilities, which led her to "tend to go to other people":

I don't think he means to be *intimidating*, but he just knows exactly what to do and it's kind of scary. You just kind of *tend to go to other people*, not the people that know less, just the people that are more laid back about it. I think he's a little too intimidating, too hyper, too excited about it, which is nothing bad. That's just not how I am. (Interview 3, May 12, 2008)

The ways in which peers' cultural and gender backgrounds contributed to limiting Vanessa's interactions with peers may have been related to her prior experiences, including managing societal, community, and institutional messages that supported the notion of a racial and gender hierarchy of mathematical ability with Asians, Whites, and men positioned as superior to Latinas/os, African Americans, and women.

Third, Vanessa negotiated racialized and gendered experiences. In the previous descriptions, Vanessa managed some racialized experiences (e.g., a lack of exposure to cultural diversity, stereotypes about cultural groups' mathematical abilities). In addition, she managed racialized and gendered experiences related to her interactions with Ms. Johnson (previously mentioned teacher). Vanessa described numerous ways Ms. Johnson mistreated her, including criticizing her preferred mathematical problem-solving strategies (e.g., constructing step-by-step solution processes, converting mathematical symbols into words), rejecting her mathematical ideas that contrasted with instructional approaches, and intimidating her as she solved problems on boards positioned in front of the class. In the following excerpt, Vanessa revealed how "racism" and her Latina background contributed to her feeling marginalized by Ms. Johnson:

Sarah: Do you want to say anything more about differences you observed in high school about how certain races were encouraged in math and others weren't?

Vanessa: Well, it was sex and it was the difference in the color of your skin.... This was precalc last year with the certain teacher that I had. She was African American and she was kind of light and she would emphasize and encourage the students that were *light skinned* instead of the other, and then the Hispanics I guess she just based it on this whole sex thing. She would literally go into the room and say, "Okay, my yellow and brown children." ...Yeah. She would say that and I'm like I'm not yellow. It's like what's the whole point? I'm a little *brown*...she would somehow integrate race, integrate it somehow...I guess she went through a lot of *racism* and stuff, but she's doing the same thing... (Interview 3, May 12, 2008)

Vanessa believed Ms. Johnson viewed her mathematics ability as inferior to "light skinned" students because of her "brown" skin and inferior to men (among the Latina/o students in the class) because of her gender. In the following quotation, Vanessa revealed that her experiences with Ms. Johnson, and in particular Ms. Johnson's criticism of her problem-solving strategies (e.g., "writing" mathematics), "slowed" down her mathematical development. In the workshop, Vanessa seemed reluctant to apply problem-solving strategies that Ms. Johnson had criticized and she was surprised to witness me translating mathematical notation into words when providing mathematical guidance to students:

I think what you have is you write a lot and for awhile I stopped *writing* everything for math and that kind of *slowed* me down and so now I have to write everything now.... That's why when the first couple of weeks that you were writing a lot it was weird 'cause I thought you were gonna be what my teacher said, "Higher math, you need less words the better." And I'm like wow she's writing... (Interview 1, January 25, 2008)

Negotiating mathematical and racial identities: Critical transformations. As the semester progressed, Vanessa's participation changed in some significant ways. For example, she contributed her ideas to mathematical discussions more frequently, she regularly solved problems with a more culturally diverse student population at board C in classroom 2, and she asked me (the instructor) mathematical questions about her work on board C in classroom 2. As these changes occurred, she challenged the aforementioned barriers tied to her EMRICs that restricted her participation.

First, perceiving differences between her and peers' cultural and language backgrounds acted as less of a barrier. As indicated in the following passage, although Vanessa maintained the belief that interacting with students with similar cultural and gender backgrounds was "important" due to the "comfort zone" this connection helped create, she also indicated that it was important for her "to learn how to get along" with students regardless of their cultural backgrounds:

Sarah: Is it important to you that there are people of your own gender and/or ethnicity in the workshop or do you not care?

Vanessa: I think it is *important* and it's *important* to have some people that are from your same racial background. Not only is it an ego booster, you just feel a certain *comfort zone* like I said. But then at the same token, I wouldn't really care if there wasn't anyone with the same background. You just have to *learn how to get along* with other people and just work with them too. (Interview 3, May 12, 2008)

As time evolved, Vanessa did gradually interact with a more culturally diverse student population compared to earlier in the semester (e.g., such as Anthony on April 10th in Figure 1 and Molly later in the semester). As this change occurred, she recognized the value of participating in mathematical discussions “with everyone else to learn about how other people study, how other people work the math problems ‘cause everyone has their own different thing” (Interview 3, May 12, 2008).

Second, transformations occurred regarding how peers' cultural and gender backgrounds contributed to her perceiving differences between her and peers' mathematical abilities. As Vanessa engaged with a broader peer population, she realized she possessed mathematical strengths that some “advanced” students did not (e.g., Asian students), she observed Latina/o students and women (including herself) exhibiting strong mathematics abilities, and she witnessed students she had initially framed as “advanced” encountering mathematical setbacks. For example, in the following excerpt, she discussed her realization that Asian students encountered similar mathematical challenges, which made her “feel good”:

They're struggling the same way I am and they're Asian.... They probably need a lot more help than I do and that makes me *feel good*. Sometimes you have to see. I mean the majority they're really smart, but some of them are struggling like any other person that's here...I always thought that they were smart until I came here and I realized not everyone is as smart as they look you can say. [laughs] (Interview 3, May 12, 2008)

These changes contributed to strengthening Vanessa's confidence as a mathematics learner and allowed her to positively merge aspects of her Latina, gender, and mathematics identities. For example, Vanessa grew to “accept” who she was “as a math student,” to perceive women (including Latinas) as “smarter” and “better” in mathematics, and to feel “proud” to perceive Latinas/os (including herself) as “good at doing math” (see the quotation in the introduction).

Third, Vanessa challenged racialized and gendered experiences. In the previous descriptions, Vanessa challenged some racialized experiences (e.g., comfortably practicing mathematics with a culturally diverse student population despite having a lack of exposure to cultural diversity, challenging socially and pri-

vately constructed meanings for White, Asian, and Latina/o mathematics learners). Additionally, she challenged racialized and gendered high school experiences involving Ms. Johnson. For example, she practiced mathematics comfortably at the boards without being criticized and recognized that her preferred problem-solving approaches were valued. The photograph in Figure 2 displays an example of how Vanessa used preferred problem-solving strategies that Ms. Johnson had criticized to attack a problem (i.e. breaking solution processes down into step-by-step formats, writing steps in words).

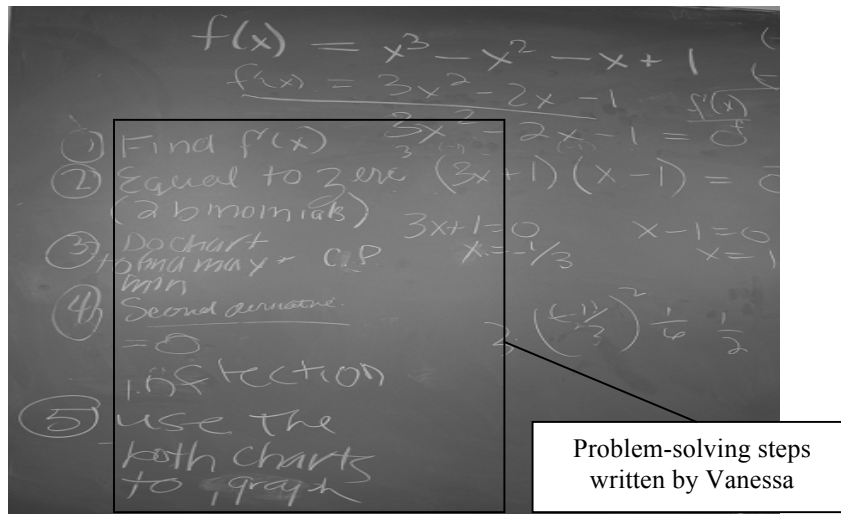


Figure 2. Example of Vanessa sharing her preferred ways of engaging with mathematics in the workshop context (Boardwork, April 8, 2008).¹⁰

What It Means For Immanuel to Be an Urban Latino Workshop Student

Immanuel is a sociable, first-generation, Latino freshman with short brown hair, brown skin, and a friendly demeanor. Due to a lack of mathematical opportunities in late middle school and high school, Immanuel experienced a decrease in his mathematical confidence. Immanuel revealed complex experiences he negotiated as a Latino that acted as barriers and avenues for his mathematical success, including experiences involving race, class, culture, language, and power. As the following discussion illuminates, Immanuel's history

¹⁰ The photograph depicts a solution for a practice exam problem. In the first photograph, Vanessa wrote: (1) Find $f'(x)$, (2) equal to zero (two binomials), (3) do chart to find max min (C.P. stands for critical points), (4) second derivative = 0, and (5) use the both charts to graph, which describes her steps for finding and classifying critical points, finding inflection points, and graphing the function.

as a Latino critically impacted how his EMRICs influenced, and were influenced by, his participation over time.

Negotiating mathematical and racial identities: Avenues and barriers for participation. When the workshop relocated from classroom 1 to classroom 2 (see Figure 1), Immanuel shifted towards frequently engaging in predominately Latina/o peer groups at board C. He revealed this shift was related to aspects of his EMRICs, including his perception that it was “easier to get along” with Latina/o peers because they were “culturally the same” and could “speak Spanish”:

I feel when you're *culturally the same* it's *easier to get along* for some reason, but I've only seen it with [Vanessa] and [Dante] and everyone because we all *speak Spanish* and just come culturally from the same background... (Interview 3, April 30, 2008)

However, Immanuel perceived speaking Spanish around peers who did not understand the language as “rude” because he did not want to “leave people out.” Therefore, he did not want his use of Spanish to limit his interactions with peers.

Immanuel also believed that cultural differences between him and his peers did not create levels of discomfort or obstruct his practice with peers: “There’s no barriers. We say hi to each other and we know if we need help who knows this, who knows that” (Interview 3, April 15, 2008). In fact, he believed Asian and White workshop students who tended to congregate together did so because they had established a close rapport with one another, not because they shared similar cultural backgrounds. He also cited friendly and unpretentious personalities, rather than cultural similarities, as a more dynamic factor that encouraged him to engage with peers. Immanuel’s perception that cultural differences did not impede his participation may have been related to his frequent exposure to culturally diversity in his prior schools, his closest friendships being formed with both Latina/o and White students throughout this life, and his belief that it was important for him to assimilate into American culture, including “to feel more equal to the rest of my peers.” Regarding this latter factor, he mentioned that Latina/o workshop students who tended to distance themselves from other students may have been “less assimilated to the American culture” (Reflection 4, April 15, 2008). Although Immanuel indicated that there were “no barriers” with peers, he did describe two barriers that limited his participation that I identified as related to his EMRICs: (a) negotiating racialized and SES experiences, and (b) perceiving differences between his and peers’ mathematical abilities due to his and peers’ cultural backgrounds.

First, Immanuel negotiated racialized and SES experiences in the workshop. For instance, he managed the lack of mathematical opportunities he had encountered in 8th through 12th grade. This lack of opportunity was related to various complex factors, including limited funding/funding cuts in his predominately La-

tina/o and/or African American schools, frequent interactions with unmotivated Latina/o and African American peer populations, high school mathematics teachers who held low expectations for Latina/o and African American students, and authority figures and unfair tracking practices that prevented him from participating in honors high school mathematics classes. For example, as a freshmen and sophomore high school student at Hook Career Academy, he interacted with academically unmotivated African American and Latina/o peers and mathematics teachers he perceived as uninterested in teaching their predominately African American and Latina/o students, which created significant barriers for his mathematical success:

From my experiences with the school, [Hook Career Academy], it was half Black and half Hispanic, they didn't want to learn the majority of them. There was like one or two, but the teachers didn't care about the students because half of the class didn't want to learn.... I mean, if the students wanted to learn over there at [Hook Career Academy], they still wouldn't teach you because they knew that it was gonna go down the drain anyways. That's just how I perceived it. (Interview 1, January 24, 2008)

Immanuel described how the negative mathematical experiences he negotiated from 8th to 12th grade, and particularly those at Hook, had a negative domino effect on his mathematics development, culminated in his decision to not enroll in a mathematics class his senior year of high school, and harmed his mathematical confidence: "I never had good experiences with learning math and I just feel like I'm not supposed to be here" (Interview 1, January 24, 2008).

The aforementioned lack of mathematical opportunities impacted Immanuel's workshop participation in terms of how he positioned his mathematics ability in relation to peers' mathematics abilities. For instance, he often described himself as "behind" and as "a little fish compared" to "smarter" workshop students, which limited his participation in terms of him refraining from sharing his mathematical knowledge in some instances and letting students that knew "how to best do it do it":

I'm always *behind*...some people are really on this and I'm trying to catch up to that.... I don't want to seem like *a little fish compared* to them...I'm like, yeah I don't know how to get past the first step, which is fine because I'll catch up eventually, but I mean I'm gonna let the person that knows *how to best do it do it*. (Interview 2, March 6, 2008)

Second, peers' cultural backgrounds contributed to Immanuel perceiving differences between his and peers' mathematical abilities. His frequent encounters with academically unmotivated Latina/o and African American peers in K-12 contexts contributed to him assuming that Latina/o and African American work-

shop students would also be less academically motivated, including in mathematics. Although he regularly interacted with Latina/o workshop students, this belief may have been related to his infrequent interactions with Anthony during much of the semester (the only African American student who persisted in the workshop). Further, he believed Asians and Whites tend to be strong in academics, including mathematics, due to, for instance, Asian students' strong work ethic and White students' parents passing on their knowledge of the American educational system to their children (this latter factor contrasted with his family experience). In fact, when asked to describe workshop students he perceived as mathematically strong he mentioned two White men (Peter and Matt). Although he indicated there were "no barriers" with students and he engaged with some Asian and White peers, his perception that Asian and White students tend to possess strong mathematics abilities appeared to contribute to him perceiving himself as less knowledgeable and refraining from sharing his mathematical knowledge in some instances. The ways in which peers' cultural backgrounds appeared to impact Immanuel's participation may have also been related to his management of societal, community, and institutional messages throughout his life that supported the notion of a racial hierarchy of academic and mathematical ability with Latinas/os and African Americans positioned below Asians and Whites.

Negotiating mathematical and racial identities: Critical transformations. As the semester progressed, Immanuel's participation changed in some critical ways. For example, he contributed his ideas to mathematical discussions more frequently, he solved problems with a more culturally diverse student population at boards A and C in classroom 2, and he asked me (the instructor) mathematical questions about work he completed on boards A and C in classroom 2. As these changes occurred, he challenged some of the aforementioned barriers tied to his EMRICs that limited his participation.

First, Immanuel challenged racialized and SES experiences. For instance, Immanuel often spoke about how the ample mathematical learning opportunities the workshop provided contrasted with the lack of mathematical opportunities he experienced in K–12 contexts (e.g., interacting with supportive and academically motivated individuals who were not "looking down" on his mathematics ability, identifying himself as a mathematical resource for students, viewing peers and the instructor as mathematical "resources," encountering opportunities to solve mathematical problems at his "own pace"). Immanuel discussed a subset of these experiences when asked to describe which workshop experiences, if any, had affected his motivation to learn mathematics:

The difference that made me feel like this is the fact that I'm really grasping the concepts and I feel like it's not being shoved down my throat. I feel like it's given to me on a plate and there telling me to take my time. It's okay if you're slow. Just take your time. You'll get there, as opposed to all my high school math classes, I feel like

(a) there wasn't enough resources to get extra help and (b) most of the teachers weren't that helpful...I mean it just doesn't work for me like that.... And I feel like it's right to be wrong because people are there to help you and somebody's gonna be wrong at one time or another and they're gonna be happy that you're there to help them. (Interview 2, March 6, 2008)

In addition to encountering resources he could draw on to learn mathematics, he identified himself as a mathematical resource for students, which was a particularly powerful experience (and change) for him. The photograph in Figure 3 illustrates how Immanuel used the boards to encourage students to use online mathematical YouTube videos (as indicated by "Math TV") because they helped strengthen his understanding of content outside of class. Some peers adopted his recommendations, which strengthened his confidence and encouraged him to continue to recommend videos: "Feels good...I've been telling people about the YouTube thing and they'll be like, 'Oh thanks, [Immanuel]. That really helped'" (Interview 3, April 15, 2008). This sharply contrasted with how he typically interacted with most peers in high school, particularly Latinas/os and African Americans at Hook Career Academy.

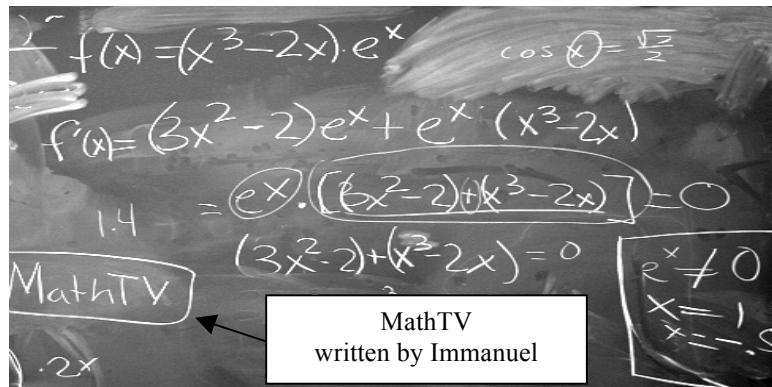


Figure 3. Example of how Immanuel used the boards to act as a mathematical resource for peers (Boardwork, April 8, 2008).

Second, changes occurred regarding how peers' cultural backgrounds contributed to him perceiving differences between his and peers' mathematical abilities. As Immanuel engaged with a more culturally diverse peer population, he indicated that the "communication barrier with everybody was broken" so he felt more comfortable asking a wider peer population mathematical questions (Interview 2, March 6, 2008). For example, in the following quotation, he described how he left his peer group to interact with Anthony, an African American male student he rarely interacted with earlier in the semester:

Sarah: Do you feel that you belong to a certain group?

Immanuel: Sometimes I do. Sometimes I don't. Sometimes I like to get out of that group 'cause they talk too much...I need help with this math problem, so I'll stand up and go to the board like the other one in this room. And today [Anthony] was having the same problem with number one...and I was like, "Damn, see that's why you're up there at that board, [Anthony]. You know what you're doing." And then he did all of it and he did it in his head and I was like, "How'd you know that?" And he's like, "Well, I took calc in high school." ...Yeah, he did it really fast, but he explained it to me, and then [Vanessa] and them were still on that graph problem. I didn't feel like doing it. I wanted to do the integrals 'cause they seemed cool. (Interview 3, April 15, 2008)

As Immanuel engaged with a broader peer population (e.g., Anthony, Hank), transformations occurred regarding how he viewed his and peers' mathematical abilities. For example, he perceived peers' mathematics abilities as more equal and advanced over time; he observed an African American male student (Anthony) and Latinas/os exhibiting strong mathematics abilities (which contrasted with some prior experiences); and he observed students he had framed as mathematically advanced (e.g., Asians) encountering mathematical challenges and "not looking down" on his mathematics ability.

These transformations contributed to strengthening Immanuel's confidence as a mathematics learner and allowed him to positively merge his Latino and mathematical identities. For example, the workshop aided him in attaining a mathematical appropriation level that he had not experienced in his prior mathematical pathway: "I just get it now after all this work we've been doing. I get all this other stuff that in my life I've never really gotten" (Interview 3, April 15, 2008). He also gained motivation due to perceiving Latinas/os (including himself) as "breaking stereotypes" about Latina/o students' mathematics abilities:

[Strengthened mathematics identity as a Latino mathematics learner]

Immanuel: I never met Hispanic or Latino people that are this high up like me...I don't know. It's perplexing me because if you're used to something all your life, like I was expecting to come to [Hall University] and not be similar to people in that cultural background because you never hear of a lot of Black or Latino people going to college. But it's funny because this is one of the only classes where it's like wow you guys want to be engineers.... It's like that's really cool.

Sarah: Does that help motivate you?

Immanuel: Yeah, it does because I don't feel alone...most of the people you see at [Hall University] are White or Asian or something like that. It's weird not to have anybody from your background that's somehow connected in a different way. That knows what's going on...my econ class was all White. I was like, "Wow, I'm the only Hispanic person interested in econ." But then when you get to this class it's like that's cool man...you and I are *breaking stereotypes*. (Interview 3, April 15, 2008)

In sum, analyzing Vanessa's and Immanuel's perspectives of their workshop experience through sociocultural, CRT, and LatCrit lenses reveals that their negotiations of their EMRICs (and their intersection with their other identities, such as gender in Vanessa's case and SES in Immanuel's case) contributed to creating significant avenues and barriers for their participation. However, as the semester progressed and their participation continued to influence how they negotiated these identities, they were able to challenge barriers they had managed earlier, which influenced some profound positive transformations in their participation.

Cross-Case Comparison

Data analysis for this study involved first constructing the above case study narratives for each participant and then comparing the findings across both cases. To complement the above findings, I now discuss important cross-case findings to illuminate how two Latina/o students negotiated their EMRICs in relation to their participation.

Three main (overlapping and positive) themes emerged regarding how participants' EMRICs shifted their participation over time. First, participants' perceptions of their and peers' mathematics abilities changed in ways that strengthened their participation. For example, both participants challenged privately and socially constructed meanings of what it means to be Latina/o, Asian, and White mathematics learners (and an African American learner in Immanuel's case) and they constructed strengthened self-perceptions as Latina/o mathematics learners.

Second, both Vanessa and Immanuel challenged racialized experiences tied to prior school experiences in ways that strengthened their participation. For example, Vanessa challenged how Ms. Johnson had constructed her preferred mathematical strategies as deficits, including due to her Latina status, which encouraged her to apply these methods in the workshop. Immanuel challenged his prior interactions with academically unmotivated African American and Latina/o peers, including by witnessing mathematically talented African American and Latina/o students use mathematical resources he recommended, which encouraged his participation.

Third, both participants established strengthened comfort levels in the workshop not only with peers but also with me (the instructor) and the mathematics,

which encouraged their participation. For example, interacting with peers and an instructor that supported their preferred ways of engaging with mathematics (e.g., writing mathematics in words in Vanessa's case and comfortably sharing links to mathematical videos in Immanuel's case), which contrasted with prior racialized experiences they managed, strengthened Vanessa's and Immanuel's comfort levels and participation.

Discussion

This study presented two case studies that illustrated how Latina/o students' participation through their EMRICs critically influenced positive shifts in their participation in a culturally heterogeneous, collaborative ESP Calculus I workshop. Vanessa's and Immanuel's voices not only revealed intimate relationships regarding how their complex negotiations of their EMRICs and their participation informed one another but also how these relationships became strengthened over time. Although participants' negotiations of their EMRICs created some obstacles for their participation, they participated through their salient identities (e.g., disciplinary, racial, gender, class) in ways that allowed them to challenge these barriers and experience positive shifts in their participation over time, which ultimately strengthened relationships among their identity development and participation. The findings indicate that understanding how Vanessa's and Immanuel's identities and (non)participation evolved and related could not be separated from the social, political, and historical contexts in which the local workshop was situated. A significant implication that this understanding has for research on students' participation in mathematics is that we must not only consider the sociopolitical nature of interactions and (non)participation in mathematics classroom contexts but also how participation in local classroom contexts relates to the broader sociopolitical environment. Sociocultural mathematics education studies that investigate students' participation without using a sociopolitical lens would not reveal the sociopolitical nature of participation, including how students' social identities relate to their practice-based identity constructions.

The case studies reveal the complexity, diversity, and significance of the sociopolitical nature of the co-construction of identity development and participation for Vanessa and Immanuel in the workshop context. Relationships that emerged between participants' emerging mathematical and racial identity (re)constructions and their participation processes were connected to various interrelated issues related to their histories and lives (e.g., meanings for Latina/o, race, racism, language, culture, gender, class, power relations, stereotypes), multiple contextual layers (e.g., society, community, family, school, peer groups), the classroom environment (e.g., interactions with supportive peers and the instructor, classroom layouts, pedagogical practices), and their agency and resilience. As-

pects of participants' EMRICs that powerfully influenced the evolution of their participation aligned strongly with factors recognized as informing Latinas/os' racial identity constructions. Such factors include meanings for racial/ethnic group memberships, racial stereotypes, treatment by teachers and/or peers in school contexts, and interactions with and degree of exposure to racial/ethnic groups (Ancis, Sedlacek, & Mohr, 2000; Barajas & Pierce, 2001; Ferdman & Gallegos, 2001). For example, interactions with encouraging dominant and non-dominant students allowed participants to challenge stereotypes about Latina/o, African American, Asian, and White students' mathematics abilities and contributed to strengthening their self-perceptions as Latina/o mathematics learners. Therefore, similar to Esmonde and colleagues (2009), this study found that aspects of marginalized students' various identities can be related to how broader contextual power relations become manifested in mathematics classrooms through collaborative classroom practices, which influence the mathematical learning opportunities they experience.

Regarding the classroom environment, particular classroom characteristics that supported strengthened relationships among identity and participation included: collaborative peer groups, self-selecting and changing peer groups, supportive instructors and peers, writing mathematics on privately located boards (i.e., not positioned in front of the class) in a spacious classroom, and "the valorization of multiple methods for thinking about and doing school mathematics" (Jilk, 2007, cited by Civil, 2008, p. 17). As the instructor, my actions contributed to encouraging participation patterns that supported positive identity development, including by treating students as valuable resources and giving them the freedom to engage with mathematics in ways that supported them to challenge prior experiences with authority figures and/or peers that had threatened facets of this development. For instance, participants were encouraged to use various languages, write mathematics in words, use step-by-step strategies, and share mathematical videos.

Participants also exercised their personal agency to actively negotiate aspects of their EMRICs in ways that influenced *supportive shifts* in their participation in terms of becoming more active members of the workshop CoP. Transformations in Vanessa's and Immanuel's participation (as previously described) occurred, in part, because of their willingness to take risks. For example, they shifted towards recording problem solutions on boards, sharing their solutions with peers and the instructor, repositioning themselves in the classroom including by engaging with a more culturally diverse peer population, and resisting cultural mathematical stereotypes. As their participation evolved, their negotiations of their EMRICs contributed to them responding to barriers they had faced earlier in the semester in diverse ways, which led to some critical transformations in how their participation developed.

Findings for both cases also resonate with mathematics education research indicating that the intersectionality of underrepresented students' mathematical and other salient identities can inform, and be informed by, their participation in mathematical learning communities (Esmonde et al., 2009; Nasir, 2002). A combined CRT and LatCrit lens revealed that avenues, barriers, and supportive shifts for participation were related to how meanings for Latina/o, race, and racism complexly and diversely intersected with covert sociopolitical constructs (i.e., gender, SES, language, culture). Similarities and differences emerged regarding how intersections among participants' salient identities and EMRICs informed their participation. For example, sharing cultural and language backgrounds with Latina/o participants increased both participants' comfort levels. However, unlike Immanuel, Vanessa's negotiations of the nexus of her mathematics, racial, and gender identities contributed to creating significant avenues, barriers, and productive shifts for her participation (e.g., witnessing Latinas' and women's mathematical talents allowed her to challenge the notion of a gender hierarchy of mathematical ability, which strengthened her desire to participate). Unlike Vanessa, Immanuel's management of his collective mathematics, racial, and class (SES) identities played powerful roles in creating barriers and productive shifts for his participation (e.g., encountering numerous mathematical opportunities in the workshop allowed him to challenge prior K-12 experiences, which strengthened his participation). On the other hand, however, shifts in Vanessa's and Immanuel's participation also strengthened aspects of their EMRIC's (e.g., constructed stronger perceptions as Latina/o mathematics learners). At a time when Latina/o students' mathematical experiences are often (negatively) essentialized in mathematics education scholarship, this study supports that the complex intersectional nature of Latina/o students' EMRICs in mathematics classrooms must be acknowledged.

Employing CRT and LatCrit also allowed for capturing participants' counter-stories, which reveal how societal stereotypes, low expectations, and barriers they faced in their mathematical trajectories, including those involving racialized, gendered, and classed meanings, impacted how their EMRICs and workshop participation related. Such stories offer possible explanations for Latina/o students' lower mathematics achievement and participation levels (Chapa & De La Rosa, 2006; Ortiz-Franco & Flores, 2001) and why some Latinas/os struggle to identify with mathematics. However, the findings also reveal how Latinas/os resisted and overcame oppressive experiences to participate, learn, and succeed in mathematics. Such findings suggest that to better support underrepresented students in succeeding in mathematics it is imperative to recognize how interlocking variables such as race, gender, and SES function in their mathematical lives and to eliminate barriers they face linked to structural, institutional, and everyday racism.

Conclusion

Addressing the mathematics education community, Gutiérrez (2013) stated:

If, as a field, we are not willing to recognize the political nature of mathematics education or the fact that teaching and learning are negotiated practices that implicate our identities, we might as well give up on all of this “talk” about equity. (pp. 62–63)

Assuming this standpoint, this study supports that the mathematics education community must embrace the sociopolitical nature of how Latina/o students co-construct their identities and participation in mathematical learning contexts because this more expansive theoretical lens can provide additional knowledge regarding *how* and *why* Latina/o students attain mathematical success. This study also addresses the importance of capturing students’ perspectives that may be invisible but also may be critical for understanding their mathematical success. Future research should use multiple data sources to examine contextualized interpretations of the meanings students give to their participation in effective mathematics classrooms. Such research will not only help to reveal the complexities, avenues, and transformations that support students’ mathematical success but also will expand knowledge about how to design identity-affirming, equitable mathematical learning environments.

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