MATHEMATICS AND RACIAL IDENTITY CO-CONSTRUCTION IN MULTIPLE SOCIOPOLITICAL CONTEXTS: A CASE STUDY OF A LATINA UNDERGRADUATE STUDENT FROM AN URBAN COMMUNITY

Sarah Oppland-Cordell[20]
Northeastern Illinois University

ABSTRACT

Although urban Latinas/os have participated in mathematics workshops in urban universities for over three decades as part of the Emerging Scholars Program (ESP), few studies have explored Latina/o students' perspectives of how and why these learning environments support them in attaining mathematical success. This article presents an in-depth case study of how Vanessa, a Latina undergraduate student from an urban community, simultaneously constructed her mathematics and racial identities as she engaged in a culturally diverse, collaborative ESP Calculus I workshop situated within broader sociopolitical contexts. Vanessa's story was selected because she offered a unique perspective of how encountering identity-affirming workshop spaces aided her in constructing a strengthened self-perception as a Latina mathematics learner. Her counter-story challenges dominant ideologies that disregard the importance of viewing Latina/o students' mathematics participation and learning as racialized forms of experience.

Keywords: Mathematics identity, Racial identity, Latina/o critical theory, Latina/o students

What does it mean to be a Latina/o in the context of mathematics participation and learning? Although mathematics education research has shed light on this question by exploring Latina/o students' perspectives of their mathematics experiences (e.g., Varley-Gutiérrez, Willey, & Khisty, 2011), too often Latina/o students' first-hand accounts of how they negotiate their mathematics experiences, including within broader sociopolitical contexts, are discounted and underexplored (e.g., Gutiérrez, 2008, 2013). A lack of research documenting Latina/o students' personal accounts of how and why they succeed in mathematics, including the roles of their histories, agency, and resilience, has contributed to the construction of dominant narratives that view Latinas/os'

[20] **Sarah Oppland-Cordell** is an Assistant Professor of Mathematics at Northeastern Illinois University. Dr. Oppland-Cordell can be reached at Northeastern Illinois University, 5500 North Saint Louis Avenue, Chicago, IL, 60625 or at s-cordell@neiu.edu. Her research interests include the identity development of marginalized students in STEM fields, relationships between marginalized students' identity development and participation in mathematics classrooms, and creating equitable learning environments for marginalized students in mathematics.

underachievement, limited persistence, and failure in mathematics as normative (Martin, 2009). According to Gutiérrez (2013), "Without the voices of marginalized people commenting on their interpretations of the mathematical practices in which they are engaged, we are unlikely to fully understand the possibilities of other arrangements in mathematics education" (p. 16).

This study adds to mathematics education scholarship that has investigated Latina/o students' perspectives of their mathematics experiences, while also responding to Gutiérrez's (2008) call for further research to be conducted on *effective* mathematics learning environments for Latina/o students. The effective mathematics learning context in which this study occurs is an Emerging Scholars Program (ESP) mathematics workshop. The ESP model, which is based on Uri Treisman's doctoral dissertation work at the University of California (UC), Berkley in the mid-1970s, has been nationally recognized for effectively supporting marginalized students in achieving, persisting, and succeeding in mathematics (Hsu, Murphy, & Treisman, 2008). However, despite this success, research on ESP mathematics workshops often fixates on participants' static achievement outcomes and neglects to investigate their perspectives of forces that influence such outcomes. Exploring such perspectives in relation to students' experiences in broader sociopolitical contextual layers can provide nuanced understandings of how and why such environments support students in attaining mathematical success.

This study addresses a gap in mathematics education literature by using an identity analytic lens to explore what it means to be a Latina undergraduate student from an urban community participating in an ESP mathematics workshop situated within broader sociopolitical contexts. In particular, I explore how a Latina's mathematics and racial identities intersect by examining: (1) What does it mean to be a Latina in the context of mathematics learning? and (2) What does it mean to be a learner of mathematics in a Latina social context? These questions are important because they can shed light on how Latina students "exhibit agency to resist their marginalization, assert their own identities, and experience mathematics learning and participation" (Martin, 2009, p. 46).

Theoretical Framework

Because this study aims to capture a Latina student's perception of the historical, sociopolitical, and situational nature of her mathematics and racial identity development, this study draws on Latina/o critical theory (LatCrit). LatCrit in education refers to "…a framework that can be used to theorize and examine the ways in which race and racism explicitly and implicitly impact on the educational structures, processes, and discourses that effect People of Color generally and Latinas/os specifically" (Solórzano & Yosso, 2002, p. 479). Key principles of this framework that this study draws on include the centrality of race and racism and their intersectionality with other forms of oppression, challenge to the dominant ideology, and the centrality of experiential knowledge (Solórzano & Delgado Bernal, 2001).

Methodologically, LatCrit encourages examining marginalized students'

experiences through counter-storytelling methods (Solórzano & Yosso, 2002). In this study, *counter-stories* refer to stories about Latina/o students' mathematical experiences, which might challenge dominant ideologies that disregard viewing Latina/o students' mathematics participation and learning as racialized forms of experience. *Racialized forms of experience* refer to viewing Latina/o students' mathematics participation and learning as "structured by the relations of race that exist in the larger society" (Martin, 2009, p. 5).

Identity

To understand Vanessa's *mathematics identity*, this study draws on Martin's (2007) definition: "Mathematics identity refers to the dispositions and deeply held beliefs that individuals develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the conditions of their lives" (p. 150). Vanessa's *racial identity* refers to how she negotiated privately and socially constructed meanings of Latina/o, race, racism, and racial inequality in relation to broader sociopolitical contexts. To understand Vanessa's mathematics and racial identity co-construction (or how she simultaneously constructed her mathematics and racial identities) this study draws on Martin's mathematics identity co-construction theory. This theory, which was used to analyze African American learners' mathematics and racial identity co-constructions, involved exploring how participants' experiences as African Americans influenced their mathematics learning, and how participants' mathematical experiences influenced their self-perceptions as African Americans.

Methods

This qualitative study employed exploratory case study methodology (Yin, 2009) to examine how a Latina undergraduate student co-constructed her mathematics and racial identities. Although research has shed light on how Latina/o students construct mathematics identities within communities of practice, this qualitative study is designed to explore how a Latina student's mathematics participation and learning in an effective mathematics learning context can be interpreted as racialized forms of experience. The purpose of this case study is not to generalize the findings to other Latina/o students, but to draw attention to the salience of race in a Latina student's mathematics experiences. This study used interview and reflection data, which aligns with LatCrit as both data sources capture the salience of race and racism, their intersection with other forms of oppression, and experiential knowledge.

Research Context

The workshop in which Vanessa participated was situated in Hall University—a predominately White, urban, Midwestern university in the US. According to an institutional report on Hall University's ESP mathematics workshops, the workshops were implemented because a significant number of

Latina/o and African American students were struggling to successfully complete their precalculus and calculus courses. During spring 2008, the author collected interview and reflection data on nine undergraduate Latina/o students (three females and six males) participating in an ESP Calculus I workshop, as part of a larger dissertation study (Oppland, 2010). Vanessa was one of the Latina students enrolled in this workshop, which ran parallel to her required Calculus I course. 27 students participated in this workshop, including roughly 41% Latina/o (four females and seven males), 30% Asian (five females and three males), 22% White (two females and four males), 7% African American (one female and one male), 44% female (twelve females), and 56% male (15 males). Within this workshop, culturally diverse peer groups collaboratively solved challenging mathematics problems while being led by a facilitator (the author).

Participant

Vanessa is a female, second-generation, Mexican American immigrant. At the time of this study, she was an eighteen-year-old, undergraduate freshman majoring in chemistry who described herself as middle class and bilingual (English and Spanish). Although aspects of Vanessa's story are representative of other Latina/o students' experiences in the larger study (Oppland, 2010), her story was selected because she offered a unique perspective on how encountering identity-affirming workshop spaces aided her in constructing a strengthened self-perception as a *Latina* mathematics learner. I highlight Vanessa's story to examine what it means to be a Latina in the context of mathematics participation, learning, and success.

Data Collection and Data Analysis

This study draws on data collected on Vanessa in the larger study (Oppland, 2010). This includes three semi-structured interviews, a follow-up interview, and four written reflections. Vanessa was interviewed a total of six hours and nineteen minutes. During interviews, she was asked to discuss mathematics experiences she negotiated in societal, community, family and school contexts throughout her life, including experiences involving race, gender, and class. These particular contexts were selected to respond to the call to understand "how school, peer, family, community, and societal forces" contribute to the development of mathematics and racial identities (Martin, 2007). Interviews were audio-recorded and promptly transcribed. Reflections, which were used to capture Vanessa's perceptions of her workshop experience, also served as a secondary data source.

To address the research questions, this study drew on Martin's (2007) mathematics and racial identity co-construction theory to develop initial codes and code definitions to guide data analysis. Initial codes and definitions were used to identify how Vanessa's negotiation of experiences as a Latina learner in broader contexts influenced her mathematics learning and how the mathematical experiences she negotiated in broader contexts influenced her perception of

herself as a Latina. While keeping the code definitions in mind, an iterative coding scheme was applied to carefully scrutinize interview data; interview data was then categorized using data tables; and text in the data tables were then reread and recoded to confirm the accuracy of the codes. Next, I meticulously analyzed and compared interview and reflection data multiple times. Through this comparison, themes emerged regarding what it meant for Vanessa to be a Latina in the context of mathematics learning and a mathematics learner in a Latina social context. Finally, narrative summaries were written, that were used to describe Vanessa's mathematics and racial identity co-construction.

Interpretations

In societal contexts, Vanessa had a keen awareness of negative ideologies the "rich," the politically powerful, and the "media" (who she often classified as White) transmitted about Latinas/os. Such messages imposed low educational expectations onto Latinas/os, lacked respect for their academic accomplishments, and created a greater disconnect between Latinas/os and those "in power." Society's unfavorable disposition towards Vanessa's collective Latina and class statuses (e.g., viewing Latinas/os on the "bottom level" in competition for jobs) and her joint Latina and gender statuses (e.g., perceiving Latinas as "just getting pregnant" instead of pursuing educational avenues) also aimed to create boundaries for her participation in academics, including mathematics:

> **Vanessa:** I just think that people don't really think about Hispanics that are in college. They don't think they can make it. I think that when they think of a Mexican - that's who I am, I'm Mexican American - people don't really look at you as Mexican American. They're like oh you're just Mexican. They're just here illegal. They're just gang banging and *just getting pregnant*. I don't think that the perspective of Hispanic is positive. I just don't think that people realize there's a lot of Hispanics struggling or trying to get a degree in college.
>
> **Author:** Who do you see as thinking that about Hispanics?
>
> **Vanessa:** I think it's more outside and it's especially people that are being influenced by politicians, the elite, and the community that's *rich* and the *media*. How many times don't you hear stuff that's not true?! I think it's basically people that are rich and *in power* that start the idea and it just goes down in scale. The other minorities that are along the same level, like Blacks, you can say Blacks are on the same level, in competition with the Hispanics. The *bottom level* I guess we could call it. They [Hispanics and Blacks] also look at it that way cause that's what they hear.

(Interview 3)[21]

Although Vanessa negotiated some positive academic and mathematical experiences in her predominately Latina/o community, she also managed several negative experiences. For example, she encountered community members struggling to overcome negative societal academic stereotypes, a lack of academic resources, messages about a weak link between mathematics and her culture, and community members who projected higher mathematical expectations onto males than females (regardless of their cultural statuses):

> Even though there's a lot of female teachers in high schools that are math teachers, it's like oh whatever, but if you're really, really, really good at it and you have a higher degree, or something like that, the community is shocked. Like what?! It should be a male. (Interview 3)

Within her community lived her close-knit family, including her hard-working, Mexican-born parents and her eleven-year-old, US-born brother. Vanessa's parents, who had an acute awareness of their occupational struggles and lower educational levels, dreamed of a better life for their daughter. They channeled this desire into encouraging Vanessa to achieve high academic goals, to graduate from college in four years, and to secure a strong occupational position after graduation. Vanessa's immediate family supported her academic endeavors by encouraging her to persist through academic challenges, motivating her to perform at a high academic level, and influencing her to frame her academic success as important. Her mother's support and encouragement played a critical role; the mother, for instance, ensured Vanessa attended a better quality high school than the one located in their neighborhood and supported her when she faced academic obstacles, including in mathematics.

> My mom was always the one that was there. If I had to cry, I'd cry with her and she'd be like, 'Oh, you can do it', and I'm like, 'Yeah, I can do it' or she would look at it in a positive way. That's what kept me going. (Interview 1)

As a K-12 student, Vanessa attended predominately Latina/o and/or African American public schools near Hall University. Although Vanessa encountered supportive teachers, she described her interactions with Ms. Johnson (her sophomore and senior high school mathematics teacher) as a major struggle in her life. Vanessa revealed that Ms. Johnson criticized students as they solved problems, failed to value students' various ways of thinking about problem-solving processes, and projected different mathematical expectations onto students based, in part, on their ethnicities, races, and genders. Vanessa believed her Latina and gender statuses played a role in the harmful treatment she received

[21] Italics were added by the author for emphasis.

from Ms. Johnson, who would "encourage the students that were light skinned" and favor males over females among the Latina/o students in her class. When describing this teacher, Vanessa stated: "She would somehow integrate race. I guess she went through a lot of racism…but she's doing the same thing" (Interview 3).

What Does It Mean For Vanessa to Be a Latina in the Context of Mathematics Learning?

Vanessa's story indicates that her Latina status and identity contributed to her being overtly and covertly assaulted in societal, community, and institutional contexts, which contributed to harming her mathematics identity development. For example, Vanessa's beliefs sometimes reflected the harmful cultural and gender mathematical stereotypes she negotiated in broader contexts. Assaults on her Latina identity appeared to contribute to her relating strong mathematics abilities "to males or certain ethnicities like Asians," positioning her mathematics ability below these gender and cultural groups, and weakening her identification with mathematics:

> If you are good at math it just means you're really smart and it's usually related *to males or certain ethnicities like Asians*. It doesn't necessarily mean you are White or Asian but it refers to how awkward it is to be good at math if you're Hispanic or a Hispanic female. (Reflection 4)

Vanessa's management of racialized school experiences also threatened her mathematics identity development. For example, her interactions with Ms. Johnson severely limited her participation in mathematics and negatively impacted her at the undergraduate level: "I feel like, if I would have had a different math teacher, things would have been a little different. She stopped me a little" (Interview 1). In conclusion, experiences Vanessa negotiated as a Latina mathematics learner in multiple contexts contributed to her positioning herself away from the top of a perceived gender and racial hierarchy of mathematical ability and forming the belief that an individual's cultural background can contribute to them encountering obstacles that slow their efforts to obtain mathematical literacy.

However, despite Vanessa's awareness of the devaluation of Latinas/os in societal, educational, and mathematical contexts, she refused to allow such racialized experiences to thwart her from participating and succeeding academically. With the aid of positive family and community influences, various encouraging experiences in school contexts, and her determination to succeed in academics and life, she adamantly resisted and refused to concede to stereotypes that framed her success in academics and mathematics as less probable. In fact, challenges tied to her Latina, female, and class statuses, separately and collectively, that aimed to limit her participation in academics often drove her to set "higher" academic goals for herself, including in mathematics:

> …females are usually not good at math and being Hispanic you should get married instead. Like what's the whole deal with math? Yeah, definitely the bar is set high. I think it's individual though. I don't think society sets the bar high. It's just like okay well why? There's a certain point where you should stop I guess in your education and then you're like wait, why? And then you just go up *higher*. (Interview 3)

What Does It Mean To Be a Learner of Mathematics in a Latina Social Context?

Although Vanessa resisted negative mathematical discourses about Latinas/os and females, her negotiations of these discourses in societal, community, and school contexts appeared to influence her to position Latinas/os (including herself) below other cultural groups in relation to academics and other aspects of life:

> I think that people from Asia like have a great advantage because you see a lot more people that are engineers and scientists and anything that has to do with math…It's different for my race, though. I think that being Hispanic…math is not important…if a female Hispanic girl was an engineer, like I know someone who's trying to be an engineer, like that's a big thing. That's a step above anything. I think they really have the advantage. I wish everyone had an advantage though. (Interview 1)

However, negotiating positive mathematics experiences and experiences that threatened her identity as a mathematics learner (including those involving race, gender, and class) also motivated Vanessa to develop a strong academic identity, including in mathematics.

Vanessa perceived her strengthened academic identity as a means to further strengthen her Latina identity. She described how developing a strong academic identity, including in mathematics, would aid her in resisting the devaluation of her Latina (and female) identities in broader contexts, positively transform the negative framing of Latinas (and females) in relation to academics in societal and community contexts, and improve her, her family, and her community members' life conditions. For example, Vanessa described how earning a college diploma would strengthen her ability to serve as a positive "role model" for Latinas within her community:

> I think in general people would obviously be proud, especially people that you can relate to, other females for instance. They'd probably look up at you and be like oh if she can do that, I can do it. Sort of like a *role model* thing. (Interview 3)

Vanessa also expressed great confidence in her Latina identity despite the challenges she had faced as a mathematics learner related to her Latina status.

The Role of the ESP Workshop

Vanessa revealed that her engagement in the ESP workshop played a critical role in strengthening her collective mathematics and racial identities:

> [*Strengthened collective mathematics and racial identities*] I was like, wow! I guess it's good to see how other Hispanic people are so good at doing math…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… (Interview 3)

> [*Strengthened collective mathematics, racial, and gender identities*] I think women are better…It's surprising because you don't really expect that. Society doesn't really expect that, but I saw a lot of very smart girls that were really good at it. You don't expect to see that because in society the norm is guys will always be or men will always be better in math than anyone else, but it's not true. It's something you can't really measure like whose better than who. It's not like a quantity thing…I think everyone has the ability. It's just how you were able to develop the skill. (Interview 3)

Challenging racialized mathematics experiences linked to broader contexts as she engaged in identity-affirming workshop spaces strongly aided in this transformation. For example, Vanessa witnessed culturally diverse workshop students displaying their mathematical strengths and encountering similar mathematical challenges, which helped her challenge cultural and gender mathematical stereotypes. She also recognized that workshop peers and the instructor valued her mathematical problem-solving strategies, which helped her resist prior racialized experiences involving Ms. Johnson.

Discussion, Conclusion, and Implications

Vanessa's counter-story reveals how she complexly co-constructed her mathematics and racial identities in the broader contexts examined, how the workshop supported her in constructing strengthen identities as a Latina and a mathematics learner, and how her mathematics participation and learning can be viewed as racialized forms of experience. Her voice reveals that she was forced to manage numerous assaults on her Latina (and gender and class) identities within *societal*, *community*, and *school* contexts throughout her mathematics development. Her experiences counter deficit theories that hold Latina students, their families, and cultures responsible for their lower achievement levels and may shed light on why some Latinas/os struggle to persist, succeed, and identify

with mathematics. However, her voice also reveals how she displayed great resilience when she encountered mathematical obstacles linked to her Latina status, including with the aid of positive *family* influences.

Although ESP mathematics workshops have supported Latina/o students in succeeding in mathematics for over three decades, few studies have investigated Latina/o students' perspectives of how and why they experience mathematical success within these environments. I define *success* as students expressing strengthened access, achievement, identity, and power in mathematics (Gutiérrez, 2008). Although this article centers on understanding Vanessa's mathematical success through the identity dimension, in the larger study, she revealed that she experienced success through all four dimensions.

Vanessa's story sheds light on the impact ESP-type mathematics learning environments can potentially have on Latina/o students' identity development. The ways in which Vanessa (re)negotiated her interconnected identities in the workshop may potentially be a mechanism underlying the achievement outcomes often documented in research on ESP settings. Encountering opportunities to engage in spaces where she could resist racialized mathematics experiences tied to broader contexts helped her to merge strengthened mathematics and racial identities.

A LatCrit lens allowed for uncovering the intersectional nature of Vanessa's mathematics and racial identity co-construction. Vanessa's narrative expands knowledge about the complexity that can potentially underlie Latina students' mathematics and racial identity co-constructions, including the powerful role of gender identity. Her story also aligns with research indicating that Latina/o students' mathematics identities can intersect in complex ways with their other salient identities (e.g., racial, gender) in mathematics classrooms (e.g., Esmonde, Brodie, Dookie, Takeuchi, 2009).

Vanessa's counter-story indicates the importance of viewing mathematics participation and learning as racialized forms of experience when attempting to understand what it means to be a Latina mathematics learner. Her story sheds light on how she experienced "Herencia de Coatlicue (the ongoing state/process of breaking free from the old boundaries of oneself to develop new ones)" (Gutiérrez, 2013, p. 10) in relation to her mathematics development as she engaged in the workshop, and the important role her racial identity (and its intersection with other salient identities) played in this process. I argue that additional studies should use an identity lens to examine Latina students' participation and learning in effective mathematics learning contexts that are situated within larger sociopolitical contexts in order to better understand the complexity underlying their mathematical success.

References

Esmonde, I., Brodie, K., Dookie, L, & Takeuchi, M. (2009). Social identities and opportunities to learn: Student perspectives on group work in an urban mathematics classroom. *Journal of Urban Mathematics Education*, *2*(2), 18−45.

Gutiérrez, R. (2008). A "gap gazing" fetish in mathematics education? Problematizing research on the achievement gap. *Journal for Research in Mathematics Education, 39*(4), 357–364.

Gutiérrez, R. (2013). The sociopolitical turn in mathematics education. *Journal for Research in Mathematics Education*, *44*(1), 37-68.

Hsu, E., Murphy, T. J., & Treisman, U. (2008). Supporting high achievement in introductory mathematics courses: What we have learned from 30 years of the Emerging Scholars Program. In M. Carlson & C. Rasmussen (Eds.), *Making the connection*: *Research and practice in undergraduate mathematics*, (pp. 205−220). Washington, DC: Mathematical Association of America.

Martin, D. (2007). Mathematics learning and participation in African American context: The co-construction of identity in two intersecting realms of experience. In N. Nasir, & P. Cobb (Eds.), *Diversity, equity, and access to mathematical ideas* (pp. 146–158). New York: Teachers College Press.

Martin, D. (2009). Researching race in mathematics education. *Teachers College Record*, *111*(2), 295−338.

Oppland, S. (2010). *The inextricability of identity, participation, and math learning among Latino/a undergraduate students.* Unpublished doctoral dissertation, University of Illinois at Chicago.

Solórzano, D., & Delgado Bernal, D. (2001). Examining transformational resistance through a critical race and Latcrit theory framework: Chicana and Chicano Students in an urban context. *Urban Education*, *36*(3), 308−342.

Solórzano, D., & Yosso, T. (2002). Critical race methodology: Counter-storytelling as an analytical framework for education research. *Qualitative Inquiry*, *8*(1), 23−44.

Varley-Gutiérrez, M. V., Willey, C., & Khisty, L. L. (2011). (In) equitable schooling and mathematics of marginalized students: Through the voices of urban Latinas/os. *Journal of Urban Mathematics Education*, *4*(2), 26-43.

Yin, R. K. (2009). *Case study research: Design and methods*. Thousand Oakes, CA: Sage.