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Creating a World for Me: Students of Color Navigating STEM Identity

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Undergraduate students of color (SoC) struggle to negotiate STEM experiences, which becomes a barrier to shaping identity and academic success. A qualitative research study was designed using a created figured worlds (FW) to observe how SoC used language to engage in activities for understanding and negotiating identities. Multiple frameworks was used to highlight the lived experiences of SoC in STEM including identity theory, FW, and intersectionality. Identity in FW demands consideration be given to the space, community, and present structures where identity work is produced. In this research SoC created ideas for new cultural models and built solidarity using multimodal communication. Twitter was useful for co-constructing ideas for new cultural models and critical for gaining agency for navigating STEM.

Keywords: *higher education, learning and academic achievement, STEM, students of color*

INTRODUCTION

Undergraduate science, technology, engineering, and mathematics (STEM) researchers have identified factors that contribute to building strong STEM identities that include family support, peers, faculty members, mentor support, and strong pre-college and college experiences (Russell & Atwater, 2005; Strayhorn et al., 2013). Carlone and Johnson (2007) advanced these ideas by viewing science identity through three major constructs: (a) competence, (b) performance, and (c) recognition. They also noted that building strong identities for students of color (SoC) in science is inclusive of the idea that one's gender, racial, and ethnic identities affect and impact their experiences in STEM. For this research SoC are students that self-identify as African American/Black, Hispanic/Latino/a, Native Hawaiian/Pacific Islander, or Native American/Indigenous persons.

Women and SoC have more difficulty thriving in undergraduate STEM programs than males and majority represented groups (Byrd, Dika, & Ramal, 2013; Sax et al., 2016). Women have been reported to struggle in specific areas of STEM such as engineering and computer science due to having lower confidence in their ability to do math (National Science Board, 2018; Sax et al., 2016). Many women also, experience perceived feelings of isolation a trend shared with SoC, but for women this experience only exist in certain STEM majors. Whereas for SoC, there are differences in the racialized and gendered experiences that impact their STEM trajectories especially at predominantly White institutions (PWIs). Many of these experiences go unnoticed and result in SoC feeling devalued and desiring to withdraw from STEM (Calabrese-Barton & Tobin, 2002). For example, participation, performance, and academic achievement in STEM alone do not necessarily lead to persistence in STEM programs (Carlone & Johnson, 2007; National Assessment of Educational Progress, 2015). This includes SoC who are competent and have achieved academically, but drop out because they struggle to negotiate their experiences, worldviews, and identities within ideological systems that serve as barriers to their education (Kozoll & Osborne, 2004).

For SoC to be successful in STEM, they must be able to understand the ways in which their marginalized identities impact their STEM identities (Charleston et al., 2014; Fries-Britt, Johnson, & Burt, 2013; Rodriguez et al., 2018). Students of color must also be provided the opportunities to self-reflect and engage in learning about their social and STEM identities. The purpose of this research was to provide first-year undergraduate SoC a space to explore and develop their social and STEM identities through teaching and learning. Thematic coding and critical discourse

analysis (CDA), was used to assess how students used reflection-based activities to understand and negotiate their identities.

Literature Review

STEM identity is defined by how SoC view themselves or perceived by others in terms of being a science, technology, engineering, or math person (Martin-Hansen, 2018, Maton et al., 2012). STEM identity as a construct that is shaped by both negative and positive experiences. Martin-Hansen (2018) stated negative experiences are perceived as barriers informed by lack of diversity, low enrollment, and decreased student persistence. These outcomes negatively impact STEM identity for SoC, especially those attending PWI's. Positive STEM experiences and higher rates of persistence result when instructors and programs are intentional in creating learning environments that cultivate a sense of belonging, illuminate shared identities, and promote academic skills (Maton et al., 2012). On average undergraduates leave STEM fields for multiple reasons. Therefore, it is necessary for programs to minimize the challenges that impact both their social and STEM identities in pursuit of higher education.

Researchers have shown that SoC in STEM experience higher education in different ways that often go unrecognized such as increased feelings of being ignored or excluded. To contribute to the research on these differences Strayhorn and colleagues (2013) examined the academic and social experiences of SoC in STEM education and noted an increase in feelings of isolation produced by alienation and invisibility. Students reported feelings of alienation when the lack of same race peers and faculty became apparent because these were the individuals students depended on for support. Whether perceived or real, the interactions that produced these feelings had a meaningful impact on the way students navigated their academic majors. These experiences are not limited to STEM majors only, but can be found in other majors and areas of campus life. However, feelings of isolation and being ignored are primary reason women and SoC choose to depart STEM majors in disproportionate numbers (Malcom & Feder, 2016; Palmer, Maramba, & Dancy, 2001; Russell & Atwater, 2005).

In a separate study, Carlone and Johnson (2007) highlighted that even STEM students who appear to be successful, tend to experience paths that are difficult because their bids for recognition in STEM are disrupted by gender, ethnic and racial factors. For example, SoC experience greater levels of alienation than their white peers and they are also less likely to receive meaningful recognition in their classrooms (Hurtado et al., 2011; Maton et al., 2012). Yerrick and Johnson (2011) attributed this lack of acknowledgment and minimizing of White educators as their way of devaluing diversity and perceiving SoC as culturally disadvantaged. The way students are viewed in academia is a microcosm of how they are viewed by dominant society and according to Ladson-Billings (1999) mainstream society expects SoC to be failures.

Student identities in higher education should not be assessed in isolation, but across contexts. The research of Tate and Linn (2005) sought to expand their understanding of identity beyond assessing individual contexts such as academic identity and begin to view them in context of other areas that considered intellectual and social identity. They defined academic identities as those gained from participation and success in activities, intellectual identities were having a desire to engage in STEM conversations, and social identities were the perceptions of others and that of self in STEM. Researchers noted that each identity observed separately, produced positive outcomes or a strong link that influenced STEM educational experiences and aspirations. However, when identities were observed in context to each other, the researchers found that students who possessed strong academic identities were plagued with a sense of not belonging. This suggests that when intellectual, academic, and social identities were assessed in context with each other, the salience of race or gender was perceived by SoC as a negative factor. Researchers recommended that institutions develop programming that supports SoC academically, socially, and intellectually.

To ensure the success of SoC in STEM, programs and instructors must intentionally create learning spaces that encourage identity work. Learning environments that are designed to intentionally place value on cultivating student identities through learning activities and self-

reflecting on experiences tend to promote persistence and positive STEM outcomes (Stolle-McAllister, Domingo, & Carrillo, 2010). In an article examining meaningful ways to support STEM students, Martin-Hansen (2018) noted how the impact of positive learning experiences on building strong STEM identities but the negative impact of learning environments is guided by biased social interactions. Therefore, in an effort to create contexts that foster experiences where SoC could positively shape their STEM identities she recommended institutional training for students, instructors, and mentors about STEM identity and STEM stereotyping. Providing SoC a space to reflect on their experiences also prove beneficial. These types of spaces are needed for SoC according to Yerrick and Johnson (2011), because their experiences are often muted and erased in educational settings, when perceived as a challenge to the authority and power of the dominant culture. Therefore, in this study the author highlights the experiences of SoC using reflection-based activities posted on Twitter in an effort to understand how SoC negotiate their identities. As a social media resource, Twitter provided a space for students to participate and engage in discussions by "reflecting on issues and topics using multimodal discourse" (Abe & Jordan, 2013).

The Shaping of a Theoretical Framework

There is not a single theoretical model that can capture the complexities of how SoC in STEM engage in identity construction and negotiation. The nature of identity theory does not fully capture the multidimensional experiences of SoC in STEM. The use of additional frameworks allowed me to integrate theoretical perspectives that embrace sociocultural or self-made enactments occurring within specific activities, spaces, and times (Gee, 2011) and critical perspectives or conflicts and tensions instrumental in shaping identity. Therefore, for this research the author relied on multiple frameworks (see Figure 1) that included identity theory, figured worlds, and intersectionality to draw attention to the identities of SoC and their experiences within different environments. Identity theory is used as the primary theory because it created an opportunity for student participants to understand all of their identities that includes both their oppressed and privileged identities. The use of identity theory allowed to easily integrate the figured worlds framework which is centered on the created space for reimagining identities. The intersectionality framework was used to highlight the experiences of SoC that occur at the intersection of two marginalized identities.

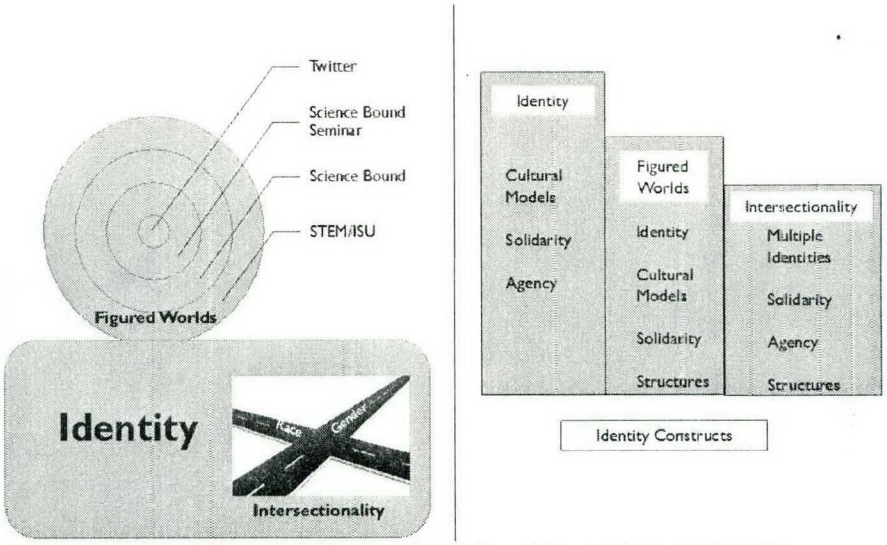

Figure 1. Integrating identity, figured worlds, and intersectionality.

Identity/Identity Work

In this research the author views identity as always under negotiation where students recognize themselves and are recognized as "a certain kinds of person" (Gee, 2001). It is also viewed as being in a constant state of flux, contextually situated, and constructed within interactions (Varelas, 2012). Identity from this viewpoint exists on both "conscious and unconscious levels" (Burke & Stets, 2009; Varelas, 2012). These interactions are necessary for shaping identities.

Identities are not constructed in isolation and neither is identity work. Identity work is co-constructed by individuals for shaping, forming, and negotiating identities through participation in activities and interactions (Rodriguez et al., 2018; Shanahan, 2009). Identity work involves seeking, reflecting, and deliberating about interests, skills, values, and goals (Perez, Cromley, & Kaplan, 2013). It is contingent on accessible resources, as well as social, cultural, and historical context in which one seeks to author oneself (Holland et al. 2001; Thompson, 2014). Identity work is also critical for understanding the experiences needed to cultivate successful STEM outcomes (Carlone & Johnson, 2007; Russell & Atwater, 2005). STEM identity work has become very popular for examining individual and group experiences for producing successful trajectories in STEM (Jackson & Seiler, 2013), especially for those who have been historically marginalized (Burt, Williams, & Smith, 2018; Rodriguez et al., 2018). For this study, identity work was carried out in a created figured world.

Figured Worlds

Figured worlds are socially and culturally constructed realms of interpretation where people come to produce new self-understandings of their identities (Holland et al., 1998; Urrieta, 2007a). The figured worlds framework, introduced by Holland and associates (1998) was designed to observe how students might co-construct or negotiate their identities within "as if" spaces impacted by re-imagining one's identity or by reproducing dominant social structures (Calabrese-Barton et al., 2013; Caraballo, 2012). They are also intersecting across multiple levels (micro/macro) by intersecting and sharing cultural resources or models that are inclusive of historical phenomena organized by narratives, storylines, and culture (Jackson & Seiler, 2018; Urrieta, 2007b). These storylines cater to the macro world and exist to perpetuate deficit perspectives (Holland et al., 1998; Urrieta, 2007a) that mirror those adopted by larger society. The figured worlds framework allowed me to examine a learning environment where SoC could perceive themselves as something other than what dominant society positions them to be by "re-conceptualizing who they are, or shifting who they understand themselves to be" (Urrieta, 2007b).

Marginalized Identities—Intersectionality

Intersectionality as a framework will be used to highlight the intersecting experiences of SoC as the grapple with multiple marginalized identities. The experiences for women in STEM across racial and ethnic backgrounds report similarities such as greater discrimination, not feeling respected as equals, or discouraging interactions with faculty (Sax et al., 2016). Students of color that are women also experience known differences at the point where gender and race intersect. Intersectionality provides a lens for observing similarities and differences in how power is experienced (McCall, 2005) for SoC, especially those that are women. Intersectionality offers a critical feminist framework for moving beyond singular notions of identity to multiple identities experienced at intersecting points (Crenshaw, 1989; McCall, 2005). Intersectionality was designed to advance the discourse about Black women and girls, intersectionality also highlights the experiences among individuals that are vulnerable to specific identities that society categorize as marginalized (Ireland et al., 2018) or having multiplicative or multiple grounds of identity in relationship to the construction of the social world. (Charleston et al., 2014; Crenshaw, 1991). Ong and colleagues (2011) described these challenges as the "double bind" where simultaneous experiences involving racism and sexism occur throughout the STEM pipeline. Experiences associated with intersectionality illuminates the double bind and the idea that identity work,

especially for SoC that are women is built upon structures of power, privilege, and interlocking systems of oppression (Calabrese-Barton et al., 2013). For this research, it was also important to view how individuals with multiple marginalized identities use dialogue to reimagine, refigure, and negotiate their racial and gendered identities.

Connecting Ideas

The common theme drawn from each of the frameworks used in this research was designed to bring attention to how SoC in STEM identities are being shaped. The extending frameworks allowed for focus on specific aspects of identity for example, the figured world framework allowed a focus on reimagining identities through dialogue in a specific space. Whereas with intersectionality the author was able to focus on multiple marginalized identities such as race and gender. However, using identity as a primary theory maintains the focus on the oppressed and privileged identities that individuals occupy. Therefore, using only figured worlds or intersectionality would not allow one to consider the other spaces where identity is shaped. For example, when considering the experiences of SOC that are also male, according to the above scenario only race would be considered a marginalized identity, gender would be a privileged identity. Integrating these frameworks worked well together for understanding the various resources SoC use to navigate STEM.

Each of the three frameworks contribute to identity building through various constructs like agency, cultural models, solidarity, and structures (Figure 1). Agency is defined as strategic making and remaking of selves through the knowledge, practice, and context of STEM for developing identities (Calabrese-Barton & Tan, 2010). To build agency or shape agentic behaviors for SoC in STEM is to "alter the world toward what they envision as being more just" (Calabrese-Barton & Tan, 2010, p. 195). While cultural models have the capacity to mediate between the micro and macro level interactions and are comprised of images or story lines of simplified worlds that are associated with words (Holland et al., 1998). These are represented by emotions, words, or images that lead to the reimagining and negotiating identity for producing agency. They can also serve to constrain identity work (Jackson & Seiler, 2018) by "implanting thoughts and actions that are unfair, dismissive, or derogatory assumptions about other people . . . and tend to represent conflicting social and cultural values" (Holland et al., 1998, p. 120). Cultural models that reflect the latter are often situated within larger institutional and social structures. Structures are relatively fixed boundaries within society that are influenced by power, privilege, and institutional barriers put in place (Holland et al., 1998; Ireland et al., 2018). The solidarity construct is represented when people recognize each other's shared knowledge, emotionally charged language, symbols, and move to collective action (Jackson & Seiler, 2018; Shelby, 2002). In addition, online solidarity is communicated through politeness, claiming common ground, exaggerating interest and emotion, inserting optimism and using pronouns like we and us (Jackson & Seiler, 2018). The constructs and frameworks were used to illuminate identity in a figured world for an in-depth understanding of how SoC navigate STEM.

Trustworthiness/Positionality

For this research, various strategies were adopted and implemented throughout the study at each stage of data collection and analysis to inform readers of the steps taken to ensure rigor (Creswell & Poth, 2017; Shenton, 2004). Trustworthiness is a criterion for measuring qualitative research for the quality of goodness or whether it is "worth paying attention to" (Guba & Lincoln, 1989). Trustworthiness was designed to parallel the rigor or conventional criteria of quantitative research. Of the multiple measures for ensuring trustworthiness, the strategy of credibility which represents the extent to which the reconstruction attributed to participants information aligned with actual construction (Guba & Lincoln, 1989); in other words, the extent to which the findings of research should be believed. For creating trustworthiness, prolonged engagement was adopted as a way to spend a considerable amounts of time with students for understanding context, culture, and build rapport and trust (Shenton, 2004). It also allowed the author to gain a better understanding of the

student's intentions and motivations while analyzing the Twitter dialogue. This strategy was easily espoused into this research because student participants were required to enroll in the course for both the fall and spring semesters with data collection occurring in the spring. The extended time spent with students culminated into relationships where they felt comfortable openly sharing their experiences. Trust was also benefited by shared identities between instructor and students. These relationships did not pose as an obstacle for the instructor becoming immersed in the culture, neither did they make the author an expert for understanding student experiences. They were "strengths that contributed to the analysis in a way that is lost when researchers have different identities" (Burt et al., 2018, p. 981). Shared identities tend to position researchers within close proximity or having a certain nearness to the participant experience.

METHODOLOGY

This research was conducted at Midwestern University, a large, research intensive, predominantly White institution (PWI) in the Midwest. The study's participants were comprised of 32 first-year students enrolled in STEM majors and participants in the Science Bound program. Science Bound is a program designed to increase the enrollment, persistence, and retention of SoC in STEM. SoC in the study are those that have at some point in their Science Bound journey identified as African American/Black, Native Hawaiian/Pacific Islander, Latinx/Hispanic, and/or Native American/Indigenous. Data were collected spring of 2017-2018 school year for eight weeks. The Science Bound seminar course met for 50 minutes weekly to connect and guide students in navigating their first year of college. As part of the research students participated in five online learning modules designed to explicitly engage them in learning that centered their identities and experiences in STEM. The modules were comprised of weekly readings, videos, online and class activities, lectures, discussion prompts, and reflection-based activities to engage SoC in identity work.

Science Bound Program

The Science Bound program is an agriculture, science, technology, engineering, and mathematics (A-STEM) pre-college through college program designed to increase the participation of underrepresented SoC in A-STEM. The program was piloted in 1989 and formally established in 1991 through a National Science Foundation grant (Wade, 2015). The pre-college program was designed to intentionally identify, recruit, and prepare SoC who demonstrated an interest in math and science beginning in grades 7–12. The program was implemented in school districts where SoC were overrepresented in their classrooms, but underrepresented in math and science advanced curriculum, activities, and programs. The Science Bound program provides after school and summer programming in the selected school districts to supplement student learning experiences and increase STEM engagement. Students who successfully complete the pre-college program earn a four-year full tuition scholarship to Midwestern University to major in a STEM field including science or math teacher education (Wade, 2015). The Science Bound undergraduate college program serves as a continued support for students' success in STEM by providing access to dedicated staff, advising, a private student study space, and first- and second-year seminar courses. The seminar courses were designed to connect students to services, activities, personal, and professional development such as internships, research experiences for undergraduates (REU), and other resources at the University. It is also a space where SoC build self-awareness, engage in community with peers, participate in identity work, and acquire agency for persisting in STEM. The intent of the Science Bound program remains to increase the number of SoC in STEM majors and the STEM workforce.

Participants

The Science Bound program welcomed 32 first-year STEM students' scholars to campus for the 2017-2018 academic year and all were enrolled in the Science Bound seminar course and in the study. Midwestern University invites a larger number of STEM majors per academic year but they were excluded from this study because they were not Science Bound scholars nor enrolled in the seminar course. Twitter reflection that centered module five learning activities were used to collect participant data. Of the 32 students enrolled in the course only 27 posted initial tweets. Many of the tweets contained multiple replies from other students or threads as used in Twitter language. The voices of all students that posted an initial response were not used and will be explained further in the data the analysis section. The analysis includes the dialogue of 11 student participants. Demographic information of participants can be located in Table 1 and to respect their privacy, pseudonyms were used. Each participant was assigned a number to represent their tweets (Table 1). For example, Tweets (T) were represented by the assigned participant number and letters (e.g., T2a). The numbers (1–11) are an additional way to identify participants and the letters (a-d) referenced specific lines in each tweet (e.g., a, b, c, etc.). In many of the tweets, students do not discuss specific racial and ethnic identities but refer to themselves as a person of color or people of color.

Table 1

Student Participant Identity Information

Tweet Number	Name	Gender	Race/Ethnicity	STEM Major
T1	Pazie	F	Black	Biology
T2	Miley	F	Hispanic/Mexican	Education: Math & Science
T3	Danna	F	Hispanic	Microbiology
T4	Aerika	F	Black/Latina	Industrial Technology
T5	Lyte	F	Latina	Biology/Pre-Medical Illustration
T6	Pisha	F	Latina	Civil Engineering
T7	Marshaun	M	Black	Biochemistry/Pre-Medicine
T8	Drake	M	Hispanic/Mexican	Animal Ecology - Wildlife
T9	Ieshon	M	Hispanic/Latino/Chicano	Animal Science/Pre-Veterinary
T10	Myra	F	Latina	Kinesiology & Health/Pre-Dentistry
T11	Melody	F	Mexican	Engineering

Student Learning Activities

The learning materials from the course were distributed using a flipped classroom learning approach. Flipped learning is a form of blended learning that requires active participation in learning activities for both online and face-to-face sessions with the instructor (Lage, Platt, & Tregua, 2000). Scheduled activities and facilitated discussions occurred during class times and the five learning modules included: (a) identity, (b) identity development vs. identity negotiated, (c)

racial and ethnic identity, (d) gender and socioeconomic status, and (e) STEM identity took place online. The STEM identity module was used for analysis for this study. The modules content included the science identity model as discussed by Carlone and Johnson (2007), the key themes of STEM identity (persistence, recognition, and negotiation), articles, and a short video clip about the story behind *Hidden Figures* (Blackdoctors.org, 2017; NPR books, 2016). *Hidden Figures* is a biographic movie about Black women mathematicians whose work was "essential to the success of early space flight" (NASA, 2018). All online activities for module 5 were made available to students using the university's learning management system.

Using Twitter

Twitter is a public microblogging/social networking site where individuals can post tweets, retweet, like, share, and comment on tweets. A tweet is a 140 character or less message that can consist of additional multimedia information such as images, gifs, emojis, and videos (Gleason, 2015). Twitter was used to "facilitate student participation and engagement in dialogue" (Abe & Jordan, 2013, p. 16). Students were asked to post one initial Twitter reflection and reply or retweet (with comment) the post of two classmates using the hashtag #sbSTEMid. The hashtag and the follower feature are Twitter's trademark structures. Hashtags were used for grouping conversations thematically (Gleason, 2015). Using the hashtag made it easier for participants to locate weekly tweets. Students used the follow feature to follow five or more individuals, groups, or organizations including, the Science Network, teaching STEM, Black Women in STEM, Latinas in STEM, Afrotech, and so on. The follower feature of Twitter also gave participants the opportunity to read and engage with user content (Gleason, 2015) including each other.

For this research Twitter was used as a space for creating dialogue, connecting, and increasing student dialogue around their social and STEM identities. In past research, Twitter was used to support learning in undergraduate learning classrooms (Carpenter, 2014) and for understanding students' reflective awareness (Gleason, 2018). For this research, Twitter was an appropriate space for student dialogue because many of them were already actively involved in using social media. It was also a great place to like, retweet, or collaborate with other scholars in STEM. Twitter reflections were collected six of the eight weeks during the study. The other two weeks were reserved for student presentations and students were not required to tweet.

Data Analysis

Data for this study were analyzed using critical discourse analysis (CDA). Discourses are based on social perspectives by which people are invited to speak, read and write, think, feel, believe, and value in historically recognizable ways combined with their own individual styles and creativity (Gee, 2004). Critical discourse analysis was ideal because it combined grammatical and textual analysis with sociocultural and critical theories of society (Gee, 2004). For this research, Gee's (2014) critical discourse analysis toolkit was used to analyze research data across multiple theoretical frameworks. According to Jackson and Seiler (2018) the toolkit is useful for exploring identity construction due to its focus on language. The toolkit is made up of specific questions to ask of data that looks closely at the details of language while connecting it to what the writers mean, intend, and seek to accomplish (Gee, 2014). CDA is an appropriate method for analyzing language through text, digital images, emojis, and so forth.

In preparation for using the toolkit, 27 tweets were posted and transcribed. Seven of the initial tweets were specifically about students' personal STEM experiences and three of the threads were selected for analysis for two reasons. First, they contained dialogue that centered how students were making meaning of their identities. Second, the threads contained more than two participant responses and rendered substantive dialogue about student experiences in STEM.

Each thread was analyzed line by line using all 28 tools in the Gee's toolkit. Some of the tools yielded more information than others. In this research, six tools emerged when observing identity work as listed.

- The subject (tool #4) which asks why writers have chosen the subject/topics they have and what they are saying about the subject or if they could have made another choice of subject and why they did not?
- The topics and themes (tool #6) ask what the topics and themes are for each clause and when the theme is not the subject/topic, and why it has deviated from the usual (unmarked) choice?
- The identity building (tool #16) asks what social recognizable identity or identities the speaker is trying to enact or get others to recognize. Also asks how the speaker is positioning others, what identities the speaker is "inviting" them to take up?
- The connecting building (tool #19) asks how the grammar and words used connects or disconnects things or ignore connections between things?
- The situated meaning (tool #23) asks what words and phrases/situated or specific meanings do listeners have to attribute to these words and phrases given the context and how the context is construed?
- The figured worlds (tool #26) asks what typical stories or figured worlds are the words and phrases of the communication assuming and inviting listeners to assume? (For a complete list, see Gee, 2014, pp.199-204)

In the presentation of data, simple coding schemes were used to provide general themes of *what they said* and Gee's CDA toolkit was used as a method of textual analysis to look at *how they said* what they said, both provided insight into the identity constructs (i.e. cultural models, agency, solidarity, and structures) that emerged.

FINDINGS

The students in this study actively participated in a created figured world where together they could reimagine and negotiate social and STEM identities by reflecting on their experiences. What follows is the analysis of three Twitter threads where SoC used dialogue to negotiate identity within STEM learning environments, for STEM persistence, and within the STEM double bind.

Thread # 1–STEM Learning Environments

In this Twitter thread, six participants entered into dialogue about their classroom interactions with peers and instructors. The thread focused on the realities associated with being the only SoC in the classroom. The majority of tweets in this thread detailed SoC being ignored, isolated, and excluded by peers. Two students focused on the interactions between them and their professors. In this analysis the author identified three themes, racial and ethnic identity and participation and recognition, and the two sides of identity to highlight the statements that centered student experiences.

Racial and ethnic identity: *What they said.* In this thread, SoC centered racial and ethnic identities by discussing experiences in the learning environment. Pazie (T1) began the thread (Table 2) by stating, "Being the only Black student in class, White students don't want to work with me or they think I am not smart enough for group projects." Pazie immediately connected race to negative outcomes that impact performance in STEM classrooms. SoC in STEM majors are underrepresented and become hyper-aware of their non-White status. There were other students in the thread that did not identify as Black but, who recognized their marginalized racial identities positioned them as the 'only one' in their classes. For example, Melody (T3b) stated, "There are often instances in which I am the only SoC in my classes." By acknowledging that she was a student of color in her tweet, Melody was distinguishing between the similarities or multiple marginalized identities she shared with Pazie as well as the differences in racial identity that were present. For Aerika (T4), racial differences were also referenced in her tweet, "for all my classes I am one of the few females of color." For each of these students, their marginalized identities became hyper-visible within their STEM learning environments.

Table 2

Thread # 1–STEM Learning Environments

Participants	Twitter Reflections
Pazie	
T1	Being the only Black student in class, white students don't want to work with me or they think I am not smart enough for group projects.
Miley	
T2a	I strongly agree!
T2b	If the STEM fields were a more inclusive place that celebrated more diversity that it would strive even more!
Melody	
T11a	Yes!
T11b	There are often instances in which I am the only student of color in my classes.
Aerika	
T4a	For all my classes I am one of the few females of color.
T4b	It makes it so much easier for professors to remember me and call me out in large lecture classes.
Lyte	
T5a	I've noticed that many white people in my class tend to ignore me and talk to their white neighbor even when I'm closer to them.
T5b	My professor notice when I'm working hard and acknowledge my work in class.
Pisha	
T6a	(Retweet w/comment) Omg Yes!!
T6b	This is definitely something I see on a weekly basis!
T6c	It's even worse when trying to find a partner to work with.
Myra	
T10a	(Solo twitter post) I believe that anyone is capable of success in STEM fields
T10b	It does not matter your skin color.
T10c	I think it is ridiculous that people believe that just because a person is white they're more likely to succeed, are we not living proof that this is false?

Racial and ethnic identity: *How they said it.* In the first tweet in the thread Pazie (T1) used language to express the frustrations of classroom experiences. The subject tool and themes tool clearly identifies why "being the only Black student" is chosen by the writer. It was selected as a way to inform readers about the classroom experiences of non-White students enrolled at a predominantly White institution. In the tweet, the writer placed an emphasis on the word "Black" by capitalizing it. The use of this word is situated in a way that attributes meaning to the term that extends beyond a reference to a color, like the term "white." Capitalizing the term "Black" references a historical, political, racial, and cultural positioning of the group (Crenshaw, 1991). In this tweet, Pazie situates her language within the context of the classroom and the dominant ways of thinking that have historically positioned SoC as non-legitimate participants in STEM. The identity tool, showed how the phrases "Being the only Black student" was used to guide readers in speculating about the racial and ethnic identities that are both under and overrepresented in STEM classrooms. It also invites readers to recognize how students with marginalized identities have historically been impacted in STEM learning environments.

Participation and recognition: *What they said.* Identities are not shaped and formed in isolation and are always under negotiation, especially in STEM learning spaces. For SoC in this thread, co-constructing STEM identities through participation in activities was limited by their classroom experiences. In many of the tweets students described having experiences that resulted in them feeling excluded, isolated, and ignored by both their peers and professors. Isolation was described as the inability to fully participate in class activities or denied the opportunity to be

recognized as legitimate STEM persons. If one revisits Pazie (T1) tweet, "white students don't want to work with me or they think I am not smart enough for group projects" it becomes evident that SoC are being denied the opportunity to become an active participant in collaborative group assignments. After echoing agreement with Pazie's experience, Lyte (T5) addressed the realities of being ignored in class by stating, "I've noticed that many white people in my class tend to ignore me and talk to their white neighbor even when I'm closer to them." These were not isolated or one-time experiences, but frequent interactions for many SoC. According to Pisha (T6), "This is definitely something I see on a weekly basis! It's even worse when trying to find a partner to work with."

Participants' experiences with professors were similar to those as peers. Although, there was one opposing perspective tweeted by Lyte (T5b) who reported being acknowledged by the professor in class stating, "My professor notices when I'm working hard and acknowledges my work in class." The language in the student's tweet insinuates that the interaction with the professor was perceived as a form of positive recognition. These types of interactions with professors were not viewed as positive for all SoC in STEM learning spaces. For example, Aerika (T4b) described an experience where having a racial identity different than other students "makes it easier for professors to remember me and call me out in large lecture classes." The attention Aerika received in class might initially appear to be a positive form of recognition, but how the language was used in the tweet suggested otherwise.

Participation and recognition: *How they said it.* Using Gee's (2014) situated meaning tool to draw out context from Aerika's (T4b) tweet as she uses the phrase to "call out." The meaning ascribed to these words are not the same as to invite to participate or be a part of, but rather to embarrass, expose, or put on the spot. The tweet left it to the readers to assume that the position of the professor was negative and from a deficit perspective for how they view SoC in STEM. In both examples, SoC were impacted by the actions of their instructors in ways that may not be present for the majority of their peer who are overrepresented in STEM learning spaces. However, the experiences of feeling ignored, isolated, and excluded by peers and professors is common for some women and SoC. When negative experiences are found to impact groups that are overrepresented in STEM, the outcomes carry less significance for STEM identity.

Two sides of identity: *What they said.* Identities are not shaped and formed in isolation, suggesting that if students are not co-constructing identities that result in new cultural models and agency, then they are co-constructing, resisting, or remain compliant to deficit-based cultural models. STEM identity is defined by two components that include first, how one sees oneself as a STEM person and second, how they are perceived by others. The above thread highlighted the latter part of this statement as it focused on how SoC were treated by their peers and professors in their STEM learning environments. They were shaping their identities using the negative interactions or experiences that positioned them as STEM outsiders.

Throughout the dialogue, students did not transition away from discussing the things that were done to them. Neither did they take up agency or take the opportunity to reposition themselves. However, despite how they were positioned, students were able to build solidarity from their shared experiences like "Omg Yes!!" as used by Pisha (T6) when retweeting Lyte's (T5) post. Acknowledging shared experiences became a form of encouragement for students. It is in these spaces (Twitter thread) that they recognize that they are not the only one's having these experiences and can navigate around them knowing that other SoC are doing the same.

Two sides of identity: *How they said it.* The other component of STEM identity is how students see themselves as a STEM person. This analysis draws from the post of a single tweet to capture a participant who was not represented in the Twitter thread self-identified as a STEM person. Myra (T10a) took a different position stating, "I believe that anyone is capable of success in STEM field. It does not matter your skin color. I think it is ridiculous that people believe that just because a person is white they're more likely to succeed, are we not living proof that this is

false?" It is clear that identity work was happening as well as ideas for new cultural models were taking shape. According to Gee's identity tool, the student was inviting readers to take up the idea that racial and ethnic identity as a factor, does not determine success in STEM as she stated, "it does not matter your skin color" and then connected it to the previous idea that "anyone is capable." The connection building tool shows how relevant the two statements were by asking others to recognize the fullness of their identities. Whereas, the figured worlds tool (Gee, 2014) was used as a way to refigure the typical story that positioned SoC in a deficit way. Myra (T10) communicated in her tweet by posing a question to her peers that highlighted their lived reality ". . . are we not living proof that this is false?" At this point the writer was asking others to acknowledge the lack of truth in how they are being positioned by others, but none of the students who participated in Twitter dialogue replied to or retweeted the post.

Thread # 2–STEM Persistence

For many of the participants in the first Twitter thread, constraints for shaping STEM identities were associated with negative classroom experiences. In this second thread, eight students were able to identify positive factors that impacted their STEM identities from the "resources available to them" (Carlone & Johnson, 2007). In this thread family support was identified as an influential factor for degree persistence and countering the constraints discussed in first thread.

Family support: *What they said.* The first tweet (Table 3) for this thread was posted by Miley (T2a), "One of the reasons I continue to pursue my degree is because of my family support." The tweet was supported by five of the seven participants and they used emotional and expressive words to both acknowledge agreement and to build solidarity. Aerika (T4) was the first to reply to the tweet, "I definitely agree! My family has played a huge role in my life and are one of the reasons I also persist in STEM." This statement acknowledged family support as impacting all aspects of who they had become. In her reply tweet to Aerika, Danna (T3) was specific in how her family supported her stating, "I am the same way. My family were very supportive of [me] attending college." Family support for SoC was noted for having a significant impact on current success.

Family support in many of the tweets centered a traditional meaning that included relatives like mom, dad, aunts, and siblings. Ieshon (T9) and Marshaun (T7) proposed new ideas for cultural models that expanded the boundaries of family support. Ieshon (T9) stated, ". . . we have to be there for each other and find family and perseverance in people we can easily relate." Ieshon clearly redefined who could be family by repositioning his peers within the Science Bound program and others. The tweet by Marshaun (T7) similarly positions Science Bound as family by exclaiming, "Also remember that you have the support of the Science Bound family behind you as well." Considering the amount of time students spend with Science Bound peers and staff, it is no surprise that they identify them as family and resource for ensuring STEM success. These tweets suggested new ideas for cultural models that redefine family support as a network. Despite the effort, the new cultural models were not taken up by other participants in the thread via replies or retweets.

Family support was also perceived as a critical resource for motivating and inspiring SoC in their pursuits toward their STEM degrees. In Miley's (T2b) tweet, "They constantly remind me of my younger siblings and relatives who are looking up to me" persistence was based on support. Whereas, Myra (T10) used family as a form of self-motivation stating, "This is a great way to push yourself. Sometimes when I feel like giving up, I think of my younger siblings." This tweet highlighted the deeper need for family support, expectation, and motivation as SoC negotiate and renegotiate the ways in which they are positioned in STEM.

Family support: *How they said it.* The theme and subject of this thread was located in the very first tweet and was used to guide readers in understanding the logic behind the connections being proposed between "degree persistence" and "family support." Melody fully endorsed the

Table 3

Thread # 2–STEM Persistence

Participants	Twitter Reflections
Miley	
T2a	One of the reasons I continue to pursue my degree is because of my family support.
T2b	They constantly remind me of my younger siblings and relatives who are looking up to me.
Aerika	
T4a	I definitely agree!
T4b	My family has played a huge role in my life and are one of the reasons I also persist in STEM
Drake	
T8a	This is awesome.
T8b	Sometimes when I feel like giving up, I think of my younger siblings.
T8c	I can relate, but at the same time, I think that it's important to remember to not put too much pressure on ourselves and just relax and do something for ourselves every once in a while.
Danna	
T3a	I am the same way.
T3b	My family were very supportive of [me] attending college.
T3c	It was never if I go to college, it was always when I go to college.
Ieshon	
T9a	The sad thing is not every minority has a strong family to support them
T9b	That's why we have to be there for each other and find family and perseverance in people we can easily relate
Marshaun	
T7	Also remember that you have the support of the Science Bound family behind you as well.
Myra	
T10a	This is a great way to push yourself.
T10b	Sometimes when I feel like giving up, I think of my younger siblings.
T10c	I want them to pursue a career too, and maybe they'll be motivated if they see me in my career.
Melody	
T11a	(Retweet w/comment) This is True!!!
T11b	Especially if you happen to be a first generation student 👩‍🎓

idea of family support by retweeting Miley's tweet and including the comment, "This is True!!! Especially if you happen to be a first generation student." This post combines an interesting contrast between the use of texts and an emoji. The situated meaning placed on the capitalized T in the word true was used as a way to emphatically demonstrate the information retweeted was applicable to her experience. The phrase "Especially if you happen to be a first generation students" was also used to inform readers of the additional implications that accompany being a "first generation student" navigating STEM. However, in Melody's attempt to further highlight this point, she embedded an emoji ("👩‍🎓") of a non-White woman graduate. Both the language and graphic used in this tweet clearly endorse the connection between family support and degree persistence for SoC in STEM.

Thread #3–The STEM Double Bind

Undergraduate SoC encounter a variety of stereotypes that influence the ways in which they negotiate their identities in STEM (Rodriguez, 2018). Stereotypes, especially when aimed at women, serve as barriers (structures) or social practices that overlook intersectional experiences in STEM spaces. In this thread identity work takes place in a space where a group of women engaged

in dialogue explicitly about STEM experiences that impact them. The Twitter thread was occupied by four female participants and the dialogue centered on structures and barriers that impacted their efforts in STEM. There were three themes that surfaced in the thread that included: representation and pushback. These themes will be discussed and analyzed in the following sections.

Representation: *What they said.* Historically, STEM majors, fields, and careers have been occupied by White males. This thread quickly produced a hot topic for understanding who occupies STEM and those that are least likely to be represented. There were multiple tweets that addressed representation in STEM beginning with the initial tweet posted by Melody (T11a) who stated, "people still doubt me . . . because I am a female going into a major dominated by white males" (Table 4). The tweet provided readers with insight into how some individuals perceive SoC in STEM, especially female SoC. Melody was not the only person in the thread that tweeted these sentiments. Pazie (T1) stated "White men seem to be dominant in almost every positive thing". Both tweets explicitly stated STEM was "dominated by" those that were "white" and "male."

Representation: *How they said it.* The situated meaning attributed to the words "dominated" or "dominant" in these texts describe people or groups that are overrepresented, influential, or holding some level of power (i.e., gatekeepers) in STEM. The language used in this thread gives further meaning to the use of those words. Take the initial tweet by Melody (T11) "There are people who still doubt me when I tell them I am pursuing a career in Engineering because I am a female. . . " The situated meaning for "still" suggests that these perceptions are long held or outdated beliefs about women in STEM that continue to be perpetuated. Melody's tweet did not specifically state who the people were that doubted her, leaving it to the readers to use the context of the tweet to fill-in the identities (Gee, 2014) of those who are influential enough to reproduce certain beliefs and maintain certain barriers.

Barriers negatively impact student outcomes in STEM, and in this thread, participants dialogued about multiple types. The "glass ceiling" as situated by Miley (T2a) was an unseen barrier used to restrict the mobility of women in STEM, but it was also positioned as a something that could be broken. Other barriers discussed in the thread were specific to the impact of gender. Danna (T3b) noted that "sex [gender] doesn't have anything to do with opportunities" or who can be successful within STEM. The writer used this language as a way to reposition herself against the structures put in place that lead to women being overlooked for opportunities. Danna's reply to Melody (T11) and Miley (T2), was used to help readers make sense of and take up the idea that there are barriers that impact women's identities simply because they choose to major in "Engineering" or "Education."

. . . The push back: *What they said.* Identities and new cultural models were co-constructed in this thread as students used this figured world as a space to share experiences and encourage each other through solidarity. The impact of their shared STEM experiences in relation to gender identity was supported by two Twitter replies from Danna (T3) that stated, "it's the same way for me" and "I totally agree!" Danna acknowledged that the experiences associated with being a woman of color in microbiology was similar to Melody's experiences in engineering. This lived reality was also shared by Miley's (T2) as she found support and inspiration from Melody's willingness to persist stating, "Good for you. . . . Hopefully, my students will be able to see it is possible." Melody (T11c) replied back with a cheer exclaiming, "WE'VE GOT THIS!! 😎". For SoC that are women in this created figured world, finding solidarity and encouraging moments through shared experiences was important for identity building.

Table 4

Thread #3 - STEM Double Bind

Participants	Twitter Reflections
Melody	
T11a	There are people who still doubts me when I tell them I am pursuing a career in Engineering because I am a female going into a major
T11b	dominated by white males.
	I didn't realize how much of an impact gender identity had in our lives until now.
Miley	
T2a	Good for you breaking the glass ceiling!
T2b	Education majors are also dominated by whites.
T2c	There are probably less than 10 minorities in my cohort.
T2d	Hopefully, my students will be able to see that it is possible to become a teacher even if they are not white.
Melody	
T11c	WE'VE GOT THIS!!😎
Danna	
T3a	(Reply to T11 & T12) I totally agree!
T3b	Sex doesn't have anything to do with opportunities
Danna	
T3c	It's the same way for me in microbiology.
T3d	Just because I'm the opposite sex doesn't mean I can't beat them at their own game.
Pazie	
T1	(Reply to T2) White men seem to be dominant in almost every positive thing.

The tweets in this thread were also used to push back deficit ideas, barriers, and structures associated with being female in White male-dominated majors. It was important for women of color to acknowledge the existence of these ideas and structures in order to push back. In the first tweet, Melody (T11b) was very explicit in stating, "I didn't realize how much of an impact gender identity had in our lives until now." Understanding the impact of gender was a new phenomenon for her, but not others. Pazie (T1), recognized and understood the impact of both race and gender. In reply to Melody (T11) and Miley (T2) she stated, "White men seem to dominate every positive thing." Pazie's tweet implied that she had not only given attention to how White men dominate STEM but other areas as well. This thread allowed these women to acknowledge the multiple ways their marginalized gender identity impacts STEM success.

. . . The push back: *How they said it.* In the tweet Melody (T11) stated, "people . . . still doubt me . . . a female going into a major dominated by white males" as if this is a typical story for many females in STEM. Conventional stories are used to marginalize people that are not considered "normal" or "typical" (Gee, 2014). For example, normal occupants in STEM according to the context of this tweet are White males, not women and especially not women of color. Using the figured world's tool, the author identified that the personal story shared by Danna (T3), embraced the present challenges as she stated "just because I'm the opposite sex doesn't mean I can't beat them at their own game." Danna (T3) used her reply to Melody in this created figured world, as an opportunity to contest this story. Using Gee's (2014) situated meaning tool, the writer used the phrase "opposite sex" to acknowledge her gender as atypical or not the norm for STEM participants, but not as something that defines her ability as a microbiology major. The latter part of the statement included her attempt to introduce a new way to confront the challenge. She invited readers to join her in perceiving the experiences as a game. A figured world is a picture of a simplified world according to Gee (2014) and in her tweet, Danna invited participants to imagine

the present barriers as a game to be won. Taking up this idea would become a new cultural resource for resisting the challenges facing women in STEM and be beneficial toward refiguring their identities.

Finding solidarity through shared experiences centered the majority of this thread. Melody's (T11) response was the most dramatic. She emphatically communicated words of encouragement by stating, "WE'VE GOT THIS!! 😎". " The words and emoji used in this tweet sent a message of enthusiasm, optimism, and inclusivity (Gee, 2014). First, the message was written in all caps which is equivalent online to yelling or some form of cheering. Next, the word "we've" was used to include and invite others to take up and believe the words of inspiration. Lastly, the smiling emoji face wearing dark sunglasses communicated a sense of cool and lack of worry. This tweet and emoji sum up the perspective of SoC that participated in this thread.

Discussion

The primary aim of this study was to examine how SoC negotiated their identities using reflection-based activities. In this research, identity work took place in a constructed figured world, where students participated in the creation of a "as if" (Holland et al., 1998) space to negotiate their identities. The course module provided students the space to participate in online learning activities and reflections on Twitter in order to engage in identity work. While interactions on Twitter were minimal, they provided students an opportunity to explicitly engage in dialogue centering racial, ethnic, and gender identities and family support. Using the CDA toolkit to guide my analysis, I found that student participation in identity negotiations led to ideas for new cultural models, for building solidarity and agency, and for acknowledging existing structures in micro (Science Bound seminar) and macro (University, STEM) worlds.

Shaping Identity

In threads one (Table 2) and three (Table 4) students reflected on the impact their racialized and gendered identities had on how they were perceived in STEM. Participants noted being ignored, overlooked, isolated, and doubted by some of their professors and peers within their STEM majors. These findings were similar to Charleston and colleagues' (2014) research where experiences among SoC in STEM were included of maltreatment, stereotyping, misperceptions, and isolation. The basis of these interactions was not because SoC were incapable of doing the work in STEM. In fact, students attributed these interactions to how their STEM identities were overshadowed by gender, race, or ethnicity recognition (Jackson et al., 2018). For example, each time a student referred to being excluded from participation in academic activities and projects by peers or instructors, it was often followed by a statement that exclaimed that they were the only student in their class of a different race or gender. The trends for women and underrepresented students that participate in STEM ebbs and flows over time but remain distinctly lower than the participation of males and non-underrepresented students (American Association of University Women, AAUW, 2010). At most institutions of learning, women of all racial backgrounds have had to become more activist-minded to effect social change. In addition the women that are least represented in STEM are SoC and they use activism to persist or survive in these programs (Ireland et al., 2018; Sax et al., 2016). Their activism derives from a culmination of experiences that includes; being perceived from a deficit perspective by instructors, opposing the dominant scientist's appearance, and other psychological and economic barriers (Ireland et al., 2018; Yerrick & Johnson, 2011). It must be recognized that SoC STEM identities are shaped and formed by factors that are less likely to impact others.

STEM identity is characterized by how students perceive themselves and how they are perceived by others. In the first thread identities were viewed solely by how SoC were perceived by others with little to no dialogue on how they perceived themselves as STEM majors. This is significant because when individuals are positioned by others and accept those positions, they are not actively participating in shaping their own individual identities (Urrietta, 2007b). Being

positioned in a certain way (i.e., non-legitimate participants in STEM) can also pose as a constraint for shaping positive identity among SoC in STEM classrooms. In these findings, despite being positioned as non-legitimate participants, many students were not passive but active participants in shaping their identities. Reflecting on identity helped liberate students from existing constraints and was essential for seeking and deliberating about interests, skills, values, and goals (Perez, Cromley, & Kaplan, 2013).

Ideas for New Cultural Models

Students are always participating in identity work and the co-construction of their identities. Shaping identities in a created figured world requires on-going interactions where new cultural models are introduced and agency is taken up. Cultural models are knowledge structures used to frame experiences (Holland et al., 1998). In this study, SoC negotiated their identities through reflective activities and dialogue where they acquired ideas for new cultural models. For example, the family support cultural model was used to describe the role of family in student persistence as well as frame who could serve as family for enhancing student success in STEM. Family support was seen as an important factor to ensuring successful paths for SoC in STEM. Although it is not the only major factor that impacts student success, it is imperative for SoC to recognize and negotiate the value of family and the impact it has on student persistence in STEM (Rodriguez et al., 2018). Family support was perceived as a positive resource accessed by students to motivate, recognize, and encourage success. Having the ability to construct ideas for new cultural models provided an extended system of support where SoC were not limited to the resources made available to them in STEM classrooms.

Cultural models have the capacity to situate SoC as more agentic. Agency is the strategic making and remaking of selves through knowledge and practice (Calabrese-Barton & Tan, 2010). In this study, participants discussed ideas for new cultural models but the ideas were not taken up by others though they still have the capacity to "mediate between the micro and macro interactions" (Holland et al., 1998, p. 297). These types of interactions position SoC to carry the resources gained from the created figured world in this seminar classroom into other worlds.

Shared Experiences

This study provided participants a way to share and build solidarity around their experiences. In all three threads SoC used language to emphatically express agreement with the experiences and ideas presented within the conversations. Solidarity was constructed among the participants when they recognized each other's "shared knowledge of emotionally charged language including symbols and built their shared knowledge upon that" (Jackson & Seiler, 2018, p. 776). As students recognized they were not the only ones being ignored or experiencing isolation in the classroom their level of agreement took on stronger emotional responses that created space for them to "move back and forth between figured worlds and creating new ways of thinking" (Calabrese-Barton & Tan, 2010, p. 205). The use of emoji was also used to endorse solidarity and became a space for creating new cultural models for negotiating identities and building agency.

Conclusion—Identity Beyond The Figured World Of The Project

In this study, SoC in STEM used Twitter reflections to show how social and STEM identities are negotiated. The author used identity theory to make sense of how SoC discussed identity in a created figured world and from intersectional experiences. The constructs that connected these ideas provided understanding for how language was used to co-construct ideas for new cultural models, influence agency, build solidarity, and resist structures for negotiating identity. The experiences discussed in the three threads and the single tweet, echo previous research about SoC in STEM. The experiences were also consistent with current literature on identity and STEM identity in a created figured world and from an intersectional experience. SoC negotiated identities centering racial, ethnic, and gendered experiences along with reasons for STEM persistence.

Future research could further investigate how other undergraduate students (not enrolled in Science Bound) of color navigate their multiple identities in a figured world at various levels in their STEM degree programs, as well as understanding how experiences over time impact and shape their identities. It may prove to be beneficial if programs introduce SoC to learning for understanding their identities earlier in their STEM journey and provide them the space to reflect on their experiences and the experiences of others for shaping identity, building solidarity, and gaining agency to ensure persistence. Student support is inclusive of the understanding that identities are not shaped and formed in isolation, and if students are not co-constructing identities that result in new cultural models and agency then they are at risk of taking up deficit-based cultural models or taking up the identities that are given to them. In this study, Twitter was used as a space for students to reflect on their identities. Future research could explore how identity negotiations in public social media spaces are used to influence or inform identities.

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