Received: 13 January 2019 | Revised: 22 April 2019 | Accepted: 8 May 2019

DOI: 10.1111/ssm.12361



RESEARCH PAPER – SCIENCE EDUCATION

WILEY | SSMA

# "Do we teach subjects or students?" Analyzing science and mathematics teacher conversations about issues of equity in the classroom

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**Funding information**
Academic Partnerships

**Abstract**

Teachers involved in a Master's level course in diversity participated in virtual, synchronous, anonymized discussions around issues of ethnic and racial diversity, gender, and stereotypes that could impact their students' participation in fields related to science, technology, engineering, and mathematics (STEM). Guided by theoretical frameworks from Social Cognitive Career Theory (SCCT) and Critical Race Theory (CRT), a convenience sample of 14 science and mathematics teachers participated in a series of virtual chats using open-ended questioning and facilitated by two university instructors. Using conversation and critical discourse analyses, three primary themes emerged: understanding of issues related to stereotypes, encouragement of females and minorities to pursue careers in STEM, and the place for diversity discussions in science and mathematics classrooms. The teachers felt burdened by curricular and administrative constraints that inhibit their ability to participate in thought-provoking critical conversations. The paper concludes with a discussion of ways teachers can assist in the STEM career identity development of their underrepresented females and students of color and calls for research that combines the key findings in SCCT and CRT to build confidence and capacity for teachers to effectively confront issues of racism, sexism, and stereotyping in science and mathematics classrooms.

**KEYWORDS**

classroom discourse, culture, equity, STEM, stereotyping, teacher education

## 1 | INTRODUCTION

Issues of diversity, including ethnic and racial diversity, continue to persist in the field of education. Teachers are challenged with understanding diversity, including their own roles and socialized perspectives toward race and gender, in diverse classrooms. With this challenge comes the need to incorporate principles of inclusive pedagogy into the curriculum. Inclusive pedagogy is a learner-centered approach to teaching that considers backgrounds and abilities of individual students, centered on creating a learning environment where all students feel welcome and included (Tanner, 2013).

With the increasing emphasis on science, technology, engineering, and mathematics (STEM) education in the United States (Bybee, 2010; Daugherty, 2013) and other countries (Bairaktarova, Evangelou, Bagiati, & Brophy, 2011; Çorlu & Çorlu, 2012; Çorlu, 2013; Sümen & Çalışıcı, 2016), teachers need to find ways to encourage all students to explore a variety of fields of study and potential careers. Although we are not saying that STEM careers are more *important* than other fields, we do contend that solving the global issues in medicine, engineering, and environmental sustainability will take a future workforce with a strong expertise in science knowledge, technology utilization, and problem-solving skills.

  

The National Center for Education Statistics (NCES) reported that nationwide demographics in U.S. public schools put White students (non-Hispanic) at 49%, Hispanic students at 25%, Black students at 15%, and Asian students at 5% (NCES, 2017). Teacher demographic data show that across the United States, the majority of teachers are White (80%) (NCES, 2017). This disparity brings up intriguing questions about how prepared White teachers are to work with students from backgrounds unlike their own, and for our focus, questions about how White teachers can effectively encourage underrepresented students to consider STEM fields as a future career path.

According to the National Science Foundation (NSF, 2017), since 2000, the number of racial and ethnic minorities graduating with Bachelor's degrees in STEM has not increased in engineering and physical sciences, and has actually dropped in mathematics. Despite growing trends in racial and ethnic minority presence in professional fields, there continues to be an underrepresentation of racial and ethnic minorities in STEM fields. Research has also shown that there are issues with female representation in STEM. Although the percentage of females has increased in psychology, biosciences and social sciences, their numbers continue to remain at 25% of the workforce in engineering, computer science, and physics (NSF, 2017). For both underrepresented minorities and females, there have been continued calls for research into ways to increase diversity in STEM (Allen-Ramdial & Campbell, 2014; Fouad & Santana, 2017; Long & Mejia, 2016; Lord et al., 2009).

## 2 | THEORETICAL FRAMEWORKS

Following the lead of researchers from the field of studies exploring underrepresentation of minorities in STEM careers, we chose Social Cognitive Career Theory (SCCT) (Lent et al., 2001; Lent, Brown, & Hackett, 2000) and Critical Race Theory (CRT) (DeCuir & Dixson, 2004; Delgado & Stefancic, 2001; Matsuda, 1995; Solórzano & Yosso, 2002) as our areas of theoretical focus. SCCT explains how self-efficacy, the belief that one is able to perform a particular task, and outcome expectations, the belief that one's behaviors will result in particular outcomes, leads to interests in particular subjects, which helps to guide career choices (Fouad & Santana, 2017). Contextual factors, such as socioeconomic status, race, gender, and the availability and quality of mentoring may be key factors in explaining the underrepresentation of ethnic and racial minorities in STEM fields. In addition, perceived and actual experiences with racism, sexism, ableism, classism, and other "-isms" hinder educational opportunities, career options, and expected outcomes (Chaves et al., 2004; Mattison & Aber, 2007; Rollins & Valdez, 2006). Using a SCCT framework helps us understand the complexity of factors related to STEM-field avoidance, as well as opportunities for teachers to intervene in working with adolescents who are at decision-making points in their educational pathways. As Fouad and Santana (2017) propose, SCCT theory can help those working directly with adolescents because it can point directly to interventions that can influence adolescent decision-making.

Studies using the SCCT model with minority middle and high school students found support for experiences in mathematics and science that led to increased self-efficacy and outcome expectations (Flores, Navarro, & Joseph DeWitz, 2008; Garriott et al., 2014). Other research using the model shows that teacher support and successful learning experiences promote the development of self-efficacy and positive outcome expectations that impact later career decisions (Flores et al., 2008; Garriott et al., 2014). It has been demonstrated that teachers play an important role in supporting adolescents' decisions to enter STEM fields. In their meta-analysis of studies built on the SCCT framework, Fouad and Santana (2017) call for research into how teachers influence STEM career choices. For example, how might early success in mathematics serve as a gateway into more advanced courses and eventual STEM careers? How can teachers structure classroom environments to better foster self-efficacy and positive outcome expectations? As we analyzed the data gathered in our discussions with teachers, we used SCCT to help us understand the impact of teachers on student course of study and career option decisions.

Critical Race Theory (CRT) (Delgado, 1995) is a belief system that places race in the center of discussions about how students fit into an educational system that is controlled by a dominant social hierarchy. The goal for CRT in education is to understand how these inequalities can be recognized, analyzed, and transformed in ways that empower students, change existing inequities, and help level the playing field for all students (Matsuda, 1995). CRT theorists reject viewing students through a deficit lens, but seek to use the students' experiences with racism, gender mistreatment, and classism to highlight their strength and resilience (Solórzano & Solórzano, 1995; Valencia & Solórzano, 1997). CRT also rejects the ideology of a colorblind society, which CRT proponents believe does nothing to solve the problem of racial inequity (DeCuir & Dixson, 2004). To expand the boundaries of the practical applications of CRT, other scholars (Bell, 1992; Collins, 2000; Collins & Bilge, 2016; Crenshaw, 1995; Williams, 1997) have added the dimension of intersectionality, which seeks to understand the ways in which gender, race, and social class intersect.

One particularly important facet of CRT is the idea of empowering individuals affected by racial injustice and inequity to share their own experiences in constructive ways, including storytelling, histories, biographies, and other formats in a process called counter-storytelling (DeCuir-Gunby

& Walker-DeVose, 2013; Delgado, 1995; Solorzano & Villalpando, 1998; Yosso, 2006). Counter-storytelling helps give voice to marginalized groups by challenging "privileged discourses," or as Delgado and Stefancic (2001) put it, "help[s] us understand what life is like for others, and invite[s] the reader into a new and unfamiliar world" (p. 41).

For students, CRT empowers them to make their presence known and challenge the privileged discourses of majority groups (Delgado & Stefancic, 2001). For teachers, including teachers of color as well as White teachers, counter-storytelling could include allowing teachers to have a space where they can discuss racialized experiences in their classroom. One avenue for opening up these discussions for teachers is through a process called critical inquiry groups (Howard & Navarro, 2016). These groups could assist teachers to develop plans of action for dealing with racialized experiences through reflection, analysis, and dialogue (Duncan-Andrade, 2004, 2005; Nieto, Gordon, & Yearwood, 2002; Picower, 2007). In this study, we set up a virtual discussion area that mirrors a critical inquiry group and led the teachers as they analyzed social justice issues in an anonymous virtual environment.

Science and mathematics teachers, to fully understand issues related to race and gender, must learn to be reflective of their own biases and stereotypes, including recognizing when students are being stereotyped or are under stereotype threat (Steele & Aronson, 1995; Steele, 2011). Steele (1997) defined stereotype threat as

> a situational threat—a threat in the air—that, in general form, can affect the members of any group about whom a negative stereotype exists… Where bad stereotypes about these groups apply, members of these groups can fear being reduced to that stereotype. (p. 614)

Student beliefs about stereotypes and how they perceive stereotype threat is an individual reaction. Some students respond by believing those stereotypes, which could lead to their disassociation from STEM careers. Other students show resiliency and personal agency in making decisions to stay academically connected and associated with STEM. Since stereotypes about females and minorities in STEM center on intelligence (Steele, 1997), some students may feel that they lack adequate intelligence to enter the field. In this regard, stereotype threat can act as a barrier to recruitment of females and minorities into STEM and also lead to higher rates of attrition as students move to fields in which they feel more capable.

In this paper, we examine what a group of STEM-field teachers enrolled in a graduate-level course in diversity believed about teachers' roles in highlighting STEM course and career options, their thoughts on underrepresentation of females and minorities in STEM, and the role of the teacher in helping students understand these issues. As we explored these topics with teachers, we asked for their perspectives, viewpoints, and stories to help us come to a deeper understanding of how race and gender manifest in their work with diverse students in STEM classrooms. Our exploration included discussions about interactions with students, parents, other teachers, and school administration as we understood the complexity inherent in guiding adolescents in future career paths. Specifically, we wanted to examine what teachers felt about encouraging underrepresented minority and female populations to consider STEM careers.

Three research questions guided the structure of our interactions with teachers:

1. What supports, skills, and strategies do teachers feel they need as they work with females and underrepresented students of color to promote interest in STEM fields?
2. How do female mathematics and science teachers describe their perceptions of STEM as a field of study for female and minority students?
3. What barriers do classroom teachers perceive in encouraging female and minorities students in their classrooms to consider STEM fields?

To answer these questions, we engaged in discussions with practicing science and mathematics teachers enrolled in a master's level course focused on diversity.

## 3 | METHODS

### 3.1 | Participants

Students (approximately 300) in an online master's level course on diversity in education were invited to participate in this study. Originally, 36 students in the course expressed interest, with 14 agreeing to participate. The study population was recruited using convenience sampling, which is a non-probability statistical sampling method. Therefore, it does not seek to represent the entire class or a specific population of science and mathematics teachers. The sample does, however, contain a sub-sample of the class who were willing to be open and honest about issues related to equity and also open to discussing these issues in a technology-driven online environment. Because the course was entirely online, students could attend from anywhere in the world, committing to join conversations in Second Life™ at designated synchronous times. Second Life™ is an online three-dimensional virtual world inhabited by avatars that are operated by their human users. Conversations occur through text chat or voice communication. Because the platform is open-ended, with no set objectives (in contrast to multiplayer online games, for example), many educational institutions, including universities, have presence in Second Life™. At the time we conducted

this project, our university had a Second Life™ simulation of our university campus.

Those enrolled in the course were all practicing science and mathematics teachers with various levels of teaching experience. All participants were female (although male students were invited). Twelve of the teachers identified as White/Caucasian/German-American (non-Hispanic) (85.7%), one teacher identified as multi-racial (7.1%), and one teacher as Black (7.1%). Students who chose to participate were asked to sign a document of Informed Consent. In addition, two university instructors participated in the discussions.

As researchers, we were personally involved in the study with our students, and felt that it was important to position ourselves in the virtual world to help facilitate the discussions. We acknowledge that we reflected on our own backgrounds as part of our participation (Darlaston-Jones, 2007). We are both White faculty members in the field of education. Professor 1 is male, and has a background in science education, previously teaching science education and computer literacy at the middle and high school levels. Professor 2 is female, with a background in literacy studies, as well as experience teaching in self-contained (all content areas) elementary school classrooms. Both have been involved in social justice matters in their capacity as public-school educators and professors, and both have experience with Second Life™, which aided the facilitation of the discussions (Baker, Wentz, & Woods, 2009; Blascovitch, 2002; de Montes, Oran, & Willis, 2002). The author and co-author worked together to develop questions for the chats, which focused on stereotyping, stereotype threat, race and racism, and the intersections of gender, race, and socioeconomic status in the fields of STEM. Although eight specific questions were used to guide the discussions, the researchers allowed the conversations to flow naturally into related areas as necessary (see Figure 1).

## 3.2 | Data collection

Each participant and the university instructors met for a total of three virtual synchronous chats, which were held at various times of day to encourage attendance. The course instructors were present for the Second Life™ (see Figure 1) chats and served as facilitators for discussions. All of the chats were conducted in the lounge area of the university's Second Life ™ space, where participants' avatars sat on virtual sofas and chairs (see Figure 2). There were between six and eight participants per chat session. Text-based chat was used (instead of voice) for a variety of reasons, including a level of privacy, less demand on computer resources, and the ability to log in from public or noisy spaces. Using the built-in logs in Second Life™ provided a time-stamped transcript. Each session was also recorded using the screen-capture software Camtasia™, which provided a backup transcript as well as a visual record of the discussions as they were happening and allowed notation of the proximity of avatars and pauses and overlaps in the conversation. Transcripts were obtained from the Second Life™ program itself, which was set to save a log file of the chats, including time stamps of the conversations. The logs were copied from.txt files into Microsoft Word. Both hand and NVivo coding techniques were used to inductively look at threads related to the research questions.

## 3.3 | Data analysis

The researchers met to conduct initial analyses, and together refined and collapsed the coding structures so that themes emerged. For an initial analysis (Charmaz, 2006), the chat logs were roughly divided into the different questions that were asked during the conversations, looking for patterns and themes that emerged based on the questions asked and by individual participant. However, it was found that the conversations and interactions were too complex to fully analyze question-by-question. This prompted a second analysis, going back to the entire text to look for themes that emerged across questions and that wove through entire conversations. We conducted this coding independently, while in the same room. As we developed our coding structure, we would stop to discuss our analysis, to confirm points of agreement, and to discuss and work through our differences until we came to consensus.

Each chat was reorganized to remove extraneous chatter, and to put the conversation themes together, without regard to timestamping, to examine the ways themes converged. These reorganized documents were much more readable and coherent, and could be further analyzed using a focused coding system that allowed the comparison of codes across documents. The conversations continued to be analyzed using a constant-comparative approach and a focused coding system, and annotations and analytical memos were documented to highlight important information (Charmaz, 2006).

For the entire coding process, qualitative analytical perspectives were used, including conversation analysis (Hutchby & Wooffitt, 2008), to examine talk and social interaction and explore how participants responded to the discussion and to one another. Critical discourse analysis (Fairclough, 2010) was also used to examine the visible and invisible spoken and paralinguistic features of course discussions taking place, including involvement and engagement. Patterns in the data were discovered by looking at word frequencies, co-locations of particular language, and semantic features of discussions. For example, we created original codes for various kinds of stereotyping, (e.g., racial, gender, ability), codes for the feelings our participants attributed to stereotypes (e.g., frustration, anger, agency), and codes for actions our participants reported when seeing stereotyping (e.g., doing nothing, offering

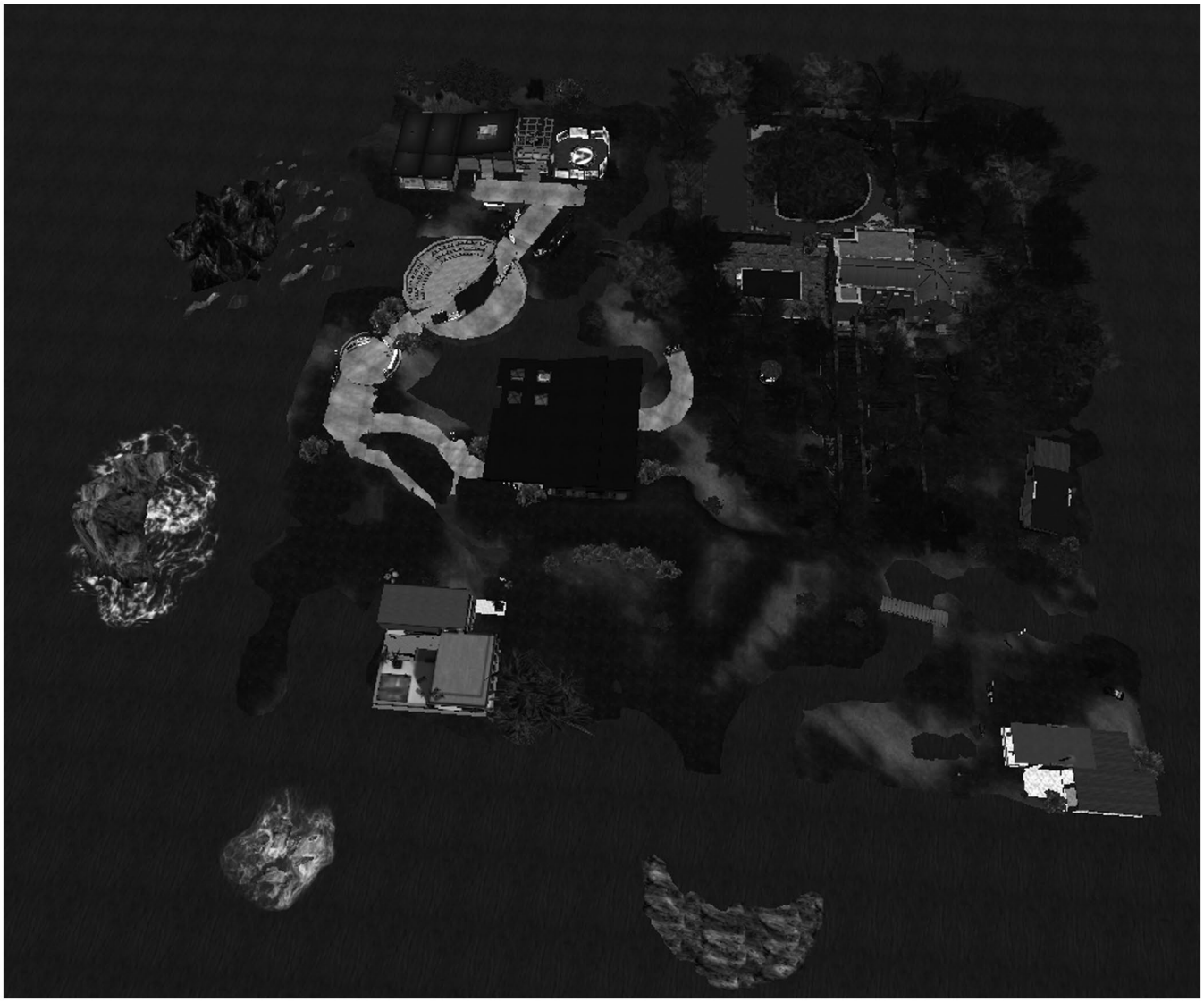

**FIGURE 1** Second life virtual world

individual support, incorporating lessons into curriculum). After coding by hand, the qualitative analysis software program NVivo was used to further identify patterns and themes that occurred between participants, groups, and courses. From these analyses, three major themes emerged: (a) teacher's understandings of stereotyping and stereotype threat, (b) encouraging females and minorities in STEM, and (c) diversity conversations in science and mathematics classrooms (see Figure 2).

## 4 | FINDINGS

### 4.1 | Teacher's understandings of stereotyping and stereotype threat

In our discussions, the teachers expressed the idea that stereotyping hindered diverse participation in STEM. They described stereotypes as preset, automatic or predetermined assumptions about people based on a single feature or characteristic. The teachers expressed their belief that stereotypes are used to judge individuals, which they believe lead to discrimination. They described stereotyping as not just thinking about something related to an individual, but also making judgments about entire populations of people.

After discussing stereotypes, the chats ventured into conversations about when the issues related to stereotyping should be discussed with children. This brought about an exchange with differing opinions, perspectives, and disagreements. We asked the teachers at what age children pick up on stereotypes and when they thought teachers should bring up issues of stereotyping in their classroom.

Mercy: It starts very young, with representation. When young children are only surrounded with and interacting

**FIGURE 2** Anonymous virtual discussions with science and mathematics teachers

with (in real life, through books/TV) people who look like them, they assert that this is what normal looks like and everyone else is [the] "other."

There was disagreement about when teaching to confront the idea of stereotypes should start:

Fearne: We should teach students early on, as early as kindergarten.

Millicent: I don't think students should be taught about stereotypes. I think we should discuss the ones they already have no earlier than 5th or 6th grade.

Sania: You don't talk to kids about stereotypes. Anyway, you don't use that language. You talk about how to treat others.

One teacher, who was adamant about using the correct terminology, explained her reasoning: "Teaching students what a stereotype is without using the term confuses them later on in school." Two of the teachers felt that discussing stereotypes with students would lead them to *start* using the stereotypes: "If you tell a group of students, especially at a young age, 'The stereotype is Asians don't know how to drive' they aren't going to work past it, they will only remember the stereotype."

The teachers expressed opinions on the problems that stereotyping can create in classrooms, and the impact on learning.

Star: I think our minds are naturally wired to make connections and attach past learning and experiences to new ones. So, we almost can't avoid having some bias or thoughts about everything new (that) we come into contact with. I think stereotypes are only negative when they directly influence or impact our behavior or actions towards someone; when we don't take the time to look past the stereotype and educate ourselves fully about that person or group before drawing a conclusion.

The teachers identified stereotyping as a mental process that all students and adults perform. We also asked about ways classroom teachers also stereotype and if it is a problem when teachers believe these stereotypes. A few of their mixed responses follow:

Sania: Yes, because teachers are a huge influence on others.

Cash: If a teacher believes [a] stereotype, he may not encourage the students appropriately.

Benson: Yes, it can be a problem when teachers believe stereotypes because they might expect something which isn't there.

Fearne: It could possibly lead to underperformance. It depends on the child; some students want to show you that you are wrong and work harder. Some students will say, "You are right, I can't do it."

From the different perspectives offered by the teachers, there seems to be no consensus about how to approach and discuss stereotypes within their mathematics or science classrooms. However, they did agree that biases are common to all teachers, and being aware of those biases could help a teacher be more effective as an instructor and mentor to diverse students. They also point to variability within students; some students of color are encouraged under stereotype threat because they want to disprove the stereotypes, yet others tend to internalize the stereotype, which subsequently hinders their classroom performance.

### 4.2 | Encouraging females and minorities in STEM

We asked, "Do you ever have the sense that your female students struggle in the areas of mathematics and science because of their expectations for themselves?"

Kacey: Oh, yeah. "I'm not good at this." I hear that all the time.
Alyx: I do not see that at my school. I see just the opposite. My female students are often times higher in these areas than my male students.
Mercy: Yep. "I'm not a math person." Not just in female students, but in low SES kiddos as well.

The teachers commented that the lack of expectations fell more along socioeconomic lines than on gender lines:

Mercy: Math is the one subject it seems okay to not learn. Parents are always following math struggles of their students with disclaimers about their own lack of understanding. Kids pick up on this.
Muskaan: I think it is very important that we clarify. I agree that this is a cultural influence and that biology is not involved. There is no math gene that one or the other sex has.

We asked about the disparity in the percentage of females compared to males in pursuing education in engineering, physics, and other physical sciences, and ideas about why this may be the case:

Millicent: Is it possible that we don't light a fire of curiosity in high school? If science is boring, there is a problem.
Cash: I think girls are encouraged to do what they want more than, say, 30 years ago when they were pressured into math/science fields.
Millicent: Do they have ample opportunities to see what an engineer does?

Based on the length of time the teachers were engaged in this topic, and the timestamping that showed how rapidly they were adding comments, this was a lively discussion of opportunities. As far as female students are concerned, one teacher said that girls have plenty of opportunities, but one asked, "but are they *aware* [emphasis added] of those opportunities?" This is an important distinction. Female students see fewer role models in highly technical fields like computer science or engineering (Lord et al., 2009), so it is possible that they may not see themselves as fitting into the culture of that career. Even before entering the workforce, they may see themselves as an underrepresented student in their coursework and undergraduate program. This may reach as far back as high school, where females and minorities may feel outnumbered in advanced/AP courses in mathematics and science (Settles, 2006).

Other teachers felt that it is up to the student to decide what they want to be:

Millicent: At some point, it has to be up to the person, whether or not the culture is inviting. If you love physics, pursue engineering or physics. Do what you love; this is the message we need to be sending. If you love art, pursue it.

Although most agreed that females need more role models, one teacher had this dissenting opinion:

Millicent: We cannot saddle our teachers with teaching content, teaching to the test, and providing appropriate, inspiring role models from the community for our kids. Something has to give. Is it not possible that we, as teachers, become these role models?

This discussion related to teachers worrying that they are already overburdened with teaching responsibilities and do not need any more responsibilities. Two of the teachers were concerned about having to look within their communities to identify these role models instead of serving as role models themselves. They also wondered if the role models for female and minorities in STEM need to look *exactly* like the students. Some research suggests students of color benefit from role models that match their intersecting identities of race and gender (Oyserman, Gant, & Ager, 1995; Syed, Goza, Chemers, Zurbriggen, 2012; Author, 2018). It is unclear if the teachers have a basic understanding of intersectionality (Bell, 1992; Collins, 2000; Collins & Bilge, 2016; Crenshaw, 1995; Williams, 1997), which could help them understand the ways in which gender and race intersect and how entrenched, White male-dominated power structures in STEM might cause students of color to be indifferent to STEM as a future career path.

This led to a discussion on whether teachers have different expectations for female students compared to male students.

Mercy: It is shown in the numbers that they do. Teachers call on boys more than girls, have increased wait time for boys, and react more positively to answers from boys.
Millicent: I think a female science teacher who is passionate about the subject and engaged with her students will speak volumes over pictures of old, dead men who won the Nobel Prize.

Three of the teachers felt that in addition to race, socioeconomic status was a factor in STEM minority underrepresentation. They also believed that there is a myriad

of problems that could make students disassociate from school in general and science and mathematics in particular. One of these factors is the background and home life that the students bring into the classroom. Two of the teacher expressed the belief that low-income students could be first-generation college students, and may not have been encouraged to take advanced courses. Mercy discussed the influence of poverty on students' performance in mathematics, but in the end concluded that race was a determining factor:

Mercy: As far as math and the performance gap, it's hard to extrapolate what is causing it, because it runs along racial and economic lines. It's also hard to know what is being perpetuated and what is being imposed by expectations. Upward mobility definitely seems to be limited as a minority, so that would be your deciding factor, I think.

## 4.3 | Diversity conversations in science and mathematics classrooms

Teachers gave varying responses when asked about how issues of racism and sexism should be approached in their classrooms. Five of the participants felt that school districts did not do enough to inform their teachers about the role racism and sexism have in academic achievement, but also expressed an understanding that sensitive topics need to be handled carefully. We asked how prepared they felt, as teachers, to talk about diversity, stereotypes, and racism in the classroom. They mostly concluded that they were not prepared:

Star: To some degree, yes. I would use the word comfortable more than prepared. The lack of preparation stems from lack of material, at least provided curriculum materials from our district. I am comfortable with the topic, though due to my own experiences and [also] the clear need for it.

Cash: In my classroom, we do not have time to discuss diversity at length. We only discuss it if the situation warrants. There is so much content to cover in 8th grade math that we cannot spend time off-subject unless it is necessary.

Because of increasing demands put on classroom teachers to cover all of their course content and prepare students for state and national high-stakes tests, they felt that they did not have time to talk about racism and stereotyping in their classes. They raise the argument that additional content added to the curriculum would get in the way of their administrative-imposed mission to raise test scores. One teacher concurred, "I absolutely feel the pressure to cover a certain amount of content. With snow days, pep rallies, and school assemblies, it's hard to fit anything else in."

The teachers talked about the difficulty of bringing up issues of racism, sexism, and other forms of discrimination in their classrooms. They all agreed, however, that respect is important and should be discussed with all students.

Jevon: We discuss, as a class, respect for one another and the environment that should exist. [We] have a lot of discussions about stereotypes because of things the students may say, but my classes are not very diverse. The school is predominantly one race and I am of another; it doesn't cause issues, but can change the type of conversations that we're having or how frequently we're having them.

Next, we discussed the types of professional development available to teachers on issues related to race and gender. They expressed the opinion that their training was inadequate to help teachers understand the issues they confronted on a daily basis. They also agreed that standardized tests are the most prioritized issue for school districts and is the most frequent topic of professional development. This led to a discussion about the availability of diversity training for classroom teachers.

Alyx: When they get into the real world, they will most likely come across diversity.

Star: Diversity is everywhere. It's something students are guaranteed to experience at one point or another.

Kacey: They are going out into a real world that doesn't necessarily look like their school, because they need to be good people.

Mercy: They need it the most [monoculture schools], because those kids aren't interacting with anyone outside their demographic. So their ideas about other groups of people tend to be really static and two-dimensional; mostly based on misinformation and stereotypes. We're talking to our minority kids about safety and a rigged system, but not talking to our majority kids about privilege.

The question of teachers not having enough time to teach issues of diversity was brought up more than once. Some of the teachers said that these topics belonged in the social studies curriculum or in character studies education. While some said, "it must be in the curriculum to be taught," some had a different take:

Sania: Sad but true; I think it belongs in the social studies curriculum. But, we as teachers should model and correct.

Kareena: Yes, to a point; however time [to discuss] needs to be taken when issues arise.

Ozzy: I think as long as it's in the curriculum, we should teach it. And if it's not, we should be addressing it in morning meetings as character education.

Sania: It should be taught every year.

Kareena: [When] teaching the curriculum, if students are angry about a comment made or how someone made them feel, they are not focused on the subject anyway.

Sania: Deal with [it] right away! And make sure your whole class hears it! It is not a science objective, but if we don't develop work habits and relationship-building, we are wasting our time. It is important to deal with it right then!

Ozzy: I don't understand why a teacher would ignore it—it's not going away.

There were mixed reactions about where discussions of race and racism belong in the curriculum. Some believed that it should not be taught in a separate class, but there were conflicting opinions about where it might fit in the overall curriculum. They also questioned why some teachers avoid the subject in the classroom; most agree it was out of a fear of parents, administrators, and even the students.

## 5 | DISCUSSION AND CONCLUSIONS

Within the conversations, we found evidence that teachers believe that perceived and actual experiences with racism, sexism, and other forms of discrimination and stereotyping do hinder educational opportunities, career options, and the kind of support students get when they are making long-term decisions. As SCCT suggests (Lent et al., 2000), the teachers in our study believed that these contextual factors could help explain the underrepresentation of ethnic and racial minorities, as well as females, in STEM careers. It was heartening to see that the teachers also felt that they had some influence and the ability to intervene in ways that could support their students. The teachers themselves believed that their understanding of the issues related to ethnic and racial identity and gender deepened as a result of the synchronous conversations. While we cannot make generalizations based on the limitations of our study (small number of participants, short time-frame), we felt that the shifts in thinking were noteworthy.

The teachers in our study seemed to be knowledgeable about constructs such as stereotype and privilege, but often expressed difficulty in talking about these issues. Most teacher-development programs have courses that address diversity, but in online courses where students are limited in the tools they use to interact, there may not be the deep conversations that lead to shifts in their worldview or the competence to lead difficult conversations themselves. Inclusive teaching and cultural responsiveness are difficult topics to address in online courses that rely on discussion boards and chat forums. Teachers have various experiences, both personal and professional, that have created lenses through which they see diversity, but those lenses do not always address teacher-educator concerns that facilitate inclusive classrooms and teaching. Real-time discussions in a virtual world solve the problems that lack of presence in online courses can cause. As online course platforms become more common, it will become increasingly important for faculty to find ways to facilitate conversations that broach difficult topics, encourage students to interact with one another, provide a means for faculty to gauge attitudes and dispositions for teaching, and develop forums where critical thinking can emerge (Grant & Lee, 2014).

The online students in the master's program, most of whom were practicing science and mathematics teachers, needed to feel open to express themselves freely in discussions, build instruction and content design that leads to worthwhile learning outcomes, and construct meaning through sustained reflections and open discourse with other students in the course (Garrison, 2007; Garrison, Anderson, & Archer, 2003). Since these were online students, without the ability to interact with one another in face-to-face ways, providing students with a virtual space to engage in synchronous discussions about sensitive topics such as racism and sexism seemed to support deep and meaningful conversations.

As far as promoting STEM, the teachers overall felt that stereotypes and racism impeded the chances of females and minorities choosing STEM careers, but they feel conflicted about their role in recruitment and how to best encourage these students. The teachers felt like the best way to encourage females and minorities to enter careers in STEM was through giving the students role models, rigorous curriculum, and encouraging them to consider all career options, no matter their race or gender.

When asked about where these issues fit into the curriculum, the teachers were reluctant to find a place in their own classroom or were eager to pass these issues off to another teacher; i.e., "I believe that belongs in social studies." It would be nearly impossible to add another course on social justice and culturally relevant pedagogy (Ladson-Billings & Tate, 2006) into the preservice teacher preparation, but more awareness must be added if teachers are going to be prepared for diverse classroom environments. If teachers are to broach these issues in their classrooms, they must feel safe in doing so. To feel safe, they must have the support of administration and other faculty who are also in a position to bring up these issues in their own classrooms. These safe spaces should be free of institutional oversight and free from judgment or bias based on their own race and gender. Some of the teachers pushed back regarding the operational constraints, one stating, "Do we teach subjects or students?" This solidifies the notion that the classroom should be primarily focused on the needs of students, and issues of sex, race, and ethnicity, particularly as it applies to STEM, should never be ignored.

The teachers expressed the importance of discussing issues of stereotyping and racism in their classrooms, but also felt that competing priorities, such as state and national tests, curriculum coverage requirements, interruptions, and classroom management concerns all contributed to lessening their time and resources to have meaningful conversations about those issues. Although the teachers seemed happy and willing to learn more, they believed that most of what was called professional development on the topic of diversity was rushed, open for controversy, and simply not applicable to their classroom environments. All the teachers agreed that deep conversations about these issues were needed, yet they also agreed that they were not happening on a consistent basis. They expressed that teachers, in general, are not ready to address these concerns and some even feel that it is a waste of valuable classroom time.

After learning that the field of STEM needs more females and minorities (Lord et al., 2009; Settles, 2006), three of the teachers expressed the concern that the burden for recruiting students into STEM might be added to their already long list of responsibilities. Although it is not completely on their shoulders, it is important that these teachers realize that they are one link in the chain of influence and that their influence can be an integral part of the student's decision to major in a STEM field. These teachers, possibly more than any others, need to be trained in stereotypes and stereotype threat, and also taught simple interventions that can help decrease stereotype threat in their female and minority students (see Author, 2016; Walton, Cohen, & Steele, 2012; Yeager & Walton, 2011). Teachers must first confront their own biases and understand how they feel through reflection and discussions with their peers. Using virtual environments similar to Second Life™ that use anonymity in discussions with teachers could prove a valuable tool in the professional development and awakening of teachers in all subject areas.

As it relates to CRT, the teachers had some misunderstandings of structural inequalities based on race, with the majority of the teachers bringing up the idea that socioeconomic status is more of a contributing factor influencing inequities than race. These beliefs represent an expression of colorblind ideology (DeCuir & Dixson, 2004), and demonstrate a privileged discourse that ignores the hegemonic power structures that cause race to be a limiting factor for students of color (Delgado & Stefancic, 2001). As well, teachers restraining discussions of race in their classrooms will likely decrease the opportunities for students of color to offer counter-stories to combat issues of racism, sexism, and microaggressions that might arise in science and mathematics classrooms (Solorzano & Villalpando, 1998). For teachers, dealing with race-related disruptions and allowing students to express their frustrations is the best way to show students that teachers care about these issues, offer a safe environment where students might mitigate the effects of stereotype threat (Yeager & Walton, 2011), and diminish the power of privileged discourses (Delgado & Stefancic, 2001).

As a follow-up, we asked the participants how these chats helped them understand issues of racism, bias, stereotyping, racial profiling, or sexism as it pertains to the mathematics and science classroom. One had this to say:

> The conversations helped me realize that bias and sexism occur in mathematics classrooms. I want all of my students to feel they can equally be successful as they want to be in a classroom and content area. I want to encourage the girls to develop a deeper determination about their success in mathematics because, as a society, I don't think we set them up for this.

To facilitate classrooms that are respectful of cultural differences and promote inclusion, we as teacher-educators strive to develop curriculum that promotes diversity and an understanding of the cultural frames that disrupt stereotyping and marginalization, as well as find ways to help teachers understand their own biases, perspectives, and beliefs regarding cultural differences. Teachers must feel the freedom to speak positively and critically to the issues of race and inequality without feeling constrained by curricular and administrative obligations. Only when teachers can challenge privileged discourses and "speak truth to power" with their students, will the issues surrounding the underrepresentation of females and minorities in STEM be confronted and changed for the better (DeCuir & Dixson, 2004; Delgado & Stefancic, 2001; Delgado, 1995; Duncan-Andrade, 2004, 2005; Nieto et al., 2002; Picower, 2007). As teacher-educators, we must push preservice teachers to find legitimate spaces where they can have open and honest conversations that will allow the disruption of constraints that hold students back. This will help them build supportive and successful learning environments that promote the development of self-efficacy and positive career decisions in their own students (Flores et al., 2008; Garriott et al., 2014). Future research should examine the role science and mathematics teachers play in the STEM identity development of their underrepresented minority students, giving particular attention to connections between SCCT and intersectionality (Brown & Lent 2017; Dickinson, Abrams, & Tokar, 2017; Byars-Winston & Griebel Rogers, 2019).

## 6 | LIMITATIONS

This research was conducted in one course at one university, with a specific demographic profile—a highly ethnically and linguistically diverse, heavily first-generation research

extensive university in the southwestern United States. Our participants opted in after being sent an invitation that was distributed to the entire class. Other than these real-time discussions, the course was entirely asynchronous; time constraints may have played a factor in participation. We do not know how those who declined to participate might have responded to the questions. Subsequently, we were only able to analyze the responses of those who volunteered to participate, which may or may not reflect the thoughts and perceptions of the entire class. Similar to experiences of other researchers who study their own classes, our students may have given answers they thought we wanted to hear rather than what they truly believed. As with other qualitative research, our findings are not intended to be generalizable, and cannot be applied to all types of universities or university courses.

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**How to cite this article:** Sparks DM, Pole K. "Do we teach subjects or students?" Analyzing science and mathematics teacher conversations about issues of equity in the classroom. *School Science and Mathematics*. 2019;119:405–416. https://doi.org/10.1111/ssm.12361