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To cite this article: Teresa K. Dunleavy, Alison S. Marzocchi & Maisie L. Gholson (2021) Teacher Candidates' Silhouettes: Supporting Mathematics Teacher Identity Development in Secondary Mathematics Methods Courses, *Investigations in Mathematics Learning*, 13:1, 43-58, DOI: [10.1080/19477503.2020.1831173](https://doi.org/10.1080/19477503.2020.1831173)

To link to this article: <https://doi.org/10.1080/19477503.2020.1831173>



Published online: 22 Oct 2020.



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Teacher Candidates' Silhouettes: Supporting Mathematics Teacher Identity Development in Secondary Mathematics Methods Courses

Teresa K. Dunleavy^a, Alison S. Marzocchi^b, and Maisie L. Gholson^c

^aMathematics Education Peabody College, Vanderbilt University, Nashville, Tennessee; ^bCollege of Natural Science and Mathematics, California State University, Fullerton, California; ^cSchool of Education, University of Michigan, Ann Arbor, Michigan

ABSTRACT

In this paper, teacher educators located at three different universities across the United States share findings emerging from our collaboration around a suite of three activities that engage our teacher candidates (TCs) around their identities as future mathematics teachers. In particular, our TCs engaged in a suite of identity-based activities in order to promote reflexivity across dimensions in a way that we argue is not possible through a single activity. We implemented activities to promote our TCs' reflexivity, as well as to engage in critical self-reflection on our own practice as mathematics teacher educators. We explore the relationship between multidimensional reflexivity and beginning teachers who hold commitments toward justice and equity in mathematics education. Three activities – a mathematics autobiography, a silhouette, and an identity card sort – were selected, modified, implemented, and reflected on across our secondary mathematics methods courses, with the goal of promoting reflexivity across dimensions. We refer to *reflexivity across dimensions* as one's ability to explore one's identity within various analytical frames. The autobiography, silhouette, and card sort offered opportunities for TCs to explore the dimensions of their *narrative*, *discursive*, and *categorical* reflexivity, respectively. We found that TCs engaged in continual questioning and perturbing of their positions in society in ways that contributed to their sense of self and promoted reflexivity across the dimensions of TCs' mathematics identities.

KEYWORDS

mathematics teacher education; mathematics teacher identity; equity; race; gender

All too often, the challenges in mathematics teaching and learning are viewed as technical problems, oversimplified to be a function of replicating techniques learned during student teaching interactions, including: using open-ended questions, closed-ended questions, and/or exercising sufficient wait time. In an ever-increasingly complex and inequitable society, addressing the challenges of teaching by solely reflecting on the technical aspects of one's practice is insufficient in addressing the politicized nature of mathematics teaching and learning (see, e.g. Gutiérrez, 2013).

Reflexivity, as defined by Margaret Archer (2009), is “the self-referential characteristic of ‘bending-back’ some thought upon the self, such that it takes the form of subject-object-subject” (p. 2). In our case, we are particularly concerned with teacher candidates (TCs) developing their capacity to think through the form of self (as the subject), mathematics teaching and learning (as the object), and self again (as the subject). This pattern of “bending-back” thought is a departure from simply *reflecting* on one's mathematical teaching practice in a technical sense. So, while Archer (2009) asserted that

CONTACT Teresa K. Dunleavy  teresa.dunleavy@vanderbilt.edu  Mathematics Education Peabody College, Vanderbilt University, Nashville, TN 37203

This article has been corrected with minor changes. These changes do not impact the academic content of the article.

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reflecting on practice is reduced to thinking about an object (e.g., teaching and learning, white womanhood, curriculum), *reflexivity* affords us the opportunity to think about one's relationship to the object, which, in our case, involves one's identity. As such, we believe that this reflexive, bending-back thought – and in particular engaging in dynamic action about one's identity – moves beyond what reflection does on its own. We therefore argue that reflexivity is necessary for teachers who aim to strive toward justice and equity in education. We use this paper to investigate what we learned from engaging our TCs in a suite of three activities developed to support their capacity for embracing reflexivity.

Through collaboration in our respective secondary mathematics methods courses, we sought to implicate some of the problems of teaching as a function of reflexivity, which we view as the capacity to frame and reframe events, or to *bend-back* dynamically, to make varied sense of one's role in a situation or event. We contend that our ability to be reflexive is based on our epistemological resources to first “see” and then, potentially see differently, and then still, see differently again.

Being reflexive in one's teaching was considered by Schön to be a temporally-bound action, either occurring retrospectively (reflection-on-action) or in the moment (reflection-in-action) (Zeichner & Liston, 2013). Reflective teaching as an act disrupts naturalized understandings and practical theories of teaching that problematically operate as common sense (Zeichner & Liston, 2013). To build the necessary epistemological resources for reflection, we designed activities that we hoped would disrupt TCs' read of themselves. We in turn posited that it would affect their views of their classrooms and school communities. Beyond reflection-on-action and reflection-in-action, we extend the temporal dimensions of reflexivity to a framework that includes three methodological dimensions: *narrative* (being able to tell a story about one's self), *discursive* (being able to read socio-political discourses), and *categorical* (being able to negotiate socio-political labels, such as Black, middle-class, woman).

A Black Feminist Framework

We endeavored to connect our TCs' lived experiences to the broader forces that structure and organize mathematics opportunities and identities. As such, we situated our perspectives within a Black feminist framework (Collins, 2002), because of how it privileges the everyday lived experiences of our TCs. The Black feminist framework invokes an intersectional reflexivity such that multiple overlapping identities are considered simultaneously. This framework honors the complexity of the socially-constructed identities held by individuals, including but not limited to dimensions involving race, ethnicity, gender, class, linguistic background, sexuality, religion, and ability.

Within Black Feminist Thought, Patricia Hill Collins (1989, 2000) theorized that we are epistemologists, i.e., knowledge creators, when we reflect on our everyday lived experiences. Black Feminist Thought originated from Collins' sociological analysis of Black women, who are situated at the margins of society as a function of race, gender, and, often class-based status hierarchies. Collins asserted that this marginalized standpoint offers a set of epistemic resources and advantages in making sense of the world, because “it distances Black women from hegemonic thought and practices – facilitating a critical attitude,” as well as provides “access to alternative discourses to interpret situations” (Sprague, 2016, p. 45). Said differently, marginalized standpoints offer a perch or a way of “seeing” oppressive structures and systems that are deemed invisible by those standpoints based on privilege (Sprague, 2016). Therefore, through this framework, TCs who hold one or more marginalized identities have valuable perspectives for engaging in reflexivity around justice-oriented and equitable mathematics teaching practices. Conversely, TCs that hold a number of identities of privilege are not as well-positioned to easily see beyond hegemonic systems and structures.

As described by Sprague (2016), Black Feminist Thought is grounded in four tenets that stand in stark contrast to positivistic perspectives: (1) the use of concrete, personal experience, (2) the incorporation of emotion and empathy, (3) the deep consideration of ethics and values inside of the sense-making process, and (4) engaging in “adversarial debate” to arrive at collective

understandings (p. 46–47). The design and facilitation of activities within our secondary mathematics methods courses deliberately rely on personal experience, emotion and empathy, ethical considerations, and discussion.

Investigating Reflexivity

We used the mathematics autobiography, the silhouette, and the identity card sort in order to investigate our TCs' reflexivity around their own racial and gender identities. We aimed for these activities to offer opportunities for TCs to make sense of their intersectional identities. We found that the differing sociopolitical and sociocultural contexts of each of our institutions and their surrounding communities also afforded rich learning opportunities for our cross-institutional collaboration and implementation. In order to narrow our investigation to constructs that address deep issues of justice and equity in mathematics education, we choose to analyze findings around our mathematics TCs' racial and gender identities. As such, we asked the following research question: What do we learn about our TCs' conceptions of race and gender in mathematics teaching and learning, as they engage in a suite of three identity-based, reflexive activities?

Our Varied Contexts

The diversity of our institutional contexts is demonstrated by a subset of each's demographic information. Site 1 (Southwest Public)¹ is a large, public, comprehensive university located in the Southwest that is both an Hispanic-Serving and an Asian American and Native American Pacific Islander-Serving Institution. At the time of the study, about 65% of faculty and 40% of TCs identified as White, less than 1% of TCs as Black, 35% as Latinx, 15% as Asian, 5% as multiracial, less than 1% as Native American, and 4% unknown. Site 2 (Midwest Public) is a large, public, predominantly-White research institution located in the Midwest. Approximately 75% of faculty and 80% of the education students identified as White, 3% as Black, 8% as Latinx, 8% as Asian, and approximately 1% as Native American. Site 3 (Southeast Private) is a moderately-sized, private, predominantly-White research institution located in the Southeast. About 75% of faculty and over 80% of the TCs identified as White, about 8% of TCs as Black, 2% as Latinx, and about 10% as Asian.

Mathematics Teacher Educator's Positionality

As scholars and mathematics teacher educators (MTEs), we hold different subsets of intersectional identities that mediate our analysis and our teaching. Dunleavy and Marzocchi identify as cis-gendered, White women from working and middle-class backgrounds, and Gholson identifies as a cis-gendered, Black woman from a middle-class background. We use our different social identities as resources and tools in our collaboration and consider them as lenses when working with our TCs.

Tools for Promoting Reflexivity in Mathematics Teacher Candidate Identity

As a team, we worked to modify the suite of activities according to our collective goals to engage TCs in making sense of their own identities. Although possibly in Fall or Spring terms according to institution, the mathematics autobiography and silhouette activities generally took place together, as individual assignments within the first three weeks of class. The card sort activity took place weeks later and involved both an individual component and whole-class discussion. Prior to engaging in the suite of activities, all TCs read Chapter 2 from Aguirre et al.'s (2013), *The Impact of Identity in K-8 Mathematics: Rethinking Equity-Based Practices*. Chapter 2, "Identities, Agency, and Mathematical Proficiency, What Teachers Need to Know to Support Student Learning," facilitated laying the

¹All names are pseudonyms.

groundwork for the suite of activities; in particular, we hoped that the ideas of Chapter 2 would support TCs to consider the role of identity in teaching mathematics.

Mathematics Autobiography

The mathematics autobiography was adapted from Aguirre et al. (2013) and involved a written, short narrative in which TCs shared how their past mathematics experiences shaped them as future teachers (see [Appendix A](#)). While the value of writing a mathematical autobiography has been previously documented (e.g., Marshall & Chao, 2018), we selected this assignment because of its juxtaposition within our suite of activities.

Specifically, the mathematics autobiography activity afforded TCs the opportunity to engage in *narrative reflexivity*. We use narrative reflexivity to point to how TCs were able to reflect on their own identities as situated within a story (or narrative) that connected their past experiences with their current beliefs and future views. The mathematics autobiography invited TCs to contextualize aspects of their identities and reflect on how their identities would shape them as future mathematics teachers. We hypothesized that this was important identity work because TCs could see how their past experiences impacted their identities and influenced future actions. We hoped that by realizing the nuances of their own experiences in mathematics, TCs would recognize their future students as complex individuals with a myriad of experiences.

Silhouette

In the silhouette activity (Gholson & Robinson, 2019), TCs created a personal silhouette that represented the internal and external messages they received around becoming mathematics teachers (see [Appendix A](#)). This activity was intended to afford opportunities for TCs to reflect on the various discourses that they were negotiating, as well as the internal messages that resulted in response to those discourses.

The silhouette provided TCs with an opportunity to engage in *discursive reflexivity*. We define discursive reflexivity as the naming and management of discourses of power in mathematics and, more specifically, mathematics teaching and learning. Some discourses naturalize mathematics ability and others construct mathematics as masculine (Hottinger, 2016). Still other discourses reinforce the racial hierarchy of mathematics ability (Martin, 2009) and racialize mathematics, including stereotypes, such as “Asians are good at math,” (Shah, 2017). This activity supports TCs in identifying prominent discourses through words and images and then asks them to describe their relationship to such discourses. The silhouette relies on images and phrases, along with their placements either inside the silhouette, to indicate an internalized discourse, or outside the silhouette, to indicate an externalized discourse.

Card Sort

Whereas the mathematics autobiography and silhouette were given as an individual assignment, the card sort activity had individual, small-group, and whole-class components. The card sort engaged the TCs in *categorical reflexivity*, in order to explore the socially-constructed categories that contributed to the construction of their identities. To start the activity, each TC was read a task card in which race, gender, sexuality, and social class were given as example dimensions of one’s identity (see [Appendix B](#)). They were then asked to identify the ten dimensions of their identity that seem the most salient to them. Whereas personality traits were not to be considered part of these identity characteristics (e.g., “friendly” or “caring”), we specifically asked TCs to include their racial and gender identities, in order to invite exploration of some of the socially-constructed aspects of their identity that are both visible, and that have historically been linked to ideas of power, privilege, and competence in the mathematics classroom.

Specifically, we adapted the original activity (also Aguirre et al., 2013) in order to encourage our TCs to acknowledge the role of privilege and power through the lens of race and gender in the mathematics classroom. We made this adaptation because we predicted that some cis-gendered, heteronormative White students may not include their gender and racial identity without being

encouraged to do so (Singh, 2019). We also intended to create discourse and debate (Sprague, 2016) – we wanted to foster conversations about how and whether students valued their racial, gender, and other dimensions of their identities. When this activity was executed at Southeast Private, the teacher educator framed the activity that year by saying, “The purpose of the activity that we’re about to do today is for us to think about our own identity. And then as we engage in the activity will think about how that affects who we are, and who we are becoming in the classroom.”

After writing down the ten dimensions of their identity that seemed the most salient, TCs were asked to decide which aspect of their identity they could discard while still maintaining the core of who they were. As the activity continued, TCs were asked to continue to discard dimensions, one at a time. In one case, one teacher educator explained:

What I’m asking you to do is to discard one card each round. It’s difficult to reduce a card for some folks; other folks have no problems getting rid of a card; but the cards that you’re discarding are ones that are less at the core of who you are than the others. They are the dimensions of your identity that if you had to part with them, you’d be willing to part with them earlier.

The process of discarding one card each round was repeated until each participant had reduced their cards to a single categorical dimension of their identity – one that they thought most represented the core of who they were.

We used small-group and whole-class discussions to attempt to deeply unpack the dimensions of how TCs saw their multiple identities intersecting with their work as mathematics teachers. In particular, we encouraged TCs to share how and when they held onto or discarded the dimensions of their identity that they discovered were the most salient – including their race and gender. We used these conversations to encourage the exploration of issues of privilege, status, and power in the classroom, along with how our individual identities play a role in our classroom mathematics teaching.

Data Collection

This study examines courses that we taught in secondary mathematics education between 2017– 2018. Our data include artifacts from each activity, including: TCs’ mathematics autobiographies, silhouettes, identity card sort mats, audio/video recordings of the card sort discussions, and individual reflections from the card sort. We hoped for these data to reveal dimensions of TCs’ narrative, discursive, and categorical identities. Mathematics autobiographies offered TCs’ narrative stories, including, for example, “that one teacher” that influenced TCs’ interest in mathematics. TCs’ silhouettes offered insight into their discursive identities, including, for example, “pressure to be the best.” The identity card sort offered insights into how TCs explored the socially-constructed categorical dimensions of their identity, such as one TC, who described themselves as both “White” and “half-Mexican.”

We share Table 1 in order to start to acknowledge the complex, intersectional perspectives that our students brought around their racial and gender identities. While we acknowledge that a table is an over-simplification of how our TCs characterized their gender and racial identities,² we feature it in order to start to share a sense of how our TCs saw themselves.

Data Analysis

Our analysis sought to make sense of the identity-based dimensions that emerged within and across the suite of activities. Our multi-dimensional reflexive framework encouraged our TCs’ narrative, discursive, and categorical reflections on themselves. We hoped this framework would allow us to pay particular attention to the affordances and limitations of each activity, as we investigated the nuanced ways that they worked together to promote TCs’ ability to reflexively question and perturb their positions in society (see Table 2).

²As we seek to honor the complexity of one’s gender and racial identities, we note that for this study, our participants’ gender and sex (i.e., man/woman and male/female) appear within the same categories. Similarly, participants’ racial and ethnic identities may appear together, although they do not always indicate markers of a particular individual’s identity (e.g., one participant identified as Chicana without identifying as Latinx or Latina).

Table 1. Summary of TCs' racial and gender identities.

Demographic Categories Assigned by Researchers		Demographic Categories Asserted by TCs Across the Three Activities
Gender Identities	Man Woman	City Boi, Chicano, Cis-Male, Male, Man Chicana, Cis-Gendered Woman, Female, Girl, Latina, Woman
Racial Identities	Asian American Black Latinx Multiracial Native American White	Asian, Asian-American, Chinese-American, Japanese-American, Korean, second-generation Vietnamese, Vietnamese Black Chicana, Chicano, Latina, Latino, Mexican Asian/White Combo, Cauc-Asian, Half-Mexican, White Cuban American, White Half-Asian Native American Caucasian, Irish American, Irish-Italian-British Descent, Italian, Italian/German, White, White/Caucasian

Table 2. Reflexive framework for analysis.

Reflexive Framework for Analysis	Identity-focused TC Assignment	Reflexivity Dimension Explored
Autobiography Silhouette Identity Card Sort		Narrative Discursive Categorical

One level of data analysis was focused on visible (i.e., performed) identities, including race, gender, and linguistic background. A second level of analysis was focused on individuals' sometimes invisible identities, including class, sexuality, religion, and dis/ability status. In a third level of analysis, we examined the data intersectionally, considering two or more identities simultaneously (e.g., White women, Latinx man). We narrowed, in particular, to analyze each activity for findings related to how TCs described their race and gender, in order to learn from individuals' reflections on the kinds of privilege and power that have been linked to race and gender in mathematics education.

Emerging Insights into TCs' Reflexivity

Our analysis surfaced key themes around how our TCs are engaged reflexively with their racial and gender identities. First, we found that as TCs engaged in narrative, discursive, and categorical reflexivity across the collective suite of activities, they were afforded multi-dimensional opportunities to learn about themselves, about one another, and for us to learn with them. This reflexive framework pointed us toward the varied and complex ways our TCs incorporated their identities into their mathematics teaching.

We also found that multiple opportunities for reflexivity were critical for TCs to evolve toward justice-oriented mathematics teaching. Finding a connection between reflexivity and justice-oriented mathematics teaching points to the individual (e.g., mathematical autobiography, silhouette) and collective (e.g., card sort) value of questioning and perturbing one's position in society. Additional insights point to our cross-institutional collaboration as critically self-reflexive teacher educators. In so doing, we build on the work of other MTEs who have facilitated individual activities promoting reflexivity in TCs across diverse institutions (e.g., Aguirre et al., 2013; Gholson & Robinson, 2019; Marshall & Chao, 2018). In summary, we find that this suite of three activities, as we worked on them together as MTEs, promoted multi-dimensional reflexivity for our mathematics TCs.

Emerging Insights: Autobiography

The mathematics autobiography assignment was selected to promote *narrative* reflexivity, by engaging TCs in the act of telling their own mathematics story. More specifically, we invited TCs to use the activity to reflect on how their identities impacted their experiences as mathematics learners, and how they envisioned their identities might impact their decisions as mathematics teachers. One suggested prompt read, “What role did race, class, gender, culture, or language play in your math learning story?” (see [Appendix A](#)).

Upon analyzing 36 mathematics autobiographies across our three institutions,³ we found that TCs who identified as men⁴ were less likely to mention their gender identities, and White TCs were less likely to mention their racial identities. In a typical example in which a TC mentioned their gender identity, TC Bella from Southwest Public wrote, “I am a female Chicana in a predominantly male profession.” We consider this a *mention* of both a racial (Chicana) and gender identity (female/Chicana). At times the mention was less obvious, such as when TC Laura from Midwest Public wrote, “I went to a small all-girls college, which was interesting going from co-educational to single-sex education.” We consider this a mention of a gender identity (girl) because Laura was discussing her educational experience through the lens of her gender. On the other hand, TC Kwan from Southeast Private wrote, “An identity I really want to harp on is that STEM is not exclusively for White and Asian males.” We do not consider this a race/gender mention because Kwan spoke about stereotypes but did not comment on his own racial or gender identity.

[Table 3](#) tracks the ratio of mentions of TCs’ gender identities and [Table 4](#) tracks the mentions of TCs’ racial identities. A table cell value of “1/3,” as located at the intersection of Asian American and

Table 3. Ratio of TCs’ mentions of their gender identities.

Racial Identities	Gender Identities		
	Man	Woman	Totals
Asian American	1 out of 2	1/3	2/5
Black	0/0	3/3	3/3
Latinx	0/3	3/3	3/6
Native American	0/1	0/0	0/1
Multiracial	1/4	1/1	2/5
White	1/5	9/11	10/16
Totals	3/15	17/21	20/36

Table 4. Ratio of TCs’ mentions of their racial identities.

Racial Identities	Gender Identities		
	Man	Woman	Totals
Asian American	2 out of 2	1/3	3/5
Black	0/0	3/3	3/3
Latinx	1/3	2/3	3/6
Native American	0/1	0/0	0/1
Multiracial	2/4	1/1	3/5
White	1/5	5/11	6/16
Totals	6/15	12/21	18/36

³The reader may note that the number of participants may differ across each activity. This is due to both data collection across multiple institutions, terms, and students’ varied consent across assignments.

⁴All participants in this study identified as cis-gender.

Woman in [Table 3](#), means that 1 out of the 3 TCs who identified as Asian American women mentioned their gender identity in their autobiography.

Patterns in Mentions of Gender Identity

While we cannot make claims about the statistical significance of any of the numbers from our study, our counts in findings offer opportunities for some noteworthy qualitative conclusions. Importantly, we found that men were less likely than women to mention their gender identity in their mathematics autobiography. Specifically, 3 of 15 men compared to 17 of 21 women mentioned their gender identity (See [Table 3](#)). TC Yenny from Southwest Public provided a representative example of a woman mentioning her gender identity. She wrote:

I am identified as a first-generation Vietnamese female in America, and those roles have impacted my math-learning story greatly. Vietnamese women were viewed as the yin in yin and yang, and as a yin, we were soft, yielding, receptive, passive, reflective, and tranquil . . . However, as I became more familiar and adaptive with the American lifestyle, I built enough confidence to answer questions in class, speaking with my peers or in a large audience, and teachers.

Yenny reflected on how stereotypes of Vietnamese women initially impacted her behavior in her classes. On the other hand, TC Matthew from Midwest Public wrote,

Throughout my grade school years, I was both mathematically successful and self-confident, and I was proud to call mathematics an important part of my life. In addition, I felt that these sentiments were natural due to stereotypes that males and Chinese people are good at math.

Matthew mentioned his gender (and racial) identity to engage reflexively with the stereotypes of mathematical giftedness in a way that was unlike Kwan's previously-mentioned reflection pushing back on this stereotype.

Patterns in Mentions of Racial Identity

We also found that White TCs who did not also identify as multiracial were less likely than TCs of color to mention their racial identity in their mathematics autobiography. Specifically, only 6 of the 16 TCs who identified exclusively as White mentioned their racial identity. On the other hand, 12 of the 20 TCs of color mentioned their racial identity, including 8 of 11 TCs who identified as Black, Latinx, or Latinx/White multiracial (See [Table 4](#)).

TC Gabriella from Southwest Public identified as both a Latina and Mexican woman, providing a representative example of a TC of color who mentioned her racial identity:

My schools were also big on tracking. Even though I scored either proficient or advanced on my [standardized tests], I was still placed in regular classes. I saw other Latino students with the same scores in my classes. The students who were in the honors classes were mostly White or Asian. The budget probably did not allow for the rest of us. We probably were just not seen as worth the money. It was not until high school that I chose my classes that I was in honors. I was with the students that had been tracked in honors their entire lives. The demographic of the school was half Latino and half White. How is it that only a couple Latino students were in the honors classes? I did way better than most of them; they would ask me for help . . . Through my class placements, I was told I was not good enough. I had to make the decision to challenge myself.

Gabriella noted instances of racial bias in tracking at her high school. On the other hand, TC Kristie from Midwest Public provided an example of a White TC who mentioned her White identity, and its role of privilege, in her mathematics autobiography:

Math is tailored to almost all of my identities, and people who are thought of as being good at math have almost all of my identities. Math is tailored to middle-upper class, English-speaking men. They have a strong western culture, which is what American schools also support. I am a White, middle/upper class, English-speaking woman, whose culture aligns with the one supported in my public school.

Here, Kristie appeared to be simultaneously acknowledging her privileged racial identity and the role of whiteness in mathematics classrooms.

Intersectional Patterns of Racial and Gender Identity

We also found patterns in the intersection of privileged identities (e.g., White men) compared to marginalized identities (e.g., Black women, Latinas). Looking specifically at the five TCs who identified as White men, only one, TC Ethan from Southeast Private, mentioned his racial or gender identity. He wrote:

I never tied my personal identity or demographic information to my mathematical identity, or at least never did so consciously, but I realize that may be a subtle side effect of White privilege, or male privilege. I've always enjoyed math because it has provided me with ample opportunities to prove competency and ability to myself.

Similar to stereotypes noted by Matthew about Chinese men as “good at math,” Ethan discussed his racial and gender identity in order to note the privilege he had experienced by simply not tying either of these identities to his mathematics education experience.

Another interesting intersectional pattern emerged when we noticed that 3 of 3 Black women and 3 of 4 Latinas mentioned both their racial and gender identity (with all 4 Latinas mentioning their gender identity). TC Brianna from Southeast Private wrote:

As I got into [college] classes and began acquiring new vocabulary to describe the inequities that I had been experiencing in my educational career as a Black woman from a poor, urban neighborhood, I began to realize that having engaging tasks and encouraging collaboration are not enough. Students need to feel welcomed enough to participate in the learning environment in order to actually gain benefit from it. I had several experiences in my undergraduate career where I felt belittled or ridiculed when I asked a question, where the professor mixed my name up with another “ethnic” sounding name, where I felt that if I said something stupid I would just be reinforcing stereotypes that my professors and peers already viewed me through.

Similar to the bias that Gabriella experienced, Brianna noted the marginalization she endured, while also thinking forward to the needs she envisioned her students would have – specifically around building community so that they might feel welcomed to participate.

Summary

The mathematics autobiography assignment allowed us to notice that TCs with privileged identities discussed these identities with less frequency than students with historically marginalized identities. We hoped our TCs would consider their own identities as well as the identities of their students. As MTEs, we wanted to continuously provide opportunities for TC reflexivity. While not all TCs reflected on their gender and racial identities in the autobiography, the silhouette and the card sort activities provided two additional opportunities.

Emerging Insights: Silhouette

Across our institutions, forty TCs participated in the silhouette assignment (see [Appendix B](#)), which invited TCs to use images and words to describe the internal and external messages they received as they worked to become equity and justice-oriented secondary mathematics teachers. See [Figure 1](#).

Across these 40 silhouettes, we found that 10 TCs used focal images other than a silhouette outline, including a timeline, a heart composed of math symbols, a photo of an iceberg, a hand-sketched military badge, and a brain. The other 30 silhouettes used an outline of a head or body as suggested by the assignment description. With the exception of eight of the silhouettes (one of which is shown in [Figure 1](#)), the silhouette outlines were gendered. In other words, in 32 of the 40 silhouettes, the TCs asserted their gender identity through stereotypical features of femininity (e.g., a ponytail) or masculinity (e.g., a man running). We also note that some TCs clearly expressed their race and gender, for example, using a silhouette of an afroed woman.

Across the messages contained in the silhouettes, we found five themes: mathematics, teaching, learning, self, and equity/justice. The analysis below represents TCs who sorted the messages between the external (i.e., societal discourses), and internal (i.e., intrapsychic discourses, or the things we tell



Figure 1. Silhouette example.

ourselves). For the purpose of maintaining anonymity across institutions, the silhouette section does not contain specific mentions of institutional or individual pseudonyms.

Generally, the external messages that TCs negotiated about *mathematics* were relatively negative, including "math is stupid," "difficult," as well as problematic tropes in mathematics teaching and learning, including "hurry up," "math is about following steps," "procedure," and "math anxiety." These messages seemed to originate from learners who dislike mathematics and from common (and erroneous) discourses about mathematical proficiency. The internal messages were generally more positive and related to perseverance in mathematics.

Similarly, the messages that TCs negotiated about the *profession of (mathematics) teaching* were also relatively negative. The external messages included: (a) questions about the value of teaching, "You

want to be a mathematics teacher?”; “Undervalued/Noble;” “Societal underappreciation;” “Don’t you want to make money???”; (b) the socio-political demands of teaching; “The focus on exam results;” “administrative pressure;” “Using technology in math education;” and (c) the importance of teaching practices, including “Differentiation – every student deserves to be challenged fairly;” “Discussions;” “Making connections.” The internal messages about teaching were generally reaffirming and expressed desire and commitment to the profession as a calling but still held concerns about class time and their readiness to teach.

External and internal messages about *learners* were generally positive, including “everyone can learn math,” “every kid is infinitely valuable,” “No one is born knowing math, and no one is born lacking math ability to learn math – Boaler.” Most of the messages related to students showed a responsibility toward creating high-quality learning experiences for children.

The messages *about self* – internal and external – were the most varied. Many of the TCs shared messages about self-doubt and fear. While most of the external messages were generally positive, some TCs shared messages that showed their negotiation of prominent discourses related to mathematics and race (or ethnicity). Two Black women TCs shared messages that indicated a low public regard of their social identity. For example, one Black woman TC added the following phrases: “Black women don’t study math. That’s a lie. Let me do math.” Another Black woman TC shared, “You are the only girl/the only Black person; you better not slack.” Interestingly, one White man TC inquired whether he would be seen as having a savior complex. In contrast to these messages where TCs questioned their social identity, one Latina TC described her ethnic and linguistic background as assets in these messages: “That is good that you are Bilingual!,” alongside “Latina” and “Mexican.”

It is worth noting that several of the silhouettes shared messages internally and externally that related to *justice, equity, and social change*. Often these words, like “equity,” were drawn in block letters or self-descriptions such as “advocate” was used. In contrast, one White woman TC shared the internal message that “Equitable isn’t possible without a system overhaul.”

Processing Internal and External Messages

The silhouette provided a creative opportunity for the TCs to communicate the variety of messages they receive about mathematics, teaching, learning, equity/justice, and themselves. The requirement to place these messages internally and externally necessarily made this assignment reflexive. This activity also afforded the TCs a way to negotiate these different messages, express their strengths and vulnerabilities, and assert themselves as a particular kind of mathematics teacher. Unlike the autobiography, which imposed a narrative structure and coherence onto TCs’ mathematics life story, and, unlike the card sort activity (described below), which only allowed TCs’ to manipulate discrete, categorical categories of their social identities, the silhouette activity expanded the mode of communication beyond words to images and symbols, and did not require any overarching coherence. We found that the silhouette allowed the TCs to surface the complexity of their thinking and feelings. That is, the TCs were able to raise tensions in their silhouettes in ways that did not require resolution. In this way, discursive reflexivity afforded an open-ended process for TC learning. We feel it is also important to note that the TCs seem to uniformly experience negative external messages about mathematics as a discipline and the profession of teaching, irrespective of their social identities; but the internalization of these external messages manifested differently for TCs of shared racial and gendered identities. And while external messages are not necessarily explicitly racialized or gendered, these messages are still mediated through TCs racial and gendered experiences.

Challenges with Interpreting TCs’ Images

While the openness of this activity is useful for surfacing the complexity of discourses, the silhouettes can be difficult to interpret without supporting texts. It was hard for us as MTEs to know what students meant by certain phrases, symbols, and images. We found the mathematics autobiography

to be useful tool in making sense of how TCs were wrestling with various discourses in mathematics education.

Additionally, the discourses that surfaced through the silhouette posters are not easily resolvable. That is, as MTEs we cannot provide closure around the low societal regard of the teaching profession, the socio-political demands of various teaching contexts, or the general disdain for mathematics among some students. Nor can we necessarily assuage their fears and doubts. This assignment can make us, as MTEs, aware of the prevalence and intensity of these fears and doubts, and create some measure of solidarity within our classes, assuring TCs they are not alone in their concerns.

Emerging Insights: Identity Card Sort

The identity card sort offered an opportunity for TCs to unpack the visible and invisible social categories that contribute to a TC's intersectional identity. In this activity, TCs were asked to write down ten socially-constructed dimensions of their identity and then discard them, one by one, keeping the core of who they are, until one central identity remained.

Facilitating "Aha!" Moments

The identity card sort activity appeared to some students to be a formative activity across methods courses, with students sharing reflections with one another that included, for example, comments like those heard that year at Southeast Private, "I never knew that about you!" and "Wow, I wish all of the students in our program were required to do this." Across our sites, we found that central to TCs' powerful experiences with this activity included reflexive conversations about one's role in society's privileges and power.

Table 5 summarizes TCs' descriptions of their race and gender through the implementation of this activity.

Table 5 offers insights into how the 45 TCs who participated in the card sort activity made sense of their racial and gender identities at our 3 institutions. First, while the directions of the card sort asked TCs to share their gender identities (i.e., man/woman), several TCs shared their sex instead (i.e., male/female). Only in one case did a TC simultaneously identify both their gender and sex (i.e., cis-gendered woman). Second, some students identified racial identities (e.g., Asian American, Black), while others identified ethnic identities (e.g., Chicana, Korean). After determining the order in which they would discard each of their ten cards, we asked our TCs to glue their card-sort mats (See Figure 2 for a Sample Card Sort Mat).

Our analysis of race and gender identity across TCs' Card Sort Mats found that the identity dimensions that carry more social capital in society (e.g., male, White) were discarded within the first 5 cards at a higher rate than identity dimensions that have been historically marginalized in the United States (including Black, Latina, and woman). See Table 6.

Table 5. TCs' descriptions of their race and gender.

45 TCs' Descriptions of their Race/Ethnicity		TCs' Descriptions of their Gender	
Demographic Categories Assigned by Researchers	Demographic Categories Asserted by TCs in the Card Sort	Man	Woman
		Man, cis-male, city boi	Woman, female, cis-gendered woman
Asian American	Asian, Asian-American, Chinese-American, Japanese-American, Korean, second-generation Vietnamese, Vietnamese	4	4
Black	Black	0	1
Latinx	Chicana, Chicano, Latino, Latina, Mexican	3	5
Multiracial	Asian/White Combo, Cauc-Asian, Half-Mexican	3	0
Native American	Native American	1	0
White	White, Caucasian, White/Caucasian, Italian, Italian/German, Irish American, Irish-Italian-British Descent	8	16
Totals		19	26

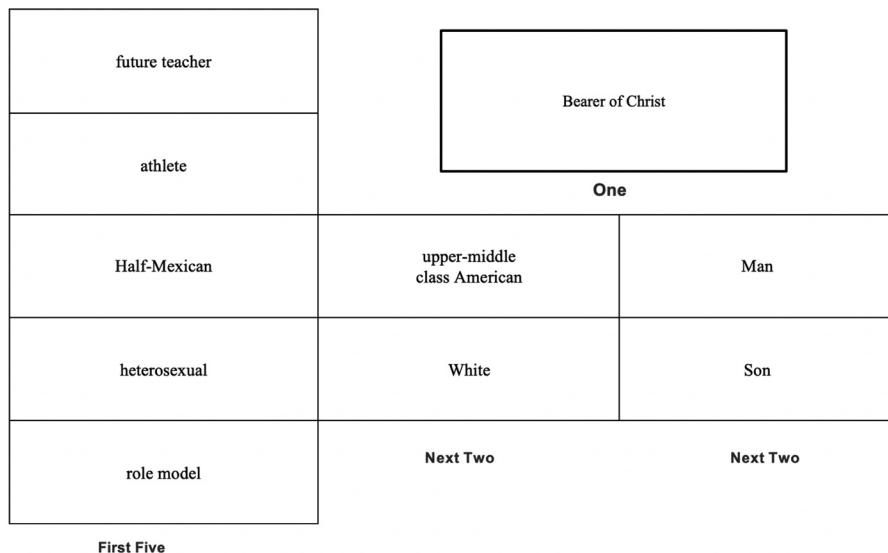


Figure 2. Sample card sort mat.

Table 6. Summarizing the patterns.

Discarded in the bottom 5 cards	Kept in the top 5 cards	Nuance
(a) 8/8 White men discarded both race and gender in their bottom 5 cards	(a) 17/26 women kept gender in their top 5 cards (b) 10/16 TCs of color kept race in their top 5 cards (9 of these were women of color) (c) 9/10 women of color kept race and gender in their top 5 cards	(a) 1 Asian male discarded Asian but kept "gay" as his #1 card (b) 3 Asian American/ multiracial Asian men (Asian American, Asian/ White Combo, second-generation Vietnamese) discarded both race and gender (c) 1 male identifying as half-Mexican and White discarded half-Mexican in the bottom 5 cards and kept White in the top 5 cards, addressing its privilege for him (d) 2 Latino//Chicano males discarded race in the bottom 5 but kept male identity markers in top 5 cards (a) 1 Latina discarded race in bottom 5 but kept all female identity markers in top 5.

First, Table 6 shows that 8 out of the 8 TCs who identified as White men *discarded* both their racial and gender identities in their first 5 cards. On the other hand, 17 out of 26 women *kept* gender as a part of their top 5 cards and 10 out of 16 TCs of color kept race in their top 5. Mirroring the intersectional mentions race and gender in the mathematical autobiographies, 9 out of 10 women of color kept race and gender in their top 5 cards.

Illustrating the Nuances

One interesting trend occurred when TCs identified as multiracial, but identified more strongly with their White identity than that of their (for example) Mexican-American or Japanese-American identities. For example, Peter, who identified as White and as half-Mexican, said he kept White longer because of all of the privileges that appearing White had afforded him over time. This comment led a classmate to make the comment, "Wow! I never knew that about you!" Conversations around how TCs centered their identities evoked discourse and debate around the role of privilege and power across our institutions. We found that our TCs were willing to talk with one another about how the categorical, social constructions of their identity had affected them as people, as well as how those identities might affect them as mathematics teachers.

Facilitating Challenging Conversations about the Role of Power and Privilege

Asking TCs to reduce their identities to a single social construct is oversimplifying the complex nature of intersectionality that our students are making sense of as they think about their own identity. It is further complex to ask our TCs to embrace thinking about how to deal with their students' identities in their classroom. We also used this activity in particular to problematize our own socially-constructed identities as MTEs, and how those identities affected what our TCs might or might not say to us (e.g., would a TC of color tell a White MTE how they felt marginalized in the mathematics classroom? Or would a White male TC tell a Black woman MTE what he thinks about the role of whiteness in mathematics education?) As such, as MTEs, we problematized how and whether the card sort activity was simply a starting point for engaging in conversations about privilege and power in mathematics education.

Concluding Thoughts

In this article, we investigated what happened when we engaged our TCs in a suite of three identity-based activities that promoted reflexivity. In particular, we considered the ways our TCs' engaged in "bending-back" (Archer, 2009), by considering the relationship between their identities and how they learned to teach mathematics. We conjectured that a single activity, alone, would not be as powerful as the suite of activities, together. We learned that the opportunities to engage in narrative, discursive, and categorical reflexivity afforded the TCs a pathway toward knowing more about themselves. We hoped that our TCs' engagement with their own identities would prove useful for the complexities of teaching mathematics.

We began by asserting that teaching mathematics is politicized (Gutiérrez, 2013). Our analysis of activities that aimed to engage our TCs' narrative, discursive, and categorical reflexivity pointed us toward the varied and complex ways in which our TCs envisioned incorporating their identities into their mathematics teaching. While we intentionally do not use our analysis to make conclusions about our TCs' intersectional racial or gender identity development, we do make a case for the importance of utilizing tools that foster opportunities for TCs to learn about their identities. Our findings contribute to the vision that social justice is not static, but is a particular way of becoming. We propose that it is this knowing and learning about oneself that will lead to the capacity for embracing students' identities and their humanity.

Our analysis explored the relationship between our TCs' varied and complex racial and gender identities as they learned to teach mathematics. We learned that the opportunities for our TCs to engage in narrative, discursive, and categorical reflexivity afforded opportunities for the TCs to be forced to know more about themselves. While we do not propose a cause and effect relationship between any single activity and one's identity-development, we have thought about the sequencing of the activities, such that the coordinated effect from autobiography, to silhouette, to card sort, might support a TC's reflexive growth. And yet, despite the sequencing presented here, this article only addresses what can be learned when TCs engage in the full suite of activities over a specific learning time period, in order to examine their bending-back reflexively on their identity.

We started this paper by sharing our positionality as teacher educators. We believe our identities affect both how our TCs engaged in the activities and how they engaged with ideas around justice, equity, privilege and power in mathematics education. We also believe that the differing sociopolitical and sociocultural contexts of each institution affords rich learning opportunities for our cross-institution collaborations. Our future analyses will explore the ways in which our identities and collaboration serve as tools and lenses for our TC learning.

Disclosure Statement

No potential conflict of interest was reported by the authors.



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Appendix A. Prompt for Silhouette activity and mathematics autobiography activity

Purpose The purpose of this assignment is to reflect on your experiences with mathematics and how this will shape your practice as a secondary mathematics teacher.

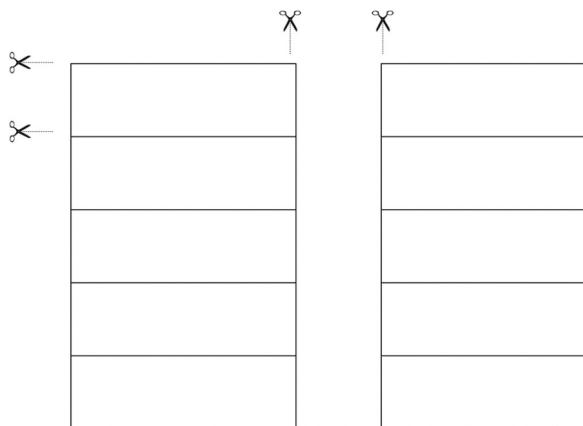
Description For this assignment, you will submit the first phase of a three-phase assignment to construct your philosophy of mathematics teaching. In this first phase, you will create a **silhouette cover page** and write a 3–4 page **mathematical autobiography**.⁵

Guidelines

- What aspects of your own history with learning mathematics do you think have an impact on your views about teaching mathematics? Please include some of your early experiences both good and bad ones. Feel free to include your experiences with mathematics classes here at university
- In what ways will your teaching *resemble* how you experienced math as a student and in what ways will your teaching *differ from* how you experienced math as a student?
- In your silhouette cover page: Add words, phrases, and images that depict the external and internal pressures and messages you experience in becoming an equitable secondary mathematics teacher.
- In your autobiography, try to address the following prompts.
- What kind of math identity do you want your students to develop in your classrooms?
- What role did race, class, gender, culture, or language play in your math learning story?
- Consider whether your attitude toward mathematics has changed over the years. If so, discuss how your attitude has changed. Describe why you do or do not like math. Perhaps you can describe what feels good about doing math, learning math, or teaching math, as well as perhaps what is scary for you.
- In your autobiography, please share what you believe mathematics is. For example, how would you define mathematics to someone who doesn't know anything about it?
- Discuss how your experiences could create opportunities and barriers in your teaching practice. Finally, discuss how your identity is shaped by external pressures and messages and also helps you make sense of different external pressures and messages related to mathematics teaching.

⁵Adapted from *The Impact of Identity in K-8 Mathematics: Rethinking Equity Based Practices*.

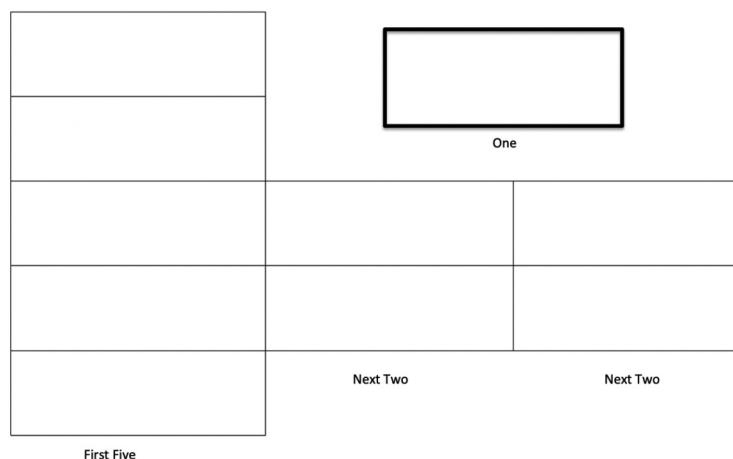
Appendix B. Sample directions and mat for identity card sort



¹ This activity was adapted from Aguirre, Mayfield-Ingram, & Martin (2013). *The Impact of Identity in K-8 Mathematics: Rethinking Equity-Based Practices*.

Teacher Identity Activity Mat

Instructions: After processing your identity cards, glue in the designated areas below.



Note. Reprinted from *The Impact of Identity in K-8 Mathematics: Rethinking Equity-Based Practices*, by Aguirre, Mayfield-Ingram, & Martin. Copyright 2013 by the National Council of Teachers of Mathematics, Reston, VA.¹