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RESEARCH ARTICLE

On the Mathematical Narration by Trans-Spectrum University Students

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ABSTRACT

More than 80 years of literature support the idea that math attitudes and experiences differ by gender. However, such research treats gender as a simple and dichotomous variable, which it is not. As such, our understandings of math affective variables are completely dominated by a cisgender narrative and a false gender binary. In particular, I argue that it is important to research the lived experiences in the math classroom and the sense of belonging felt by trans-spectrum students. This qualitative study has employed a narrative methodology to analyze the semi-structured interviews of 6 participants who identify as trans-spectrum university students in order to explore the tactile lived experiences in the math classroom as it relates to gender, when gender is considered holistically. Overall, the participants indicated that while mathematics as a discipline is not gender-specific, the participants face discrimination and microaggressions around mathematics that help create a chilly atmosphere. The participants, then, narrate their sense of belonging in regard to a separation between mathematics as a discipline and mathematical activities. Collectively, all participants presented stories that highlight conflicts within various social binaries, such as male/female or private/public school.

INTRODUCTION

Research on gendered differences in mathematics began as early as the 1930s (see, for example, Eells & Fox, 1932). By the 1960s, the attempt to gain an understanding of the gender differences in mathematics was a serious and flourishing research topic; this trend has continued to this day. In the public sphere, the common conception is that males are more successful at and are more likely to enjoy math than females. Our contemporary society has, unfortunately, not made great strides towards achieving gender equality in regard to these affective variables in math, be it through the choice of the curriculum, pedagogy, classroom culture, or some other environmental feature of the mathematical learning experience. Although these gendered differences often appear quantitatively as micro-inequalities (Campbell & Beaudry, 1998; Etzkowitz et al., 1992), hundreds of micro-inequalities spanning years of schooling logically become large and insurmountable gender differences (Campbell & Beaudry, 1998).

The fact that women exhibit poorer math attitudes than their male peers is certainly problematic, as these multiple gendered gaps prevent women from accessing power in a patriarchal society (Lim, 2004). Obviously, these gender gaps cannot be explained by differences in physiology (Alper & Gibbons, 1993; Blickenstaff, 2005; Damarin & Erchick, 2010), and so it is logical to assert that these gender gaps are socio-culturally constructed (Lim, 2004). This is in line with considering gender as a variable separate from sex, with gender being socio-culturally constructed (Rands, 2009; Wilchins, 2014). However, the

literature surrounding gender and math attitudes tends to treat gender as a simple and dichotomous variable, even though gender is neither of these (Wilchins, 2014). This research thus fails to acknowledge gender identities outside of the cisgender binary and neglects the potential impact of social transition on the mathematical experience of trans-spectrum students. As such, it is not clear whether the lived mathematical experiences or attitudes of trans-spectrum individuals could corroborate or disagree with the current body of educational research in gendered affective differences in mathematics.

According to numerous scholars, trans-spectrum students generally experience a negative campus climate. Trans-spectrum students routinely face cis-centric curricula (Garvey & Rankin, 2015), chilly classroom conditions (Garvey & Rankin, 2015; Pryor, 2015), and faculty or staff unprepared to deal with trans-spectrum issues (Beemyn, 2005; McKinney, 2005; Pryor, 2015; Sausa, 2005). During campus discourse, trans-spectrum students indicate they feel invisible (McKinney, 2005; Pusch, 2005), tokenized (Pusch, 2005; Wentling et al., 2008), or obnoxious (Hart & Lester, 2011), although the recent relative influx of trans-spectrum scholarship may harbor great possibilities in uncovering strategies for inclusion (Kersey, 2018; Nicolazzo, 2017). Still academia (especially mathematics) operates as a “boys club” (Page et al., 2009), which privileges certain (dominant, masculine, heteronormative) epistemologies and styles of learning. In fact, Yeh and Rubel (2019) assert that the high status of mathematics as an academic discipline can be attributed in part to its hegemonic construction as masculine and socially normative. Trans-spectrum and queer students whose identities are mismatched with this academic culture within science, technology, engineering, and math (STEM) disciplines are thus excluded.

Looking specifically at trans-spectrum students, as opposed to a lesbian, gay, bisexual, trans-spectrum, and queer (LGBTQ) collective is a worthwhile endeavor. This population deserves more than to just be folded into a participant pool consisting of any individual that reports an identity on the LGBTQ spectrum (Beemyn, 2003). The main contention is that the independence of sexuality and gender is an analytic necessity for understanding the lived experience of individuals in a gendered society (West & Zimmerman, 1987). More importantly, it is crucial that researchers pursue lines of questioning on gender differences in mathematics when gender is conceptualized beyond a binary.

However, the implications of taking this turn may be more profound. What questions have we never thought to ask by stunting our conceptualization of gender? What possibilities will this explode open in educational research? By treating gender as a simple and dichotomous variable in educational research, *what do we not know* about math attitudes and the lived math experience of this population? Similarly, *what do we not know* about *who is allowed to do mathematics*? Hence, the purpose of this study is to explore the lived mathematics classroom experiences and mathematical attitudes of a range of trans-spectrum university students, troubling the historically binary male/female approach to research surrounding mathematics education. Given that the present study is interested in the holistic and nuanced exploration of the intersection between affective math variables and gender as exposed by the lived experiences of trans-spectrum individuals in higher education, there are 3 highly open research questions driving the study.

1. In what ways do trans-spectrum university students narrate their lived experiences with mathematics?
2. In what ways do trans-spectrum university students narrate their sense of belonging in mathematics?
3. What are the most salient aspects (if any) of the gender presentation or gender attribution of trans-spectrum university students that dictate their individual lived experiences in and attitudes towards mathematics?

It can be argued that all research is inherently biased because it is impossible to separate the research from the researcher; the researcher is necessarily human and unavoidably brings to the research a certain worldview crafted by their experiences and positions in society. These biases are, unfortunately, generally not transparent. A subjectivity statement is included here to provide such transparency.

I am a White, straight, cisgender, able-bodied male. I have spent my entire adult life entangled with math classrooms in higher education, as both a student and a teacher. I am deeply interested in and

concerned with the ways in which math attitudes and lived math experiences present differently by gender. As a self-proclaimed feminist and a male in a male-dominated field, it is a consistent worry that I am personally contributing to a culture in which masculine gender expressions actively oppress others.

Additionally, I am a firm believer in social justice and the ways in which education can act as a vehicle to help enact social justice. I also believe that historically marginalized individuals cannot be enculturated out of schools unless we consent to robbing them of their power to fight oppression. As a White, heterosexual, cisgender man I am acutely aware of my ability to enhance voices and advance a discourse. Through this, I have attempted to mitigate my subjectivities by bracketing my own experiences with the math classroom and social justice because, as an individual with a phenomenological epistemology, the true lived experiences of the participants are more important than my desire to advance a discourse in the way I conceive to be most just. As will be explained in the next section, peer-checking was employed during the research process whenever possible. Additionally, all participants were provided with the findings and asked for feedback so as to best ensure my subjectivities did not taint the results. Lastly, in this document, the choice of all vocabulary is intentional. For a full elucidation of vocabulary, see Cassidy (2019).

METHODS

Mathematics is envisioned as a neutral and objective field. Such rhetoric leads to binary thinking and assumed cisgender identities, relegating queer identities as irrelevant and propagating heteronormativity and cissexism. These “unexamined, taken-for-granted assumptions about how the world is and ought to be conceal patterns of domination and submissions” (Mishler, 1995, p.114). This is a problem of dominant narratives, about who can and cannot speak valuable contributions in mathematics into existence. As such, access to alternative narratives is necessary. To begin to access these alternative narratives and the tactile lived experiences of this population, a qualitative research methodology is the most appropriate.

In particular, this study utilized a narrative inquiry research design with semi-structured interviews. This was a reasonable choice, given that narrative analysis allows researchers to systematically study the human experience (Riessman, 2002), semi-structured interviews may best encourage a narrative discourse (Hiles & Čermák, 2008; Willig, 2013), and narrative inquiry is increasingly being used in studies of educational experiences (Connelly & Clandinin, 1990). The narrative research design has implications towards methods of data collection, data management, data analyses, representation of findings, validity, and rigor.

There is no singular best way to define narrative-based research (Hiles & Čermák, 2008). As such, I will side with Smith (2007) in referring to narrative inquiry as “an umbrella term for a mosaic of research efforts, with diverse theoretical musings, methods, empirical groundings, and/or significance all revolving around an interest in narrative” (p. 392). While each participant was unique, narrative research methods allowed me to probe at the patterns of similarity that bind participants, as well as the aspects of their lived mathematical experiences that differentiate (Josselson, 2006). Similarities were to be expected, as math is a gendered experience (see, for example, Alper & Gibbons, 1993; Blickenstaff, 2005; Herzig, 2004; Oakes, 1990; Piatek-Jimenez, 2008) and all of the participants commonly had a trans-spectrum at the time of the interviews, albeit possibly cisgender presentation at the time of mathematical course-taking. Cogently, though, differences were also to be expected, as the literature readily attests that the trans-spectrum population is not homogenous (Hart & Lester, 2011; Sausa, 2005; Schilt & Westbrook, 2009). The findings, then, need to speak to the range of experiences and attitudes witnessed across the trans-spectrum regarding mathematics.

For this study, data collection was based on a purposive sampling technique, “whereby participants are selected according to criteria of relevance to the research question(s)” (Willig, 2013, p.91). The larger population under consideration were any persons that (i) identify on the trans-spectrum, (ii) were university students (or were very recently university students), and (iii) who have enrolled in at least 3 for-credit math courses, with at least 2 for-credit math courses having been completed with a grade of C or better. These criteria allowed participant narratives to speak directly and

cogently to the research questions while disallowing the participants from using the research as platform to singularly voice the opinion that “math sucks,” as had been my experience with earlier, similar research. The target population for this study was participants who satisfy the above 3 criteria and who additionally (iv) speak English, (v) reside within the U.S., and (vi) are interested in participating. Each participant was given a brief overview of the study, a consent form, and assured that all names used in the final report (first, last, dead, university) would be randomly generated pseudonyms.

For this study, the pool of relevant individuals was solicited through my personal connections, by interactions with local campus LGBTQ support structures, and through online forums for trans-spectrum support hosted on Reddit, with the request to “boost” my call for participants by sharing the information in other locations (real and virtual) that I did not have access to as an outside researcher. I was granted permission to post a call for participants on 2 online forums which had, at the time of posting, possibly overlapping populations of 88,997 and 41,433 respectively. Five other online communities either denied or ignored my request to post a call for participants. In general, it seems most publicly accessible online forums for trans-spectrum individuals had specific rules against such solicitation, with one forum going so far as to write “we are not your personal zoo; you may not use [our forum] to gather data or respondents for research” in their guidelines (Rules for r/genderqueer, n.d.). Initially, 13 candidates were solicited who met all 6 of the stated criteria, however only 6 were additionally willing and able to participant in the interview format. All 6 of these participants were included in the research. Cursorsy descriptions for these 6 participants can, in no particular order, be found in Table 1.

Table 1.		
IN THIS ISSUE:	Description of Participants	
Name	Gender Identity	Pronouns
Mia	Transfemme	she/her/hers
Edgar	Trans man	he/him/his
Stanley	Trans guy / male	he/him/his
Collin Oz	Non-binary	they/them/theirs & he/him/his*
Gene	Male	he/him/his
Denise	MtF / female	she/her/hers
*Collin indicated that masculine pronouns may be easier to ask for in a binary world, but overall had no preference for he/him/his over they/them/theirs. As such, I have done my best to use pronouns for Collin interchangeably.		

For our semi-structured interviews, questions were sometimes, but not always, about gender. Questions were always about the participants’ experiences with and attitudes towards math, but amended from participant-to-participant to make sense for them as individuals. As with all qualitative research, it is crucial that the participants are comfortable and at ease in answering the questions, participating in a dialogue, and sharing their narrated lived experiences (Willig, 2013), so the participants were able to choose their interview location. Each participant was interviewed once, with interviews lasting approximately one hour.

Hiles and Čermák (2008) offer several strategies in which to analyze narrative data. In order to address the specific research questions of this study, 3 strategies were employed. Specifically, the data was analyzed holistically for the form of the narrative (to address the first research question), holistically for the content of the narrative (to address the second and third research questions), and categorically for the content of the narrative (to address the second and third research questions). First, to investigate the form of the narrative holistically, I analyzed the various plot typologies per participant. That is, I considered if the participant has presented me with a “narrative [that] is *romance, comedy, tragedy* [or] *satire*, i.e. narrative structures affirming the social order, breaking/restoring the social order, loss of the social order, and cynical challenge to social order, respectively” (Hiles & Čermák, 2008, p.156, emphasis in original). Any plot typology beyond the 4 listed here was also considered, with participants sometimes utilizing several, in combination, per interview, or invoking new or obscure typologies to narrate their

lived experiences. Since the onus in this form of analysis is on the narrative as a whole, it was done with broad-strokes readings (and re-readings, as necessary) of the transcripts.

Second, to investigate the content of the narrative, I used narrative coding to break the transcript into digestible and coherent pieces. That is, individual idea units (the smallest unit of analysis, containing one piece of new information or better focus on old information) were clustered thematically into stanzas. Stanzas were defined by their unitary perspective on an idea. The narrative as a whole contained larger units of analysis than a stanza, which were called episodes. Episodes consisted of several adjacent stanzas that have a specific time, location, or other such large bounding property. Pivotal episodes were read and re-read, looking for patterns, dissonances, and themes across the narratives and participants. At this stage, the interest was in “exploring and establishing links and associations within the entire story” (Hiles & Čermák, 2008, p.155) in order to speak directly to aspects of belonging, math attitudes, saliency of gendered identity in forming attitudes, or any other content that would help answer the posed research questions.

Finally, to investigate the content of the individual topics I discussed with the participants, I used inductive in vivo coding. Separate codes that stand for the same concept were categorized together in a singularly-named category that encompasses this single idea. Codes were collected into categories although the categories were not necessarily created exhaustively of all codes, and some codes were present in multiple categories. These categories were then collected into large themes. Each larger theme was constructed based on the criteria that it: was salient among the participants, accurately encompassed existing in vivo codes and categories, and acted as a “recognizable configuration of meanings which co-occur in a way that is meaningful and systematic rather than random and arbitrary” (Willig, 2013, p.58). Again, categories were collected into themes neither exhaustively nor mutually exclusively. Taken together, the findings identified in the data were from a coalescence of these 3 methods.

Of course, I followed all ethical guidelines as stipulated by my institution’s IRB, including providing each participant with a consent form to sign before interviewing. Additionally, the given topic of gender may be sensitive, and participants may not have been openly out as identifying as trans-spectrum. As such, pseudonyms were randomly generated for all participants; participants were not allowed to have any input into their own pseudonyms. Moreover, every participant had the option to have all contact, including interviews, take place through the Skype typed environment, so that the participant need not fear the interview being overheard by anyone (including family members, which the literature and experience indicates is a major source of transgender violence/harassment) (Pusch, 2005). Additionally, participants were provided with information for local counseling centers, suicide hotlines, and queer-support hotlines at the conclusion of the interview.

RESULTS

The results presented here constitute a subset of the findings presented in the author’s doctoral dissertation, Cassiday (2019). The data analysis resulted in 2 major findings. Tersely, the participants indicated that while mathematics as a discipline is not gender-specific, they face discriminations around mathematics that help create a chilly atmosphere, for example, having success in areas such as engineering or programming attributed to some male figure; the classroom atmosphere changing during transition in non-tangible way; or interacting with professors who are clearly unable or unwilling to be accepting and/or professional with a student transitioning. Additionally, collectively, the participants all provided a narrative that highlights the absurdity of particular social norms.

Degrees of Math Biases

The participants were all clear that there should, in general, not be any inherent gendered biases in mathematics as a field of study. Here, Collin was the most forward, asserting that “learning is not gender-specific. It’s available to all of us and anybody can have the capacity to just get into whatever study they’d like.” This sentiment was carried throughout the participants. However, while the

participants agreed that there should, in general, not be any inherent gendered biases in mathematics as a field of study, all of the participants spoke of potential issues surrounding mathematics or the math classroom that could impede academic success.

Stanley, for instance, has taken quite a few math courses as part of his computer science degree and describes the act of doing math as fun. However, he seems to convey a gradual falling out with the surrounding culture. This came up twice in our interview. First, Stanley said as a child he was very invested in playing chess. With age, though, “if you're the only girl in the chess club, nobody wants to play you.” By his secondary education, remaining in the chess club was a trying experience, being that “nobody would play with” him, and by the time Stanley made it to the university he found it impossible to remain in the chess club, with the only person willing to play Stanley being “a creepy guy who couldn't stop hugging” him. Stanley entirely attributes being unable to find appropriate chess partners to his gender presentation. Secondly, he explains that there were numerous instances where his peers would not rely on his expertise simply because of his gender presentation. For example, during a hackathon event in which computer enthusiasts quickly collaborate to create some functioning software within a short timeframe, Stanley and a female peer were locked out of a team project halfway through the event, causing their team to fail. It is important to note that Stanley was not out until his last year of his undergraduate studies, so when asked, Stanley, again, attributed his peers not relying on his expertise (including being locked out of the hackathon project) directly to sexism. As such, Stanley had no qualms with mathematics proper, but struggled greatly with discrimination in the community of those that rely on mathematics.

Denise, Collin, and Mia narrated experiences within the math classroom. Denise, very early on in the interview, stated that “math is math” and in the math classroom, no one makes explicit notions of gender. In her words, “There wasn't a whole lot of like, hey, this person's a boy, this person as a girl. Okay. More about the math.” However, she quickly shifted gears and attempted to articulate experiencing microaggressions during her transition, naming it an “atmosphere change.” In her words,

my perception of math stayed the same, but like in the math class it just, everything felt different. Maybe I was just more self-conscious about everything, like the way I presented or way I talked, but, um, I did feel like I was treated a little bit differently in class, but it was nothing like outright, just like less people talk to me, or more people talked to me, I don't know.

When pressed, she was unable to give much in the way of a tangible example, outside of certain people talking to her less. However, as is typical with microaggressions, I was not expecting her to name grand gestures of inequalities in the classroom.

Similarly, Collin was unable to pinpoint what it was about the math experience that made it easier for him to belong post-transition. Instead, Collin just repeated “there is something more to it” when we were talking about perceived and real mathematical biases when considering their experiences pre- and post-transition. Mia expressed a similar sentiment, and concluded that she was best only coming out to faculty members that she knew would be “really accepting” to her transition in order to be comfortable and successful in her math courses. Collin, though, had an additional hurdle in that they labeled some of their math professors as “perverted” in regard to his transition. It was clear Collin was uncomfortable broaching the subject further, so we moved on to another line of questioning after Collin stated that he was “very hard pressed to go into a room alone with them to begin with. But then like after I was out, I especially didn't.”

Conversely, Gene and Edgar exposed more overtly positive narratives. Note that Gene attended and graduated from Eastern Research University (Eastern), a well-renowned east coast research university. Gene told me, “there didn't seem to be any gender-specific biases probably because everyone's socially awkward as hell at Eastern” and “I think I was very fortunate in a lot of my friends that I knew, I never heard any negative experiences of like being a girl in math or things like that.” Similarly, Edgar told me that before, during, and after his transition all of his instructors and peers were supportive and inclusive; he never had issues with gender discrimination of any kind at his university, labeling his instructors as great to everyone. Gene took the narrative further, belaboring a more nuanced point in explaining that at Eastern, the women in math were so capable and goal-oriented that, as he put it, “you

wouldn't like, no misogynist in the world would ever challenge or try to mansplain things cause they were just so strong." Hence, to Gene, any potential biases in mathematics (which he admits at the end of the interview may exist in engineering or other STEM fields) were counteracted by strong females.

Comedic Narratives

The narratives of all 6 participants met the literary definition of being a comedy in one way or another. Hiles and Čermák (2008) refer to a comedy as a narrative structure that breaks/restores social order (p.156); this is aligned with the definition Booker (2004) provides. Montemurro and Chewning (2018) provide perhaps the most general definition of a comedy in modern literature. Here, the protagonist "serves as a vehicle for which the shortcomings of the prevailing social order are exposed" (Montemurro & Chewning, 2018, p. 467) with the protagonist eventually reestablishing themselves within the social order. While this, definitionally, may invite humor, the comedic plot typology is not inherently humorous and in fact none of the participants told a humorous narrative. In the end, I chose to interpret any narrative in which the participant initially experiences life in a way that highlights the absurdity of particular social norms and eventually establishes themselves within the social order in a way that is most sensible to them as a comedic narrative. This typology was applicable to all 6 participants, although given that any plot can be attributed as a comedy given that it generically breaks and then restores social order (Hiles & Čermák, 2008), it was typical for participants to express these comedies differently from one another.

Mia had perhaps the most typical comedic narrative in which the absurd social norms highlighted revolve around our binary gendered society. Mia started closeted (and thus presenting masculine), at an unnamed university, but with gender dysphoria and heavy depression, her attendance suffered. While no one was actively malicious to Mia, she describes herself as closed off and not outgoing. The lack of attendance ultimately led to failing grades and a loss of her scholarship, even though as a male-presenting student she was in a position of power in a math classroom. She started again at a community college with a new lease on life, where she had a fantastic discrete math professor before transferring to a new university, Northern Midwest State University (NMSU). Here, her community college professor had apparently served the class so well that even though Mia was (for whatever reason) required to take the equivalent discrete math course at NMSU with "what my school considers one of the worst teachers for that course," she easily passed the class. She describes herself at NMSU as being out with herself, even if not out with everyone. The result, according to Mia, is she is overall more open. This means going to more office hours, being the de facto leader of her study group, and working as a math tutor. Hence Mia, accepting herself as femme (in her words), was able to position herself to be successful in mathematics by strengthening her mental health in spite of embracing a position that yields lesser feelings of acceptance (Good & Dweck, 2012) in the patriarchal "boys club" of mathematics (Page, Bailey, & Van Delinder, 2009).

The story of gender attributions and gendered expectations as they conflict with a participant's gender identity were a main source of ire in the abstract for all of the participants, including Mia. Fortunately, these participants were currently experiencing the latter part of a comedic narrative, in which the protagonist has reaffirmed themselves in the social order in a meaningful way.

Consider Collin, who began his mathematical journey at a boarding school starting their junior year of high school. At this boarding school, Collin went by his last name, Oz. He initially attributes this to there being 2 Collins at the boarding school, but quickly concedes that Oz, being gender-neutral, was a much more natural fit than their deadname. Moreover, Collin describes being fairly comfortably gender ambiguous at the boarding school without being out. Apparently, according to Collin, his classmates had suspicions that their gender identity could be other than cisgender, but it overall was not important in that learning environment. However, upon graduating from the boarding school, Collin attended Southern Research University (SRU), a large research university in the south where their gender attributions were a far more relevant part of the learning experience. At SRU, Collin describes feeling dysphoria, which did not go over well with his family. The psychological stress of this, compounded with a disappointing environment, triggered the reasoned response in Collin of stepping back from schooling for a time. In the

comedy of Collin, then, the absurdity of gender constructs becomes an instance of social schooling norms already being highlighted as comedic.

DISCUSSION AND CONCLUSION

The existence of findings common amongst participants is not meant to contradict the assertion in the literature that the trans-spectrum population is not homogenous (Hart & Lester, 2011; Sausa, 2005; Schilt & Westbrook, 2009); instead, the findings may emphasize this fact by highlighting dissonances between participants, with the findings being bound by their thematic similarity, not homogeneity. For example, the comedy of Collin was relatively different than the comedy of Mia. Although both were comedies, these 2 participants have narrated decidedly different lived experiences. It is possible to argue that the one overarching finding, above all else, is that the participants offer quite a few dissimilarities in their experiences and attitudes.

However, answers to the initial research questions can be found across the 6 participants in the abstract. For example, every participant narrated an experience in which they have reaffirmed themselves in a meaningful way against seemingly nonsensical social orders (Booker, 2004). This finding was substantiated by analyzing the narratives holistically for form.

To belong in mathematics is to be accepted and to have valued contributions (Good & Dweck, 2012; Petters, 2018). The participants conveyed their sense of belonging curiously. The participants agreed that there should, in general, not be any inherent gendered biases in mathematics as a field of study. Hence, everyone is able to belong to mathematics, and mathematics is not viewed by the participants as a male-dominated discipline. Previous research, considering gender as a binary, have concluded that women have a lower sense of belonging in mathematics, resulting in enrolling in fewer math courses (Good & Dweck, 2012). However, all of the participants spoke of potential issues surrounding mathematics or the math classroom that could impede academic success. For the following, I considered activities to be in proximity to math, but separated, if they differed from mathematics as a discipline. As such, activities such as teaching math, learning math, or applying math to different disciplines or hobbies as seen as simply “near math.”

The majority of participants, throughout our interviews, indicated that they both had valuable contributions to make to mathematics or that others valued their contributions, with Stanley the sole outlier to respond negatively to both questions. This initially posits a high degree of belonging. However, only half of the participants indicated that they have valuable contributions to make in mathematics, and of these 3, all indicated that their only valuable contributions are as a teacher, drawing a distinction between teachers and mathematicians. Here, once again, the participants have narrated their sense of belonging in terms of proximity to mathematics. Similarly, 5 of the 6 participants expressed that others value their contributions, but generally provided caveats about the contributions being in a context different from pure mathematics (i.e. teaching or calculating molarity). Belonging, then, is seen as highly contextual and depends on the degree of separation from mathematics as a discipline. This finding was substantiated by analyzing the narratives holistically and categorically for content.

Additionally, careful readings, re-readings, and evaluations of the interviews in full as well as every unit of data analysis suggests that there is, in most cases, no salient aspect of gender presentation or gender attribution of the participants that dictate their lived experiences in and attitudes towards mathematics. Again, this finding was substantiated by analyzing the narratives holistically and categorically for content.

The present findings problematize the masculinized image of mathematics as a challenge, in which the novice student is meant to struggle to overcome and abandon helpers (Chelser & Chelser, 2002). It is overall not clear who is meant to be socialized into mathematics this way. Recall that one of the purposes of this study was to explore what questions educational researchers have never thought to ask by viewing gender as a simple and dichotomous variable. It is true there was a clear dissonance between the comedic narratives offered here and the traditional, gender-based view of mathematics as masculine challenge. However, more powerfully, to be wholly inclusive of all of the infinitely many gender

identities, educators should read comedic narratives as one possibility on how students, with any gender identity or gender performance, could be successful in mathematics. Educators and educational researchers could fold the findings here into existing intellections on the experiences all students face in math classrooms. In particular, it is important to note here that participants, unprompted, tended to describe successful interactions in math as engaging, supporting, and “hands on,” and similarly described disappointing interactions in terms of lack of support or lack of engagement. As such, even for the participants who were successful in mathematics, it is not clear that the traditional, masculinized, challenge of mathematics was meant for them.

I challenge educators to not only problematize the notion of teaching mathematics as a challenge, viewing this practice as an act of trans-exclusionary and sexist exclusion, but to abandon this practice in entirety, as educators should continue to constantly question who their mathematics is for. The data here supports that educators could successfully teach mathematics by embracing a culture of caring (in which supportive and nurturing relationships between students and educators are prioritized, as espoused in Chelser & Chelser (2002)). Additionally, I ponder if educators should be viewing mathematics as a comedy. The absurdity of, say, Russel’s Paradox, breaks the social order explained by naïve set theory, yet aspiring mathematicians, through careful guidance, are able to reaffirm their understanding of set theory with axioms that avoid such a paradox, re-establishing themselves within the mathematical order with a more inclusive understanding of the material. Future research could continue explore the lived experience of our students, with gender holistically considered, to determine if comedic approaches, approaches of caring, masculinized challenges, some other approach, or some combination of these approaches, best informs modern classroom discourse in a way that benefits all students.

The counter narratives as presented here paint a hopeful picture. Consider the claim of Dubbs (2016) that “[i]ncremental changes to existing research trajectories, such as simply drawing on updated notions of gender identity within the current context of gendered research in mathematics education, will still fail to include queer students” (p. 1046). In the present research an incremental change in mathematics research trajectory by folding in an updated conception of gender and a queer theoretical lens *has not* failed to be inclusive. Hopefully, the present research may explode open the possibilities of what can be studied, how it can be studied, what can be asked, how it is asked, of whom it is asked, and many more questions we have likely not thought to formulate yet.

REFERENCES

- Alper, J., & Gibbons, A. (1993). The pipeline is leaking women all the way along. *Science*, 260(5106), 409-412.
- Beemyn, B. (2003). Serving the needs of transgender college students. *Journal of Gay & Lesbian Issues in Education*, 1(1), 33-50.
- Beemyn, B. G. (2005). Trans on campus: Measuring and improving the climate for transgender students. *On Campus with Women*, 34(3), 77-87.
- Blickenstaff, J. C. (2005). Women and science careers: leaky pipeline or gender filter? *Gender and Education*, 17(4), 369-386.
- Booker, C. (2004). *The seven basic plots: Why we tell stories*. New York, NY: Continuum.
- Butler, J. (1999). *Gender trouble: Feminism and the subversion of identity* (10th anniversary ed.). New York: Routledge.
- Campbell, J. R., & Beaudry, J. S. (1998). Gender gap linked to differential socialization for high-achieving senior mathematics students. *The Journal of Educational Research*, 91(3), 140-147.
- Cassiday, C. J. (2019). *On the mathematical experiences of trans-spectrum university students* (27547133) [Doctoral dissertation, Morgan State University]. ProQuest.
- Chesler, N. C., & Chesler, M. A. (2002). Gender-informed mentoring strategies for women engineering scholars: On establishing a caring community. *Journal of Engineering Education*, 91(1), 49-55.
- Connelly, F. M., & Clandinin, D. J. (1990). Stories of experience and narrative inquiry. *Educational Researcher*, 19(5), 2-14.

- Damarin, S., & Erchick, D. (2010). Toward Clarifying the Meanings of "Gender" in Mathematics Education Research. *Journal for Research in Mathematics Education*, 41(4), 310-323.
- Dubbs, C. (2016). A queer turn in mathematics education research: Centering the experience of marginalized queer students in Wood, M. B., Turner, E. E., Civil, M., & Eli, J. A. (eds). *Proceedings of the 38th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Tucson, AZ: The University of Arizona.
- Eells, E. C., & Fox, C. S. (1932). Sex differences in mathematical achievement of junior college students. *Journal of Educational Psychology*, 23(5), 381-386.
- Etzkowitz, H., Kemelgor, C., Neuschatz, M., & Uzzi, B. (1992). Athena unbound: Barriers to women in academic science and engineering. *Science and Public Policy*, 19(3), 157-179.
- Garvey, J. C., & Rankin, S. R. (2015). The influence of campus experiences on the level of outness among trans-spectrum and queer-spectrum students. *Journal of Homosexuality*, 62(3), 374-393.
- Good, C., Rattan, A., & Dweck, C. S. (2012). Why do women opt out? Sense of belonging and women's representation in mathematics. *Journal of Personality and Social Psychology*, 102(4), 700.
- Hart, J., & Lester, J. (2011). Starring students: Gender performance at a women's college. *NASPA Journal about Women in Higher Education*, 4(2), 193-217.
- Herzig, A. H. (2004). 'Slaughtering this beautiful math': Graduate women choosing and leaving mathematics. *Gender and Education*, 16(3), 379-395.
- Hiles, D., & Čermák, I. (2008) Narrative psychology. In C. Willing and W. Stainton Rogers (Eds.), *The Sage Handbook of Qualitative Research in Psychology*. London: Sage.
- Josselson, R. (2006). Narrative research and the challenge of accumulating knowledge. *Narrative Inquiry*, 16(1), 3-10.
- Kersey, E. (2018). *Refracting gender: Experiences of transgender students in postsecondary stem education* (10822977) [Doctoral dissertation, Perdue University]. ProQuest.
- Lim, J. H. (2004). Girls' experiences in learning school mathematics. *Focus on Learning Problems in Mathematics*, 26(1), 43.
- McKinney, J. S. (2005). On the margins: A study of the experiences of transgender college students. *Journal of Gay & Lesbian Issues in Education*, 3(1), 63-76.
- Mishler, E. G. (1995). Models of narrative analysis: A typology. *Journal of Narrative and Life History*, 5(2), 87-123.
- Montemurro, B., & Chewning, L. V. (2018). Aging "hot": Images and narratives of sexual desirability on television. *Sexuality & Culture*, 22(2), 462-478.
- Nicolazzo, Z. (2017). Imagining a trans* epistemology: What liberation thinks like in postsecondary education. *Urban Education*. <https://doi.org/10.1177/0042085917697203>
- Oakes, J. (1990). Chapter 3: Opportunities, achievement, and choice: Women and minority students in science and mathematics. *Review of Research in Education*, 16(1), 153-222.
- Page, M. C., Bailey, L. E., & Van Delinder, J. (2009). The blue blazer club: Masculine hegemony in science, technology, engineering, and math fields. *Forum on Public Policy Online*, 2009(2). Retrieved from <https://eric.ed.gov/?id=EJ870103>
- Piatek-Jimenez, K. (2008). Images of mathematicians: a new perspective on the shortage of women in mathematical careers. *ZDM*, 40(4), 633-646.
- Petters, A. O. (2018). Belonging. *Notices of the AMS*, 65(2), 120-123.
- Pryor, J. T. (2015). Out in the classroom: Transgender student experiences at a large public university. *Journal of College Student Development*, 56(5), 440-455.
- Rands, K. E. (2009). Considering transgender people in education: A gender-complex approach. *Journal of Teacher Education*, 60(4), 419-431.
- Riessman, C. K. (2002). Analysis of personal narratives. In J. Gubrium & J. A. Holstein (Eds.), *Handbook of interview research: Context and method* (pp. 695-710). Thousand Oaks, CA: Sage.
- Rules for r/genderqueer. (n.d.). Retrieved from <https://www.reddit.com/r/genderqueer/about/rules/>
- Sausa, L. A. (2005). Translating research into practice: Trans youth recommendations for improving school systems. *Journal of Gay & Lesbian Issues in Education*, 3(1), 15-28.
- Schilt, K., & Westbrook, L. (2009). Doing gender, doing heteronormativity: "Gender normals," transgender people, and the social maintenance of heterosexuality. *Gender & Society*, 23(4), 440-464.

- Smith, B. (2007). The state of the art in narrative inquiry. *Narrative Inquiry*, 17(2), 391-398.
- Wentling, T., Windsor, E., Schilt, K., & Lucal, B. (2008). Teaching transgender. *Teaching Sociology*, 36(1), 49-57.
- West, C., & Zimmerman, D. H. (1987). Doing gender. *Gender & Society*, 1(2), 125-151.
- Wilchins, R. (2014). *Queer theory, gender theory: An instant primer*. Bronx, New York: Magnus Books.
- Willig, C. (2013). *Introducing qualitative research in psychology* (3rd ed.). Maidenhead: Open University Press.
- Yeh, C., & Rubel, L. (2019). Queering mathematics: Disrupting binary oppositions in mathematics education. Paper presented at the 2019 Annual Meeting of the American Educational Research Association, Toronto, CA.

