WORKING GROUP ON GENDER AND SEXUALITY IN MATHEMATICS EDUCATION: EXPERIENCES OF PEOPLE ACROSS CULTURES

Rebecca McGraw
University of Arizona
rmcgraw@math.arizona.edu

Katrina Piatek-Jimenez
Central Michigan University
k.p.j@cmich.edu

Lynda Wiest
University of Nevada, Reno
wiest@unr.edu

Ana Dias
Central Michigan University
dias1al@cmich.edu

Harryson Júnio Lessa Gonçalves
State University of São Paulo
harryson.lessa@unesp.br

Jennifer Hall
Monash University
jenniferhall@monash.edu

Angie Hodge
Northern Arizona University
University of New York
Angie.Hodge@nau.edu

Betsy Kersey
University of Northern Colorado
elizabeth.kersey@unco.edu

Laurie Rubel
University of Haifa & City
LRubel@brooklyn.cuny.edu

The Gender and Sexuality in Mathematics Education Working Group convened in 2018 with a focus on (1) language use, multidimensional understandings of gender and sexuality, and influences of these on methods, results, and interpretations; (2) interactions between gender/sexuality and students' self-perceptions; and (3) the roles of curriculum, pedagogy, and teacher education in students' experiences of gender and sexuality. The 2019 Working Group will continue with these foci, but with an added dimension of learning through examination of work in gender and sexuality in mathematics education across the world, including country/culture-specific studies, and cross-cultural studies.

Keywords: Gender and Sexuality; Equity and Justice; Affect, Emotion, Beliefs, and Attitudes

The Gender and Mathematics Working Group (GMWG) began more than 20 years ago at PME-NA 20 in Raleigh, North Carolina. At this conference, mathematics education scholars came together "in order to weave together the findings of various strands in research and understanding of issues in gender and mathematics" (Damarin et al., 1998, p. 78). The GMWG continued to meet from 1998 to 2007, with the exception of the 2003 joint conference between PME and PME-NA in Honolulu, Hawaii**.** The group also reconvened for the 2011 PME-NA conference in Reno, Nevada. The GMWG's past discussions have involved reviewing the scholarship surrounding gender and mathematics, defining research strands, determining gaps in the literature, and establishing directions for future work. Some notable accomplishments of this group have been creating a visual representation of the field of gender and mathematics and the social and psychological complexities of the topic (Erchick, Condron, & Appelbaum, 2000) and publishing a monograph on gender and mathematics research as a joint project with scholars from the International Group for PME (Forgasz, Becker, Lee, & Steinthorsdottir, 2010).

The Gender and Sexuality in Mathematics Education Working Group convened in 2018 at PME-NA 40, after a hiatus of a seven years and with an updated title to reflect current trends in the field. Prior to the conference we identified preliminary themes across our work, including (1) the choice of language that we as scholars use when conducting research on gender and sexuality in order to be inclusive of all individuals and to reflect a multi-dimensional understanding of gender and sexuality, and how our choices of language and methods may affect

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our research results and interpretations; (2) interactions between gender/sexuality and students' perceptions of themselves as mathematical learners, including experiences inside classrooms, in less formal learning spaces (e.g., summer camps, homes); and (3) the role of curriculum, pedagogy, and teacher education in the study of gender and sexuality in mathematics education.

Much of our time during the 2018 conference was spent becoming familiar with one another's recent work, and more broadly exploring the experiences and interests of the working group participants, including both the co-authors and others in attendance. Dr. Ana Dias, who was not a co-author for 2018, gave a presentation to the working group about the current social and political context of education, gender, and sexuality in Brazil. In addition, two of the co-authors (Dr. Elizabeth Kersey and Dr. Jennifer Hall) led the group in a very informative presentation and discussion about language and methodology in gender and sexuality research. We also welcomed and heard from new participants who joined us on the final day due to previous unavailability, and we considered opportunities for sharing resources and collaborating in the future. Based on the work of these three days, and to further develop and contextualize our knowledge and research related to gender, sexuality, and mathematics education, the working group leaders decided to propose for 2019 a focus on how these topics are experienced by students and teachers, and studied by researchers, outside of the U.S. In addition to work conducted within the U.S., among our 2019 proposal co-authors are individuals who have studied gender and/or sexuality as related to mathematics education in Australia, Brazil, and Israel. In addition, for this proposal, we have examined the literature from China, Ghana, Jordan, and Saudi Arabia. Short summaries of this work are provided below.

Rebecca McGraw, University of Arizona

Rebecca McGraw's work related to equity, gender, and mathematics includes co-facilitating a residential summer math camp for middle grades girls (led by Lynda Wiest, a co-author of this paper), studying teacher classroom practice from an equity perspective (e.g., distribution of images by gender in classroom resources, patterns of participation, course-taking, and achievement), and investigating pre-service secondary teacher preparation (Bay-Williams & McGraw, 2008; Eli, McGraw, Anhalt & Civil, forthcoming; McGraw & Lubienski, 2007; McGraw, Romero & Krueger, 2009; Rubinstein-Avila et al., 2014). Currently, Rebecca McGraw is particularly interested in the development of teacher and student beliefs about mathematics and learning, and the development of middle/high school students' mathematical identities. Recently, she has begun working with several colleagues, including one at King Saud University, to plan a year-long mathematics education program for Saudi teachers. This program would be modeled, in part, after the Building Leadership for Change through School Immersion (Khbrat) programs currently happening across the U.S. In the following paragraphs, Dr. McGraw has summarized some of the recent research related to mathematics, gender, and sexuality in Saudi Arabia.

According to Abu-Hilal et al. (2014), public schooling in Saudi Arabia began around 1930 with girls beginning to enroll in the 1960s. Rapid progress was made thereafter in terms of the number of girls enrolled, reaching 50% of the total students enrolled in 2000, according to the Ministry of Education. The school system, policies, and curriculum are strongly centralized, and teaching methods are frequently targeted towards rote learning, and not particularly oriented towards skills needed for a global economy (Hein, Tan, Aljughaiman, & Grigorenko, 2015). Pre-college education is entirely single-sex; however, a co-educational university, King Abdullah Science and Technology University, opened in 2009. As of 2018, enrollment

included 35% Saudi students (65% international students) and the student body was 37% female (https://www.kaust.edu.sa/en/about/media-relations#part3).

In many countries around the world, researchers have found that mathematics self-concept is highly related to achievement (Mohammadpour & Ghafar, 2014). In Saudi Arabia, boys exhibit a higher self-concept while girls exhibit higher achievement (Abu-Hilal et al., 2014; Marsh, et al., 2014). Some researchers have argued that differences in the ways that boys and girls are raised in Saudi Arabia and in their expected future roles in society, lead boys to have a higher, or even inflated, self-concept, while girls are motivated to prove themselves academically and secure places at local universities through achievement (Abu-Hilal et al., 2014). To some extent, the Big Fish Little Pond Effect (Marsh & Parker, 1984) may be at play, with boys comparing themselves to only to other boys and girls to other girls (Abu-Hilal et al., 2014; Marsh, et al., 2014). Research on Saudi Arabian teacher practices by gender is sparse; however, in one study of teachers' Mathematical Knowledge for Teaching (MKT), researchers found that female teachers scored significantly higher than male teachers on both number and operation content knowledge and knowledge of content and students scales of a translated version of the Learning Mathematics for Teaching (LMT) (2008) instrument (Haroun, Ng, Abdelfattah, & Alsalouli, 2016). This difference may explain some component of the difference found in students' achievement scores by gender.

With regard to student interest in future careers, it is in the more gender-egalitarian countries (such as the U.S. compared to Saudi Arabia) that boys and girls are *less* interested in careers involving mathematics, and in which researchers find gender differences in interest in such careers, with girls significantly less interested than boys (Goldman & Penner, 2016). The research of Charles and Bradley (2009) suggests that gender-egalitarian contexts can "encourage girls and boys to express societally approved gender ideals as part of their gender performance…. Education in these contexts [serves] . . . an expressive function, so that students' educational choices are thought to reflect important aspects of who they are." (Goldman & Penner, 2016, p. 415). Currently, Saudi Arabian women have access to higher education exclusively through women's colleges (with the exception of King Abdullah Science and Technology University). These colleges are on completely separate campuses that are attached to male-only universities. The one exception is the all-female Princess Nourah Bint Abdulrahman University. Founded in 1970, it currently serves approximately 60,000 women, making it the largest women's university in the world. Altogether, women currently account for over 60% of all Saudi university students (Islam, 2017); however, access to jobs is very limited. For example, in 2015, 57% of science graduates were women, but their share of the total labor force was only 16% (Islam, 2017). As in a number of other places throughout the world, gender discrimination in STEM workplaces, and particularly in computer science and engineering, as well as the masculine gendering of STEM, continue to create barriers to entry and advancement (DeBoer & Kranov, 2017).

Katrina Piatek-Jimenez and Ana Dias, Central Michigan University

Katrina Piatek-Jimenez's research interests focus on what motivates women to study mathematics at the undergraduate level and what influences their decisions whether or not to continue in mathematical careers, including factors such as the development and role of one's mathematics identity (Cribbs, Piatek-Jimenez, & Mantone, 2015; Piatek-Jimenez, 2015), images of mathematicians (Piatek-Jimenez, 2008a), knowledge of mathematical careers (Piatek-Jimenez, 2008b), and equity within mathematics textbooks (Piatek-Jimenez, Madison, & Pzybyla-Kuchek,

2014). Ana Dias's research interests include the politics of mathematics education, adult numeracy, ethnomathematics, and mathematics in vocational education and training. Ana Dias and colleagues have conducted comparative studies of professional education curriculum in the U.S. and Brazil (Gonçalves & Dias, 2017), Freirean mathematics education (Gonçalves & Dias, 2016), and the history of professional education in Brazil (Gonçalves, Pires, Dias, & Monteiro, 2013a; 2013b; 2013c). In the following paragraphs, these scholars summarize some of the recent work on gender and mathematics in Jordan.

Drs. Piatek-Jimenez and Dias chose to study the country of Jordan for two reasons. First, Jordan is a country in which girls repeatedly score higher in mathematics on standardized exams than boys. Given that this is not the case in the United States, these scholars decided that it would be interesting to learn more about Jordan's culture and educational system to better understand what influences girls to be more successful on standardized examinations in mathematics. Second, Central Michigan University (CMU) has a large number of Jordanian students in the doctoral program in mathematics. Since the program's first PhD graduates in the year 2000, CMU has had 21 students from Jordan earn their PhD from the mathematics department. Given that from 1995 to 2015 only 90 students from Jordan earned a PhD in mathematics in the United States (National Science Board, 2018), CMU has awarded a large percentage of those degrees. Further, CMU's mathematics department currently has eight Jordanian students pursuing PhDs in mathematics. Therefore, these scholars wanted to learn more about the country of Jordan and its culture, with the intent to design a qualitative study to better understand gender and mathematical interest and achievement in the country of Jordan.

A substantial amount of research shows that girls in Jordan score higher than boys on standardized exams in mathematics. This is true not only with large-scale international assessments, such as the TIMSS (Innabi & Dodeen, 2006, 2017), but also with a national exam developed by the Jordanian Ministry of Education (Al-Bursan et al., 2018). Although these researchers found that certain nuances exist based on specific variables, such as the mathematical content or context of items, or whether the students attended coeducational or single-sexed schools, a clear pattern that shows girls achieving higher overall than boys on mathematics assessments exists.

This is not the case only for the subject of mathematics. In Jordan, "girls outperform boys at all levels and in all subjects" (Education Reform for Knowledge Economy Project II (ERfKE), 2014). At the collegiate level, a larger percentage of the female population attend college than the male population (UNESCO Institute of Statistics, 2019). According to one report (Ripley, 2017), at the University of Jordan, which is the country's largest university, women outnumber men by a ratio of almost two to one in their undergraduate programs. Amongst the students in the sciences, the division is even greater, with women outnumbering men by a ratio of almost 3.5 to 1 (University of Jordan, 2012). Despite these advances in their education, women consist of just under 20% of the actual workforce.

There may be multiple reasons why girls in Jordan academically outperform boys. One conjecture could be that it is because the girls have fewer freedoms and more restrictions put on them by their parents and therefore spend more time studying than the boys; if true, this may not the whole story (Ripley, 2017). A difference in the quality of schooling may play a role as well (ERfKE II, 2014; Ripley, 2017). In the public school system in Jordan, children attend coeducational schools only until third grade. After that point, boys and girls are filtered into separate single-sex schools, and, where difference exists in the quality of teachers, this may likely play a role in achievement differences. In Jordan, because of societal expectations,

women rarely work jobs that require long hours or evening hours, or that involve close involvement with men (Kawar, 2000; Shteiwi, 2015). As such, the teaching profession is common for women because the hours are conducive to societal expectations and it is an all-woman environment in the single-sex schools. On the contrary, teaching is not a preferred profession for many men. Due to cultural norms, men are expected to be primary breadwinners, yet the pay for teachers in Jordan is quite low. Therefore, many male teachers work two or three jobs to help earn enough money to pay their bills. This leads to lower job satisfaction for male teachers (ERfKE II, 2014). Further, the boys' schools tend to be more violent than the girls' schools, which also leads to a less conducive environment for learning (ERfKE II, 2014; Ripley, 2017). Although the government has acknowledged these differences between the boys' and girls' schools and generally place strong women teachers in the lower elementary grades so that boys can develop a stronger foundation during their initial co-educational years (Ripley, 2017), in many ways these differences have not yet been systemically addressed.

Lynda Wiest, University of Nevada, Reno

Lynda Wiest's scholarly interests involve understanding factors that influence gender differences in mathematics, including those that relate to dispositions and beliefs, and strategies and opportunities for supporting and encouraging females in mathematics. Dr. Wiest has particularly focused on the role that out-of-school-time (OST) learning can play in this regard because it is an area of rising scholarly interest in education, especially in STEM education (e.g., McCombs et al., 2012; Slates, Alexander, Entwisle, & Olson, 2012). Dr. Wiest developed and has directed a residential summer math program for middle school girls for 20 years, conducting research in association with the program and recently publishing the first book of its kind on OST STEM programs for females (Wiest, Sanchez, & Crawford-Ferre, 2017). Dr. Wiest has worked for multiple years with graduate students from Ghana at University of Nevada, Reno, which has spurred her interest in mathematics education in that country. In the following paragraphs, Dr. Wiest summarizes some of the recent research related to mathematics, gender, and sexuality in Ghana.

Gender equality in Ghana is promoted not only as a human rights issue but also as one that is vitally linked to the pursuit of sustainable national development, such as one that has the potential to increase the socioeconomic well-being of all people (Zaney, 2014). Some gender issues in education in Ghana include the fact that only two girls for every three boys graduate from senior high school, that girls are more likely than boys to be over-age for their grade level and to drop out of school, and that females have a higher adult illiteracy rate than males (Camfed Ghana, 2012; UNESCO, 2016). Despite barriers to girls' education in Ghana, improvements have been made due to the joint efforts of governmental and nonprofit organizations, which have included eliminating school fees and providing training for school counselors and teachers (Eppenauer, 2018).

Nevertheless, Ghanaian males outperform females in school mathematics, only a little more than half as many females as males pursue elective mathematics in secondary school, and males far outnumber females as college mathematics/statistics students (Asante, 2010; Baah-Korang, Gyan, McCarthy, & McCarthy, 2015; Frempong & Asare-Bediako, 2016). Reasons offered for these differences are sociocultural, such as societal stereotypes that lead to greater familial financial investment in boys' education due to a greater expectation for social mobility for boys, whereas girls are generally expected to preserve current traditions and are more subject to early marriage (Asante, 2010). Such social pressures, as well as a lack of female role models in

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mathematics, also contribute to weaker mathematics-related dispositions, such as self-esteem and self-confidence, for females in Ghana (Asante, 2010, 2012). Girls who do break with this pattern and pursue elective mathematics seem inclined to do so based on their higher social status, which includes family support and role models (Baah-Korang et al., 2015; Boateng, 2017). The minimal research conducted on gender in mathematics education in Ghana has been conducted at the upper academic levels (secondary, tertiary), with little attention to the younger grades, where the roots of gender inequity might first take hold.

Ana Dias, Central Michigan University, and Harryson Gonçalves, State University of São Paulo

As previously stated, Ana Dias's research interests include the politics of mathematics education, adult numeracy, ethnomathematics, and mathematics invocational education and training. Harryson Gonçalves's background and research are in the area of curriculum studies and mathematics education, in particular diversity and inclusion or curricula as gendered and racialized texts. In the following paragraphs, Ana Dias and Harryson Gonçalves describe some related research from Brazil.

Previous research on Brazilian mathematics education has focused on comparing boys' and girls' scores on standardized international tests (Machado, 2014), examining gender stereotypes and gendered discourse in mathematics education (de Souza & Fonseca, 2010), and analyzing mathematics textbook illustrations and story problems in relation to gender stereotypes (Casagrande, 2006). Our focus is on research that encompasses a non-binary view of gender and sexuality. Diversity in gender expression and sexual identities is a reality in Brazilian schools, and teachers, including mathematics teachers, often find themselves unprepared to fight homophobia, transphobia, bullying, and other problems that directly affect students, often resulting in school dropout, self-mutilation and suicide attempts.

Examining the public policies and legislation in Brazil, three distinct moments are evident; naming, recognizing, and including (Pinto, 1999). In many schools there are efforts to name and classify (e.g., activities clarifying or defining gender and sexuality, different gender and sexual expressions and identities); efforts and strategies to recognize (e.g., who the different groups are, how they organize, what their political and social demands are), and mechanisms of inclusion (accepting, respecting, and valuing diversity, respecting human rights, combating school drop-out and violence against minorities). However, as Seffner (2013) points out, policies of inclusion inevitably generate procedures of labeling, and end up acting as mechanisms of oppression, even when guided by good intentions. Seffner (2013) addresses the challenges faced when schools attempt to promote mechanisms of inclusion and of respect towards sexual and gender diversity.

Even with the best intentions, sometimes these mechanisms have unintended results, and Seffner (2013) argues that this is due to a certain naïveté in relation to the ways in which heteronormativity works. In his school ethnography he describes five cases, in one of which he found that students responded to a campaign to value diversity by mocking the campaign slogan "value diversity" by changing it to "value Arthur" (Arthur is a pseudonym that the author uses for a homosexual student in the school). The slogan was later spread around as "value the literature teacher" in reference to the school's literature teacher who was openly gay. In another case described by Seffner (2013) a student, here called Renato, complained that in two situations, when the teachers invited a gay leader for a collective interview and showed some videos with anti-homophobia campaigns, the classmates – both boys and girls – claimed that the event was

happening "just because of Renato." A friend of Renato´s said that she would "rather attend a math class than talk about stuff like that," leaving Renato in an awkward position.

How prepared is the mathematics teacher to deal with such situations? What is the role of mathematics in the curriculum? Although it may seem that these topics are outside the field of mathematics education, they directly affect students and teachers of mathematics. When the student said that she would rather have a math class than hear a speaker talk about inclusion, she was not necessarily referring to how much she enjoys her math classes, but probably also signaled the fact that students will be held accountable for their mathematics performance in exams at school, and especially, in the "vestibular" exams which determine entrance into higher education institutions in the country.

A few authors, such as Peralta (2019), have questioned how school mathematics may reinforce labeling, categorizing, and comparing social groups. Peralta's focus is in preschool mathematics activities, which consist mainly of seriation, classification, and ordination. We believe that adequate preparation of mathematics teachers in gender and sexuality issues need to move beyond examining stereotypes about women in mathematics textbooks (which is currently the emphasis of the literature used in Brazilian teacher preparation programs). Further efforts need to a) promote educational efforts in partnership with social movements, and not only scholars; b) create curricular materials that focus on the hegemonic mechanisms of heteronormativity, instead of focusing on homosexuality (that is, problematizing the norm itself and not those presently out of the norm); and c) avoid activities that have as sole focus defining different gender and sexual identities, which end up being almost like an effort in taxonomy and often result in labeling.

Jennifer Hall, Monash University

Jennifer Hall has long had an interest in "gender issues" research in mathematics education. Dr. Hall began formally investigating this topic through a Master's degree research project, in which was an exploration of the experiences of women mathematics majors at a Canadian institution (Hall, 2010). More recently, Dr. Hall has conducted research in Australia and Canada (Hall & Jao, 2018a, 2018b) about the general public's views of gender and mathematics. Notably, for this study, the data collection instrument from a previous, similar study by Forgasz and Leder was altered (1) to make all the questions non-binary (e.g., "For which gender…") and (2) to add questions that explicitly queried the participants' views on gender. In another recent project, Dr. Hall and colleagues (e.g., Hall, Robinson, Flegg, & Wilkinson, in press) investigated the supports and challenges faced by undergraduate mathematics majors in Australian universities. This project has an explicit focus on gendered aspects of the students' experiences, and, like the previous project, gender-related data are collected in non-binary ways. Data collection is complete for both projects, and analysis and writing are underway.

In Australia, there is a long tradition of "gender issues" research in mathematics education, primarily linked to the work of Helen Forgasz and Gilah Leder, the latter of whom is the winner of the 2009 Felix Klein Award. Forgasz and Leder have widely published in the area of gender and mathematics for decades, with notable publications such as *Mathematics and Gender* (Fennema & Leder, 1990), *International Perspectives on Gender and Mathematics Education* (Forgasz, Becker, Lee, & Steinthorsdottir, 2010), and *Towards Equity in Mathematics Education: Gender, Culture, and Diversity* (Forgasz & Rivera, 2012).

With regard to achievement on international large-scale assessments, such as the Programme for International Student Assessment (PISA), which assesses 15-year-old students, no

statistically significant gender differences in mathematical literacy were found between Australian boys and girls from 2003 to 2015 (Thomson, De Bortoli, & Underwood, 2017). In contrast, on the Trends in International Mathematics and Science Study (TIMSS; Thomson, Wernert, O'Grady, & Rodrigues, 2016), gender differences in mathematics achievement in favoring boys were found in 2015 for Grade 4 students; this marks the first statistically significant gender difference since the 1995 iteration of the test. No statistically significant gender differences were found in 2015 for Grade 8 students, and there has only been one such difference since 1995 (in boys' favor).

With respect to participation at non-mandatory levels of study, women remain a minority of students in university programs in the mathematical sciences, and women's proportion of the enrolments has been declining in recent years (Australian Academy of Science, 2016; Johnston, 2015). For instance, in 2014, only one-third of the students who graduated with an honors bachelor's degree in the mathematical sciences were women (Johnston, 2015). Over the past 15 years, there has been a slight downward trend in the number of women, compared to a substantial upward trend in the number of men, graduating with honors degrees in the mathematical sciences (Johnston, 2015).

Angie Hodge, Northern Arizona University, with contributions by Dakotah Wilkey, Northern Arizona University

Angie Hodge's research interests lie at the intersection of active learning (Ernst, Hodge & Yoshinobu, 2017) and gender equity in the STEM disciplines. Most recently, Dr. Hodge conducted research on a four-week summer camp for underrepresented middle school girls (Hodge, Matthews, & Squires, 2017). In addition, Dr. Hodge conducted a research study on why some women choose STEM fields and what has made them successful in such majors (Weber & Hodge, 2012). In the following paragraphs, Angie Hodge, with contributions by Dakotah Wilkey, has summarized some of the recent research related to mathematics, gender, and sexuality in China.

In China, gender equity has been a common topic studied in mathematics education research as mathematics has been seen as a male dominated field of study. The achievement levels of girls in mathematics have not been found to be significantly different than boys, except that the highest scorers on the college entrance examinations are more likely to be boys (Tsui, 2007). Based on findings such as this, some researchers have advocated for analyses of societal factors, including home and school backgrounds, to further investigate male domination of mathematics-related fields (Zhu, Kaiser, & Cai, 2018). For example, researchers conducted a study in poor, rural areas of China in which they aimed to measure the factors of health, nutrition, and background and how these factors might affect children (Zhou et al., 2016). These researchers concluded that health and nutrition did not seem to be related to engagement with mathematics fields later in life; however, girls were found to have lower levels of self-efficacy and self-esteem, and higher levels of anxiety (Zhou et al., 2016), which may contribute to their opting out of certain academic areas and/or making different career choices than boys do.

The lack of a gender difference academically in China may be related to the recently changed policy that formerly allowed families to only have one child. Prior to this law, boys were found to have more value placed on their education than girls. There was a time where the laws were more relaxed, leading to some children having siblings. In one study, researchers found that having a male sibling negatively impacted female students potentially due to parents having a male preference (Kubo & Chaudhuri, 2017). Chinese parents often depend on their children

when they grow older, so seeing their children succeed is crucial, regardless of gender. Parents who only have one child have expectations that are more gender-neutral, removing competition and value placed on some children over others (Tsui, 2007). In fact, having a single, female child may lead to more educational spending to ensure that the child is successful in the competitive job market, leading to more success in academic endeavors. This may be related to the ways gender, achievement, and selection of mathematics-related careers is experienced by students in China.

Betsy Kersey, University of Northern Colorado

Betsy Kersey is primarily concerned with ways that we can research gender without reinforcing the gender binary. In her dissertation study, she used a narrative framework to analyze the experiences of transgender students in STEM fields, some of whom were nonbinary, in order to gain insight into how the treatment of students in mathematics and other STEM fields are gendered, both for those within and those who transcend a binary notion of gender. Several interesting findings emerged. Perhaps most surprisingly, those participants who were assigned male at birth and then transitioned to align their presentation with their gender identity as women reported that being treated as male, even though it meant they had more social power, felt uncomfortable and sometimes even insulting. Once they transitioned and others in their programs perceived and treated them as women, they had less social power, but experienced this as affirming of their identity and saw it as an improvement in their circumstance. This suggests that there are subtleties in how we regard gender-based privilege and discrimination to which we should attend.

Betsy Kersey is collaborating with Rowen Thomas, a colleague pursuing their doctorate in Higher Education and Student Affairs, to propose a variety of ways that researchers can ask their participants about gender to provide some structure without reducing gender to a binary. The first model is the gender oppression plane (Kersey, 2018). The second model is a pictorial model based on the color wheel that would allow participants to select both what gender(s) they identify with and to what degree, if any, they identify in that direction. These models would be best suited for qualitative research. The first model focuses on how participants are perceived by others and how their treatment varies based on their perceived gender; the second model focuses on how an individual identifies. The third model is a Likert-scale adaptation of the model for gender used by the Gender Unicorn (Trans Student Educational Resources, 2017) and would be best suited to quantitative research. This model is also readily adaptable to asking about sexual/romantic attraction. Finally, Dr. Kersey is collaborating with Jennifer Hall on an article about the ethics of studying gender. The work of these researchers draws from relevant statements from professional organizations in mathematics and mathematics education around the world, as well as previous work conducted by researchers in other fields, such as science education. This work focuses primarily on the collection and analysis of data, how to avoid forcing participants to choose a category that does not fit them, and some considerations when analyzing data related to gender.

Laurie Rubel, University of Haifa and City University of New York

Laurie Rubel's current research focuses on the educational experiences of women Palestinian citizens of Israel (Arab Israelis, who represent 25% of the population of Israel). Arab Israelis are a minority group with limited access to opportunity and resources and lower socioeconomic standing in Israel (Bar-Tal & Teichmann, 2005; Zuzovsky, 2010). Arab Israeli girls outperform

boys in mathematics (Rapp, 2015) and have been found to have beliefs about success in mathematics different from Western or Westernized peers (Forgasz & Mittelberg, 2008). It has been hypothesized that girls appropriate academic success to overcome the lower status that they hold, as a minority in Israel as Palestinians exacerbated by their role as women in a patriarchal society (Rapp, 2015), and as an unintended consequence of less diversity among course offerings in Arab high schools (Ayalon, 2002).

Laurie Rubel's research methodology consists of life-story interviews with Arab Israeli women in undergraduate and graduate programs in mathematics education, from diverse Arab ethnic groups and geographies, in which they are asked how they understand and interpret the effects of local racialized narratives in relation to learning, how they interpret their achievement and others' lack of achievement, and which factors they identify as supporting or inhibiting their success. Dr. Rubel's analysis will pursue the educational experiences of these women, as told in their own stories and counterstories, with particular attention to how these stories converge or contrast with Western narratives. The commentary will include analysis of researcher positionality (Milner, 2007) and Dr. Rubel will discuss methodological tensions inherent to research about equity in mathematics in relation to social groups known to espouse conservative, patriarchal, and homophobic ideologies.

Plans for Active Engagement During the Conference

During sessions 1 and 2 we plan to begin our work with a series of short presentations by the working group authors about research that has been or is being conducted across the various parts of the world described previously. We will focus on situating the research within the respective cultures, and we will explore the ways gender and sexuality are constructed and re-enforced, especially, but not only as they relate to mathematics education. We believe it is important to attend to cultural contexts, and, where possible, we will include short, publicly available video highlighting stories of the experiences of individuals within these cultures and/or artifacts of student/teacher work. We will highlight themes that emerge across cultures and discuss ways in which we see our own cultures anew based on studying the experiences of others. We will also include time for non-co-author participants who have engaged in mathematics-education related work outside of the U.S. to share their work and experiences. It is important that this time is both informative and interactive, and thus will likely take us well into the second session. During sessions 2 and 3, our time will be devoted to break-out group work, followed by a large group-sharing session at the end of Session 3. Break-out groups will be arranged according to individual interest, with the goal of generating questions to be investigated and creating (small) sets of online resources and potential collaborators. One aim is to begin to consider opportunities for cross-cultural collaborations, leveraging our own connections and those of other participants. Each break-out group will generate a plan for moving the work forward, and collectively we will determine a timeline for engaging in this work after the conference ends. These sessions might initiate a process for developing materials that could lead to an edited volume.

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