Preface to "Adolescent Girls' Construction of Moral Discourses and Appropriation of Primary Identity in a Mathematics Classroom"

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My research interest in gender and equity issues in mathematics education has a long history stemming from my dissertation research in which I examined the intersection of race, gender, and class in a middle school mathematics classroom. Though I completed my dissertation as an ethnographic study in 2002, I was deeply puzzled by the contrasting perceptions and experiences manifested in each participating girl's profile. I wondered if further analysis would provide more powerful means to unravel the complexity and subtle dynamics in the girls' emerging social and academic identities.

My 2008 article "Adolescent girls' construction of moral discourses and appropriation of primary identity in a mathematics classroom" published in *ZDM—the International Journal on Mathematics Education, Special issue—"Mathematics Education: New Perspectives on Gender"* was borne of this lingering question. I continued the search for a more robust and effective theoretical and analytical approach to seemingly inconsistent and even contradictory voices of my young adolescent participants. Bakhtin's (1981) theory of language and identity and Gee's (1999) discourse analysis provided me with the means to systematically dissect the multilayered voices of the girls and their identities. To my pleasant surprise, the results from my new theoretical and analytic endeavor largely supported my previous ethnographic findings regarding the sociocultural context of the mathematics classroom and each girl's location in the classroom. As a result, I gained confidence in my arguments in previous work—that there could be a qualitatively different set of challenges faced by a smaller subset of girls in school mathematics—and, therefore, the gender equity discourse should be restructured considering two other powerful sociocultural factors, race/ethnicity and class, in American schooling contexts.

Gender issues in mathematics education have been a controversial topic worldwide during the last four decades. Concerned with girls' lower mathematics per-

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formance reported in early studies in the 1970s, feminist scholars raised public awareness facilitating various instructional strategies that supported more positive mathematics learning experiences among girls (Leder 1992; National Center for Education Statistics [NCES] 2005). As a result, many publications in the 1990s and early 2000s reported that traditional gender differences in mathematics achievement favoring males had gradually decreased in the United States and Great Britain (e.g., Department for Education and Skills [DfES] 2005; Fennema 1996; NCES 2005). Witnessing a significant improvement in girls' status in schooling processes, some researchers have argued that gender inequity in mathematics education is no longer an urgent topic for scholarly discussion. Some even contest that it is boys who experience significant disadvantages in the current schooling system (e.g., Sommers 2000; Weaver-Hightower 2003). However, the most recent PISA results (OECD 2010) and NAEP data (NCES 2010) provide a puzzling picture of this long-standing issue. The majority of Western countries, such as United Kingdom, United States, Germany, Netherlands, Canada, and Australia showed a large and consistent gender gap in mathematics favoring boys. In some countries (e.g., Australia), the PISA results testified to the resurge of the traditional gender gap, facilitated by the conservative backlash during the last ten years (Forgasz 2008). The latest NAEP data confirmed a similar pattern in American education. The traditional gender difference favoring boys seems to have resurged in the modified data of 2004, and more evidently in the 2008 data. A statistically significant gender difference between boys' and girls' mathematics performance was found for students aged 13 and 17, while the data for 9 year olds did not show a significant gender difference.

Educational researchers have long argued that the American schooling process can never be properly understood without simultaneously considering the three powerful sociocultural factors: gender, race/ethnicity and class (Campbell 1989). Research on gender and mathematics is unlikely to be an exception to this thesis. Not surprisingly, during the last 30 years, numerous American policy researchers have reported a great disparity in students' mathematics performance across racial/ethnic lines as well as by different socioeconomic spectra (Lee 2004; Kohr et al. 1989; NCES 2010). African Americans and Hispanics consistently perform lower than their White and Asian counterparts. More interesting is that the gender difference that emerged during the last ten years varies across different racial subgroups; 13 and 17 year old Whites and Hispanics exhibit a statistically significant gender difference favoring males while African Americans and Asians do not show any significant gender difference for any of the three age groups. The gender gap observed among Whites is consistent for both middle and working class subgroups. As a result, White working class girls who perform 5–6 points below their male counterparts are the lowest achieving students among all White students. Hispanic boys perform significantly higher than Hispanic girls at age 13 and 17. However, this gender difference favoring boys is relatively small and not statistically significant among Hispanic middle class students. In contrast, Hispanic working class boys significantly outperform Hispanic working class girls by a large margin. The off-set effect of gender is also found among African America students. Even though they

show no significant gender difference as a whole, 13 and 17 year old middle class African–American girls score about the same as or slightly higher than their male counterparts, while working class African–American girls consistently score lower than their male counterparts at age 17. Therefore, it is fair to say that both Hispanic and African–American girls from middle SES tend do as well as their male counterparts. On the contrary, both Hispanic and African–American working class girls tend to fall behind their male counterparts.

What can be discerned from these data? Working class girls are the most vulnerable group of students in school mathematics in the United States in almost all racial/ethnic subgroups. As a whole, girls' mathematics performance, though varying in degrees across racial/ethnic subgroups, seems to be more influenced by contextual factors such as family SES than is boys' performance. Girls from middle or upper class families seem to perform at the same level as their male counterparts, while girls from working class backgrounds seem to fall far behind than their male counterparts with the same SES background. Therefore, I argue that the recent NAEP data suggest great challenge and hardship faced by working class girls in their mathematics learning, especially those from Hispanic and African–American backgrounds. The off-set effect of gender observed in the two minority groups, and a more consistent gender gap appearing among the White samples, indicate that working class girls' struggle in school mathematics may be qualitatively different from that of middle class girls.

This emerging pattern of gender gap by race and SES is, in fact, a diversion from previous studies that reported the lack of significant interaction effect by gender by race by SES in student mathematics achievement (e.g., Gilleece et al. 2010; Kohr et al. 1989). The vulnerability of working class girls, as compared to their male counterparts, is an interesting phenomenon that differs from other studies conducted in England and other Western countries (e.g., Machin and McNally 2005; Mensah and Kiernan 2010). However, this is not a phenomenon unique to American schooling either. A similar observation was documented in Australian schools, that is, that girls' participation in higher mathematics is largely influenced by their class status (Lamb 1996). Lamb (1996) reported that the gender gap favoring boys was much weaker among girls from middle class families, and suggested that the higher SES status of their families offset the negative impact of gender. As a result, it was argued that the traditional gender difference is more evident among Australian students from socially disadvantaged backgrounds (Teese et al. 1995).

What, then, could be the major challenges faced by working class Hispanic and African–American girls in their mathematics learning? Though there might be multiple challenges, I would like to highlight one critical element, a profound social disconnection from their (mathematics) teachers and the dearth of social/academic support provided to these girls. In my two current studies, one with White and Hispanic high school students comparing their classroom experiences with a computer-based tutorial program, and the other, a longitudinal study with three racial/ethnic groups of high-achieving middle school girls, the importance of social support provided to poor minority girls in their mathematics learning appeared evident. Not surprisingly, based on some social network and cultural knowledge afforded through their family

backgrounds, middle class minority girls seemed to have a higher chance to develop a positive relationship with their teachers. Yet, poor Hispanic and African–American girls, even the high-achieving girls, in the two studies tended to experience a deeper cultural and social disconnection from their teachers and school contexts as a whole. The poor minority girls participating in these two studies were primarily concerned with having a psychologically safe space and developing a social and emotional bond with others in their school contexts. In fact, these minority girls' strong desire for a safe space and social support is not a totally new finding. Several researchers have already reported that girls are more likely than boys to form a more closed and tight social network, and that such a close social network significantly influences academic pursuits (Riegle-Crumb et al. 2006). As a result, with strong instructional and social support from their teachers and peers, coupled with their own desire to make a difference in their lives, some minority girls seem to excel in their academic work (Hubbard 2005). It should be noted that working class minority girls' social disconnection from their teacher(s) poses a critical dilemma in their mathematics learning. Because of the scarcity of instructional support available to these girls through their families or communities, their mathematics teachers are almost their only reliable source of mathematical knowledge. As a result, while feeling disconnected and uncomfortable, these girls have no option but to depend heavily upon their teachers who may not understand their psychological and academic fragility.

The cultural and social dis/connection has been contested in many recent publications (e.g., Tyler et al. 2010) and could be a double-edge sword. Although the social and cultural disconnection between working class minority girls and their teachers has contributed to existing gender, racial/ethnic, and class inequities in mathematics education, the same element could become a powerful means to support these girls' enthusiastic learning in mathematics (Ladson-Billings 2009). As I argued in the 2008 article, what seems most urgent is raising a troupe of in-school practitioners—teachers and school administrators—who willingly proclaim themselves advocates of these most vulnerable groups of students and re-conceptualize their teaching and service in the light of social activism. Ironically, this argument seems to be far removed from the dominant research discourse in mathematics education which has focused on the cognitive process of individual learners to explain how authentic mathematics learning may occur. However, the confluence of social context and mathematics learning outcomes, as reflected in the varied gender inequity phenomena across racial/ethnic and class backgrounds, might be a new, though not unique, dilemma in American schooling contexts where three powerful sociocultural factors, gender, race/ethnicity, and class, have created a complex dynamic shaping the entire schooling experience of individual students, including their mathematics learning. Furthermore, this confluence of three sociocultural factors in mathematics education is clearly one of the most compelling research agendas in the international research community as researchers become increasingly aware of the intricate relationships of gender, race, and class in school mathematics.

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