Editor's Perspective Article: Supporting Female Students in Mathematics for Alternative Certification Teachers

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Abstract

This article is a follow-up to the last editor's perspective article about supporting new alternative certification teachers as they teach students from underrepresented groups in mathematics (Evans, 2013). The focus for this article narrows the scope to emphasize support needed for female mathematics students. Alternative certification teachers in the New York City Teaching Fellows (NYCTF) program, among others, were surveyed to determine their attitude toward teaching female students in mathematics. It was found that while NYCTF teachers did not score differently from traditionally prepared teachers on the survey instrument, NYCTF scored higher than another cohort of teachers. NYCTF teachers indicated highest agreement with the idea that female students are just as capable of engaging in higher level mathematics as are male students and mathematics is a subject in which both female and male students can succeed.

Keywords: *alternative certification, mathematics, female students*

The views expressed in this article are the editor's views and do not necessarily reflect the views of the National Association for Alternative Certification.

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In the previous issue of this journal, I presented an editor's perspective article about supporting underrepresented groups in mathematics for alternative certification teachers (Evans, 2013). In this article I narrowed the focus to female students in particular. The problem of differences in male and female mathematics achievement and engagement is not new (Fennema, 1974; Fennema & Sherman, 1977). While some researchers found differences in achievement beginning after middle school (Hyde, Fennema, Lamon, 1990; Leahey & Guo, 2001), others have found differences as early as kindergarten and in the lower grades, particularly among the higher achieving students (Penner & Paret, 2008; Robinson & Lubienski, 2011; Robinson, Lubienski, & Copur, 2011). Robinson and Lubienski (2011) concluded differences become pronounced between first and third grade.

Mathematics achievement and engagement can affect later educational and career choices for female students. For example, female college students outnumber males in areas such as education, social sciences, and humanities (Dey & Hill, 2007). However, male students outnumber females in mathematics, physical sciences, and engineering (Dey & Hill, 2007). Dey and Hill (2007) reported 61% of mathematics and physical sciences students were male, while only 39% were female. Even more striking was 82% of engineering students were male, while only 18% were female. Riegle-Crumb, Moore, and Ramos-Wada (2011) found White and Latina female students were 50% as likely as White male students to aspire toward mathematics-related careers. McCrea (2011) said teachers did not encourage female students to pursue careers in mathematics-related fields, but rather in fields such as liberal arts and humanities. Milgram (2011) claimed that encouraging young women to enter mathematics-related careers not only helps the young women succeed, but also helps to diversify those fields and bring in new perspectives.

It is possible that supporting new alternative certification teachers in their beliefs regarding success in mathematics for female students may change their classroom expectations. Li (1999) found teachers had higher expectations for male students, had more positive attitudes toward male students, and tended to stereotype mathematics as a male domain. Even when there are no differences found on standardized test scores between male and female students, teachers believed male students were more talented at mathematics than female students and generally have been found to exhibit gender bias in teaching mathematics (Duru, 2011). Additionally, Robinson and Lubienski (2011) said, "Prior research indicates that teachers' beliefs about students' knowledge and abilities vary by gender and are important influences of classroom processes and student achievement in… math" (p. 273). While teacher beliefs tend to be stable and difficult to change (Connor, Edinfield, Gleason, & Ersoz, 2012; Reeder, Utley, & Cassel, 2009), they are malleable and can be changed with effort and appropriate support (Pajares, 1992). As new alternative certification teachers enter the classroom, teacher educators can provide support for new teachers in changing any negative beliefs about female mathematical aptitude.

Teacher beliefs can develop long before they become teachers (Lortie, 1975), which means alternative certification teachers enter their programs and classrooms with specific beliefs about teaching even before the first day of their teacher preparation programs and first day of teaching

their classes. Hence, there is great responsibility on the teacher educators who support the alternative certification teachers as alternative certification teachers enter the profession.

Having female role models in mathematics class may benefit female students (Weber, 2011; Wiest, 2009), which makes it important for female mathematics teachers to have positive attitudes and dispositions toward the subject. While there is importance for students to be exposed to female mathematicians, scientists, engineers, and other mathematics-related career professionals, confident female teachers can also be role models for their female students. Both female and male teachers of mathematics need to possess progressive attitudes and beliefs about female success in mathematics so that they have the same high expectations to support female students in their mathematics achievement and engagement.

New York City Teaching Fellows Alternative Certification Program

In the previous article I gave the background (Evans, 2013) on one particular alternative certification teacher preparation program, the New York City Teaching Fellows (NYCTF). It was stated that NYCTF is the largest alternative certification program in New York (Kane, Rockoff, & Staiger, 2006), and the program grew very quickly since the inception of the program in 2000. Boyd, Lankford, Loeb, Rockoff, and Wyckoff (2007) said, "Fellows grew from about 1 percent of newly hired teachers in 2000 to 33 percent of all new teachers in 2005" (p. 10). There are more than 8000 NYCTF teachers in New York, which is about 11 percent of all New York City teachers (NYCTF, 2012a). As I wrote in the previous article,

> The NYCTF teachers enter the program in June and immediately begin graduate coursework in a master's degree program while being immersed in fieldwork. In September NYCTF teachers become the teachers of record in their own classes while they continue their graduate studies in education over the next several years. Teachers receive a provisional Transitional B teaching license in New York and are eligible to apply for initial certification upon successful completion of their program and state certification examinations (Evans, 2013, p. 18).

NYCTF teachers work in high-need schools throughout New York City (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006), which is in line with NYCTF's self-described mission to "recruit and prepare high-quality, dedicated individuals to become teachers who raise student achievement in the New York City classrooms that need them most" (NYCTF, 2012b). Additionally, teacher retention rates among NYCTF teachers are generally high with "92 percent completing their first year of teaching, 75 percent teaching at least three years, and over half teaching at least five years" (NYCTF, 2012a).

Attitudes toward Teaching Female Students

Teachers in mathematics methods for elementary school teachers in the alternative certification NYCTF program were surveyed to determine their attitudes toward teaching mathematics to female students. Two other cohorts of teachers were surveyed for comparison: traditional master's degree program preservice teachers and Teacher Education Assessment and Management (TEAM) program preservice teachers. The TEAM program is a collaboration with the TEAM organization and partnering university. The organization facilitates partnerships with

universities and student members receive tuition discounts since they come to the university in a cohort (TEAM, 2012). Cohorts consist of 12 to 20 Orthodox Jewish teachers enrolled in the program to prepare for certification to teach in Yeshiva and Hebrew academies.

The total sample size consisted of 52 teachers in the NYCTF program, 14 traditional preservice teachers, and 12 TEAM teachers. The survey instrument used was the Attitudes toward Teaching Female Students in Mathematics (ATFSM) instrument and consisted of 10 items using a 5-point Likert scale (Evans, 2013).

A one-way ANOVA was conducted to determine if there were overall differences between the three groups (see Table 1 for means and standard deviations), and a statistically significant difference was found at the .05 level with $F(2, 75) = 4.226$, $p = .018$, $\eta^2 = 0.101$. A post hoc test (Tukey HSD) determined exactly where the means differed among the groups. NYCTF teachers scored significantly higher than TEAM teachers with $p = .013$.

Table 1
Overall Means and Standard Deviations for All Teachers

Group	Sample Size	Mean	SD
NYCTF	52	4.48	0.468
Traditional	14	4.41	0.386
TEAM	12	4.05	0.483
Total	78	4.40	0.476

Means and standard deviations for each item are presented in Tables 2 and 3 for all teachers and NYCTF teachers, respectively.

Table 2
Survey Results on ATFSM for All Teachers

Items	Mean	SD
1. Female students are just as capable of engaging in higher level mathematics as are male students.	4.79	0.589
2. Female students are just as capable of going into a mathematics-based career as are male students.	4.81	0.457
3. Teachers should model problems in mathematics using female characters (e.g., using female names in word problems).	4.22	0.878
4. Classroom books should have pictures of females engaging in mathematics (e.g., textbooks).	4.28	0.851
5. It is important for teachers to differentiate their teaching in order to reach female students.	3.96	1.122
6. Mathematics is a subject in which *both* female and male students can succeed.	4.88	0.322
7. It is important to expose students to female professionals in mathematics-based careers.	4.54	0.697
8. Teachers should take female student interests into consideration when teaching mathematics.	4.32	0.875

9. If female achievement is lower than male achievement, it is due to environmental factors.	3.42	1.264
10. I am confident in my ability to support female student learning in mathematics.	4.67	0.526

Note. N = 78

Table 3
Survey Results on ATFSM for NYCTF Teachers

Items	Mean	SD
1. Female students are just as capable of engaging in higher level mathematics as are male students.	4.90	0.358
2. Female students are just as capable of going into a mathematics-based career as are male students.	4.87	0.397
3. Teachers should model problems in mathematics using female characters (e.g., using female names in word problems).	4.31	0.919
4. Classroom books should have pictures of females engaging in mathematics (e.g., textbooks).	4.38	0.867
5. It is important for teachers to differentiate their teaching in order to reach female students.	4.02	1.093
6. Mathematics is a subject in which *both* female and male students can succeed.	4.90	0.300
7. It is important to expose students to female professionals in mathematics-based careers.	4.65	0.590
8. Teachers should take female student interests into consideration when teaching mathematics.	4.38	0.953
9. If female achievement is lower than male achievement, it is due to environmental factors.	3.65	1.327
10. I am confident in my ability to support female student learning in mathematics.	4.67	0.513

Note. N = 52

Conclusion

Just as was found in the last article, no difference was found between NYCTF teachers and traditionally prepared teachers, but a difference was found between NYCTF teachers and TEAM teachers. TEAM teachers come from a traditional Orthodox Jewish background and may hold more traditional and religious views toward female students. However, it should be noted that the TEAM teachers had positive dispositions toward female learning in mathematics (mean of 4.05), but this was significantly lower than the NYCTF teachers' score. Most of the teachers in the TEAM program were female with 9 female and 3 male teachers.

NYCTF teachers indicated highest agreement with the idea that female students are just as capable of engaging in higher level mathematics as are male students and mathematics is a subject in which both female and male students can succeed. NYCTF teachers indicated lowest agreement with the idea that if female achievement is lower than male achievement, it is due to

environmental factors and it is important for teachers to differentiate their teaching in order to reach female students. As similarly found in the previous article, NYCTF appeared to be more committed to student equality in regard to ability and success. However, interestingly teachers were less committed to the idea of differences due to environmental factors, which seems to contradict the inherent similarities in female and male genetic equality in ability. This should be further investigated.

It is important that teacher educator's support new teachers in their dispositions toward female mathematics students. Robinson and Lubienski (2011) said that teacher gender beliefs can impact achievement. By eliminating misconceptions about female ability in mathematics and improving dispositions where needed, teacher educators may be able to have a powerful indirect impact on the achievement of many female students.

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