
Alternative Certification Middle and High School Mathematics Teacher Differences

Brian R. Evans, Ed.D.
Pace University, New York

Purpose

The purpose of this study was to determine the differences in content knowledge and beliefs between several variables among New York City Teaching Fellows (NYCTF) in regard to mathematical content knowledge, attitudes toward mathematics, and concepts of self-efficacy.

New York City Teaching Fellows

- Alternative certification program developed in 2000 in conjunction with The New Teacher Project and the New York City Department of Education (NYCTF, 2008; Boyd, Lankford, Loeb, Rockoff, & Wyckoff, 2007).
- There was a 7000 teacher shortage predicated for fall 2000, with a possible shortage of 25,000 teachers over the next several years (Stein, 2002).
- Teaching Fellows grew from around 1 percent of all newly hired teachers from its beginning in 2000 to 33 percent of all new teachers by 2005 (Boyd, Loeb, Lankford, Rockoff, & Wyckoff, 2007).
- Teaching Fellows currently account for 26 percent of all New York mathematics teachers and currently there are about 8800 Teaching Fellows teaching in New York City (NYCTF, 2010).

Research Questions

Are there differences in mathematical content knowledge, attitudes toward mathematics, and concepts of teacher self-efficacy between

- Middle and high school Teaching Fellows?
- Mathematics and Mathematics Immersion Teaching Fellows?
- Undergraduate college majors among the Teaching Fellows?

Methodology

Sample: 42 NYCTF in mathematics methods course

Instruments:

- Mathematics Content Test
- New York State Content Specialty Test (CST)
- Attitudes Toward Mathematics Inventory
- Mathematics Teaching Efficacy Beliefs Instrument (MTEBI)

Quantitative methods:

- Independent Samples t -tests
- Analysis of Variance (ANOVA)

Mathematics Teaching Efficacy Beliefs Instrument (MTEBI)

Mathematics Teaching Efficacy Beliefs
Instrument (MTEBI) two subscales:

- Personal Mathematics Teaching Efficacy (PMTE) specifically measures a teacher's self-concept of his or her ability to effectively teach mathematics.
- Mathematics Teaching Outcome Expectancy (MTOE) specifically measures a teacher's belief in his or her ability to directly affect student learning outcomes.

Results Research Question 1

Statistically significant differences (*t*-test) between middle school ($N = 26$) teacher and high school teacher ($N = 16$) scores on the mathematics content pre and posttests with large effect sizes.

For attitudes toward mathematics and concepts of self-efficacy there were no statistically significant differences found between middle and high school teachers on both pre and posttests.

Results Research Question 2

Statistically significant differences (*t*-test) between Mathematics Immersion Teaching Fellows ($N = 30$) and Mathematics Teaching Fellows' ($N = 12$) scores for the mathematics content pre and posttests with large effect sizes.

For attitudes toward mathematics and concepts of self-efficacy there were no statistically significant differences found between Mathematics and Mathematics Immersion Teaching Fellows on both pre and posttests.

Results Research Question 3

Teaching Fellows were grouped according to their undergraduate college major. Three categories were used to group teachers: liberal arts ($N = 16$), business ($N = 11$), and mathematics and science ($N = 15$) majors.

Results Research Question 3

Statistically significant differences (ANOVA; see Table 1) on the pre and posttests.

Post hoc Tukey HSD test revealed that mathematics and science majors had significantly higher content knowledge on the pre and posttests than business and liberal arts majors. There were no other statistically significant differences.

For attitudes toward mathematics and concepts of self-efficacy there were no statistically significant differences found between the undergraduate college majors.

Table 1: Means and SD for Content

Pre, Post, and CST Tests	Mean	Standard Deviation
Content Knowledge Pre Test		
Liberal Arts (<i>N</i> = 16)	70.13	16.382
Business (<i>N</i> = 11)	64.45	15.820
Math/Science (<i>N</i> = 15)	87.33	12.804
Total (<i>N</i> = 42)	74.79	17.605
Content Knowledge Post Test		
Liberal Arts (<i>N</i> = 16)	81.19	15.132
Business (<i>N</i> = 11)	76.82	14.034
Math/Science (<i>N</i> = 15)	93.60	7.679
Total (<i>N</i> = 42)	84.48	14.225
CST Content Knowledge		
Liberal Arts (<i>N</i> = 16)	255.81	18.784
Business (<i>N</i> = 11)	249.64	18.943
Math/Science (<i>N</i> = 15)	273.80	15.857
Total (<i>N</i> = 42)	260.62	20.184

Further Analyses

Since significance was found for the mathematics content test across several variables, the same variables were analyzed using the New York State Content Specialty Test (CST) scores. The same statistically significant results were found for all three research questions.

Discussion

- It was found that high school teachers had higher mathematics content knowledge than middle school teachers.
- It was found that Mathematics Teaching Fellows had higher mathematics content knowledge than Mathematics Immersion Teaching Fellows.
- It was found that mathematics and science majors had higher mathematics content knowledge than non-mathematics and non-science majors.
- However, no differences were found between these variables in attitudes toward mathematics and concepts of self-efficacy.

Discussion

Teachers had the same highly positive attitudes toward mathematics and same high concepts of self-efficacy regardless of content ability, as evidenced in the comparison between middle and high school teachers, Mathematics and Mathematics Immersion Teaching Fellows, and mathematics and science majors and non-mathematics and non-science majors.

Discussion

This means that attitudes and self-efficacy in this study were unrelated to how much content knowledge one possessed.

This is interesting considering that high content knowledge is a necessary, but not sufficient, condition for good teaching (Ball, Hill, & Bass, 2005).

Teachers in this study believed they were just as effective teaching mathematics despite not having the high level of content knowledge as some of their colleagues.

Discussion

- Further research should
 - Address whether or not there are differences in teaching ability among the Mathematics and Mathematics Immersion Teaching Fellows
 - Address whether or not there are differences in teaching ability among the teachers with mathematics and science majors and non-mathematics and non-science majors.

Discussion

- Recommendation
 - Since New York State holds the same high standards (30 credits of mathematics content) for both high school and middle teachers alike, strategies to better middle school teachers' content knowledge should be investigated.
 - Better preparation in mathematics content for Mathematics Immersion Teaching Fellows and non-mathematics and non-science majors is needed. Perhaps completion of 30 credits in mathematics content should be required before starting the Teaching Fellows program.

Discussion

For the sake of urban students who have teachers in alternative certification programs, the certification of high quality teachers must continually be a high priority for policy makers, administrators, and teacher educators.