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# TEACHER QUALITY, CONTENT KNOWLEDGE, AND SELF-EFFICACY IN ONE MATHEMATICS TEACH FOR AMERICA COHORT

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Teacher Quality, Content Knowledge, and Self-Efficacy in one

Mathematics Teach for America Cohort

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## Abstract

The purpose of this study was to understand the relationships between mathematical content knowledge and perceptions of teaching self-efficacy in one cohort of Teach for America teachers. It was found that teachers had high levels of self-efficacy. It was also found that mathematics related majors had higher mathematical content knowledge than did business majors, but similar levels of self-efficacy. Liberal arts majors had similar content knowledge and levels of self-efficacy as did mathematics related majors.

## Introduction

This research is a follow-up study to a previous study conducted with first year Teach for America (TFA) teachers in New York (Evans, 2009). The previous study found a significant increase in both mathematical content knowledge and positive attitudes toward mathematics over the TFA teachers' first year teaching. Teachers' reflective journals revealed that they generally believed an emphasis on social justice in their coursework was of biggest benefit to them, and that classroom management was the biggest problem faced in their teaching. Additionally, it was found that mathematics related majors had significantly better content knowledge scores on the pre- and posttests and better attitudes toward mathematics on a pretest than did business majors. The purpose of this present study was to understand the level of teacher self-efficacy and differences between content knowledge and self-efficacy among teachers of different undergraduate majors in the TFA program.

## Need for the Study

TFA is a non-profit organization formed in 1990 with the intention of sending college graduates to low-income schools to make a difference for the underserved students (Kopp, 2003). There have been several prominent studies conducted on TFA teachers in the elementary schools specifically (Darling-Hammond, 1994, 1997; Darling-Hammond, Holtzman, Gatlin, & Heilig, 2005; Laczko-Kerr & Berliner, 2002), but not at the secondary level (Evans, 2009; Xu, Hannaway, & Taylor, 2008). Further, most studies focused primarily on student achievement and teacher retention, admittedly two of the most important variables. However, examining only these variables is not sufficient if the goal is to increase teacher quality.

Darling-Hammond et al. (2005) found that certified teachers consistently produced significantly higher student achievement gains as compared to uncertified teachers, including typically uncertified TFA teachers. Laczko-Kerr and Berliner (2002) found that students of TFA teachers performed more poorly than students of equally inexperienced, but fully certified, teachers. However, students of uncertified TFA teachers performed the same as students of other uncertified teachers (Darling-Hammond et al., 2005; Laczko-Kerr & Berliner, 2002). Certified TFA teachers, after two to three years of teaching and enrolling in a teacher preparation program, performed just as well as other certified teachers in the field. Darling-Hammond et al. cautioned that upon becoming certified many TFA teachers leave teaching. Few studies have addressed mathematical content knowledge with teacher perceptions of self-efficacy (Jones Newton, Leonard, Evans, & Eastburn, under review; Swars, Daane, & Giesen, 2006; Swars, Hart, Smith, Smith, & Tolar, 2007), and no known studies have addressed this issue in alternative certification. Jones Newton et al. (under review) found a relationship between mathematics content knowledge and perceptions of self-efficacy for elementary preservice teachers taking a mathematics methods course. Swars et al. (2007) found an increase in teacher self-efficacy over

the course of an elementary mathematics methods class. It is possible that beliefs about self-efficacy may be a greater variable in quality teaching than content knowledge alone (Ernest, 1989).

## Theoretical Framework

Ball, Hill, and Bass' (2005) emphasis on the importance of content knowledge for teachers formed the framework of this study. Ball et al. said, "How well teachers know mathematics is central to their capacity to use instructional materials wisely, to assess students' progress, and to make sound judgments about presentation, emphasis, and sequencing" (Ball et al., 2005, p. 14). Ball et al. suggested that teachers with high content knowledge could help narrow the achievement gap in urban schools. In New York City in particular, and throughout the United States in general, TFA teachers are often placed in high-need urban schools.

Additionally, Bandura's (1986) construct of self-efficacy theory framed this study's focus on self-efficacy in TFA teachers. Bandura found that teacher self-efficacy can be subdivided into a teacher's belief in his or her ability to teach effectively, and his or her belief in affecting student learning outcomes. Teachers who feel that they cannot effectively teach mathematics and affect student learning are more likely to avoid teaching from an inquiry and student-centered approach with real understanding (Swars et al., 2006).

This current study was grounded in this literature (Ball, Hill, & Bass, 2005; Bandura, 1986) since content knowledge and self-efficacy are integral to the teaching and learning process for teachers and their students. Teachers with higher levels of content knowledge and self-efficacy are better able to produce high student achievement than are teachers with lower levels. This study expands upon the literature by examining these constructs among a cohort of new in-service TFA teachers.

Research Questions

1. What level of self-efficacy did TFA teachers possess?

2. Was there a difference in mathematical knowledge between undergraduate majors for TFA teachers?

3. Was there a difference in perceptions of self-efficacy between undergraduate majors for TFA teachers?

Methodology

The sample in this quantitative study consisted of 22 mathematics middle and high school TFA teachers in their second year of teaching and enrollment in a graduate teacher education program with TFA and their partnering university, a large urban university located in New York. For mathematical content knowledge the sample was the entire 22 teachers. However, when self-efficacy was examined the sample was reduced to 19 teachers since two teachers who agreed to participate in the study did not return their self-efficacy instruments, and one teacher left teaching and the TFA program all together in the second year.

Undergraduate majors for teachers consisted of liberal arts ($N = 8$), business ($N = 9$), and mathematics related majors ($N = 5$). This study followed these teachers through their first two years of teaching while completing their graduate teacher education program.

Teachers took the New York State Content Specialty Test (CST), a test required by New York for teacher certification, the summer before they began their program. The range of possible scores on the CST is 100 to 300, and the minimum passing score is 220. Teachers were given a self-efficacy survey in their second year of teaching and graduate education program. The self-efficacy instrument was adapted from the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) developed by Enochs, Smith, and Huinker (2000), and measures

perceptions of self-efficacy.  The MTEBI is a 21-item 5-point Likert scale instrument with choices of strongly agree, agree, uncertain, disagree, and strongly disagree, and is grounded in the theoretical framework of Bandura's self-efficacy theory (1986).  Based on the Science Teaching Efficacy Belief Instrument (STEBI-B) developed by Enochs and Riggs (1990), the MTEBI contains two subscales: Personal Mathematics Teaching Efficacy (PMTE) and Mathematics Teaching Outcome Expectancy (MTOE) with 13 and 8 items, respectively. Possible scores range from 13 to 65 on the PMTE, and 8 to 40 on the MTOE.  The PMTE specifically measures a teacher's self-concept of his or her ability to effectively teach mathematics.  The MTOE specifically measures a teacher's belief in his or her ability to directly affect student learning outcomes.  Enochs et al. (2000) found the PMTE and MTOE had Cronbach alpha coefficients of 0.88 and 0.77, respectively.

## Results

Research question one was answered using independent samples $t$-tests (see Table 1). TFA teachers had statistically significant higher scores on both the PMTE and MTOE than neutral values coded as "2" in the data.  Further, the effect sizes for both PMTE and MTOE were very large, and this means that TFA teachers had high levels of self-efficacy.  It should be noted, however, that comparing actual self-efficacy scores with neutral responses should be interpreted with caution.

Table 1

*Independent Samples t-Test Results on MTEBI (PMTE and MTOE) Scores*

| Assessment | Mean | SD | $t$-value | Effect Size |
|---|---|---|---|---|
| PMTE Actual Scores | 3.01 | 0.320 | -13.725** | 4.47 |
| Neutral Scores | 2.00 | 0.000 | | |

| | | | | |
|---|---|---|---|---|
| MTOE Actual Scores | 2.85 | 0.394 | -9.381** | 3.05 |
| Neutral Scores | 2.00 | 0.000 | | |

$N = 19$, $df = 18$, two-tailed

Equal variances not assumed.

** $p < 0.01$

      Research question two was answered using a one-way ANOVA (see Tables 2 and 3). TFA teachers were grouped according to their undergraduate college majors, and three categories were used to group teachers: social science ($N = 8$), business ($N = 9$), and mathematics related ($N = 5$) majors. For mathematical content knowledge, the one-way ANOVA revealed a statistically significant difference. A post hoc test (Tukey HSD) was performed to determine exactly where the means differed and revealed that mathematics related majors had significantly higher mathematical content knowledge as measured by the CST than did business related majors, $p < 0.05$. There were no other statistically significant differences.

Table 2

*Means and Standard Deviations on Mathematical Knowledge (CST Scores)*

| CST Scores | Mean | Standard Deviation |
|---|---|---|
| Content Proficiency Pre Test | | |
|     Liberal Arts ($N = 8$) | 272.88 | 14.177 |
|     Business ($N = 9$) | 255.22 | 20.891 |
|     Mathematics ($N = 5$) | 285.00 | 20.149 |

| | | | | |
|---|---|---|---|---|
| Total (*N* = 22) | 268.41 | | 21.407 | |

Table 3

*ANOVA Results on Mathematical Knowledge (CST Scores) for Major*

| Variation | Sum of Squares | df | Mean Square | F |
|---|---|---|---|---|
| Between Groups | 3100.888 | 2 | 1550.444 | 4.516* |
| Within Groups | 6522.431 | 19 | 343.286 | |
| Total | 9623.318 | 21 | | |

* $p < 0.05$

Research question three was answered using a one-way ANOVA.  No statistically significant differences were found between the various undergraduate college majors and perceptions of self-efficacy as measured by the MTEBI with two subscales: PMTE and MTOE. This means there were no differences between college major and perceptions of self-efficacy.

## Discussion and Implications

It was found that TFA teachers had high levels of teaching self-efficacy, which means that teachers had strong beliefs in their ability to teach effectively and affect student learning outcomes.  This finding has particularly interesting implications since the literature shows teachers tend to have high levels of student outcome expectancy while they were pre-service teachers.  However, outcome expectancy generally declines when the teachers become in-service

and the realities of the classroom are encountered (Swars et al., 2007). Teachers in this study had high levels of outcome expectancy despite being in-service teachers. It is possible that TFA teachers are a unique group with higher than usual confidence in their teaching due to the highly selective nature of the TFA program. As previously stated, TFA teachers are generally high achievers coming from very selective universities. This should be further investigated in future research for alternative certification in-service teachers. Comparisons of self-efficacy should be made between TFA teachers and other categories of teachers.

Mathematics related majors had higher mathematical knowledge than did business majors as measured by the CST. This was consistent with the results found in the previous study (Evans, 2009). Similarly, in the previous study there were no differences found between mathematics related majors and liberal arts majors. A possible explanation is that mathematics taught to business majors may be different from mathematics taught to liberal arts and mathematics majors. Mathematics in liberal arts and mathematics programs may be more traditionally academic and aligned with the content taught in middle and high school, whereas business mathematics may be taught from an applications perspective.

There are several implications from these results. First, although mathematics related majors had higher mathematical content knowledge than did business majors, no differences were found in their perceptions of their ability to effectively teach mathematics or their beliefs in their abilities to directly affect student learning outcomes. This is interesting because despite mathematics related majors having higher mathematical ability than business majors, it appears that there is no effect on their perceptions of their ability to teach mathematics effectively and for their students to learn from them. There is a concern that teachers coming from backgrounds other than mathematics related fields do not have enough mathematics content knowledge to

effectively teach mathematics. The findings of this study showed that even though a difference was found for content knowledge between the two majors, perceptions of teaching ability were not found to be different. This is significant since self-efficacy is an important variable in quality teaching (Bandura, 1986; Ernest, 1989). Future research should investigate what effect this has on student achievement.

Second, no differences in mathematical ability or perceptions of self-efficacy were found between mathematics related majors and liberal arts majors. The implication is that one does not need to have a mathematics related undergraduate major in order to have sufficient content knowledge and perception of one's ability to effectively teach mathematics. This indicates that for the TFA teachers who participated in this study it did not matter whether they were mathematics and engineering majors or history, music, political science, psychology, public policy, sociology, and Spanish majors. This could have significant implications for future selection of TFA candidates, and candidates from other alternative certification programs as well. This is an important issue that should be further investigated. Additionally, future research should investigate how student achievement compares between students of teachers from both liberal arts and mathematics backgrounds.

Given the need for high quality mathematics teachers, particularly in high-needs urban schools, it is imperative that students in these schools are getting the quality education they deserve. To make sure this is happening we must continuously examine teacher quality in teacher preparation in traditional programs and especially alternative pathways programs such as TFA, to ensure that all children have the highest quality teachers.

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