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MATHEMATICAL CONTENT  
KNOWLEDGE, EFFICACY, and PROBLEM  
SOLVING ABILITIES in ALTERNATIVE  
CERTIFICATION

Brian R. Evans

*Pace University*, bevans@pace.edu

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Elementary Teachers' Mathematical Content Knowledge, Efficacy, and Problem Solving  
Abilities in Alternative Certification

Brian R. Evans

Pace University, New York

Abstract

The purpose of this study was to understand teachers' mathematical content knowledge, self-efficacy, problem solving abilities, and teacher beliefs in an elementary education mathematics methods course for special education teachers in the New York City Teaching Fellows and Teach for America alternative certification programs. Findings revealed a significant increase in mathematical knowledge and self-efficacy. Additionally, teachers were found to have high self-efficacy and strong problem solving abilities. Teachers generally found that helping students with disabilities learn mathematics was the biggest issue in their teaching, and that the use of technology and manipulatives were the most important topics in their learning.

This study examined mathematics content knowledge, concepts of self-efficacy, problem solving abilities, and teacher perceptions among new elementary school mathematics teachers in two alternative certification programs, New York City Teaching Fellows (NYCTF) and Teach for America (TFA). Understanding teacher knowledge is important because it is directly related to student achievement (Hill, Rowan, & Ball, 2005). Self-efficacy is a teacher's belief in his or her ability to teach effectively and positively affect student learning outcomes (Bandura, 1986; Enochs, Smith, & Huinker, 2000), and an important component for successful teaching. Further, it is recommended that mathematics should be taught through a problem solving perspective (NCTM, 2000; Schoenfeld, 1985).

Teachers' concepts of self-efficacy affect instructional decision-making, which impacts students learning (Parajes, 1992; Soodak & Podell, 1997). Soodak and Podell (1997) argued that teachers with high self-efficacy devote more time to instruction than teachers with lower levels of self-efficacy (Gibson & Dembo, 1984). Soodak and Podell (1997) found that preservice teachers exhibited higher levels of self-efficacy than when they began teaching in the field. However, through experience the level of efficacy rose again. Soodak and Podell (1998) suggested a reexamination of teaching training programs in this respect.

Few studies have addressed mathematics knowledge with teacher beliefs of self-efficacy (Jones Newton, Leonard, Evans, Eastburn, & Tatum, in press; Swars, Daane, & Giesen, 2006; Swars, Hart, Smith, Smith, & Tolar, 2007). Jones Newton et al. (in press) found a relationship between mathematics content knowledge and concepts of self-efficacy for elementary teachers taking a mathematics methods course. Swars et al. (2006) examined the relationship between mathematics anxiety and teacher efficacy in elementary pre-service teachers, and it was found that lower mathematics anxiety was related to higher concepts of self-efficacy. Further, 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 (Bandura, 1986; Ernest, 1989). In a study of science teachers, it was found that teachers with high self-efficacy were more likely to teach through a student-centered inquiry approach (Rubeck & Enochs, 1991).

Problem solving continues to be of high importance in mathematics education (NCTM, 2000; Posamentier & Krulik, 2008; Posamentier, Smith, & Stepelman, 2008). It is one of the five National Council of Teachers of Mathematics (NCTM) process standards (NCTM, 2000), and is critically important in how students best learn mathematics (Posamentier et al., 2008). The National Council of Supervisors of Mathematics (NCSM) has considered problem solving to be the principal reason for studying mathematics (NCSM, 1978).

In order to understand what problem solving is, first it must be understood the definition of a mathematical “problem.” Charles and Lester (1982) defined a mathematical problem as task in which (a) The person confronting it wants or needs to find a solution; (b) The person has no readily available procedure for finding the solution; and (c) The person must make an attempt to find a solution. According to Krulik and Rudnick (1989), problem solving is a process in which an individual using previously acquired knowledge, skills, and understanding to satisfy the demands of an unfamiliar situation. Polya (1945), in his seminal work *How to Solve It*, outlined a general problem solving strategy that consisted of (a) Understanding the problem; (b) Making a plan; (c) Carrying out the plan; and (d) Looking back.

Understanding the level of elementary school mathematics teachers’ problem solving abilities is critical in supporting them to teach their students from a problem solving perspective. For example, teachers are critically important in developing abstract thinking in students in the

problem solving process. However, Cai (2000) has shown that sixth grade U.S. students rarely used abstract strategies in their problem solving. Strong problem solving abilities among teachers are needed if teachers are to teach mathematics well because content knowledge by itself, while being necessary, is not sufficient for good teaching (Ball, Hill, & Bass, 2005; Ma, 1999). The NCTM (2000) said, “Problem solving is not only a goal of learning mathematics but also a major means of doing so” (p. 52). If there is interest in good student problem solving, teachers need to be more than proficient in their own problem solving abilities.

Ball et al. (2005) had emphasized the importance of content knowledge for teachers. Additionally, Bandura (1986) stressed that teacher self-efficacy can be subdivided into a teacher’s belief in his or her ability to teach well, and his or her belief in a student’s capacity to learn well from the teacher. Finally, the NCTM (2000) and Schoenfeld (1985) have emphasized problem solving as a way of teaching though an emphasis on problem solving as an important process standard. Ball et al., Bandura, Schoenfeld, and the NCTM *Principles and Standards for School Mathematics* formed the theoretical framework for this study.

#### Purpose of the Study

The purpose of this study is to add to the literature by providing an understanding of teachers’ mathematical content knowledge, self-efficacy beliefs, level of problem solving abilities, and teacher beliefs in an elementary education inquiry-based mathematics methods course for special education teachers in the New York City Teaching Fellows (NYCTF) and Teach for America (TFA) programs. This study expands upon the literature by examining the field experience relationship, specifically in-service teaching, with content knowledge, self-efficacy beliefs, problem solving, and beliefs of new teachers in alternative certification programs. At the beginning and end of the semester teachers took a mathematics content

examination and self-efficacy questionnaire, and at the end of the semester teachers took a problem solving examination. Finally, teachers were required to keep reflective teaching and learning journals, and state and justify their teaching philosophies in terms of back to the basics approach to reformed-based constructivist methods.

### Alternative Certification Programs

There has been a recent interest in studying the effects of alternative teacher certification in America's classrooms with a particular interest in teacher quality issues (Boyd, Grossman, Lankford, Michelli, Loeb, & Wyckoff, 2006; Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006; Boyd, Lankford, Loeb, Rockoff, & Wyckoff, 2007; Darling-Hammond, 1994, 1997; Darling-Hammond, Holtzman, Gatlin, & Heilig, 2005; Humphrey & Wechsler, 2007; Kane, Rockoff, & Staiger, 2006; Laczko-Kerr & Berliner, 2002; Stein, 2002). The NYCTF and TFA programs are two such alternative certification programs.

### Background on New York City Teaching Fellows

The NYCTF program is an alternative certification program developed in 2000 in conjunction with The New Teacher Project and the New York City Department of Education (Boyd et al., 2007; NYCTF, 2008). The program goal was to recruit professionals from other fields to supply the large teacher shortages in New York City's public schools with quality teachers. There was a 7000 teacher shortage predicted for fall 2000 with a possible shortage of 25,000 teachers over the next several years (Stein, 2002). Prior to September 2003, New York State allowed for teachers to obtain temporary teaching licenses to help fill the teacher shortage. Teaching Fellows generally are recruited to teach in high needs schools throughout the city (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006).

The NYCTF program has grown very quickly since its inception in 2000. “Fellows grew from about 1 percent of newly hired teachers in 2000 to 33 percent of all new teachers in 2005” (Boyd, Loeb, Lankford, Rockoff, & Wyckoff, 2007, p. 10). Of all alternative certification programs in New York City, Teaching Fellows represent the most alternative certification teachers in New York City (Kane et al., 2006). Teaching Fellows represent 11 percent of all New York City public school teachers, and 22 percent of all special education teachers (NYCTF, 2010). The average grade point average in 2008 for new Teaching Fellows was 3.3 (NYCTF, 2008).

A concern with alternative certification is the lack of retention, especially in large urban areas such as New York City (Darling-Hammond et al., 2005). Sipe and D’Angelo (2006) found when surveying Teaching Fellows that about 70 percent of them intended to stay in education. NYCTF reports that 92 percent of Teaching Fellows completed their first year of teaching, 73 percent completed at least three years of teaching, and half have taught for at least five years (NYCTF, 2010). Boyd, Grossman, Lankford, Michelli, Loeb, and Wyckoff (2006) reported that about 46 percent of Teaching Fellows stayed in teaching after four years as compared to 55 to 63 percent of traditionally prepared teachers. Kane et al. (2006) found that Teaching Fellows and traditionally prepared teachers had similar retention rates.

#### Background on Teach for America

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. Its founder, Wendy Kopp, was herself a new graduate of Princeton University looking to do something more with her life after graduation (Kopp, 2003). She considered that many recent college graduates at America’s top universities would consider teaching low-income students if given the

opportunity. The idea was that there should be a teachers' corps that would allow new graduates at top universities with an interest in teaching to quickly begin teaching students in underserved communities. Kopp considered that her idea could be a Peace Corps for the 1990s, and that the teachers would either stay in education or go into other sectors and remain advocates for public education. Thus, the framework for what would become TFA was developed. Recent college graduates would commit to teaching for two years while taking coursework in teacher education, and they would serve in low-income schools throughout the United States. TFA reported that the average grade point average for TFA teachers was 3.6 (TFA, 2010).

There have been several prominent studies conducted on TFA teachers in the elementary schools specifically (Darling-Hammond, 1994, 1997; Darling-Hammond et al., 2005; Laczko-Kerr & Berliner, 2002). These studies focused primarily on student achievement and teacher retention, clearly two of the most important variables. However, this is not sufficient if the goal is to increase student achievement by increasing the quality of teachers. Suell and Piotrowski (2007) called for a strong academic coursework component for alternative pathways teachers, which makes determining quality teacher preparation important. Generally, findings on the effectiveness of TFA teachers in the classroom have been mixed. Humphrey and Wechsler (2007) called for more research into alternative certification pathways. They said, "Clearly, much more needs to be known about alternative certification participants and programs and about how alternative certification can best prepare highly effective teachers" (p. 512).

Humphrey and Wechsler said that more research is needed specifically on teacher backgrounds.

Research has found that certified teachers consistently produced significantly higher student achievement gains as compared to uncertified teachers, including typically uncertified TFA teachers (Darling-Hammond et al., 2005; Laczko-Kerr & Berliner, 2002). According to



Darling-Hammond et al., certified TFA teachers, after two to three years of teaching and enrolling in a teacher preparation program, performed just as well as generally certified teachers in the field. However, Darling-Hammond et al. caution that upon becoming certified, many TFA teachers leave teaching. Moreover, this is in contrast to TFA's own report of teacher retention on the TFA website. TFA claimed that about two-thirds of TFA teachers stayed in the field upon completing their time in the program, and half of those remained in teaching. This means that about one third stayed in the classroom upon fulfilling their commitment. Another one third maintained non-teaching roles in education, such as in administration or advocacy (TFA, 2008). As of 2010 there were 17,000 TFA alumni (TFA, 2010). According to TFA, over 5600 remained teaching in the classroom after their commitment ended (TFA, 2009).

#### Research Questions

1. What differences existed between teachers' mathematical content knowledge before and after an elementary mathematics methods course?
2. What differences existed between teachers' concepts of self-efficacy before and after an elementary mathematics methods course? Further, what level of self-efficacy did teachers possess at the end of the semester?
3. What level of problem solving abilities did new teachers have in an elementary mathematics methods course?
4. Was there a difference between NYCTF and TFA teachers in their mathematical content knowledge, concepts of self-efficacy, and problem solving abilities?
5. What were teachers' beliefs about teaching and learning mathematics?

#### Methodology

The methodology of this study involved both quantitative and qualitative methods. The sample in this study consisted of 24 new teachers in the NYCTF ( $N = 9$ ) and TFA ( $N = 15$ ) programs. One third was male and two thirds were female. The teachers in this study were selected due to availability and thus represented a convenience sample. Participants were enrolled in an inquiry-based elementary mathematics methods course for elementary school special education teachers that involved both pedagogical and content instruction.

Teachers were given mathematics content examinations and self-efficacy questionnaires at the beginning and the end of the semester, and were given a problem solving examination at the end of the semester. The mathematics content examination consisted of 20 multiple choice items that measured knowledge of number sense, fractions, decimals, and percents (6 items); probability and statistics (4 items); measurement and geometry (5 items); and algebra (5 items), and was based on the PRAXIS mathematics examination (Educational Testing Service, 2005), as adapted by Jones Newton et al. (in press). Possible scores ranged from zero to 20 points. To further determine content knowledge, sub-scores from mathematics section of the New York State Content Specialty Test (CST) and Liberal Arts and Sciences Test (LAST) were used in answering research question four. The CST and LAST are required by New York State for teacher certification and teachers generally take the test upon entering the graduate program.

The self-efficacy questionnaire was the Mathematics Teaching Efficacy Beliefs Instrument (MTEBI) developed by Enochs et al. (2000), and measured concepts of self-efficacy. The MTEBI was a 21-item five-point Likert scale instrument with choices of strongly agree, agree, uncertain, disagree, and strongly disagree, and was 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 contained two

subscales: Personal Mathematics Teaching Efficacy (PMTE) and Mathematics Teaching Outcome Expectancy (MTOE) with 13 and 8 items, respectively. Possible scores ranged from 13 to 65 on the PMTE, and 8 to 40 on the MTOE. The PMTE specifically measured a teacher's self-concept of his or her ability to effectively teach mathematics. The MTOE specifically measured 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.

The problem solving examination consisted of five problem solving situations as adapted from the literature (Krulik & Rudnick, 1989; NCTM, 2000; Posamentier & Krulik, 2008; Posamentier et al., 2008). It is important that students be unfamiliar with the problems because in order to be authentic problem solving students should encounter unfamiliar situations with no immediate solutions available. Each item was worth two points and possible scores ranged from zero to 10 points. Sample problems were as follows.

A bicycle dealer just put together a shipment of two-wheel bicycles and three-wheel tricycles. He used 50 seats and 130 wheels. How many bicycles and how many tricycles did he make if he used all seats and wheels available?

Jim bought a new camera that cost more than \$30 but less than \$40. He paid for the camera with \$5 bills and \$1 bills. He paid with the same number of each. What did the camera cost?

Teachers were required to keep reflective journals on their teaching and learning over the course of the semester, which provided qualitative data regarding their beliefs about teaching and learning mathematics. The teaching journal had guiding questions such as: How are your students learning? What challenges do you face? What successes have you had? Has your attitude toward teaching shifted over the course of the semester? The learning journal had guiding questions such as: How has this course affected your teaching? What has been helpful?

What are the most important concepts you've learned in this class? Finally, the final item on the final examination in the class required the teachers to state their own positions toward teaching mathematics from a traditional back to the basics approach to a reform-based constructivist approach, and then justify their responses.

### Limitations

The major limitation in this study is the role of the teacher-researcher since the instructor in the mathematics methods course was also the researcher in this study. Therefore, consideration must be given for possible bias in student reporting since the students in this study knew that the instructor would be conducting the research. As in all survey research, internal validity issues arise due to student self-report.

As previously mentioned, the sample in this study consisted of a convenience sample due to availability, which restricts the generalizability of this study. Therefore, teacher content knowledge, self-efficacy, and problem solving abilities should be further investigated with randomly selected larger samples in future research.

### Results

The first research question was answered using the mathematical content knowledge test, and data were analyzed using paired samples *t*-test (see Table 1). The results of the paired samples *t*-test revealed a statistically significant difference between pretest scores and posttest scores for the mathematics content knowledge test, and there was a large effect size.

The second research question was answered using the MTEBI with two subscales: PMTE and MTOE, and data were analyzed using paired samples *t*-tests. The results of the paired samples *t*-test revealed a statistically significant difference between pretest scores and posttest scores for the PMTE, and the effect size was moderate. Further, the results of another paired

samples *t*-test revealed no statistically significant difference between pretest scores and posttest scores for the MTOE.

Table 1

*Paired Samples t-Test Results for Content Test and Self-Efficacy Test (PMTE and MTOE)*

Assessment	Mean	SD	<i>t</i> -value	<i>d</i> -value
Content Test				
Pretest	75.00	16.151	-3.778**	0.85
Posttest	87.08	11.971		
PMTE				
Pretest	2.70	0.504	-2.575*	0.45
Posttest	2.91	0.478		
MTOE				
Pretest	2.69	0.691	-0.213	
Posttest	2.71	0.666		

$N = 24$ ,  $df = 23$ , two-tailed

\*\*  $p < 0.01$

\*  $p < 0.05$

Further, the second part of the second research question was answered using independent samples *t*-tests to determine if the participants had significantly better concepts of self-efficacy at the end of the semester as compared to a neutral value coded as “2” on the survey sheet (see Table 2). For the PMTE the results of an independent samples *t*-test revealed a statistically significant difference between PMTE scores and neutral scores, and the effect size was very large. For the MTOE the results of an independent samples *t*-test also revealed a statistically significant difference between MTOE scores and neutral scores, and the effect size was also very large.

Table 2

*Independent Samples t-Test Results for PMTE and MTOE Scores*

Assessment	Mean	SD	<i>t</i> -value	<i>d</i> -value
PMTE Actual Scores	2.91	0.478	-9.310**	2.69
Neutral Scores	2.00	0.000		
MTOE Actual Scores	2.71	0.666	-5.249**	1.50
Neutral Scores	2.00	0.000		

$N = 24$ ,  $df = 23$ , two-tailed

Equal variances not assumed.

\*\*  $p < 0.01$

Descriptive statistics were used to answer research question three. At the end of the semester teachers had a mean score of 8.54 out of 10 possible points on the problem solving examination with a standard deviation of 1.615, which represents the teachers' level of problem solving abilities.

The fourth research question was answered by using independent samples *t*-tests to determine if the NYCTF and TFA teachers differed in their content knowledge, concepts of self-efficacy, and problem solving abilities. No statistically significant differences were found between NYCTF and TFA teachers on all three variables including using CST and LAST scores.

The fifth research question was answered using data collected from the teaching and learning journals. The teaching journal was used as a reflection upon the teachers' actual teaching and classroom experiences. As part of the mission of the school of education where this study took place, teachers are encouraged to be reflective practitioners. Similarly, the learning journal was used as a reflection on the learning in the mathematics methods course.

Analysis of the teaching journals revealed that the most commonly addressed topic was special education issues in the classroom. Teachers addressed their struggles and successes of working with students with disabilities. The next most frequently mentioned topic was mathematics anxiety. Teachers not only addressed the anxiety their students experienced, but

also the anxiety they themselves held as teachers of mathematics. Teachers also expressed concerns about a lack of conceptual understanding in their students. Teachers lamented the difficulty in helping their students learn mathematics for understanding, as well as the lack of understanding students possessed prior to entering the classroom. Finally, teachers often reflected upon the emphasis placed upon standardized testing in their schools and the need to prepare students for the examinations, and they resented the emphasis on standardized testing. Surprisingly, very few teachers reported difficulty with classroom management.

Analysis of the learning journals revealed that the most commonly addressed topics were the use of technology and manipulatives in the classroom. Teachers appreciated exposure to these learning tools and implemented them in their own classroom. Manipulatives used in class included base ten blocks, Unifix cubes, Cuisenaire rods, and the Tower of Hanoi, among others. Next, teachers most often addressed their conceptual understanding of mathematics content. Teachers in the methods course appreciated the focus on understanding mathematics since many of them lacked conceptual understanding themselves. Recall that the teachers reflected upon their concern that their own students lacked conceptual understanding in their teaching journals. The topic of differentiation and numeracy were frequently mentioned in the journals. Additionally, microteaching was a topic that many teachers thought enhanced their learning in the course. Every teacher was required to present a 10 minute microlesson that involved a “hook” to get students interested. Many teachers found observing other teachers teach to be a very valuable aspect of this course. Finally, problem solving was often mentioned in the reflective journals. Teachers were given a “problem of the day” problem solving situation that they were to solve in groups at the beginning of each class.

Research question five was also answered using the data collected from the final item on the final examination of the methods course, in which teachers were required to rank their teaching philosophies as traditional, moderate, or reform. Teachers were evaluated based upon their justification for their positions, but not the positions themselves. The number of teachers who had traditional views was two; the number who had moderate views was eight; and the number who had reform views was 14. These numbers, however, do have some overlap. Of the two traditional oriented teachers, one stated that she would like reformed-based teaching ideally, but that traditional methods was more practical. Of the eight moderate oriented teachers, two stated that they ranked themselves as moderate, but tended to align more with reformed-based methods. Two teachers said they think reformed-based methods are better for teaching, but traditional methods of evaluation are better for student assessment. All of the 14 reform-oriented teachers firmly placed themselves as reformed-based instructors. They generally stressed the need for understanding, inquiry, critical thinking, problem solving, and real-world connections.

### Discussion

It was found that elementary teachers increased their mathematical content knowledge and self-perception of their abilities to teach effectively over the course of a one semester inquiry-based mathematics methods course for special education teachers while teaching in the own classrooms. Further, it was found that at the end of the semester the teachers generally had high concepts of self-efficacy both in terms of their ability to teach well (as measured by the PMTE), as well as their ability to positively affect student outcomes (as measured by the MTOE). Additionally, teachers had relatively high problem solving abilities, and no differences were found between Teaching Fellows and TFA teachers in terms of content knowledge, concepts of self-efficacy, and problem solving abilities. Analysis of the reflective journals



revealed that teachers revealed that the most commonly addressed topic was special education issues in the classroom. Teachers reflected on their struggles and successes of working with students with disabilities. Teachers found that the use of technology and manipulatives were the most important topics addressed in their learning. Finally, the majority of teachers considered themselves to be reformed-based teachers.

Over the semester there was an increase in mathematics content knowledge, which is attributed to the combination of focus on content and pedagogy in the mathematics methods course, along with the teaching experience the teachers in this study were gaining. Future studies should focus on the contributions to an increase in content knowledge from the coursework and teaching components, separately.

The results of this study are consistent with the finding of Palmer (2006) and Swars et al. (2007), who found that there was an increase in self-efficacy in terms of elementary pre-service teachers' ability to teach well and their ability to positively affect student outcomes. However, Palmer (2006) and Swars et al. (2007) examined pre-service elementary school teachers, while in this study teachers were in-service and enrolled in alternative certification programs. Also, Palmer looked at efficacy using the STEBI-B for science, and Swars et al. used the MTEBI for mathematics, as was done in this present study. Soodak and Podell (1997) also found that preservice teachers exhibited higher levels of self-efficacy than when they began teaching in the field, but through experience the level of efficacy rose again. The results of this study were somewhat inconsistent with the results found by Hoy and Woolfolk (1990), who found a significant decline in beliefs to positively affect student learning outcomes during student teaching, which had been attributed to teachers' exposure to the realities of the classroom. However, in this present study teachers had an increase in this belief despite early encounters

with the realities of the classroom. Perhaps there is something different about alternative certification preparation that could explain this difference. Change in self-efficacy should be further investigated, especially for alternative certification teachers.

It was found that teachers had relatively high problem solving abilities. This is in contrast to findings in the literature (Ball et al., 2005; Ma, 1999), and commonly held perceptions of teacher problem solving ability (Paulos, 1990). The translation of strong problem solving abilities into the classroom should be further investigated, and it is suggested that alternative certified elementary school teachers be evaluated for their implementation of their problem solving abilities into the classroom.

No statistically significant differences were found between Teaching Fellows and TFA teachers on the three variables examined. It is commonly claimed by TFA that their candidates come from the most highly ranked and selective universities in the United States, with the implication is that those among America's brightest become TFA teachers. These results are surprising considering there is a common perception held by those working with the programs in New York that TFA teachers, while not staying in education quite as long as Teaching Fellows, have stronger mathematics content knowledge. However, Constantine et al. (2009) claimed that of the various alternative pathways programs, NYCTF and TFA were the more selective of the other alternative pathways programs in candidate selection. In 2008, approximately 20 percent of TFA applicants were accepted into the program with about 15 percent of applicants actually starting the program (TFA, 2008). In 2008 only about 15 percent of NYCTF program applicants were accepted into the program. Over 8 percent of applicants actually entered training in the summer before teaching with an additional 1 percent beginning early in the 2007/2008 academic year (NYCTF, 2008).

Since the teachers in this study were special education teachers, it was not surprising that teachers most often reflected upon the challenges and successes they had with their special education students in their teaching journals. It was surprising, however, that very few teachers reflected on classroom management issues. Classroom management is often considered a top concern among new teachers (Costigan, 2004; Cruickshank, Jenkins, & Metcalf, 2006; Evans, 2009; Veenman, 1984). This should be examined in future studies.

Teachers expressed concern about lack of conceptual understanding in their students and an appreciation for the emphasis on understanding in the methods course. The method course in which these teachers were enrolled had a strong emphasis on teaching for understanding. It has been shown that many U.S. elementary teachers lacked the content understanding needed to teach well (Ma, 1999), and that this should not be a surprise given that these teachers graduated from the same system that researchers wish to improve (Ball et al., 2005). Hence, a cycle of non-understanding persists. Nurturing conceptual understanding in teachers is important given the relationship between teacher knowledge and student achievement (Hill et al., 2005).

Teachers most commonly addressed the use of technology and manipulatives in the classroom in their learning journals. The methods course placed strong emphasis on using technology and manipulatives to enhance student learning in line with the NCTM *Principles and Standards for School Mathematics* (NCTM, 2000).

Teachers frequently mentioned differentiation and numeracy in their learning journals. The school of education where this study takes place has a strong emphasis on differentiated instruction. It should be noted that teachers in this class had been exposed to differentiation prior to enrolling in the method course. Teachers were required to read Paulos' *Innumeracy*:

*Mathematical Illiteracy and its Consequences* (1990). In this book Paulos addressed what it means to be numerate (i.e. mathematically literate) in a democratic society.

Teachers often discussed problem solving in their learning journals. Problem solving as a way of teaching was thoroughly addressed in the course with considerable time devoted to problem solving in the mathematics classroom as recommended in the literature (NCSM, 1978; NCTM, 2000; Schoenfeld, 1985).

Ball et al. (2005) found that teacher knowledge is an important variable in preventing the achievement gap from growing in high need urban schools. Additionally, self-efficacy impacts student learning (Parajes, 1992; Soodak & Podell, 1997), and it is possible that beliefs about self-efficacy may be a greater variable in quality teaching than content knowledge alone (Bandura, 1986; Ernest, 1989). Future studies should examine content knowledge, concepts of self-efficacy, and problem solving abilities in the special education context. Considering the high need for special education teachers, schools of education must be careful in determining the abilities and beliefs of special education teaching candidates. Further, considering the large number of alternative certification program candidates who teach in high need schools (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006; Kopp, 2003), it is extremely important for the sake of these students that educational researchers understand teacher knowledge, concepts of self-efficacy, and problem solving abilities.

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