Journal of Urban Mathematics Education
December 2011, Vol. 4, No. 2, pp. 96–130

When Am I Going to Learn to be a Mathematics Teacher? A Case Study of a Novice New York City Teaching Fellow

Michael Meagher
Brooklyn College
City University of New York

Andrew Brantlinger
University of Maryland
College Park

In this article, the authors present a case study of a Mathematics Teaching Fellow of the New York City Teaching Fellows program. The presentation focuses on the Teaching Fellow's family and educational background, her beliefs as a novice teacher, preparation to teach mathematics, and first-year experience teaching middle school mathematics in a "high-needs" school in New York City. The authors contend that although the Teaching Fellow articulated reform-oriented instructional beliefs, she was unable to enact them in the classroom. This lack was due, in part, to the inadequacies in the induction support system that was promised to her. The authors situate the case study using results from a larger study of novice Mathematics Teaching Fellows and analyze the case study from a perspective that supports reform-oriented approaches to mathematics teaching.

KEYWORDS: alternative teacher education, mathematics education, reform mathematics teaching, urban education

The New York City Teaching Fellows (NYCTF) program was started in 2000 to address "the most severe teacher shortage in New York's public school system in decades" (NYCTF, 2010, p. 1) and to replace uncertified teachers with (transitionally) certified teachers in "high-needs" schools (Goodnough, 2000a, 2000b, 2004). From 2004–2008, NYCTF was the largest program in the United States providing an alternative route to teaching certification. Currently, one in four mathematics teachers in New York City come through the Teaching Fellows program (NYCTF, 2010) and, over the past decade, more than two-thirds of new middle and high school mathematics teachers entering the New York City public school system were Teaching Fellows (V. Bernstein, personal communication, 2006; NYCTF, 2010).

MICHAEL MEAGHER is an assistant professor in the Department of Secondary Education in the School of Education in Brooklyn College, City University of New York, 2608 James Hall, 2900 Bedford Ave., Brooklyn, NY 11210; email: mmeagher@brooklyn.cuny.edu. His research interests are in the areas of mathematics teacher preparation in urban schools and advanced digital technologies in the teaching and learning of mathematics.

ANDREW BRANTLINGER is an assistant professor in the Department of Teaching, Learning, Policy, and Leadership in the College of Education – University of Maryland, 2226 Benjamin Building, College Park, MD 20742; email: amb@umd.edu. His research interests are in the areas of the sociology of education, critical pedagogy, and mathematics teacher preparation.

In this article, we present a case study of Kelly,[1] a first-year Mathematics Teaching Fellow. We focus on Kelly's social and educational background, her beliefs as a novice teacher, preparation to teach mathematics, and first-year experience teaching middle school mathematics in a high-needs school in New York City. We situate Kelly's individual case study in a larger context by using results from a larger observational study of 8 novice Mathematics Teaching Fellows (MTF) completing state required graduate coursework at four universities; survey data from 167 MTF who, like Kelly, had taught for one year in schools; and other research that we and our colleagues have conducted relating to MTF (see Brantlinger, Cooley, & Smith, 2009; Donoghue, Brantlinger, Meagher, & Cooley, 2008; Foote, Brantlinger, Haydar, Smith, & Gonzalez, 2011). We analyze Kelly's case study from a perspective that supports reform-oriented approaches to teaching of mathematics (NCTM, 2000). Our perspective is one of looking for questioning, applying strategies, communicating, reasoning and reflecting, and tasks that engage students in higher-order thinking, novel problem solving, and communication of their developing ideas about mathematics.

Review of Literature

Urban districts have had chronic difficulties recruiting and retaining teachers qualified to teach in such areas as mathematics, science, and special education (Levin & Quinn, 2003; Liu, Rosenstein, Swan, & Khalil, 2008). As a result, high-needs urban schools that serve lower-SES youth of color are more likely to be staffed by less qualified and less experienced teachers than schools that serve higher-SES student populations (Lankford, Loeb, & Wyckoff, 2002; Peske & Haycock, 2006). Given the link between teacher quality and student achievement, these race- and class-based gaps in human resources pose a serious problem for students in high-needs urban schools (Peske & Haycock, 2006; Rivkin, Hanushek, & Kain, 2005; Rockoff, 2004; Sanders & Horn, 1994).

Over the past decade, issues of teacher quality and teacher recruitment have received increased attention from policymakers, philanthropists, education researchers, the media, and the public (Kramer, 2010; Levy, 2000; Peske & Haycock, 2006; Rotherham, 2008; U.S. Department of Education, 2010). The *No Child Left Behind Act of 2001* (NCLB) has put districts under considerable pressure to find "highly qualified" teachers in such subjects as mathematics, science, and special education. It must be noted, however, that the problem of recruiting and retaining qualified teachers for New York City schools pre-dates NCLB by at least two decades. In 1990, some 14,000 uncertified or "temporary license" teachers worked in New York City schools, up from 7,000 in 1980 (Goodnough, 2004).

[1] A pseudonym, as are all names of people and places throughout.

In the spring of 2000, to help improve the quality and certification status of staff working in the more than 100 New York City public schools deemed "failing," state officials paved the way for alternative routes to teaching (Goodnough, 2000b). The NYCTF program was a public relations coup for the New York City Department of Education (DOE) because the newly minted "transitional" teaching license allowed education officials to count Teaching Fellows among the ranks of certified teachers after they fulfilled minimal preservice preparation program of 200 hours and passed state certification exams (Goodnough, 2004). To allay concerns about what the media and even the DOE referred to as "boot camp" preservice training (Goodnough, 2000a), DOE officials pointed out that the Fellows were the "best and the brightest" who held prestigious educational credentials prior to admission to NYCTF, and that many had real-world work experience as professionals, hence were fully qualified (see editorial by New York City Schools Chancellor Levy, 2000). The district and NYCTF literature (NYCTF, 2010) also touted an intensive mentoring and induction program to support the Fellows once they became teachers of record (New Teacher Center, 2006).

Alternative Teacher Certification

Alternative routes to teacher certification are the alternative to traditional, 4-year undergraduate programs housed in university colleges (schools or departments) of education. Early-entry alternative routes are those in which participants become certified teachers of record in a comparatively short timeframe, often after completing 200 combined hours of coursework and fieldwork. The theory behind early-entry programs is twofold: (a) that program participants bring particular skill sets, knowledge, and dispositions (e.g., content knowledge, real-world experience, professionalism, enthusiasm) that makes the full slate of traditional pre-employment coursework unnecessary, and (b) that effective teacher development takes place in the classroom with appropriate on-site induction and mentoring support (Johnson & Birkeland, 2008). In many early-entry alternative route programs, including NYCTF, participants continue to take courses required for standard- or full-teacher certification as they begin full-time teaching with transitional or temporary licenses.

A number of studies have compared the characteristics of participants in early-entry alternative and traditional route programs who teach in similar school contexts and have the same number of years of experience. Many of these comparative studies address the effectiveness with which alternative and traditional route teachers with similar experience and similar teaching placements effect student achievement or retention of classroom teachers (i.e., retention) (see, e.g., Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006; Darling-Hammond, Holtzman, Gatlin, & Heilig, 2005). Taken as a whole, this research finds that traditionally and alternatively certified teachers with similar experience in similar teaching

contexts are, for all intents and purposes, similarly effective at raising student achievement. When it comes to the effectiveness of teachers from traditional and alternative pathways, there is more within-pathway variation than between-pathway variation (Boyd et al., 2006).

At the same time, this research indicates that alternative route teachers, at least those in the nationally prominent NYCTF and Teach for America programs, have considerably higher rates of attrition than traditional teachers who teach in similar schools (Boyd et al., 2006; Darling-Hammond et al., 2005; Stein, 2002; Veltri, 2008). There are several possible explanations for this. First, it could be that many participants in early entry alternative routes see teaching either as a resume builder or as a possible career they can "try out" (Chin & Young, 2007; Veltri, 2010). Second, it could also be because, as one study of New York City teachers prior to the NYCTF program finds (Darling-Hammond, Chung, & Frelow, 2002), participants in early-entry alternative route programs report feeling, on average, less prepared to teach than participants in traditionally certified programs. Third, it could be because the induction and mentoring components of early-entry alternative programs often fail to live up to their promise of helping new teachers learn to teach on the job (Foote et al., 2011; Humphrey, Wechsler, & Hough, 2008; Veltri, 2008, 2010; Zeichner & Schulte, 2001).

Given the substantial amount of variation of teacher quality within pathways and substantial variation of program quality of both alternative and traditional route programs alike, some scholars make the argument that the field needs to move past simple alternative vs. traditional route comparisons and simplistic arguments about one route or the other being uniformly superior. Humphrey and colleagues (2008) posit that, while early-entry alternative programs adequately prepare some types of candidates, they do not work for all types. Based on a study of seven early-entry alternative route programs and their participants, these scholars argue that whether or not a particular route is effective depends on an interaction between the program, the participant, and the context of her or his initial teaching placement.

Reform-Oriented Ideals Meet Classroom Realities

Research on novice teachers who have gone through traditional routes indicates that many hold idealistic and reform-oriented (e.g., student-centered, progressive, constructivist) views of teaching as preservice candidates, but adopt "traditional" teaching methods (e.g., lecturing, emphasizing student control and memorization) once they become teachers of record (Costigan, 2004; Flores, 2006; Lortie, 1975). Cohen (1988) argued that novice teachers do not maintain their reform-oriented perspectives because traditional teaching methods are more familiar and less demanding than reform-oriented methods. Traditional methods also help novice teachers cope with discipline issues and navigate an unfamiliar

curriculum. Some blame schools of education and their traditional approaches to teacher preparation (e.g., National Council on Teacher Quality, 2006; Walsh & Jacobs, 2007) for this situation arguing that they over-emphasize re-form-oriented ideals, ideals that run counter to the culture of public schools and "counter to the main thrust of educational reform efforts in the U.S. in the early twenty-first century" (Labaree, 2005, p. 277).

Yet, this phenomenon is not limited to traditional teacher preparations. A study by Costigan (2004) indicates that a similar mismatch exists between how participants in early-entry alternative route programs imagine themselves teaching as preservice candidates versus how they teach as first-year teachers. Based on a study of approximately three-dozen participants in the NYCTF program, Costigan concludes that there is a disjuncture between the classrooms alternate route teachers envision as preservice candidates and those they implement as novice teachers. As preservice candidates, these Teaching Fellows articulated high-minded ideals (e.g., "befriending" and "molding students"). However, once they begin teaching, their interview and journal narratives focus almost exclusively "on issues of daily survival, such as dealing with the troublesome children in their classes" (p. 133). Costigan reports that the focus on management is fueled by the Fellows' desire to create what one called a "safe space" (p. 136) where learning can occur but also where they can realize the ideals they articulated as preservice candidates.

Goodnough's (2004) observational study of one first-year Teaching Fellow in the NYCTF program supports Costigan's (2004) findings. According to Goodnough, the Teaching Fellow she studied was initially "motivated by idealism and naiveté" (p. 51) and expressed the desire to employ student-centered (e.g., whole language) instructional approaches. However, a mandated scripted curriculum and an in-school mentor compelled her to employ teacher- and control-centered methods. Initially resistant, this first-year Teaching Fellow eventually "accept[ed] the party line and knuckl[ed] under to a routine that instinct told her would not help the children or her in the long term" (p. 113). It is important to note here that the NYCTF program partners with schools of education that provide Teaching Fellows with state required preservice and in-service graduate coursework. Hence, it may very well be that university-based teacher educators strongly emphasize the same progressive and reform-oriented ideals in the minds of Teaching Fellows that they are accused of planting in the minds of traditionally certified teachers (Walsh & Jacobs, 2007).

At the same time, national, standards-based reforms in mathematics adopted in the period from 1985–2000 recommend that teachers adopt non-traditional, reform-oriented teaching methods (Cohen & Hill, 1998). The National Council of Teachers of Mathematics (NCTM) (1989, 1991, 2000) asks mathematics teachers to emphasize student thinking and student-centered problem solving throughout

instruction. Nevertheless, despite such professional opinions and evidence that support the effectiveness of reform mathematics strategies (Stein & Lane, 1996; Schoenfeld, 2002), large-scale studies (e.g., Third International Mathematics and Science Study) suggest that reform instruction has yet to take hold among U.S. teachers—inclusive of urban mathematics teachers (Newmann, Lopez, & Bryk, 1998; Stigler & Hiebert, 1999; Weiss, Pasley, Smith, Banilower, & Heck, 2003). A number of scholars (e.g., Kennedy, 1999; Stigler & Hiebert, 1999) conjecture that this situation is largely the result of the institutionalization of traditional teaching during preservice teachers' own K–12 education—*the apprenticeship of observation* (Lortie, 1975)—as well as experiences with cooperating field-placement teachers who too often use traditional methods. Stigler and Hiebert note further that, in contrast to teachers in some high-performing countries, Japan in particular, U.S. teachers generally work in isolation and fail to have substantive exchanges about teaching and learning with colleagues. However, increased mentoring by informed and competent mentors and professional development in reform methods may be changing this scenario for novice teachers in the U.S. (New Teacher Center, 2006).

Methods

Here we present one of eight case studies detailing a Fellow's first-year teaching; it is from a large-scale, mixed methods case study project of MTF completed over a 2-year period. This case was selected for presentation because Kelly, the young woman in the case, was representative of the large number of MTF who were recent college graduates: White, female, and middle class (Donoghue et al., 2008). Kelly was also chosen because she articulated her ideas clearly and in detail.

Study Context

MetroMath scholars at City University of New York (CUNY) conducted the large-scale, case study project. MetroMath was a Center for Learning and Teaching funded by the National Science Foundation from 2004–2009. As MetroMath scholars, we were among a dozen researchers who worked on the project and were responsible for collecting data in Kelly's classroom during the 2006–2007 school year. While our primary focus was on Kelly's instruction, we also collected data on Kelly's experiences as she completed her state-mandated Master of the Arts of Teaching (MAT) degree coursework at Borough University (BU), one of four partnering universities that provided graduate courses for MTF during the 2006–2007 academic year. At that time, Kelly was one of approximately 55 first-year MTF taking graduate courses at BU; a slightly smaller number of second-

year MTF were also taking graduate courses at BU. During this time, I, the primary author, worked as an assistant professor teaching methods and research courses to approximately 40 MTF at another NYCTF partner university. While I was not Kelly's instructor, my regular contact with other MTF provided insights that informed data collection and analysis.

School Context and Case Study Class

In her first year, Kelly taught at a large, non-selective, middle school in a New York City neighborhood predominantly populated by African American, Caribbean, and Hispanic families. The school is a "high-needs" school; New York City DOE data indicates that approximately three-fourths of student families receive public assistance at the school (New York City DOE, 2011). Similar to many city middle schools, at the time of this study, the school was divided into academies to create a small school feel and give students a cohort model whereby they took most of their subjects together in academically differentiated groups of approximately 30. At the time that Kelly began teaching, the school was undergoing a "Restructuring Year," which meant that it had been failing to sufficiently raise student achievement for 2 consecutive years. The class that was the focal point of our study was, within the context of the school, a high-track class. Kelly also taught two lower-track courses in her first year. The high-track class consisted of 17 Black (i.e., Caribbean and African American) girls, 4 Black boys, 3 Latinas, 4 Latinos, 1 Asian girl, and 1 Asian boy. While advanced for the school, the students in this class tested at grade-level in mathematics on average. Our decision to observe Kelly's high-track class rather than the lower-track classes should be viewed in the context of our larger set of case studies participants, who taught a mixture of advanced-, regular-, and remedial-track courses. Our entire corpus of classroom observations reflected this diversity. To add depth, we observed Kelly's lower-track classes on two occasions in her first year and similar lower-track classes in her second year.

Research Questions

In this article, we explore the following four research questions:

1. What is the nature of the preparedness of a typical first-year Mathematics Teaching Fellow to teach in a high-needs middle school?

2. What are the instructional views and goals of a first-year Mathematics Teaching Fellow?

3. What does teaching "look like" in the classroom of a first-year Mathematics Teaching Fellow, and how consistent is this instruction with reform-oriented mathematics teaching?

4. What is the nature of the induction and support available to an alternatively certified mathematics teacher in NYCTF, and how does it impact her professional development?

Reform-Oriented Research Perspective

Our expectations for Kelly's teaching and our analysis of the observed teaching episodes are based on a reform approach to mathematics instruction (NCTM, 2000). Our perspective is one of looking for questioning, applying strategies, communicating, reasoning and reflecting, and tasks that engage students in higher-order thinking, novel problem solving, and communication of their developing ideas about mathematics (e.g., Henningsen & Stein, 1997; Stein, Grover, & Henningsen, 1996; NCTM, 1991, 2000). We believe this perspective should be at the center of mathematics teacher education programs and of early years mentorship of new teachers. The perspective we take is also appropriate because we demonstrate that Kelly expressed an interest in learning and implementing reform-oriented methods of teaching middle school mathematics. It is further appropriate because students in high-poverty schools have typically been taught using traditional methods in teacher-centered, teacher-controlled classrooms (Cwikla, 2007; Haberman, 1991; Lipman, 2004; Newmann, Lopez, & Bryk, 1998; Weiss et al., 2003) in spite of evidence that they would benefit from reform-oriented approaches (Boaler, 2002, 2006; Boaler & Staples, 2008; Schoenfeld, 2002; Stein & Lane, 1996).

Data Sources and Analysis

Observational data. We collected classroom observational data on Kelly in the form of field notes, videotapes, and audiotapes twice a month (on average) during her first year of teaching. The video and audio data were used as supplements to the field notes.

Interview data. After each classroom observation, during a post-observational interview, Kelly was asked to reflect on the lesson that was just observed. We asked follow-up questions based on things that stood out to us in the lesson, things that we were confused about, and more general issues we were discussing with the larger group of MetroMath scholars. These post-observation interviews were recorded and transcribed. We also conducted in-depth, formal, question-and-answer interviews with Kelly (and the seven other case study participants) at the beginning and end of the 2006–2007 school year. These interview

questions dealt with such aspects as the Teaching Fellows' educational background, ongoing graduate coursework at BU (and three other institutions), and beliefs about teaching mathematics in New York City public schools.

Specifically, the interview was divided into six sections, questions that explored (a) decision to become a mathematics teacher, (b) preservice summer program at the partner university, (c) general goals for teaching and teacher identity, (d) teaching mathematics, (e) particular school setting that the MTF will be or would like to be teaching at fall semester, and (f) policy-related issues relevant to secondary and middle school mathematics. Specific questions in these sections included: How were you taught mathematics in high school? Based on your experiences in the NYCTF preservice program, how prepared do you feel to enter the classroom? What strengths do you have that help or will help you succeed as a mathematics teacher? What do you believe to be the big ideas of (middle and secondary) school mathematics? Describe the communities and neighborhood environment the school is situated? Have you heard of the National Council of Teachers of Mathematics or the standards-based reform movement in mathematics education? Here, we collated portions of the interviews discussing the Fellows' beliefs about the nature of school mathematics and mathematics teaching and learning.

Survey data. We collected survey data from 167 in-service MTF at the four NYCTF programs for mathematics in August of 2007 (approximately 70% of Kelly's MTF cohort who remained in the classroom after one year). The design of the surveys, informed in part by the observational component of the large-scale project, allowed us to examine the representativeness of our eight cases to the MTF who completed the surveys (e.g., their use of required textbooks, beliefs about students) and to compare these case participants' ideas to the aggregate data of the entire cohort. The survey was a combination of open-ended questions (e.g., Briefly explain what aspect or experience of the summer program you believe most helped you to prepare to teach math? What do you consider to be effective math teaching? What are some important similarities or differences between students in "high-needs" urban schools and students you went to school with?) and Likert-like questions (e.g., Use the following scale—never, briefly, occasionally, regularly, extensively—to rate how often students in low-track and high-track courses should engage in the following activities: e.g., hypothesis, theory, or generalizations; relearn basic skills (taught by past teacher); and use manipulatives and models). Here, we examined only the survey questions related to the Fellows' views of mathematics and mathematics education.

Data coding. The coding scheme used to analyze field notes was produced in collaboration with the MetroMath scholars (i.e., research team) during our weekly research meetings. It emerged from an open-coding process (Emerson, Fretz, & Shaw, 1995) whereby several members of the team coded early sets of

field notes from the eight case studies and, through discussion as well as repeated application to the new field notes being generated, agreed on a set of codes that could be applied to all the field notes of the project (e.g., professional development, classroom management, teacher math questions, and opportunity for meaning making). We used these broad codes to partition the data and to focus in on particular issues such as our research questions. We further coded within each of these categories (e.g., under Classroom Management we developed "sub-codes" such as positive and negative interactions, and classroom culture). We wrote memos and developed themes for each of the larger codes based on the within category coding and reading. Reliability of the coding was established through the fact that the field notes from all eight case studies were being used by all the research team for various parts of the project and, thus the application of codes had multiple checks. In the case of Kelly, we (the authors here) were the observing team for the classroom visits and reached consensus on the coding of the field notes. In this article, we used the codes to mark data (e.g., recorded classroom events, excerpts in interviews) relevant to the aforementioned research questions.

The Case of Kelly

In the remainder of the article, we describe Kelly's transition into mathematics teaching in a high-needs urban school in the context of her being an Mathematics Teaching Fellow in the NYCTF program. The description is divided into sections that address the following topics: (a) background information about Kelly relevant to her current job as a mathematics teacher and her preparation to teach, (b) Kelly's views about mathematics teaching in urban schools and the 2-month preservice preparation she received, (c) a detailed description of an early lesson, (e) a mid-semester review of how Kelly perceived her teaching, and the nature and effect of the induction support she was receiving, (f) a detailed description of lesson later in the year, and (g) a description of Kelly's reflections on her first year of teaching. These sections roughly conform chronologically to Kelly's first year of teaching. The first two sections are relevant to our first research question about Kelly's preparedness to teach, the second and fourth sections are relevant to our second research question about Kelly's instructional views and goals, the third and fifth sections are relevant to our third question on the nature Kelly's mathematics instruction, and the fourth section addresses our fourth research question on the nature and effect of the induction support Kelly receives.

Kelly's Background and Preparation to Teach

Kelly was 24-years of age when she became a teacher of record. White and female, she was, in many ways, the prototypical Mathematics Teaching Fellow.

Indeed, more than 55% of Kelly's NYCTF mathematics cohort members were between the ages of 21–25 when they began the program, more than 55% were female, and more than 50% were White (Donoghue et al., 2008[2]). And Kelly, as did approximately 75% of her mathematics cohort, self-identified as middle or upper class (Donoghue et al., 2008).

Kelly came to her position as an urban middle school teacher after having been away from exposure to any mathematics coursework for the 6 years she was in college and graduate school. In the interview conducted a week before she began teaching, Kelly reported that in high school she had received high marks in all subjects, including mathematics. She also recalled that she was tracked into selective programs, including high-track mathematics courses, throughout her years of K–12 schooling. In the preservice interview she claimed: "I think I'm good with math but I was [also] in AP [i.e., Advanced Placement] English, History and Science. So I'm a good student." Despite receiving the highest possible score on the AP Calculus exam, she admitted that she was not interested in studying mathematics or science in college. Statistics I was the only mathematics course she completed in college. Again, Kelly was typical of other Fellows in her cohort in this regard. Two thirds of Kelly's cohort indicated that they were in upper or honors tracks for mathematics in high school. And, while more than 90% took either AP Calculus or Calculus I in high school or college, the typical mathematics Fellow only took a few mathematics courses in college and bit less than one third of her cohort had the equivalent of a mathematics minor or above (Donoghue et al., 2008). Kelly graduated from a large, prestigious Eastern State University with a double major in International Relations and Religious Studies. She spent her senior year at an American university in Africa. She was interested in pursuing a career with the intelligence services but postponed pursuing this option in order to complete a Master of Arts degree in Islamic Studies.

Kelly said that she still retains a long-term goal to become a university professor. She became interested in teaching when it became apparent that the possibility of working in the intelligence community would involve commitments that she was not ready to make at that time. She researched alternative teacher certification programs and perceived the highest need area to be mathematics. Feeling that her high school mathematics background was sufficient to teach middle school and with a desire to live in New York City, Kelly interviewed with Teach for America and NYCTF. Kelly reported that after her Teach for America interview she "was completely turned off by" the other applicants and the interviewers and what she perceived to be a paternalistic attitude of the program, namely: "We're gonna go into these poor places and we're gonna be the savior" and

[2] Of the 92% of Kelly's cohort that reported their race on the preservice survey, 51% identified as White, 15% as East or South Asian, 23% as Black, and 11% as Latino/a (both non-White and White).

"we're gonna go in and save places that can't pull it together themselves." In her NYCTF interview, she found "normal" interviewers and a more "laid back" approach and opted for that program.

NYCTF assigned Kelly and another 55 MTF to a graduate program (MAT) at BU. The remaining 240 (approximately) were assigned to one of three other NYCTF partner universities for mathematics. Kelly spoke positively of her experience in the 2-month NYCTF preservice summer program at BU as did the majority of those MTF assigned to this university (Brantlinger et al., 2009). She found the instructors, several of whom had worked as administrators in New York City schools, to be effective at providing general information and specific tools to survive teaching in New York City public schools. As she said, "It was a great experience. They're so organized … everybody [i.e., her peers] had such creative, dramatic math lessons and then what's amazing about BU, which is gonna get me through the year."

Kelly and her BU cohort mates noted that the summer preservice coursework at that university focused extensively on "instructional design and delivery" and classroom management (Brantlinger, et al., 2009). Kelly reported, "the mantra at [BU] is 'organization and discipline is gonna get you through your first year.'" Program directors at BU confirmed this focus, claiming to emphasize the "pragmatic over the theoretical" in their preservice program. The preservice curricula at the other university programs were not so focused on classroom management and organization. However, it is important to note that, Kelly and her BU cohort mates were more appreciative of their preservice preparation than MTF at the other university partners (Brantlinger et al., 2009). As Kelly put it:

> It's nice like at [BU] that they prepare you for that. If you're not being prepared for a hard to staff school or these kind of discipline issues-if you came from a college that didn't even deal with that, then you'd be scared to death and completely unprepared. (August 2006)

This quote speaks to an overarching theme of Kelly's discourse, namely, her perception that urban schools are riven by discipline issues and her first task in her teaching is to control the situation. In this sense, she was like the novice Teaching Fellows Costigan (2004) interviewed. As we will see below, there is something of a contradiction of Kelly's considerable desire for control, as she also wanted to alleviate students' fear of mathematics and use it as a liberating tool.

Kelly's Views of Urban Mathematics Instruction Prior to Teaching

In the preservice interview, we asked Kelly about her initial thoughts about teaching mathematics in a high-needs New York City school. Kelly described her readiness and gratitude: "I think that [BU] is amazing at getting us ready for that

first day of school." While feeling prepared to begin the school year, Kelly's confidence seemed also to stem from a relationship she developed with a supervisor professor from BU. He had a professional relationship with Kelly's school and told her that he thought she would be successful. Kelly reported that he had been proactive in putting her in contact with his mentees from previous years who worked at the school. He was also helpful in providing advice on how to survive in the first months of teaching. Much of Kelly's calm in facing the coming school year appeared to be based on her sense that she would be able to call on this professor if she was having difficulty in her professional life.

When asked about how her secondary teachers taught mathematics, Kelly described traditional instruction and teacher-centered classrooms. She noted that teachers typically did one or two sample procedural problems on the board and then gave students similar problems to complete on their own. She observed that teachers only interacted with the students when called upon to do so. Kelly felt that this system was possible because her schools were in a middle-class, Midwestern suburb, hence were full of "highly motivated" students (for more on Teaching Fellows' perspectives on teaching urban youth, see Brantlinger, Cooley, & Brantlinger, 2010). Kelly stated:

> I think the teachers pretty much thought, "I don't have to do much and these kids will pick up on it" …they sat at an overhead, would do one or two examples, and put an entire list of problems on the board and tell us to start working. And we would do it but I think we were just highly motivated, good students that if ten problems were put on the board we're gonna go at it. (August 2006)

Kelly was successful as she earned high grades and scored well on standardized tests. At the time, she felt that she was learning mathematics. However, poised to enter the classroom in the fall of 2006, she expressed different feelings about her secondary mathematics preparation. She now considered her former mathematics teachers to have used a deficient approach largely because they failed to link school mathematics to her own life or to real-world applications. As Kelly elaborated:

> I never actually learned—which is what I'm struggling with now, is how to apply to real life. [My high school teachers] didn't actually do any of those motivations to make that link. So when I'm sitting there trying to think, "Hmmm, how does an imaginary number actually—how am I supposed to have—make them want to learn and tell them it's important to learn imaginary numbers?" …And then our [BU] professors are telling us it's not really about the formula, give them a calculator or both, or give them the formula. And I'm—wait a minute, that was all I learned, how to memorize the formula and plug it in. (August 2006)

Kelly expressed a desire to address this situation by making the middle school curriculum she would teach more relevant to her future students' lives. However, she admitted that she did not have clear ideas about how she could accomplish this in the days before she would begin as a teacher of record. As the above excerpt indicates, Kelly judged her preservice program at BU as not particularly helpful in this regard as mathematics-specific teaching methods were not a focus (Brantlinger et al., 2009). Hence, it is not surprising that Kelly did not know what is meant by "reform" or "student-centered" approaches to mathematics education. This lack of understanding was symptomatic of the larger lack of contextual and professional understanding exhibited by Kelly and other preservice MTF we interviewed. When asked about NCLB legislation, Kelly reported that she was aware of it but unfamiliar with the details. To be fair, it may be that BU and the other universities cover these topics in more depth during in-service graduate coursework that follows the preservice program.

Kelly did not have much educational or practical mathematical background to draw on as she entered her first year. While Kelly appreciated the management and lesson planning techniques she learned in the BU preservice program, she expressed concern about her lack of exposure to mathematics-specific teaching methods and mathematics content prior to becoming a teacher of record. When asked about the specifics of her teaching, she made general statements, and admitted that she had not developed a well-formed vision of mathematics instruction:

> I know how to get through my first week. I don't really know how I'm gonna teach math beyond that … I don't know how I'll do it because it's probably impossible but I would like to find some way to vary each class … I'm shooting for two or three days a week have an exciting motivation … I don't understand how I can do instruction, independent work, group work … I bought a book, Barnes & Noble the other day of critical thinking problem solving. (August 2006)

Kelly was not unique. While the preservice MTF at BU felt generally well prepared to manage and organize their classrooms, like Kelly, more than 45% reported on a survey item being only "somewhat prepared," "under prepared," and "not prepared at all" to "teach mathematics using a variety of instructional methods" in their first year (Brantlinger et al., 2009).

In a similar vein, Kelly, the seven other case studies, and an additional 12 MTF in Kelly's cohort (at BU and other universities), were generally unable to articulate a complex, detailed, and coherent vision for teaching mathematics in interviews conducted prior to the 2006–2007 school year (Donoghue et al., 2008). When asked in the preservice interview how they would "teach for understanding," what they thought "effective mathematics teaching looked like," or to describe what they envisioned as they "imagined themselves teaching," only a few were able to articulate clear and detailed descriptions. Many admitted that they

did not yet have a clear vision of what "effective" mathematics teaching looked like and, when pressed, fell back on the idea that the mathematics curriculum needed to be made more real-world relevant. One of Kelly's cohort mates at BU, also a MetroMath case study, reported the following in her preservice interview:

> The only thing that helped me out in the summer [program at BU] on how to teach math was to bring real-world situations—real-life situations—into the course. So I think that will be helpful because a lot of students when they want to understand something you have to relate to what they know. You can't give a problem and say "when you play tennis" because most city kids don't play tennis, so they won't understand it. So that's one thing I learned when teaching math, give problems that relate to them and their life so they can have a better understanding. (Cristina, August 2006).

In spite of being unable to articulate an alternative model of instruction, Kelly and other MTF we interviewed verbally distanced themselves from the traditional model of mathematics instruction that many reported experiencing in their own schooling. Instead, they articulated reform-oriented ideals (e.g., real-world motivations, focus on understanding, collaborative activities) for their instruction.

Admittedly, it might be difficult for the MTF to develop a detailed and coherent vision of an alternative to traditional mathematics instruction because of their streamlined preservice program, which comprised 140 hours of coursework and 60 hours of clinical fieldwork (Brantlinger et al., 2009). As one participant enrolled in a different partner university reported:

> I taught 6th and 7th grade my first year and content wise was not a problem at all. As far as everything else that's involved in teaching, I thought the program gave me enough to get through the first week and then after that [not much]—but at least I knew what to do on the first few days, and that's important (James, August 2006)

As mentioned, less than a third of the 2006 cohort of MTF took more than a few mathematics classes in college. A sizable number had only learned that they would be mathematics teachers a few weeks prior to beginning the NYCTF program (Donoghue et al., 2008).

Kelly's primary stated goal was to gain control of her classroom. In the preservice interview, Kelly reported:

> My goal is not—is to be organized but not to have—I know we're supposed to have math goals but my biggest goal is to have control of the classroom. I am so afraid of having 12- and 13-year-olds having more control over me than I have over them. (August 2006)

Kelly was not unique amongst her peers at BU and in her broader cohort in worrying about their ability to manage a classroom (Brantlinger et al., 2009). This

concern for control is to be expected given the extensive exposure to classroom management techniques in her preservice preparation and Costigan's (2004) research on novice Teaching Fellows would suggest.

Kelly noted a clash between her ideas about classroom organization and management and the customs at her school. Kelly said that the school she would teach at required her to have her students sitting in groups and that this was not her preference stating:

> What I got from my principal is that we have to have kids in groups from day one … and I think I would—in terms of discipline and getting control I would have liked … them to be sitting by themselves in rows for the first little while but that can't happen. (August 2006)

Her school was not unique in this requirement as the district mandated "workshop" instructional model required all schools and teachers to include collaborative student work in their daily lessons (New York City DOE, 2006; Stein & Coburn, 2007; Traub, 2003). Yet, Kelly thought it would be easier to gain control of the class if the students were sitting in rows. She also had personal concerns about controlling the class because she did not feel that she was very "intimidating" and was afraid that students would see her as a "pushover." However, she had what she perceived to be an advantage in that she has a moderate level of Spanish, framing this as a control mechanism rather than an avenue for improved communication with students:

> So I don't actually don't want them to know that I don't know very much [Spanish]. Like if they wanted to talk to me in Spanish, I can try, but I quickly realized that I like that—having that little air of mystery that they don't know how much I know so they are much more cautious to break into Spanish because they think I don't know it. (August 2006)

Despite the "me vs. them" issue of classroom control, Kelly mostly expressed genuine compassion toward school-aged youth. She "loved" working with middle school age students during her many years as a swimming instructor. Further, she stated that her main mathematical goal was to alleviate some of the math phobia she attributed to some students. She reported, "I just want to, somehow over the course of the year, alleviate any fear of math and make it interesting." (August 2006). She wanted to give her future students reasons not to give up on mathematics. She also said that she wanted to find out about students' lives and connect mathematics to what she finds out: "I want to have those overall concepts of what they're learning in class can have that link to life" (August 2006). We see here an interesting juxtaposition of, on the one hand, a strong desire for control and close management and, on the other, a desire to allow students to engage and express themselves freely through mathematics.

A Lesson Early in The School Year

The lesson observation we discuss in detail here took place after Kelly had been teaching for about five weeks. When the students arrived to class, a "Do Now" is written on the board. A Do Now is a posted problem or set of problems that students work on as they settle into their seats. It was a feature of the district mandated Workshop instructional model (Stein & Coburn, 2007; Traub, 2003) and most lessons we observed Kelly and the other MetroMath case studies teach included a Do Now (Donoghue et al., 2008). The Do Now for this lesson reads:

Solve/Evaluate.
1. $x - 4 = -9$
2. $-10 = 5y$
3. $3a + 8 = 2$
4. $-12 = -8 + 4b$

The vignette that follows occurred about 20 minutes into the 90-minute period as Kelly began to review the Do Now problems with her class. This review followed student "work time" on the Do Now, announcements, and a review of graded quiz questions. Note that in the vignette, the evaluative remarks and commentary in italics were written in the first author's field notes. The second author videotaped the lesson and added additional comments of his own after the field notes were completed.

Kelly: How did you guys solve these? Let's look at the 'Do Now.'
Many students are still writing the day's behavioral objective. *This is another instance of minor disorganization in not being clear about what students are supposed to be working on.*
Kelly: How did you guys solve number one" [i.e., $x - 4 = -9$]? [Student A], what did you do?
Student A: I back tracked
Backtracking was a procedure that Kelly and other middle grades mathematics teachers introduced as an official part of the curriculum.
Kelly: Which is?
Student A: I did –5. I put umm
Kelly: We're on number one. How did you guys do that?
Student B: It's –5.
Kelly: It is –5. How did you do that?
We see here that Kelly immediately affirms a correct answer, which is a typical feature of Kelly's instruction in all her classes and in all but one of the other seven case study Teaching Fellow's mathematics instruction.
Student C: I added 4 and that makes it –5.

Kelly: Ok. Your goal is to get the variables all on one side of the equation and get the values on the other side. So what you do to one side you have to do to the other side. That's the key to the whole solving equations with variables on both sides. What you do to one side you have to do to the other.
We see here that Kelly takes ownership of the mathematics by expanding on the students' response and putting it in the teacher's words. Again, this is typical for Kelly and seven of eight of our case studies.
Kelly: So what did we do for number two? (–10 = 5y) [**Student D**] what did you do?
Student D: I did '5 + 10.'
Kelly: Interesting.
Contrast her reaction here with the situation above where a correct answer is affirmed. Here an incorrect response gets "interesting." Student D is subsequently ignored.
Kelly (to Student E): What did you do?
Student E: It's –2.
Kelly: –2. How did you get that?
Student E: 5 times –2 is –10.
Kelly: Yeah. He just thought about it. 5 times what? That's called 'guess and check' what he did. You could divide both sides by 5.
Again we see Kelly take ownership of the mathematics discussion. Kelly also shows the calculation on the overhead but writes it in over the "Do Now" questions so everything is starting to get a little cramped, although she does use different colored markers.
Kelly: How about number three [3a + 8 = 2] What did we do? [**Student F**], what was the first thing you did?
Student F: It's –2.
Kelly: –2?
It's hard to tell here but I think [Student F] is solving by inspection or guess and check but Kelly is looking for a first step. Specifically she is looking for "subtract 8 from both sides."
Student F: What is that? positive 8?
Kelly: positive 8
Student F: negative 3
Kelly: –3? Who has a different idea, a different approach? Yes?
Student G: Subtract 8.
Kelly: Subtract 8 would be the first thing. What do we get here? To get rid of the variables we do the exact opposite. So here 'a' is being multiplied by 3 so to get rid of it, to get a by itself you divide by 3. Right?
Again we see Kelly both privileging correct responses and taking over the explanation of the mathematics from the student. Kelly also asks a "pseudo-

> *question," a typical feature of traditional instruction (Cazden, 2001) and something we regularly observe in seven of the eight cases. Kelly does not wait for students to respond to her question before responding herself.*

The above episode is representative of whole class discussions in Kelly's classroom at this early point in the school year. It also highlights a number of significant issues that surfaced in Kelly's teaching throughout her first year. In particular, despite the reform-oriented attitudes evident in her preservice interview, her whole class instruction is consistently teacher-centered. She poses mostly procedural problems that require students to rehearse previously taught methods. She controls both mathematical explanations and evaluations of responses, leaving little space for student thinking to surface or be addressed in a responsive manner. She privileges students' correct answers by leaving them unchallenged but immediately challenges incorrect answers with comments such as "interesting" and "are you sure?" Kelly silences student confusion in the apparent attempt to avoid unpredictable or uncomfortable instructional moments during whole class discussions or presentations (Leinhardt 1989; Skott, 2001; Tanner & Jones, 2000; Westerman, 1991).

A "mini-lesson," a lecture or guided discussion portion of the required workshop model lesson format, followed the whole class discussion (New York City DOE, 2006; Stein & Coburn, 2007; Traub, 2003). In the "mini-lesson," Kelly leads students through three examples of solving equations. Following the mini-lesson, Kelly assigns a number of problems from the state-required textbook and, early in the year, students either worked on these individually or with a nearby student. Rather than finding or creating tasks that might better build on students' current understandings, Kelly typically designs the "student work period" portion of the lesson around textbook problems. Further, Kelly often assigned textbook problems before she had worked through them herself and, as a result, the problems often did not relate very well to topics covered in the mini-lesson.

There is a certain irony in her instruction because, at this early point in the school year, Kelly already had fallen into a pattern of teaching that she had critiqued in her summer interview; namely, doing a couple of example problems and then asking the students to do a number of similar problems. Again, Kelly's instruction remained teacher-centered in spite of her desire to teach differently and in spite of the district mandated workshop model that was designed to limit a teacher-centered instruction (New York City DOE, 2006; Stein & Coburn, 2007; Traub, 2003). In fairness to Kelly, this traditional model of teaching is prevalent in U.S. schools (Stigler & Hiebert, 1999) and tends to override reform-oriented policies (Cohen & Hill, 1998; Spillane, 2004).

Kelly used the assigned textbook as her primary curricular resource as do many novice teachers (Kauffman, Johnson, Kardos, Liu, & Peske, 2002). Kelly's

demonstrations of new material rarely strayed from presentations of examples from the required textbook, hence were not particularly responsive to her students' prior understandings or developing ideas. As the episode above indicates, this lack of responsiveness held for whole class discussions and also during lesson components that might allow her to pay more attention to student understanding. It also held for the "student work period" that Kelly included as part of the workshop model. During this phase of the lesson, Kelly frequently told individual or small groups of students explicitly or exactly how to solve the assigned textbook problems. At other times, she provided them with enough "clues" to allow them to progress efficiently through the assigned problems. From a student perspective, it seemed that finishing assigned work took precedence over understanding it. Kelly's students quickly learned to rely on her, rather than themselves or their classmates, to complete in-class assignments.

It is important to note that Kelly continued to express a desire to teach in a more reform-oriented manner at this early point in the school year. However, she continued to be at a loss as to how she would accomplish reform teaching. In the follow-up interview to the lesson above, Kelly reported, "I still want to work on the students being more reliant on each other and less on me for answers [and] I am still struggling with making the material interesting." Kelly's students were not blank slates as they likely had learned in prior years to rely on mathematics teachers for answers to difficult problems (Stigler & Hiebert, 1999).

More positively, Kelly seemed to have developed a positive relationship with many of her students. In a post-lesson reflection, Kelly observed, "I am feeling much more confident as the weeks go by [and I am] much more relaxed with my position as the teacher, and giving the students more responsibility in their own learning environment" (Post-lesson Interview, September 2006). She reported having few substantive management issues with the focus class for this study. With this class, she was aware of "only a few management issues such as getting out of their seats." Kelly admitted that she continued to struggle with stressful and disruptive management issues in her two low-track classes in this early part of the school year.

In our post-observation reflections in the early part of the school year, we both noted how comfortable Kelly appeared in front of the focus class students. Kelly seemed to be in a reasonable position to develop as a middle school mathematics teacher and she had every reason to look to her university classes, administrators, mentors, and colleagues at the school for support in improving basic aspects of her pedagogy. Yet in a reflection on the above lesson, Kelly wrote, "no one has helped me with much of anything in terms of math content." It became apparent that, if reform-oriented instruction was the goal, Kelly's preservice training and in-service support around mathematics pedagogy was insufficient.

In summary, in the first part of the school year, Kelly struggled to varying degrees with such aspects of her teaching as implementing cognitively-demanding and -appropriate mathematics tasks, listening to students, and facilitating classroom mathematics discourse. While these are concerns for most novice teachers (Moyer & Milewicz, 2002; Tanner & Jones, 2000), in some teacher education programs, such issues around mathematics instruction are addressed in student teaching or later in in-service professional development. These pedagogical ideas clearly were not being addressed for Kelly.

Kelly's teaching was again fairly typical of other MTF. For example, seven of the eight case studies we observed generally followed the workshop model and six of these seven implemented it in teacher-centered ways manner at the outset of the 2006–2007 school year. The eighth case study rejected the workshop model and adopted an even more teacher-centered lesson format, one that provided little space for collaborative student work. All of the case study MTF struggled with classroom management issues, albeit to varying degrees. As discussed at the end of the next section, Kelly's lacking mentoring and induction experiences were also fairly typical (Foote et al., 2011).

The Middle Part of the Year

Kelly's journey through the middle part of her first year is marked by her attempts to change the teacher-centered dynamic of her class. We also describe how some early direct support she received both from the school administration and the university representative to the school diminishes over time, limiting her capacity to implement the reformist ideals she aspires to.

Supports

One of the major aspects of Kelly's first year, and a central story repeated by other novice MTF, revolves around ongoing professional development and support (Foote et al., 2011). As do participants in other early-entry alternative route programs, participants in NYCTF enter the classroom under the assumption that there will be a battery of supports in place to ensure optimal development. Induction support is particularly important given the streamlined preservice preparation in such programs (Humphrey, Wechsler, & Hough, 2008; Johnson & Birkeland, 2008). As an in-service Teaching Fellow, Kelly could expect to receive professional development and support from five distinct sources: (a) her university classes, (b) a university supervisor, (c) assistant principals, (d) a mathematics coach appointed in a general consultant role in the school, and (e) a New York City DOE mentor hired by the school. The assistant principal and coach are supports available to all teachers; however, the university supervisor and New York City DOE mentor are unique to the Teaching Fellows program.

The university classes. During her first 2 years as an in-service teacher, Kelly took two evening courses a semester at BU and a couple more over the summers. In her first semester following the preservice program, Kelly took one class in Special Education, one class in Literacy in the classroom, and one in Web Design. These classes were in addition to the six credit hours of preservice graduate coursework that Kelly completed over the summer.

Kelly was looking to her graduate classes to help her develop not as a teacher in general but specifically as a mathematics teacher. Kelly did not take a mathematics teaching methods course in her first year at BU and ended up frustrated with respect to the latter goal:

> I'm not taking any classes on how to teach math. So, how am I supposed to be a good math teacher? [BU instructors] purposefully talk about other subjects because we're like, "well you guys know about mathematics so let's talk about English, let's talk about science. Let's do a debate on technology and science classroom, or Special Ed in the classroom" …you want us to be well rounded, we're not even well rounded in our subject area yet. (May 2007)

Kelly's critique of the in-service coursework at BU represented a shift as she had been extremely positive about BU's preservice coursework and had felt well prepared for the beginning of the school year. In in-depth interviews, the other two case studies at BU were also quite critical of the BU program for similar reasons and the more general sense that much of the coursework was irrelevant to their teaching context. Reflecting on his first year at BU, a different case study reported that he "wasn't very satisfied with the program at [BU]." In contrast to Kelly, he did take one mathematics methods course during his 2 years at BU and reported that this course, unlike most, was "very good." He claimed that this course provided "great resources" and "good techniques" for "working with manipulatives, collaborative groups, how to write quality assessments, how to analyze student work, stuff like that" (May 2007).

The university supervisor. University supervisors were to visit Fellows on a monthly basis, and their formal observations impacted the decision to award full teacher certification or not. As mentioned above, Kelly had a very positive initial relationship with her BU supervisor. He had taught at Kelly's school decades earlier and continued to maintain close contacts there. He also had taught in Kelly's summer program at BU. On the survey, Kelly wrote the following: "He came in and helped with my classroom setup. Also suggestions on how to deal with bad behavior." However, the relationship lapsed as the school year progressed with Kelly commenting in a post-observation interview that

> I'm not falling on my face, so he's got other things to do. Because he spends a lot more time with [Teacher] than he ever did with me. He was here a lot in September. I really haven't seen him since. He stops in to say hello, but he even, he's sup-

> posed to see me once a month for Borough University but the last three times he's just stopped in for a lesson plans so he can write it out because he trusts me. (May 2007)

As we discuss below, the university mentor's failure to help Kelly's development as a *mathematics* teacher may have been as a result of the positive impression he had of her prior to her teaching. From our reform-oriented mathematics perspective, the problem is that his focus appeared to have been on control and survival and not on enhancing pedagogy and instructional competencies. Hence, Kelly was lacking on the support she need to develop as a reform mathematics teacher. Although we can assume these mentors left Kelly alone because she demonstrated basic survival skills, it might imply that other beginning teachers are not necessarily getting coaching in mathematics pedagogy and content.

Assistant principals. There were two assistant principals in the school who worked with new teachers, including Kelly, on and off throughout the year. Her somewhat cynical summary of the extent to which they helped was, "they saw me in September or October, they realized I was competent…and then they've never helped me at all" (May 2007). The relationship seemed to improve in the second half of the school year with the assistant principal for mathematics was coming into her class occasionally. Mid-year Kelly reported, "I asked [him], 'can you stop in and see how things are going?'…So he's stopped in a few times and gave me some pointers" (May 2007). She considered the specific advice he gave her about her mathematics instruction to be useful. As she related:

> He was telling me about how to develop from one idea to the next, connect, because I wasn't connecting. …I was reviewing graphing and he said this is a good opportunity to do positive and negative numbers. He said that they're not good at it, so if you are creating tables [of values] you should also try, find time to stick in a little revision on adding and subtracting integers. I was like, "Oh, I never even thought about doing that. (May 2007)

The assistant principal thought highly of Kelly, and commented that she was "highly motivated, very effective, very dedicated. She's excellent. She's excellent. She has tremendous skills as a first year teacher" (March 2007). He continued: "What has impressed me is her knowledge. We have her teaching one of the more advanced eighth grade classes and teaching them high school. [I am impressed with] her knowledge in conveying the lesson, getting her lesson across to the kids" (March 2007). As noted in the previous section, our reform-tinted observations did not support as glowing an assessment, and Kelly herself has expressed concern about her own instruction and preparation in this regard.

The mathematics coach. The mathematics coach, appointed in a general consultant role in the school (e.g., to help align mathematics instruction with state standards), provides another level of support for novice and experienced mathe-

matics teachers alike. While many coaches are assigned to schools by the New York City DOE, other schools, such as Kelly's, hire their own coaches as part of decentralization efforts (O'Day, Bitter, & Gomez, 2011). For the most part, Kelly did not find the coach to be useful: "She was supposed to have come to my classroom once a week [but it never happened]" (May 2007). Nevertheless, Kelly found the coach was helpful on occasion, for example, with some suggestions, discussed below, for project work she could do with the students.

DOE mentors. By state law, the New York City school district was to provide the Fellows with mentors. This mentorship was to be more extensive than the university-based mentorship. However, Kelly had a DOE mentor who, instead of visiting her bi-monthly as required, observed Kelly teach one full lesson per month. On the in-service survey Kelly wrote, "My mentor was great at helping me with personnel things-days off, death in the family, can I change schools, etc." (May 2007). Like many mentors, Kelly's carried around materials developed by The New Teacher Center (NTC, 2006). Kelly wrote: "This massive book which we went through was useless. It was better to just talk about what was happening and my needs."

When we consider these five supports together, except for rare occasions, it appeared no one was systematically examining Kelly's teaching and helping her improve her general and mathematics specific instructional skills. Because, in comparison to other new teachers in the school, her classroom management skills were seen as good, and she had a positive relationship with many of her students, she gained the reputation of being a successful teacher and administrators apparently felt their time would be better spent elsewhere. Unfortunately, this inadequately applied support system did not allow Kelly to fully develop as a mathematics teacher. With regard to a triumvirate of basic pedagogy: norms, tasks, and discourse (Henningsen & Stein, 1997), Kelly's training (together with her background and personality) was sufficient to help her achieve reasonable success with norms but left her struggling with tasks and discourse.

Kelly's experiences with mentoring and induction were typical. As we report elsewhere (Foote et al., 2011), the first-year MTF report typically receiving formal mentoring once or twice a month. While 3 in 10 Teaching Fellows report meeting with their mentor on a weekly basis, an equal amount report receiving no formal mentoring at all in the first year. Like Kelly, even those who received regular mentoring did not find it to inform their instructional practice.

Attempts to change the class dynamic

After a few months of experience, when she had developed good working relationships with students, Kelly attempted to change the dynamic of her class through the incorporation of more group work. She did so, in part, to conform to the culture of the school and the district-required workshop model, a model that

she expressed mixed feelings about. Indeed, on the in-service survey, Kelly "strongly agreed" with the statement "your school administration makes sure you teach with the workshop model." Kelly again was typical in this regard as the majority of Kelly's cohort we surveyed either "strongly agreed" or "agreed" with this statement. She also attempted to make instructional changes to facilitate more student-to-student communication and collaboration. In a mid-year interview, Kelly reported her attention to group work was working to some extent:

> The amount of individual questions I have to answer [has gone down] as I have been stressing working with their groups. However, with that emphasis on group work, I am seeing a lot of work that looks identical and so I worry there is too much copying going on and not enough collaboration.

Classroom observations over this time period indicated that while Kelly had seated her students together in pairs and asked them to rely on their partners and other nearby pairs, she had not changed the types of tasks she gave students nor the reward structures (as individual rather than collaborative performance was graded), so many continued to work individually. As was the case in lessons from earlier in the year, Kelly gave her students tasks that generally consisted of a set of problems chosen in a rather ad hoc fashion from the textbook.

Later in the year, based on comments from her mathematics coach, Kelly assigned group-oriented activities that required students to work together. For example, in one lesson she had groups collaborate on a poster that represented a set of data by using either a bar chart or a pie chart. She recalled:

> So, I asked the math coach what to do and she said choose things that [the students] know already like order of operations or reading graphs and that kind of stuff and make projects that you don't have to teach them anything that they can just work on their own for the double period. And that you're reinforcing skills that they already know (May 2007)

Evidently, Kelly did not see collaborative student activities as spaces to advance mathematical ideas. She implied that mathematical ideas only develop when the teacher uses direct instruction. During the collaborative project-based lessons we observed, Kelly spent more time commending students for their presentation style than for mathematical understanding. Student mathematical errors often went uncommented on or uncorrected in group activities and presentations. Such errors were not used to further student understandings. In interviews, Kelly seemed generally aware of the limitations of these lessons. Reflecting on what the students would have learned from one lesson, she stated:

> Not a whole lot. They, I mean the ones that did the percents got a quick review of that. You know what, not much. I mean they all knew how to do it, so I guess they got to look at how their class did the problems. (March 2007)

While the shift toward more group work resulted from Kelly's desire to change the classroom dynamic, it seems also that she neither have the requisite understandings nor a complete commitment to this approach. She concluded that the students do not learn a lot when she is not directly "teaching them anything." We see this as symptomatic of Kelly's view of herself as the holder of knowledge, which she has a duty to teach to the students.

A Lesson Late in the School Year

In this section, we present a typical lesson that Kelly taught towards the end of the school year. We again note that, by mid-year, we see Kelly as a teacher who began the year with a good teaching presence in the classroom, a commitment to improving instruction, and a willingness to learn. It was also clear that, earlier in the year, she was falling into many of the common difficulties of novice teachers in terms of her relatively weak command of content knowledge for teaching, pedagogical skills such as questioning, and a tendency to take over explanations from students. She continued to rely to a large extent on the district-required textbook for lesson plans—although, she expresses ambivalence about the value of this textbook in interviews and on the survey. In part, because she has not received adequate support, Kelly has not developed in terms of task selection, task implementation, and facilitation of discourse.

The "Do Now" written on the board is:

1. 20 rolls cost $4.97 for Brand A and 15 rolls cost $3.99 for Brand B. Which brand is cheaper and by how much?

2. Represent as an expression: One side of a square is *t*. What is four times the perimeter minus 10?

The focus of the lesson is unit conversion or proportional reasoning for comparison as the first Do Now problem indicates. Kelly includes the second problem for the purposes of curriculum spiraling or review. After providing the students a few minutes to get settled and begin working on the Do Now, Kelly calls on students to review the two problems. Kelly searches for and repeats correct answers from students as she stands in front of the class. She does not write anything down to keep track of student responses.

Before class, Kelly wrote solutions to two unit conversion examples on a poster, which she next displays on the board. These are routine unit conversion problems (e.g., comparing 62 inches and 2 yards by converting yards to inches) but they involve quite a bit of formal notation and manipulation, and the work seems to be beyond the students' current level of understanding. Kelly reads out the problems and talks through her solutions without asking any questions. She then goes through a third example by reading it out from the book but without writing anything on the board. Effective board work is not a skill that Kelly has developed very well. She has developed the habit of requiring students to listen to her and follow along in a text without writing anything down. Limited board writing places a considerable cognitive burden on the students and it is a burden that many appear unable to bear much of the time. After a few heads go down on desks, Kelly next asks students to follow along in the textbook.

Kelly then sets the students the task of working on eight similar unit conversion problems from a test-prep booklet. Some time later, a small group of students has called Kelly over to discuss question number six: A pile of dimes weighs 1000 grams. If each dime weighs 2.3 grams, how much money is in the pile?

[As above the evaluative comments in italics come from the researcher's field notes.]

Student A: I got two thousand three hundred but it's got to be [inaudible]
Kelly: A thousand is what? How many? In a?
Student A: Gram.
Above is the first instance of many in this episode where Kelly's questioning technique is to say an almost complete sentence but substituting "what" for the last word and asking the students to fill in that word. She is" funneling" them towards the correct answer.
Kelly: in a gram. But you have: each dime weighs 2.3 so you want to take the total weight and do what?
Student A: times?
Kelly shakes her head "no."
Student A: divide?
The students have been doing a number of these problems and almost all of them involve the students either dividing or multiplying two quantities presented in the problem. [Student A] knows that she must either multiply or divide so she picks one. She also knows that Kelly will tell her if she is correct or not. Does [Student A] have a reason for saying "multiply" first? Kelly (almost?) never asks students "Why?" so we (and Kelly) do not get insight into student thinking.

Kelly: Divide. [affirms] because you want to know how many dimes weighs a thousand grams.
Student A: So I would divide it?
Kelly: Right now you're…
We see here a common Kelly behavior, which is to take over the conversation. Notice how much Kelly speaks and how little the students speak. Notice also that the students are never asked to explain anything but are brought along at each step by Kelly.
Some laughter at tables in middle of the classroom. Kelly turns and glares, a few students make eye contact with her.
Kelly: You can stay after if you want to play around. We don't have time for this.
This incident may point to some of the lack of quality in the discussions that Kelly has with the students. It seems that she is sometimes anxious to get through discussions quickly and to move the students forward to the "student work period" because she is anxious about the behavior of other students in the class.
Kelly turns her attention back to the girls she's been working with.
Kelly: OK, so you divide it. What do you get?
Student B (works on the calculator)**:** Divide what?
Kelly [to Student A]**:** divide what?
Student A: You don't do a thousand?
Kelly nods.
It seems that Student A really doesn't know what's going on here but through her conversation with Kelly she can get through the problem and get the right answer. At no stage is Student A really questioned about the problem or is any attempt made to make sense of the problem by analogy with smaller numbers or estimation of what might make sense as an answer.
Meanwhile Student B has finished working on the calculator and shows the display to Kelly. Kelly points at calculator screen: that's right.
Student A looks intently at the calculator and then leaves and goes to her own desk.
Student A is seemingly content at this point. It's not clear that she understands the problem but she does have the answer.
Kelly: Now, so the only question is what are your answers in?
Student A: Money
Kelly: They're in money but they're in dollars right? And you're in dimes so how many dimes are in a dollar.
We see again here how Kelly drives the entire episode forward. Kelly is the one who points out that there is an issue still to be addressed and Kelly is the one who points out the direction for addressing the issue.

Student B: Ten.
Kelly: Ten. So you need to do what now.
Student C: Divide?
Kelly: By?
One can easily imagine that if Student C had said "multiply?" then Kelly would have shook her head and Student C would have said, "divide?"
Student C: ten.
Student B still looks puzzled.
It is not clear that Student B is clear on what the answer is. One might argue that she comes out of this episode the best in that she is still confused! Student A and Student C have the answer but it is not at all clear that they have engaged with the problem in any meaningful way.

This teaching episode was representative of many that took place during student work time in the last quarter of the school year. By this time, Kelly has developed norms in her class such that she can have the students working in pairs and has the time to get involved in quite lengthy discussions with small groups of students with only minimal disruption from outside. We see, however, that the lesson was procedural in focus; Kelly introduces an algorithm for solving unit conversion problems and does so without building on students' prior understandings of, for example, money or real-world experiences with measurement. The tasks she sets her students also are highly "proceduralised" as she expects students to follow the approach that was outlined in the textbook. Further, during student work time her discourse and question techniques serve to "funnel" (Wood, 1998) students toward correct answers. Typical of many U.S. mathematics teachers (Stigler & Hiebert, 1999), Kelly does not want her students to experience a whole lot of frustration in learning new mathematical ideas. Stigler and Hiebert (1999), among others, have noted that many U.S. mathematics teachers may pose what might be more conceptually challenging mathematics, but are very quick to break the problem down into steps and procedures in order to limit the amount of time that students struggle intellectually with the mathematics.

End of Year Interview

An interview with Kelly at the end of the school year showed Kelly to be unhappy with many of her experiences in her first year of teaching. One of her greatest concerns was that the various supports, inasmuch as they were there for her, were providing help that was too general and not focusing enough on mathematics. In terms of her in-service graduate coursework at BU, she asked: "I'm not taking any classes on *how to teach math*. So, how am I supposed to be a good math teacher" [emphasis added]? She further complained that "the test is all the school cares about and they make that obvious." She felt that she was progressing

as a teacher in general terms such as having control of the classroom but admitted that she struggled in her goals of finding real-world problems and helping alleviate students' fear of mathematics.

At the end of the school year, Kelly resigned her position at her school and joined another school where she perceived the mathematics department to be more coherent and the administration to be more supportive of teachers' development. Our MetroMath survey study indicates that more than 15% of Kelly's MTF cohort did not return for their second year of teaching and another 20% changed schools (both voluntarily or otherwise) before they began their second year of teaching (Donoghue et al., 2008).

Discussions and Implications

With two in three new mathematics teachers in New York City public schools presently coming through the Teaching Fellows program and with such early-entry alternative route programs increasingly common, particularly in large urban districts, there is a need for careful research of the experiences of such teachers in their early years of teaching.

The research presented here tells the story of a typical experience of a new mathematics Teaching Fellow in a New York City public school. The story we tell is designed to give the reader insight into what the mathematics teaching of a typical recruit in an alternative certification program might look like. The story is of a teacher who we see as having the potential to be an effective middle grades teacher, but who was failed by the system of induction supports that were designed to help her reach that potential. We see in the evidence presented that despite a full set of university courses and at least three individuals who had supportive or mentorship roles, there was, in fact, almost no situation in which a mentor or other qualified individual was carefully examining Kelly's teaching and helping her develop pedagogical skills such as questioning, board work, and incorporation of students' mathematical ideas. Other skills left under developed were choosing tasks that engage students in higher-order thinking, novel problem solving, and communication of their developing ideas about mathematics. What is most striking about Kelly's case is that she is clearly conscious of the failure of the system, as she asks: "When am I going to learn to be a mathematics teacher?"

Many New York City public schools are difficult to staff and have difficulty retaining staff. To address this shortage, it is important that all aspects of training and support for incoming teachers are designed and implemented in such a way that allows for potential to be developed, for teachers to be supported, and students to have effective experiences in mathematics classes. The evidence of this case study suggests that such a system is not in place for some new Teaching Fel-

lows in the New York City public school system resulting in students not benefitting from effective instruction.

Students in high-needs urban schools face a steady stream of inexperienced and under-qualified teachers (Darling-Hammond, 2004; Peske & Haycock, 2006). While they cannot address the former issue, NYCTF and other high profile alternate route programs promise to address the latter issue by recruiting candidates who have prestigious educational credentials (e.g., having graduated from highly ranked universities, having scored in the top quartile on the SAT exam).

Early-entry alternative route programs operate on the assumption that the "highly qualified" candidates they attract can be readied to teach in streamlined preservice programs and, with the proper induction support, learn to teach "on the job." This case study, in particular when combined with our broader research on MTF, challenges such assumptions on several levels. First, NYCTF program attracts a large number of recent college graduates and other candidates who, like Kelly, lack both strong backgrounds in mathematics and prior work experience relevant to mathematics teaching (Donoghue et al., 2008). Second, our research indicates that MTF begin teaching without being well versed in mathematics-specific teaching methods (Brantlinger et al., 2009). Third, more often than not, the promised mentoring and induction support for Teaching Fellows fails to materialize, leaving new MTF to fend for themselves (Foote et al., 2011). Research on NYCTF and other early-entry alternative route programs similarly finds that most are unable to provide adequate mentoring and induction support for their candidates (Humphrey et al., 2008; Veltri, 2010). And finally, novice MTF rely on teacher-centered teaching scripts that contradict their own visions of effective instruction and, in this case, visions of effective instruction articulated in district policy documents (New York City DOE, 2006; Stein & Coburn, 2007; Traub, 2003).

The results presented here are intended to contribute to the necessary understanding of the effect of alternative certification models on mathematics teaching in urban environments. With ever increasing numbers of mathematics teachers coming from such ranks this understanding is important for both teacher education programs and school districts as they adapt to the changing pathway to certification landscape.

Acknowledgments

This material is based upon work partially supported by the National Science Foundation under Grant No. ESI-0333753.

References

Boaler, J. (2002). Learning from teaching: Exploring the relationship between reform curriculum and equity. *Journal for Research in Mathematics Education, 33*, 239–258.

Boaler, J. (2006). Urban success. A multidmensional mathematics approach with equitable outcomes. *Phi Delta Kappan, 87*, 364–369.

Boaler, J., & Staples, M. (2008). Creating mathematical futures through an equitable teaching approach: The case of railside school. *Teachers College Record, 110*, 608–645.

Boyd, D., Grossman, P., Lankford, H., Loeb, S., & Wyckoff, J. (2006). How changes in entry requirements alter the teacher workforce and affect student achievement. *Education Finance and Policy, 1*, 176–216.

Brantlinger, A., Cooley, L., & Brantlinger, E. (2010). Families, values, and class relations: The politics of alternative certification. In M. Apple, S. Ball, & L. Gandin (Eds.), *International Handbook of the Sociology of Education: Critical Research for Social Justice.* New York: Routledge.

Brantlinger, A., Cooley, L., & Smith, B. (April, 2009). *Preservice preparation of mathematics candidates in the New York City Teaching Fellows program.* Paper presented at the annual meeting of the American Educational Research Association, San Diego, CA.

Cazden, C. (2001). *Classroom discourse: The language of teaching and learning* (2nd ed.). Portsmouth NH: Heinemann.

Chin, E., & Young, J. W. (2007). A Person-oriented approach to characterizing beginning teachers in alternative certification programs. *Educational Researcher, 36*, 74–83

Cohen, D. K. (1988). Teaching practice: Plus change. In P. W. Jackson (Ed.), *Contributing to educational change: Perspectives on research and practice* (pp. 27–84). Berkeley, CA: McCutchan.

Cohen, D. K., & Hill, H. C. (1998). *State policy and classroom performance: Mathematics reform in California*, Consortium for Policy Research in Education (CPRE Policy Briefs RB-23-May). Philadelphia, PA: Graduate School of Education, University of Pennsylvania.

Costigan, A. (2004). Finding a name for what they want: A study of New York City's Teaching Fellows. *Teaching and Teacher Education: An International Journal, 20*, 129–143.

Cwikla, J. (2007). The trials of a poor middle school trying to catch up in mathematics: Teachers' multiple communities of practice and the boundary encounters. *Education and Urban Society, 39*, 554–583.

Darling-Hammond, L. (2004). Inequality and the right to learn: Access to qualified teachers in California's public schools. *Teachers College Record, 106*, 1936–1966.

Darling-Hammond, L., Chung, R., & Frelow, F. (2002). Variation in teacher preparation: How well do different pathways prepare teachers to teach? *Journal of Teacher Education, 53*, 286–302.

Darling-Hammond, L., Holtzman, D. J., Gatlin, S. J., & Heilig, J. V. (2005). Does teacher preparation matter? Evidence about teacher certification, Teach for America, and teacher effectiveness. *Education Policy Analysis Archives, 13*(42).
Retrieved from http://epaa.asu.edu/epaa/v13n42/.

Donoghue, E., Brantlinger, A., Meagher, M., & Cooley, L., (March, 2008). *Teaching mathematics in urban schools: The New York City Teaching Fellows program.* Paper presented at the annual meeting of the American Educational Research Association, New York, NY.

Emerson, R., Fretz, R., & Shaw, L. (1995). *Writing ethnographic fieldnotes.* Chicago, IL: University of Chicago Press.

Flores, M. A. (2006). Being a novice teacher in two different setting: Struggles, continuities and discontinuities. *Teachers' College Record, 108*, 2021–2052.

Foote, M., Brantlinger, A., Haydar, H., Smith. B., & Gonzalez, L. (2011). Are we supporting teacher success?: Insights from an alternative route mathematics teacher certification program for urban public schools. *Education and Urban Society, 43*, 396–425.

Goodnough, A. (2000a, July 2). Wanted: Bored professionals who have teaching in mind. *New York Times*. Retrieved http://www.nytimes.com/2000/07/02/nyregion/wanted-bored-professionals-who-have-teaching-in-mind.html?scp=1&sq=Wanted:%20Bored%20Professionals%20Who%20Have%20Teaching%20in%20Mind.%20&st=cse.

Goodnough, A. (2000b, July 15). Regents create a new path to teaching. *New York Times*. Retrieved from http://www.nytimes.com/2000/07/15/nyregion/regents-create-a-new-path-to-teaching.html?pagewanted=all&src=pm.

Goodnough, A. (2004). *Ms. Moffett's first year: Becoming a teacher in America*. New York: Public Affairs.

Haberman, M. (1991). The Pedagogy of poverty versus good teaching. *The Phi Delta Kappan, 73*, 290–294.

Henningsen, M., & Stein, M. K. (1997). Mathematical tasks and student cognition. *Journal for Research in Mathematics Education, 28*, 524–549.

Humphrey, D. C., Wechsler, M. E., & Hough, H. J. (2008). Characteristics of effective alternative teacher certification programs. *Teachers College Record, 110*, 1–63.

Johnson, S., & Birkeland, S. (2008). Is fast-track preparation enough? It depends. In P. Grossman & S. Loeb (Eds.), *Alternative routes to teaching. Mapping the new landscape of teacher education* (pp. 101–128). Cambridge, MA: Harvard Education Press.

Kauffman, D., Johnson, S. M., Kardos, S. M., Liu, E., and Peske, H. G. (2002). "Lost at sea": New teachers' experiences with curriculum and assessment. *Teachers College Record, 104*, 273–300.

Keller, B. (2000, June 14). States move to improve teacher pool. *Education Week*, 1, 20.

Kennedy, M. (1999). The role of preservice teacher education. In L. Darling-Hammond & G. Sykes (Eds.) *Teaching as the learning profession: Handbook of teaching and policy* (pp. 54–88). San Francisco, CA: Jossey Bass.

Kramer, M. (2010). Statement to the U.S. House of Representatives Appropriations Subcommittee on Labor, Health and Human Services, Education and Related Agencies Field Hearing. Retrieved from http://www.mccollum.house.gov/index.php?option=com_content&task=view&id=867&Itemid=53.

Labaree, D. (2005). Progressivism, schools, and schools of education: An American romance. *Paedagogica Historica, 41(1&2)*, 275–288.

Lankford, H., Loeb, S., & Wyckoff, J., (2002). Teacher sorting and the plight of urban schools: A descriptive analysis, *Educational Evaluation and Policy Analysis, 24*, 38–62

Leinhardt, G. (1989). Math lessons: A contrast of novice and expert competence. *Journal for Research in Mathematics Education, 20*, 52–75.

Levin, J., & Quinn, M. (2003). *Missed opportunities: How we keep high-quality teachers out of urban schools.* New York: The New Teacher Project.

Levy, H. (2000, September 9). Why the best don't teach. *New York Times.* Retrieved from http://www.nytimes.com/2000/09/09/opinion/why-the-best-don-t-teach.html.

Lipman, P. (2004). *High stakes education: In equality, globalization, and urban school reform*. New York: Routledge.

Liu, E., Rosenstein, J. G., Swan, A. E., & Khalil, D. (2008). When districts encounter teacher shortages: The challenges of recruiting and retaining mathematics teachers in urban districts. *Leadership and Policy in Schools, 7*, 296–323.

Lortie D. (1975). *Schoolteacher*. Chicago, IL: University of Chicago Press.

Moyer, P. S., & Milewicz, E. (2002). Learning to question: Categories of questioning used by preservice teachers during diagnostic mathematics interviews. *Journal of Mathematics Teacher Education, 5*, 293–315.

National Council on Teacher Quality. (2006). *What education schools aren't teaching about reading and what elementary teachers aren't learning.* Washington, DC: National Council on Teacher Quality.

National Council of Teachers of Mathematics (1989). *Curriculum and evaluation standards for school mathematics.* Reston, VA: National Council of Teacher of Mathematics.

National Council of Teachers of Mathematics (1991). *Professional standards for teaching mathematics.* Reston, VA: National Council of Teachers of Mathematics.

National Council of Teachers of Mathematics (2000). *Principles and standards for school mathematics*. Reston, VA: National Council of Teachers of Mathematics.

New Teacher Center. (2006). *Understanding New York City's groundbreaking induction initiative: Policy implications for local, state, and national education leaders.* Santa Cruz, CA: New Teacher Center.

New York City Teaching Fellows (NYCTF). (2010). *NYC teaching fellows: Our impact*. Retrieved from https://www.nycteachingfellows.org/purpose/impact.asp.

New York City Department of Education (New York City DOE). (2011). *School Web Sites*. http://schools.nyc.gov/Offices/EnterpriseOperations/DIIT/WebServices/DynamicSchoolPortals/default.htm.

Newmann, F. M., Lopez, G., & Bryk, A. S. (1998). The quality of intellectual work in Chicago schools: A baseline report. Chicago, IL: Consortium on Chicago School Research. Retrieved from http://ccsr.uchicago.edu/publications/p0f04.pdf.

O'Day, J. Bitter, C., & Gomez, L. (Eds.). (2011). *Education reform in New York City: Ambitious change in the nation's most complex school system.* Cambridge, MA: Harvard Education Press.

Peske, H., & Haycock, K. (2006). *Teaching inequality: How poor and minority students are shortchanged on teacher quality*. Washington, DC: The Education Trust.

Rivkin, S., Hanushek, E., & Kain, J. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*, 417–458.

Rockoff, J. E. (2004). The impact of individual teachers on student achievement: Evidence from panel data. *The American Economic Review, 94*, 247–252.

Rotherham, A. (2008). *Achieving teacher and principal excellence: A guidebook for donors.* Washington DC: Philanthropy Roundtable.

Sanders, W., & Horn, P. (1994). The Tennessee value-added assessment system (TVAAS): Mixed methodology in educational assessment. *Journal of Personnel Evaluation in Education, 8*, 299–311.

Schoenfeld, A. (2002). Making mathematics work for all children: Issues of standards, testing, and equity. *Educational Researcher, 31*(1), 13–25.

Skott, J. (2001). The emerging practices of a novice teacher: The roles of his school mathematics images. *Journal of Mathematics Teacher Education, 4*, 3–28.

Spillane, J. (2004). *Standards deviation: How schools misunderstand educational policy.* Cambridge, MA: Harvard University Press.

Stein, J. (2002). *Evaluation of the NYCTF program as an alternative certification program*. New York: New York City Board of Education.

Stein, M., & Coburn, C. (2007). *Architectures for learning: A comparative analysis of two urban school districts*. Seattle, WA: University of Washington, Center for the Study of Teaching and Policy.

Stein, M., Grover, B. W., & Henningsen, M. (1996). Building student capacity for mathematical thinking and reasoning: An analysis of mathematical tasks used in reform classrooms. *American Educational Research Journal, 33,* 455–488.

Stein, M., & Lane, S. (1996). Instructional tasks and the development of student capacity to think and reason: An analysis of the relationship between teaching and learning in a reform mathematics project. *Educational Research and Evaluation, 2*, 50–80.

Stigler, J., & Hiebert, J., (1999). *The teaching gap.* New York: The Free Press.

Tanner, H., & Jones, S. (2000). *Becoming a successful teacher of mathematics*. London, United Kingdom: Routledge/Falmer.

Traub, J. (2003, August 3). New York's new approach. *New York Times.* Retrieved from http://www.nytimes.com/2003/08/03/edlife/03EDTRAUB.html.

U.S. Department of Education. (2010). *A blueprint for reform: The reauthorization of the Elementary and Secondary Education Act.* Washington, DC: U.S. Department of Education.

Veltri, B. T. (2008). America teachers in poor, urban schools teaching or service?: The site-based realities of Teach for America. *Education and Urban Society*, *40*. 511–542

Veltri, B. T. (2010). *Learning on other people's kids: Becoming a Teach for America Teacher*. Charlotte, NC: Information Age.

Walsh, K., & Jacobs, S. (2007). Alternative certification isn't alternative. Washington, DC: Thomas B. Fordham Institute & National Council on Teacher Quality.

Weiss, I., Pasley, J., Smith, S. P., Banilower, E., & Heck, D. (2003). *Looking inside the classroom: A study of K–12 mathematics and science education in the United States.* Chapel Hill, NC: Horizon Research.

Westerman, D. (1991). Expert and novice teacher decision making. *Journal of Teacher Education, 42*, 292–305.

Wood, T. (1998). *Alternative patterns of communication in mathematics classes: Funneling or focusing.* In H. Steinbring, M. Bartolini-Bussi, & A. Sierpinska (Eds.), Language and communication in the mathematics classroom (pp. 167–178). Reston, VA: National Council of Teachers of Mathematics.

Zeichner, K., & Schulte, A. (2001). What we know and don't know from peer-reviewed research about alternative teacher certification programs. *Journal of Teacher Education, 52,* 266–282.