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RECONSIDERING THE STUDY OF MATHEMATICS INSTRUCTIONAL PRACTICES: THE IMPORTANCE OF CURRICULAR CONTEXT IN UNDERSTANDING LOCAL AND GLOBAL TEACHER CHANGE

ABSTRACT. This paper discusses the case of one teacher, Jackie, whose instructional practices illuminate the importance of textbooks and student/parent expectations in shaping pedagogy. Jackie teaches in the Plainview district, which offers parents and students a choice between a reform-oriented, integrated curriculum (*Core Plus*) and a more conventional algebra sequence (the University of Chicago series). Each day, Jackie teaches two very different sections of accelerated eighth-grade mathematics using each of these curricular materials. Drawing from students' survey responses, classroom observations, and teacher interview data, we show ways in which Jackie's pedagogy differs considerably between the two courses and we shed light on reasons underlying this variation.By examining one teacher who enacts different practices in each of the two curricular contexts, this paper highlights factors that contribute to teachers' enacted curricula – factors that have been understated in previous mathematics education research on teacher development. The study establishes the importance of distinguishing between *global* and *local* teacher change, and suggests implications for future studies of teaching and reform.

KEY WORDS: contextual factors, enacted or implemented curriculum, reform, teacher change, teacher development, parents

INTRODUCTION

Over the past twenty years, scholars have studied factors that enable teachers to move from ''traditional'' to ''reform-oriented'' forms of mathematics teaching. ''Traditional'' mathematics teaching is usually typified as ''provid[ing] clear, step-by-step demonstrations of each procedure, ...provid[ing] adequate opportunities for students to practice the procedures, and offer[ing] specific corrective support when necessary'' (Smith III, 1996, p. 390). In contrast, ''reform-oriented'' teaching – as

defined by the National Council of Teachers of Mathematics (NCTM) *Standards* documents (1989; 1991; 2000) in the United States – has shifted the teacher's role to be that of a facilitator who selects tasks, draws on multiple representations, guides student thinking, asks mathematical questions, and encourages classroom discourse. We begin this paper by describing these two types of teaching practices, as they have typically been portrayed. However, we want to make it clear that we do not see these practices as dichotomous. As is clear in this study, a single teacher can utilize a wide range of methods, combining both ''traditional'' and ''reform-oriented'' practices.

In addition to research on teacher change, a parallel line of work involves the development and study of curricular options available to teachers. For instance, in the United States, curriculum materials that were available commercially are now in competition with materials that were developed with funding from the National Science Foundation (NSF) to embody the spirit of the reform documents published by the NCTM. In much literature, these curriculum materials have been referred to both as ''NSF-funded'' or as ''reform-oriented''. We will use the term ''reform-oriented'' throughout this paper to refer to the materials that were developed with NSF funding.

The mathematics education research community has begun to investigate what makes these reform-oriented materials different from curriculum materials not funded by NSF. For example, Remillard (1991) has shown that commercially available curriculum materials typically portray skills in isolation of meaningful applications and prompt more traditional roles for teachers and students, whereas some of the reform-oriented elementary curricula provide alternatives to these perspectives.

Where these two bodies of literature intersect is in examinations of teachers' interactions with and use of curriculum materials. Studies on curriculum materials that preceded national standards in mathematics and science education suggested that textbooks can impact both what and how teachers teach, as well as what and how students learn (Alexander & Kulikowich, 1994; Begle, 1979; Tobin, 1987; Usiskin, 1985). Current literature indicates that teachers will differ in their implementation of reform-oriented curriculum materials, in part because they have different conceptions (i.e., beliefs and knowledge) of mathematics (e.g., Lloyd & Wilson, 1998; Remillard, 2000, 2002). However, the nature of the interaction between curriculum materials and mathematics teachers, especially at the secondary level, has not been explored in depth in current literature. In fact, some authors

have argued that we, as a research community, have a long way to go in conceptualizing what we mean when we say someone is ''using'' curriculum materials (see Remillard, 2005).

In these two parallel lines of research, an important factor that has been de-emphasized is that of context. We purposely use the phrase ''curricular context'' in our title because, as this study highlights, teacher change and curriculum implementation do not take place in a vacuum. There are important contextual factors that need to be considered when studying these phenomena, including stakeholders' perspectives and the history of mathematics instructional reform in the given location. The ''curricular context'' is ever present and must be part of this discussion. Much of the research on teacher change has focused on *global* changes[1] – i.e., shifts in teachers' over-arching orientation toward teaching, which involve long-term changes in beliefs, values and practices. Such shifts can often be identified by observing practices that were not previously part of the teacher's repertoire and through changes in the ways in which teachers talk about teaching. However, this study illuminates how the curricular context can influence teachers' practices at a *local* level. By *local* changes, we mean fluctuations that occur from class-to-class and from day-to-day based on the contextual conditions in which a teacher works, including changes in students, administrative or parental pressure, or curriculum materials. Although a teacher's global orientation toward teaching heavily influences instructional practices, contextual factors can prompt local changes in teachers' enacted instruction.

This paper offers an empirical investigation of one teacher's implementation of two different sets of curriculum materials. The focus teacher aligns herself with reform-oriented beliefs and practices, yet she is required to teach both Algebra I using a traditional curriculum as well as an integrated mathematics course using a reform-oriented curriculum, in a school that offers students and parents a choice between these two options.[2] The purpose of this study was to examine the nature of her teaching in each of these curricular contexts, focusing on the similarities and differences that occur as she implements the two different curricula. We also consider, from the teacher's perspective, why the differences occur. The ways in which the teacher's instructional practices shift from one class period to the next raise the importance of distinguishing between global and local teacher change.

LITERATURE ON TEACHER CHANGE

We draw, in part, from bodies of literature related to facilitating teacher change in our analysis and interpretations. Scholars have studied many critical levers of teacher change, including school level supports and policies (Newmann & Associates, 1996), teachers' beliefs or conceptions (Cooney & Shealy, 1997; Ernest, 1989; Stipek, Givvin, Salmon, & MacGyvers, 2001; Wilson & Cooney, 2002), and professional development and support for teachers as they implement reform-oriented curriculum materials (Clarke, 1997; Grant & Kline, 2000; Jones & Nelson, 1992; Lloyd, 2002). There are two themes in the literature on teacher change that are relevant here.

First, some of this literature begins to outline developmental stages that teachers move through as they try to change their teaching practices (e.g., Franke, Fennema, & Carpenter, 1997; Goldsmith & Schifter, 1997; Schifter, 1995; Spillane & Zeuli, 1999; Thompson, 1991). For example, Schifter (1995) talks specifically about the "conceptions of mathematics [that] teachers enact in practice" (p. 18) as they move from "an ad hoc accumulation of facts, definitions, and computation routines" to being more attuned to "systematic mathematical inquiry organized around investigations of 'big' mathematical ideas" (p. 22). Most of this literature implies that individual teachers have a particular pedagogical stance that, although it is evolving over time, is consistent enough at any particular point in time to be described and categorized somewhere on a traditional-reform continuum. In fact, Schifter (1995) states that while "a teacher might enact different conceptions of mathematics on different days, there tends to be a 'center of gravity,' a conception that guides a teacher's major instructional goals over an extended period of time, an overarching agenda for student learning" (p. 22). The idea of "center of gravity" relates to what we call global change in the introduction. We return to this quote later in the discussion to highlight another point being made that we think this case draws particular attention to.

A second related theme is that literature on teacher change typically draws from data collected in only one class period per day for each focus teacher. This research design is sensible in studies focusing on elementary school teachers, who typically teach just one mathematics class period each day. In the US, however, the school day in secondary schools (students aged 12–18) is divided into about seven class periods, each about 45 to 50 min long. Typically secondary mathematics teachers are assigned six periods of mathematics to teach

daily, during which they see different students in each class period. Although relatively sparse, literature on secondary mathematics teacher change also typically examines teachers in only one of their many mathematics class periods per day. This research design, again, conveys the assumption that a teacher's particular pedagogical stance is reasonably consistent throughout the teaching day, ignoring possibly substantial local changes in teachers' practices. Many factors could influence how each class period plays out on a given school day. The assumption that, by observing one class period, it is possible to understand a secondary mathematics teacher's instructional practice, more broadly, might oversimplify the study of such a complex endeavor.

Taken together, the literature on mathematics teacher change conveys an underlying assumption that individual teachers have an epistemological and pedagogical orientation that permeates their mathematics teaching. With the necessary school-and district-level supports in place, teachers' beliefs and pedagogical approaches can move from being traditional to more reform-oriented,[3] a change that can be monitored through regular observations of a single mathematics class period.

This is not to say that scholars convey that teacher change is simple or straightforward. For example, Wilson & Goldenberg (1998) highlight the case of Mr. Burt, who despite major pedagogical changes still "insisted on telling many of the important points, emphasizing what he considered to be correct ways to think about things... [he was] still quite directive" (p. 285). They conclude that, "even well-intentioned teachers like Mr. Burt" will make only limited progress toward reform unless they "undergo a significant pedagogical and epistemological shift" (p. 289). Many scholars concur regarding the critical importance of teachers' beliefs in facilitating teacher change. After an analysis of five studies on teacher change, Cooney (2001) concluded, "Clearly teachers' conceptions about mathematics and mathematics teaching strongly influence if not dictate their movement toward a reform-oriented teaching environment" (pp. 18–19). As with most of the literature on teacher change, these examples focus on *global* changes in teachers' instructional practice.

Although not their primary research focus, Sowder, Philipp, Armstrong and Schappelle (1998) note contextual obstacles to teacher change, including lack of both administrative support and school resources. In their study there is a glimpse of what we are calling *local* change: After studying teachers across various school contexts, they began to question the extent to which these contextual factors shape teachers' pedagogy:

Contextual differences also played a major role in influencing the types of instruction in the classrooms, so much that we frequently found ourselves wondering how individual teachers would change their teaching styles if they were to switch schools and classes. (pp. 182–183)

The study reported here raises an additional question about the extent to which a teacher's pedagogy would remain consistent across contexts. Specifically, we investigate what occurs when a teacher is asked to teach two very different curricula that were intentionally chosen by students and parents. We focus on one teacher, Jackie, who has many of the attributes that the literature indicates will support reform-oriented teaching (e.g., district and school-level support, professed beliefs aligned with the NCTM *Standards*, innovative curriculum materials, and intensive professional development). We investigate some factors that influence the teaching strategies she uses in each of her two curricular contexts. This case highlights the importance of distinguishing between *global* and *local* changes, and examines the extent to which *local* changes occur in the instruction of a teacher who exhibits many important aspects of a reform-oriented, *global* orientation. The case sheds light not only on the importance of reform-oriented curriculum materials in shaping teachers' practices, but also on the importance of two other factors that are often overlooked in teacher development literature: the expectations of both students and parents.

CONTEXT OF THE STUDY

The School and Curricular Materials

The Plainview school district serves 5000 students in a relatively affluent community (population 50,000) encompassing a major University. However, the district also includes students from lower-and working-class backgrounds (11% qualify for free/reduced lunch). Plainview students are primarily Caucasian, with Asian students making up most of the 19% minority students in the schools. Plainview was chosen for this study because of particular changes in mathematics curriculum and instruction occurring there.

In the mid-1990's, the Plainview elementary mathematics program changed to include the reform-oriented, *Standards*-based *Investigations* mathematics curriculum in grades K-4. At that time, Plainview also began piloting the reform-oriented *Mathematics in Context* (*MiC*) curriculum in grades 5–8. The district's curriculum leaders and mathematics cabinet[4] collaborated with the creators of *MiC* to provide three years of mandatory professional development with the 5th through 8th

grade Plainview mathematics teachers, including summer workshops, monthly study groups, and further individual assistance from *MiC* consultants and the district mathematics coordinator. One teacher at each grade level became a lead teacher and received additional professional development with the *MiC* developers in Madison, Wisconsin, and at the Freudenthal Institute in the Netherlands.

Despite the strong support of most district staff involved in these adoptions, there was heated controversy among parents, school board members, and a few teachers about the transition to *MiC*. The controversy over *MiC* was fueled partly by a decline in middle-school scores on the computation portion of the Iowa Test of Basic Skills that became apparent, just as *MiC* was beginning to be piloted in some Plainview classrooms. This type of controversy, especially in schools made up primarily of middle-class families, is not uncommon in adoptions of reform-oriented initiatives. See, for example, Talbert (2002). (According to some district and *MiC* leaders, the drop was too early to be attributable to *MiC*). In conjunction with *MiC* developers, the district developed multiple ways to address the community's concerns. Yet despite Plainview's attempts to address parents' concerns, and despite the complete rebound of computation scores (and the fact that other standardized test scores in mathematics concepts and problem solving have remained steady or increased), dissension about *MiC* has remained. However, the district continues to use *Investigations* and *MiC* for its elementary and middle school curricula.

The community controversy over *MiC* slowed plans to replace the high school's traditional mathematics sequence with reform-oriented curriculum materials. The curriculum materials at the high school remained unchanged until fall, 2000, when the district's mathematics cabinet and teachers introduced a four-year, integrated mathematics sequence based on the new reform-oriented *Core Plus* texts. Hoping to avoid the controversies that arose in the community upon the transition to *MiC*, district leaders decided to offer parents, students, and teachers a choice between the ''traditional'' sequence (Algebra I, Geometry, Algebra II, Pre-Calculus) using the *University of Chicago School Mathematics Project* (UCSMP) texts, and the *Core Plus* sequence integrating algebra, geometry, pre-calculus, and statistics (and is therefore referred to in the district as ''Integrated Mathematics''). Accelerated middle school students beginning high school mathematics in 7th or 8th grade are also given the choice.

TABLE I
School district comparison of traditional and integrated mathematics

Traditional Algebra Sequence	Integrated Sequence (*Core Plus*)
Mathematics strands are studied separately, one each year.	Mathematics strands are integrated each year.
Teacher demonstrates.	The teacher guides and assesses (using multi-dimensional assessment).
Students practice.	Students investigate real-life contexts (often in groups) and develop a rich understanding of mathematics that enables them to solve new problems.

Information about the two options is sent home to parents in school newsletters and presented via local-access television. Each spring, the district holds a parent meeting specifically for parents of accelerated 6th and 7th grade students who will be taking Algebra I or Integrated Mathematics I (*Core Plus*) at the middle school. At these meetings, the district's mathematics coordinator and teachers explain the differences between the two mathematics options, as outlined in Table I. These mathematics leaders emphasize some of the differences between the instructional approaches advocated by each curricula and the fact that *Core Plus* integrates algebra, geometry, algebra II and precalculus (and includes some statistics/probability that the traditional sequence does not include). This table was developed to convey the instructional differences that parents/students could expect in each course. The descriptions reflect the mathematics cabinet's intention to offer a more "reform-oriented" and a more "traditional" option. While one might conclude that Jackie simply varied her teaching to meet the demands of this table, we would argue (based on the literature on teacher change) that curriculum implementation is more complex than this. Despite these leaders' efforts to promote the Integrated sequence, over 80% of students (and/or their parents) have chosen the traditional sequence (Lubienski, 2004).

The Teacher

One of the main proponents of curricular reform in the Plainview district has been an eighth-grade teacher named Jackie. She began teaching in the Plainview district over a decade ago with a propensity for teaching in reform-oriented ways. Having been a science major in

her undergraduate program, she valued inquiry-based learning and, when she stayed home to raise her young children, she found herself reading about mathematics teaching:

> I had been subscribing to NCTM journals, and I read them at home. The kinds of things they were advocating were the kinds of things I was interested in – like how students were thinking, instead of how fast they could multiply (TI, Mar 04[5]).

After her children grew older, Jackie earned her mathematics teaching credential and came to Plainview to teach middle school mathematics at the time the district was piloting *MiC*. She saw that the new curriculum fitted well with her personal philosophy of teaching and "jumped whole-heartedly into the ideas of the reforms" (TI, Mar 04). Because of her enthusiasm for *MiC*, she quickly became a lead teacher in the district. Jackie participated in intensive, reform-oriented professional development at the University of Wisconsin and the Freudenthal Institute.

Jackie has been a member of the district's mathematics cabinet for most of the past decade, where she has promoted *Standards*-based curricula and assessments. She recently attained National Board Certification and has been one of the most active Plainview teachers in terms of attending and presenting at NCTM annual meetings, typically paying her own way to attend. She also obtained grant funding to go to the International Congress of Mathematics Education (ICME) in Copenhagen and in Japan, where she participated in a special post-ICME conference on lesson study.

The recent changes in Plainview's high school course offerings impacted the middle school, where accelerated students begin taking high school mathematics. On a typical day, Jackie teaches three class periods of *MiC* to 8th graders, as well as one class period of Algebra I and one of Integrated I to accelerated 7th and 8th graders. When initially learning to implement the new curriculum, Jackie went beyond the *Core Plus* summer institute (plus follow up) for Integrated I teachers and attended an additional summer institute for Integrated II teachers "just so I could learn where students were going" (TI, Mar 04). She has also consistently participated in an online support group for *Core Plus* users, often responding to other teachers' questions.

Over the past decade, Jackie has found that "it's more fun to teach mathematics" (TI, Mar 04) than science, particularly when she can teach mathematics in reform-oriented ways. She noted, though, that reform-oriented teaching is more challenging than typical forms of teaching:

It's very easy to teach the traditional way – we've been taught that way, we've been prepared to teach that way, and [traditional] books are set up to throw a few examples on the board. If you aren't interested in how students think, then you won't enjoy teaching in a reform-oriented way. I believe in what the NCTM *Standards* say, and I believe in what the [*Core Plus*] materials are trying to do. I'm not sure I'm doing it faithfully, but I'm working toward it. If someone gave me *Saxon*[6] and said it was all I could teach, I don't think I'd keep teaching (TI, Mar 04).

Throughout her Plainview teaching career, Jackie has been an advocate for mathematics instructional reform in the district, even when it was unpopular. Jackie's overt presence in the adoption of *MiC* and her intense, enthusiastic involvement in reform-oriented professional development would likely cause any district insider or outsider to label her as a ''reform-oriented'' teacher; that is, she appears to have a *global* orientation that values key aspects of reform-oriented instruction.

RESEARCH QUESTIONS

Given Jackie's background and curricular situation, we were interested in the extent to which her teaching style varies by course. She is clearly an advocate for reform. However, she has experienced the political backlash related to the *MiC* adoption, and now teaches students who have intentionally chosen either traditional or reform-oriented curricular materials. In this intriguing curricular context, we ask:

- What is the nature of Jackie's teaching in each of her classes?

  In what ways does this teacher change her pedagogy in each of her classes?
  What about her teaching remains consistent across her classes?

- What are some of the factors that influence how she teaches in each class?

The data reported here were collected as part of a larger study on the parent/student choices between Plainview's two high school mathematics sequences and their ultimate effects on student outcomes (Lubienski, 2004). Given that the larger study's focus was the high school curricular options, the focus here is on Jackie's teaching of Algebra I and Integrated I, as opposed to her teaching of *MiC*.

DATA COLLECTION AND ANALYSIS

During the past four years, Jackie's Algebra I and Integrated I students were surveyed each fall ($n = 121$ in Algebra I and $n = 82$ in

Integrated I, representing a sample of over 80% of Jackie's Algebra I students and over 90% of her Integrated I students). Students were asked a variety of questions intended to document the instructional practices students were experiencing in their courses, as well as students' reactions to these practices (see the first column in Table II for a sampling of these survey questions). The survey items regarding instruction were designed to reflect some of the primary shifts advocated by both the NCTM *Standards* and the *Core Plus* texts, including movement toward more extensive problem solving opportunities, student collaboration, and appropriate calculator use, as well as movement away from teacher lecture as the primary means of mathematics instruction. The response options for the questions were based on survey items from the National Assessment of Educational Progress, which asks students to report how often various activities occur in the classroom: "Almost every day," "once or twice a week," "once or twice a month," or "never or hardly ever."

To complement the survey data, two researchers observed Jackie's Integrated and Algebra classes for five consecutive days in March 2004. These five days were selected because Jackie felt they were fairly typical of her overall instruction and because there were no unusual circumstances (e.g., field trips, examinations) taking place. Two purposes for the classroom observations were: (a) to see whether the differences reported by students were evident, and (b) to capture more detailed examples of instructional similarities and differences between the two classes. One researcher took extensive field notes to document the general form and substance of classroom interactions. The observations were not audio-taped or video-taped because human subjects and school district approval had not been given to collect recorded data, which would involve the voices or images of students whose parents had not given permission for participation in the study.

The other researcher coded for particular instructional activities at 15-s intervals, following the observation system developed by Foegen and Lind (2003). The coding categories centered on differences that were statistically significant in the student surveys (see left column of Table III for the coding categories). The codes utilized were defined by the researchers prior to the observations. For example, "individual work" and "small group work" were differentiated based on the level of observed interaction taking place in the assigned groups. Specifically, an interaction was coded "individual" if the students were physically sitting together, but there was no relevant verbal or physical interaction observed in that 15 s interval, whereas it was coded as

TABLE II
Student survey responses by course

In your math class, how often do these things happen?	Algebra I $N = 121$				Integrated I $N = 82$			
	Never or hardly ever	Once or twice a month	Once or twice a week	Almost every day	Never or hardly ever	Once or twice a month	Once or twice a week	Almost every day
***Students work in *groups*	39%	38%	20%	3%	0%	0%	0%	100%
***Your teacher *lectures* at the board or overhead for most of the class period	4%	9%	20%	67%	18%	21%	53%	8%
**Students use calculators	0%	4%	14%	82%	0%	0%	2%	98%
***You spend *more than 10 min* working on a single math problem	26%	36%	27%	11%	1%	30%	46%	23%

**Differences in means for Algebra and Integrated students are significant at $p < .01$ level.
***Differences in means for Algebra and Integrated students are significant at $p < .001$ level.

TABLE III
Summary of observation data percentage of time spent in various activities

	Day 1		Day 2		Day 3		Day 4		Day 5		Average	
	Alg	Int	Alg	Int	Alg	Int	Alg	Int	Alg	Int	Alg	Int
Level of participation structure												
Individual work	0	35	6	0	23	36	0	0	0	9	6	16
Small group work*	1	21	1	69	13	38	0	0	0	52	3	36
Whole-class, teacher-led interactions*	87	27	91	23	55	13	84	95	64	27	76	37
Nature of whole-class interactions												
Teacher Lecture**	24	4	42	6	43	11	55	15	30	.2	39	7
Teacher-facilitated questions and answers	61	12	46	16	11	1	29	77	33	24	36	26
Student/teacher discussion	2	11	.2	1	0	0	0	2	0	1	.4	3
Graphing calculator use												
Using Graphing Calculator (Individual Use by Target Students)*	0	42	0	22	0	11	0	0	0	62	0	27
Using Graphing Calculator (Teacher-Led, Whole-Class Use)	9	1	0	2	0	0	0	74	0	0	2	15

*Differences in means between Algebra and Integrated classes are significant at $p < .05$ level, using 1-tailed test.
**Differences in means between Algebra and Integrated classes are significant at $p < .01$ level, using 1-tailed test.
Table note: The percentages of time spent in the three levels of participation do not sum to 100% because of non-instructional tasks such as taking roll.

"small group work" if the students were talking to each other about the task at hand. In coding individual and small group activities, a randomly selected male and female were observed, with the students reselected every 5 min. Additionally, predefined distinctions were made amongst "teacher lecture", "question and answer", and "discussion" based on the talk that occurred in the whole group activities. Talk was coded as "teacher lecture" when a monolog took place and only the teacher was talking. In "question and answer," the talk moved back and forth between the teacher and students, often occurring in a Initiation-Respond-Evaluate format (Mehan, 1979). The interactions were coded as "discussions" when: the discourse was more balanced between the teacher and students; students expressed new or novel ideas and these became the discussion topic; and/or more exploratory talk was happening as students tried to make sense of ideas and the teacher tried to understand their thinking about a problem (Barnes, 1976; Nystrand, 1995). Distinguishing between "question and answer" and "discussion" was important because literature on instructional reform highlights the significance of student thinking in determining the direction of classroom interactions; student thinking is central to teachers who change their instructional practices to become more reform-oriented (e.g., Franke et al., 1997; Goldsmith & Schifter, 1997; Schifter, 1995; Spillane & Zeuli, 1999; Thompson, 1991).

The student survey data were analyzed in SPSS. Specifically, the four ordinal response categories (daily, weekly, monthly, never) were assigned values (1–4), and then two-tailed t-tests were used to compare the means of Algebra I and Integrated I students in order to determine significant similarities and differences in Jackie's instruction. In order to provide the most robust student-reported information of Jackie's teaching that our data would allow, we included the student survey data collected across the four years of the study (as opposed to utilizing only the data that was collected in the fourth year, when the classroom observations were conducted). However, we did examine the survey data to determine whether Jackie's teaching in her Algebra or Integrated courses tended to shift over time – e.g., to become more or less similar, or more or less reform-oriented. There were no strong or consistent shifts. Overall, the findings reported here are highly consistent with the data collected in year four only.

To analyze the observational data collected, the percentages of time spent in various instructional activities were compared between the Algebra I and Integrated I courses. One-tailed t-tests were used to compare the mean percentages of time for each activity over the five

days observed, using class periods as the unit of analysis. One-tailed tests were used because the purpose was to confirm the differences reported in student surveys. Given that there were only five class periods observed for each course, and given that these class periods were not randomly selected from across the year, the t-tests of the observational data are provided only as indicators of the strength of the Algebra-Integrated instructional differences found for the days observed, as opposed to suggesting that the differences would exist throughout the year, or for teachers other than Jackie. The detailed field notes added nuance to our understanding of the differences that were reported by students. Additionally, they were used to search for discrepant events and to triangulate other data sources.

After analyzing the student survey data and the observational data, the results were reported to Jackie. The three researchers then conducted an intensive, 90-min interview with Jackie, probing her level of agreement with the findings, other similarities and differences that she noted when reading the classroom observation field notes, and the factors that influenced her pedagogy. The three researchers took extensive notes during the interview, compiled their notes, and then individually analyzed them for salient themes before coming back together to agree upon the main influential factors reported by Jackie.

RESULTS

Results are reported for three data types: student survey, observational, and teacher interview data. The student surveys and observations shed light on the similarities and differences in the instruction occurring in Jackie's Algebra and Integrated classes. Jackie's interview data illuminates underlying causes of the patterns found. However, before presenting the results of our data analyses, we begin with some holistic description of the Integrated and Algebra classes we observed to provide some necessary context for the reader.

Integrated I Overview

When Integrated I began each day, the students physically rearranged their desks so that each group of four students faced one another, rather than all of the chairs facing the front of the room as they did in Algebra I. Jackie often reminded Integrated students that they were to be talking through the solutions to the problems with other students in the small groups, reminding them particularly when they were

working individually. Jackie expressed her frustration with two of the groups after the first observation, stating that she had tried many combinations of students in each group throughout the school year, hoping some of the quieter Integrated students would interact with their peers more. (In contrast, when Algebra students worked on homework problems, they were asked to lower their voices and to work quietly.)

During the second and third days of the week observed, Integrated students collected data for an investigation of decay and growth problems by engaging in some hands-on activities (e.g., dropping tacks on a paper plate that was divided into four equal parts). After taking attendance and asking a few questions, Jackie had students work in small groups. The remainder of her interactions with students took place while students worked in their groups. On the fourth day, Jackie led a summarizing discussion of the findings of the experiments. Each group was asked to load the data they collected for one experiment into a single graphing calculator and Jackie asked a series of questions to help students recap and share their findings with the other groups. Throughout this activity, more than one solution for many of the problems was discussed – occasionally Jackie requested this; at other times, students offered another way to solve the problem without Jackie's elicitation. This was the only time that Jackie stood in front of the room to present information and the only time she used the graphing calculator to show students mathematical representations on the overhead. Throughout the week, students used graphing calculators whenever they chose to do so.

Algebra I Overview

In contrast, Jackie spent the bulk of each Algebra I class period at the white board in the front of the room. The lesson format was very similar to those described in traditional mathematics lessons: (a) Jackie read through the solutions to the homework and answered students' questions about problems; (b) the class listened as Jackie showed them how to solve the next mathematics problem (e.g., factoring and solving quadratics); and (c) students worked on the assigned homework problems. During the first two activities, there was often an emphasis on what to do next. For example, students were given a quadratic equation and Jackie asked what they would do next to solve the equation. Students rarely used graphing calculators. However, once, after a student asked what a particular graph would look like, Jackie used the graphing calculator and the overhead screen in front of the class.

Homework was due each day in Algebra whereas Integrated students handed in homework problems once each week. Both classes, however, were assigned a set of "Problems of the Week" which consisted of about six problems related to a range of mathematical ideas, all of which were problem solving situations.

Student Survey Data

There were statistically significant differences between Jackie's Algebra I and Integrated I students on four survey questions: frequency of group work, teacher lecture, calculator use, and students working more than 10 min on a single problem (see Table II). While *every* Integrated student surveyed indicated that *students worked in groups* almost every day, only 3% of Algebra students indicated that group work occurred with such frequency, and almost 80% of Algebra students indicated that group work occurred only once or twice a month or never. Similarly, *teacher lecture* was reported to be much more frequent in Algebra I, with over two-thirds of the students reporting that Jackie lectured at the board for the majority of the class period "almost every day," whereas only 8% of Integrated students indicated this frequency of teacher lecture. While the majority of Jackie's Algebra and Integrated students reported that they *use calculators* in their math class "almost every day", this percentage was 98% for Integrated students and only 82% for Algebra students. Finally, twice as many Integrated (23%) as Algebra (11%) students reported that they *spend more than 10 min on a single math problem* "almost every day", with almost two-thirds of Algebra students (compared to less than one third of Integrated students) indicating that they spend such time on a problem monthly or never.

Although beyond the scope of this article, there were remarkable similarities in Jackie's Algebra and Integrated students' responses to survey questions focusing more on student affect than specific instructional practices. Specifically, there were no statistically significant differences between the Algebra and Integrated students' responses to questions regarding their enjoyment of, and frustration with learning mathematics.

Observational Data

The observational data confirmed and provided additional details about the instructional differences reported by students. Consistent with the differences identified in the student survey data, there were statistically significant differences in the amount of observed time

spent in small group work, whole-class interactions, teacher lecture, and in students' use of graphing calculators. (See Table III.) Specifically, whereas over one third (36%) of class time observed in Integrated I was devoted to small group work, this occurred only 3% of the time observed in Algebra I. Whole-class, teacher-led interactions occurred 76% of the time in the Algebra class, compared with only 37% in Integrated I. Whole-class interactions tended to consist of three activities: teacher lecture, teacher-led questions and answers, and discussion among students and the teacher. Of these three, there was a statistically significant difference for only the first activity, with teacher lecture occurring 39% of the time in Algebra I, versus only 7% in Integrated I. Finally, more student graphing calculator use occurred in Integrated I than Algebra I, with students using them on their own (without teacher direction) 27% of the time in Integrated I, and never during the days observed in Algebra I.

Despite the substantial differences, there were aspects of instruction that were similar between the two classes. It is important to note, however, that the number of days examined was small, and if more days were examined, some of the differences in these areas would be significant. That said, there were no statistically significant differences in the percentages of time devoted to individual student work, teacher-facilitated questions and answers, and student/teacher discussion. In fact, student/teacher discussion occurred rarely in both classes. The detailed field notes captured the nature of the whole-group interactions, during which Jackie did the majority of the talking. While the talk moved back and forth between procedural and conceptual in both classes, Jackie rarely asked students if they agreed or disagreed with other students' ideas. In both classes, the few times she asked whether students agreed or not occurred after she made a correct statement.

In the whole-group interactions, students in both classes seemed at ease to speak up when they did not understand something. In the Algebra I class, students quickly let Jackie know which homework problems they did not understand at the beginning of class and asked follow-up questions when Jackie explained the problems. Students also asked questions during the lesson, for instance, when Jackie talked about the characteristics associated with the graph of a quadratic that had only one solution, one student said she "didn't get it." Jackie went on to draw a graph and explain that the solution would lie on the x-axis, rather than the graph crossing the x-axis twice. In the Integrated class, students would also speak up when they "didn't get" something during both whole-group discussions and small group explorations.

Differences in the frequency of whole-class graphing calculator use were also not significant. Yet, the field notes revealed that in Integrated I, Jackie initiated graphing calculator use during the whole group discussions, as part of the planned lesson. In Algebra I, the one instance of whole-class graphing calculator use occurred after a student asked what a particular equation's graph would look like. In response, Jackie spontaneously typed the equation into the graphing calculator to show students that the cubic equation would yield a graph that crossed the x-axis in three places because, in this case, it had three real roots.

Additionally, the detailed field notes suggested that Jackie stressed connections and sense making in both Algebra I and Integrated I. There were instances of Jackie taking an idea with which students were already familiar (e.g., If the product of two numbers equal zero, then one or both of the numbers must be zero.) and extending it into the domain of algebra (e.g., If the product of two linear expressions equal zero, then one of the factors must be zero). She also focused on the meaning behind particular mathematical words they were using, e.g., ''exponential regression'' in Integrated I, ''rational'' numbers in Algebra I. In Integrated, Jackie returned to students' previous experiences with linear regression and asked them what ''exponential regression'' meant. Students pointed out that an exponential was a curve and she prompted them to also focus on what a regression was (i.e., that the curve would be one of 'best fit' where it represented the data well, but may not go through all of the points in the data they collected). In Algebra, when they focused on rational numbers, Jackie asked students what the root word of ''rational'' was. One student responded ''ratio'' and they discussed the fact that this particular set of numbers includes all numbers that can be written as fractions.

Despite important similarities in Jackie's instruction in Algebra I and Integrated I, the differences in key aspects of the role of Jackie and her students, as conveyed by the survey and observational data are striking in these classrooms. In Algebra I, Jackie appeared to lecture the majority of the time, group work was rare, and students infrequently worked for an extended period of time on any one mathematics problem. In the Integrated class, the scene was dramatically different on these dimensions.

Interview Data

When delving into why these differences exist, the most important information source is Jackie, herself. Jackie is fully aware that she uses a different pedagogical style in each class; after reviewing our survey

and observational data, she remarked, ''nothing surprised me'' (TI, Mar 04). In fact, she consciously chooses to teach differently in the two classes. In our interview with Jackie, she consistently indicated her agreement with the *Standards*, but also pointed to key barriers to implementing a reform-based pedagogy throughout the school day:

> The Standards fit the way I like to do things... One barrier [to reform implementation] is **parent** reaction – if they don't know what you are doing and why you are doing it, that can cause some problems. Also, it is difficult for me to redesign **curriculum materials** that are not *Standards*-based. Time is a huge factor in that, but so is the knowledge that many of the **students** who have chosen to take algebra make the choice because they want a traditional approach (TI, Mar 04, emphasis added).

In this and similar statements made during the interview, Jackie consistently pointed to three factors that shape the differences in her teaching of Algebra I and Integrated I: (a) the curricular materials being used in each class; (b) parental expectations and desires; and (c) students' reactions to aspects of reform-oriented instruction as well as their instructional preferences. These three factors impact her teaching at the *local* level.

Textbooks

As Jackie explained, the Algebra and Integrated curriculum materials provide different types of activities for the students to do, and present the mathematical content in very different ways. The format of the Algebra book supports a more traditional pedagogy: new information is given to students and then homework problems are offered to practice. According to Jackie, the Integrated book sets up extended investigations that can span two or three days, whereas in the Algebra book, the ''content feels more choppy'' (TI, Mar 04). The Integrated book poses problems in which students are asked to ''work in groups and pull out the mathematical ideas...it asks students to mess around and look at related ideas...and why something makes sense'' (TI, Mar 04). Jackie noted that the Integrated books ''are designed for cooperative learning and to get kids to think about the math'' (TI, Mar 04). She explained that the more cohesive, problem-centered structure of the Integrated curriculum materials seem to help students become ''more self-directed – there's something about the way the lessons are structured that pulls this out of the kids'' (TI, Mar 04).

When pushed for specific examples of how the curriculum materials differ in their treatment of particular topics, Jackie explained that ideas such as the Pythagorean Theorem are simply given to students in the Algebra text and then students are asked to apply them. In

contrast, the Integrated materials pose problems to help students discover the Pythagorean Theorem and to connect it to their previous knowledge. She explained that connections among algebraic representations are emphasized more in the Integrated materials – she finds it easier to discuss "how tables, graphs, and equations are related to each other" (TI, Mar 04) – and graphing calculator explorations of these ideas are integrated throughout the materials. In Algebra I, the ideas and representations are treated separately: "In Algebra there are separate chapters for these things with fewer connections between them...connections are not easily made by students" (TI, Mar 04).

Jackie tries to help her Algebra students see the connections among ideas, and she sometimes supplements what is in the Algebra book to do this. She recognizes that she could teach her Algebra course in a more reform-oriented way. Yet, to do that, she feels she would essentially need to recreate the curriculum: "If I wanted to teach Algebra as a *Standards*-based course, I'd have to design everything from the ground up...and I probably *should* do that, but then here are all these parents who didn't want that. So what is my obligation here?" (TI, Mar 04)

Parents

The above quote highlights the complexities in teaching in the context of curricular choice: sometimes what the teacher thinks might be better for students collides with parental expectations and demands. This tension is not unfamiliar to Jackie, having been involved in the parental backlash related to the adoption of *MiC*. Jackie explained the pressure she feels from parents this way:

> Parents are mainly interested in the progress of their own students – I am open to parent concerns, ... but I haven't heard any direct complaints. If students seem to do well and enjoy the class, then parents are pretty happy. There are a lot of educated parents who were successful in the traditional approach – they think, 'If it worked well for me, it will work for my kids, too' (TI, Mar 04).

When asked whether the school administration mandates a particular pedagogy or closely monitors her instruction, she replied, "The administration tends to leave teachers alone and assume they are doing a good job unless a parent complains. There is no time [for them] to worry about it otherwise" (TI, Mar 04). Hence, avoiding parent complaints allows Jackie autonomy in her classroom. However, she feels the need proactively to adapt her teaching style for the Algebra class because she knows that the parents make a conscious decision to enroll their child in Algebra, and that the parents have specific expectations for both the curriculum and accompanying pedagogy.

Parents' desires for particular forms of instruction are closely connected with their students' learning preferences and needs.

Students

Typically, when Jackie talks to parents about students' mathematics options, she tells them they should make their decision based on what they know about their child:

> I tell them to look at the materials and invite them to observe the classes. ... I talk about the benefits of both. In Integrated there is a fluidity of representation, lots of different topics, the focus is on developing understanding and concepts more than procedures, and more working in groups and getting students to talk through problems. In Algebra, students work more on their own and they develop better symbol manipulation skills (TI, Mar 04).

The students are also involved in this decision and Jackie recognizes that some students "want to be told how to do it, see it, and then do it ... and other students like to problem solve and work together to figure the problems out" (TI, Mar 04). Jackie remarked that "what [Algebra] students want may not be right," (TI, Mar 04) but she also acknowledged that most of her students and parents have chosen the traditional sequence.

In discussing these issues, Jackie revealed conflicting feelings regarding whether reform-oriented teaching is necessarily best for all students. When asked if she would like the district to offer only Integrated mathematics, she answered, "Philosophically, I would like it... but politically, in this district, that's never going to happen" (TI, Mar 04). Although most of her comments and political actions in the district indicated that she saw more benefits to Integrated Math than Algebra, she also repeatedly expressed concerns about individual students' preferred learning styles and needs. For example, she raised concerns about her English Language Learners:

> Algebra is 80% naked equations and for the other 20% I'm standing on my head, and the ESL kids look miserable – they spend 8 h in another language all day. Integrated might help their language, but they have five other classes for that. And it's nice for them to actually be able to DO something in a class (TI, Mar 04).

Another issue Jackie discussed is that of students' resistance to writing and discussion in mathematics class: "From day 1 the Algebra students say that...they hate to write a sentence" (TI, Mar 04). She tells parents when advising them about their choice, "If your child can't stand to write a sentence, then they won't enjoy Integrated" (TI, Mar 04). In fact, Jackie admits that her expectations for the quality of written responses in her mathematics courses have decreased over the

years due to student resistance to her demands for writing full explanations with complete sentences. She sometimes feels tired of pushing for more complete explanations from 8th graders who often have a "What's in it for me?" attitude. "After all," she explained, "you only have so many hairs to pull out" (TI, Mar 04). She described similar student resistance to her efforts to involve students in whole-class discussion. She said she always (in both courses) tries to go "three why's deep – Why's that? Why's that? Why's that?" (TI, Mar 04). Yet, Jackie's students – particularly her Algebra students – tend to give more superficial responses than she desires.

Summary

Consistently three themes – curriculum materials, parent expectations, and student reactions, arise when Jackie discusses her choice of instructional practices in Integrated I and Algebra I. Jackie notes that the *Core Plus* materials enable her to teach in problem-centered ways not supported by more traditionally structured materials. If she were to teach in such a way without a reform-oriented textbook, she would need to create problems and materials herself, something that she does not have time to do. Having experienced first-hand an intense community backlash against *MiC* mathematics, Jackie is acutely aware of the power of parental dissatisfaction. She also knows that parents and students choose a specific course, and they expect a particular pedagogy to accompany it. Given the resistance of Algebra students to reform-oriented methods, and given that parents tend to judge the quality of her teaching based on students' enjoyment of her courses, student reactions both directly and indirectly affect Jackie's teaching. She grapples with how best to address students' desires, feeling some conflict between the instruction she believes is generally most powerful, while also acknowledging that students have different learning preferences and needs.

DISCUSSION AND IMPLICATIONS

Drawing from students' survey responses and classroom observations, this study reveals ways in which one teacher's pedagogy differs considerably between two curricular contexts. Despite having had extensive professional development, professing agreement with central tenants of the NCTM *Standards*, and having been a promoter of *Standards*-based reform in her district, Jackie consciously varies her teaching throughout the day. Jackie's Integrated students work in groups, spend

extended time on mathematics problems, and use graphing calculators more often than her Algebra students. Jackie's Algebra students report that she lectures the majority of the time. Jackie points to curricular materials and student/parent expectations and desires as critical factors that shape these differences in her pedagogy.

From this case study, we cannot conclude that all or even most teachers would use these particular materials as Jackie does, nor that other teachers would face the same set of contextual constraints on their teaching. Clearly, this is a case of one teacher using two curricula in a district with a particular history of reform that is not representative of all school districts.

However, Jackie's case illuminates aspects of instruction that can change and remain constant when teaching in different curricular contexts, and suggests reasons underlying this pedagogical variation. Clearly this case indicates that curriculum materials, themselves, can facilitate or debilitate reform-oriented instruction. However, this study also challenges us to examine carefully some of the issues involved in teachers' changing practices, including: (a) the ways in which students and parents influence teachers' instructional decisions; (b) the importance of the history of the reform in the district; and (c) the significance of distinguishing between *local* and *global* teacher change.

Attending to Students and Parents in Studies of Teacher Change

Factors external to a teacher's background, beliefs, and knowledge must be examined in studies of teacher change. Specifically, whereas some studies have already suggested that school-level supports must also be considered (Newmann & Associates, 1996), this study points to the importance of understanding the role that students and parents play in shaping pedagogy. In the same way that teachers have been apprenticed into school-appropriate behaviors, so have also students and their parents.

Jackie thought carefully about her students' learning preferences and struggled with their opposition to some of the practices involved in *Core Plus* (e.g., writing about their mathematical reasoning). Tirosh and Graeber (2003) contend that students must be involved in understanding the change and the rationale for these different practices. Rarely are issues related to student learning preferences or student resistance addressed in teacher change or in curriculum adoptions. Yet, Jackie is not the only teacher to have struggled with getting students to fulfill new expectations; a similar story was told by Van Zoest & Bohl (2002) about a preservice teacher's use of *Core Plus* materials.

In fact, these issues become increasingly important to students as they progress in school (Ponte, Matos, Guimaraes, Leal, & Canavarro, 1994). High school students are more concerned with their futures and thus more aware that their unfamiliarity with new practices could negatively impact their grades (Ponte et al., 1994). Students who feel more successful in classes where they have been told what to do may resist exploring ideas in a less structured environment. Jackie was aware that students had particular learning preferences and, while her general philosophy aligned more with *Core Plus*, she suspected that there may not be a single form of instruction that is best for all students.

Jackie's struggles to address these competing commitments brings to mind Lampert's (1985) conception of teachers as a "dilemma managers," for whom competing perspectives about students' needs are "endemic and even useful" instead of "a burden that needs to be eliminated." (p. 192). In a similar way, Ball (1993) offers insights into how students impacted her instructional decisions. These researchers offer an insiders' perspective on their classrooms that is absent in much of the literature on teacher change.

While both Lampert and Ball have offered important insights into the role of students in their everyday teaching decisions, what these and other authors have not addressed to date is how parents influence teachers in their dilemma-management. Parents have been found to be influential in shaping textbook adoptions, tracking policies, and other school-, district-, and state-level policies (McGrath & Kuriloff, 1999; Peressini, 1998; Wilson, 2002). Most studies of parents' influences on schooling have tended to occur at that broader level – focusing on policies outside the classroom, rather than ways in which parents' exert direct or indirect pressure inside the classroom. In fact, we know relatively little about how parents influence the pedagogy of individual teachers. This study suggests that even when parents do not actively complain to teachers, the threat of parental disapproval can influence teachers' decisions regarding instruction.

Attending to Historical Context in Studies of Teacher Change

Additionally, this study highlights the importance of understanding the *historical* context in which teacher change occurs. In Plainview, the strong community backlash against middle school mathematics reform has produced the current situation in which a choice between two high school curricula is offered. The strength of that backlash, along with the fact that parents and students have experienced reform-oriented

curriculum materials in earlier grades and are making a conscience decision to either continue or discontinue their use, clearly influences the seriousness with which Jackie considers the desires of students and parents. Cherryholmes (1988) argues that much educational research tends to be dangerously ahistorical in nature. This study highlights the importance of breaking with that trend in research on teacher change; it is important for scholars to understand the historical context of teachers' experiences in their school setting before making claims about whether and why changes do or do not take place.

Global and Local Teacher Change

Jackie's case raises questions about prioritizing global change to the exclusion of local change, as has been the tendency in existing research on teacher change. We return now to Schifter's (1995) statement that while "a teacher *might enact different conceptions of mathematics on different days*, there tends to be a 'center of gravity,' a conception that guides a teacher's major instructional goals over an extended period of time, an overarching agenda for student learning" (p. 22, emphasis added). The other important focus for research on teacher change that is mentioned in this quote is a reference to teacher's fluctuations on different days or different class periods-what we are calling "local changes." Jackie's case reveals the potential significance of local changes, given the wide variation in her practices from one class period to the next. The extent of this variability raises questions about the notion "center of gravity," a term that might suggest that teachers' beliefs and practices are consistent enough to allow placement in a single location on a traditional-reform continuum. Indeed, the use of the word "center" might conjure up an image of a single point, as opposed to a loosely bounded range of practices, as might be more fitting.

In Jackie's case, her emphasis of the meaning of mathematical ideas did appear to remain constant during our observations of her teaching, yet her use of particular pedagogical strategies, such as cooperative group work and lecture, changed dramatically. Jackie appeared to have a set of instructional strategies and tools from which she drew to tailor her teaching to the curricular context. Because we attended to the *range* of Jackie's practices and the reasons underlying them, we understand more fully her as a teacher than we would have if we had focused solely on locating her on a single place on a traditional-reform continuum.

Taking both local and global changes into consideration is more in line with current thinking about teacher beliefs in mathematics education. According to this literature, the beliefs that teachers draw upon

(from the entire range of beliefs they hold) depend on what is happening at a particular point in time and the particular set of students with whom they are working: "A belief is a cluster of dispositions to do various things under various associated circumstances" (Scheffler, 1965, as quoted in Wilson & Cooney, 2002, p. 130). As Wilson and Cooney (2002) point out, this definition implies that a range of evidence about what a person says and does is necessary to make claims regarding beliefs. In particular, these authors call into question research that claims there is an inconsistency between a teacher maintaining that the "essence of mathematics is problem solving," while emphasizing only procedural knowledge during instruction (p. 130). They offer three other interpretations for the perceived inconsistency, including: "(1) We do not have a viable interpretation of what the teacher means by problem-solving. (2) The teacher cannot act according to his or her belief because of the practical or logistical circumstances. (3) The teacher holds the belief about problem solving subservient (or "peripheral" in Green's (1971) terms), to the belief that the teaching of mathematics is about certainty and procedural knowledge" (pp. 130–131).

Applying these alternative interpretations to the case of Jackie, it could be that she cannot act on her beliefs due to the curricular context. Alternatively, it could be that she holds the belief that parents and students should have a say in their education more centrally than her belief about the importance of reform-oriented teaching.

Either way, Jackie's global orientation, which includes competing beliefs, allowed room for the local changes we identified in this study. When such alternative interpretations seem plausible, what is needed is deeper understanding of how this teacher makes meaning (Wilson & Cooney, 2002). It is possible that if her global orientation was more strictly and convergently "reform oriented," with less concern for meeting parents' and students' expectations, that we would not see the local changes that were so evident in this study. This possibility raises questions for further research.

FUTURE RESEARCH

Jackie's case suggests important implications for the design of future studies of teacher change. Jackie's variation in instruction raises questions about the validity of claims made in studies of teacher change that examine only one section of a teacher's day, particularly at the secondary level where multiple sections of mathematics courses are

taught. Studies of secondary teacher change may need to examine multiple sections of teachers' days, because even in more typical settings where the textbook remains constant, differences in the expectations of students (and their parents) could create differences in teachers' enactment of the curriculum from one class period to the next. Most studies on teacher change thus far have focused on elementary grades. Although much of what has been learned there likely applies to teachers more generally, this study points toward issues, such as pressure from parents and students, that may be more specific to secondary settings, where college preparation stakes are perceived to be higher (Lubienski, 2004; McGrath & Kuriloff, 1999).

This study also raises questions about the ways in which a particular global orientation toward reform-oriented instructional practice might place some bounds (but not others) on teachers' practices, and the local changes that occur in response to different curricula, students and parents. There is much to understand about which types of instructional practices are particularly subject to local changes (e.g., group work or calculator use) and which practices tend to remain constant across a teacher's various teaching contexts (e.g., as the amount of student-initiated discussion remained constant for Jackie). Perhaps if Jackie's global orientation was more narrowly or strongly reform-oriented, we would not have seen such dramatic local changes in her instruction. That is, Jackie's global orientation included competing commitments that might have limited the implementation of some aspects of instruction valued by reformers, and allowed for a wider variety of traditional and reform-oriented instructional practices than would be used by a teacher with a deeper or more convergent reform-oriented, global orientation.

Further investigations of Jackie and teachers like her can shed additional light on the aspects of instruction that appear to be influenced by curricular context, as well as those that appear more resistant to local changes. As scholars seek ways to improve teachers' practices, the political and social contexts that influence teachers need to become more focal. By examining a teacher who enacts different practices in each of two curricular contexts, this study reveals factors that contribute to teachers' enacted curricula – factors that have often been understated in previous research on teacher change. In doing so, this study highlights the potential usefulness of distinguishing between global and local teacher change, and opens up new questions about the relationship between these two constructs.

NOTES

[1] We want to recognize the contribution of the anonymous reviewers and JMTE Associate Editor Dina Tirosh in our articulation of these different kinds of change. Their questions and suggestions pushed us to become clearer about the focus of this paper and its contribution to literature on teacher change.

[2] Because the school district calls the Algebra I curriculum "traditional," we use this term to distinguish it from the reform-oriented curriculum.

[3] While some of these authors do not use the language of "reform" and "traditional" teaching, the characteristics described about the teachers would fit the terms as defined in the previous section. For example, Newmann and Associates (1996) describe "authentic pedagogy," which focuses on involving students in activities such as engaging in extended conversations to build shared understandings and making connections to the world beyond the classroom, both of which are included in the NCTM documents.

[4] The Plainview mathematics cabinet is made up of local teachers, parents, university representatives and the district's mathematics coordinator.

[5] Data from the teacher interview will be noted by TI ("teacher interview") and the month and year in which the interview took place.

[6] *Saxon* is a mathematics textbook authored by John Saxon and published by Saxon Publishers. Its primary philosophy is that mathematics is best learned through skill practice and review. In the U.S., Saxon is considered the archetype of "traditional" texts, due to their "single-minded focus on repetitive practice..." (Kirshner, 2000, p. 21).

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