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Influence of mathematics curriculum implementation strategies on nature of instructional tasks, classroom discourse, and student learning

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Influence of mathematics curriculum implementation strategies on nature of instructional tasks, classroom discourse, and student learning

by

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A thesis submitted to the graduate faculty in partial fulfillment of the requirements for the degree of

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ABSTRACT

This study presents a comparative case study of curriculum implementation strategies of four teachers in two school districts, the influence of teachers’ decision making on the nature of instructional tasks, and the learning environment that emanates from the two settings. The aim of the study is to gain insight into the relationships among curriculum implementation strategy, instructional tasks, and the teacher-student interaction that characterizes the classroom discourse in these settings. The results integrate research on curriculum implementation strategies, instructional tasks, and classroom discourse. This study suggests that students have a better opportunity to learn in classroom environments where teachers use standards-based curriculum materials.
CHAPTER 1. INTRODUCTION

With increased requirements on students to develop a deep and interconnected understanding of mathematical concepts, more emphasis is being placed not only on the students’ capacity to understand the facts in mathematics but also on their capacity to do mathematics. There is need for both policy makers and educators to deepen their knowledge and understanding of the various impacts on student learning when teachers use different curriculum implementation strategies.

Student learning outcomes are defined in terms of the knowledge, skills, and abilities that students have attained as a result of their involvement in a particular set of educational experiences. Student learning is influenced by the experiences students go through in the classroom. Therefore, it is not only the materials themselves that impact on learning, but also how the teachers help the students to experience the materials. These experiences can be through instructional tasks as well as through teacher-to-student interactions or student-to-student interactions in the classroom.

Documented research on curriculum implementation strategies indicates that teachers use and enact curriculum materials in different ways. These approaches result in diversities in how the teachers use curriculum materials. This variation reflects the complexities between the written and the enacted curriculum as well as the variations of educational experiences that the students go through. In his study with middle school science teachers, Brown (2002) indicated that the teachers used the curriculum guide either by way of: (a) offloading—where the teacher offloads curriculum design responsibilities onto the curriculum and follows it fully, (b) adapting—where teachers use suggestions offered in materials but adapt them to
suit their particular needs or preferences, and even (c) improvising—where teachers move away from the curriculum suggestions substantially and create their own curriculum.

Other research studies have also identified ways in which teachers adapt the curriculum materials. For instance, Brown and Campione (1996) talk of “lethal mutations” in describing a situation where teachers make substantial changes in written materials and no longer maintain the intended goals of a lesson. In other cases, teachers choose a middle ground of adapting curriculum materials by supplementing or adding to the materials and/or replacing certain components of the curriculum (Brown & Edelson, 2003; Remillard, 2005; Remillard & Bryans, 2004).

In their research with 10 elementary school teachers, Sherin and Drake (2004) revealed other curriculum use strategies such as identifying, reading, evaluating, and adapting as interpretive activities which teachers engage in prior to, during, and after instruction. While examining ways in which teachers adapt lessons, the study revealed that teachers also adapt the curriculum by: (a) creating—developing new components for the lesson, (b) replacing—substituting one component of the lesson with something else, or (c) omitting—deleting one part of the lesson without adding anything else.

These research studies revealed that teachers have the professional autonomy to make decisions on the curriculum implementation strategies that they use during the enactment stage. Other research studies have focused on the classroom discourse with emphasis on the instructional environment which promotes student learning. The choice of content for teaching, the nature of instructional materials, and the preferred mode of using the materials to a large extent provide the environment in which the teacher, the student, and the materials interact. These studies have reflected that the interaction between the teacher and the student
is the one that brings the curriculum to life, but the link between curriculum implementation strategy and the instructional environment is highly assumed.

In the current study, I examine the dynamics that play out in the classroom after teachers have made the decisions about how to use curriculum materials. This is a comparative case study where I have investigated four teachers from two different school districts: (a) where a standards-based curriculum is adopted and used in the classroom setting, and (b) where the teachers use a variety of different resources and create their own curriculum. I intend to use the conceptual lens of mathematics academic tasks since classroom instruction is generally organized around the academic tasks, and the tasks that students engage in determine what they have in terms of opportunities to learn about mathematics (Stein et al., 1996). I also examine the nature of classroom discourse within the two settings because the discussion reflects the teacher-student interaction as well as the student-student interactions while carrying out the instructional tasks. Although I do not underestimate the other factors that may affect the student learning in these two settings, I have used the nature of academic tasks and the level of student engagement as two aspects that will likely determine what mathematics will be learned and how it has been learned when teachers decide to use a particular implementation strategy.

**Purpose of the Study**

The purpose of this study is to investigate the influence of curriculum use strategies on the nature of the instructional task and the teacher-student interaction, which can maintain or lower the level of cognitive demand (Stein et al., 1996). In particular, the study will focus on the influence of curriculum implementation strategy on the nature of the instructional tasks, classroom discourse, and student learning. The research examines the decisions that
teachers make when preparing and enacting the lesson in the classroom. By curriculum implementation strategy, I refer to the manner in which the teachers engage with the curriculum materials as they play the role of interpreter of curriculum materials. I will further examine whether these decisions play a significant role in the classroom discourse, and the manner in which students carry out the instructional tasks. I will compare the instructional tasks that teachers use in the two settings and the nature of classroom discourse that results when the students carry out the task. Finally, I will evaluate the student learning outcomes in terms of the students’ contributions in class.

**Conceptual Framework**

The conceptual framework of curriculum implementation strategies, instructional tasks, and classroom discourse guide this study. In this framework, curriculum implementation strategy is defined as the manner in which the teacher read, evaluated, and adapted the curriculum materials (Remillard, 1999; Sherin & Drake, 2004). Instructional tasks are defined as the classroom activities, questions, or problems whose purpose is to focus students’ attention on a particular mathematical concept, idea, or skill. Classroom discourse is defined as the type of discussions in which the teacher and the students engage in when performing the task. According to the framework, the curriculum implementation strategy influences the nature of instructional task, the classroom discourse, and eventually students learning. I hypothesized that there is an interconnected relationship between the curriculum implementation strategies and what and how the students learn mathematics.

Teachers’ decisions when transforming the written curriculum to enacted curriculum influence the nature of instructional tasks. This can occur through simplifying the tasks as they present them to the students, substituting, or otherwise. The nature of instructional tasks
influences the teacher-to-student interaction and student-to-student interaction, since the communicative functions revolve around the task given. That means classroom discourse is directly affected by the teachers’ decisions, and what happens in the classroom influences instructional decisions which teachers make. Classroom discourse influences student learning; therefore, curriculum implementation strategies have a direct effect on student learning. Figure 1 illustrates the multifaceted theoretical relationship between the curriculum implementation strategies, instructional task, and classroom discourse.

*Figure 1*. Relationship between the curriculum implementation strategies, instructional tasks, classroom discourse, and student learning.
CHAPTER 2. LITERATURE REVIEW

Curriculum Implementation Strategies

Research studies of teachers’ use of curriculum materials reveal that teachers’ ideas about mathematics and how it is learned as well as their views about teaching contribute significantly to their use of curriculum materials (Collopy, 2003; Lloyd, 1999; Remillard, 1999). Teachers’ enactment of curriculum materials is shaped by the beliefs and commitments they hold, teachers’ ideas about mathematics and how it is learned, as well as their beliefs about teaching and the teacher’s role. In the process of transforming the curriculum materials, teachers may modify the prescribed materials or may adhere to the text. They may try to cover the prescribed curriculum or only part of it. All of these decisions influence student learning.

The students’ classroom practices also play a role in the enacted curriculum (Remillard & Bryans, 2004). This shows that the teachers have a crucial role of interpreting and using written curriculum materials in a manner that will enhance learning in the classroom. The participants in the current study vary in their implementation strategy, and, hence, I want to examine whether these variations have an impact on student learning outcomes.

In the standards-based curricula, learning is said to have occurred when students develop an understanding of the relationships between and among concepts and between mathematical concepts, principles, and the procedures of doing mathematics (Hiebert & Wearne, 1993). The students should not only learn facts and understand mathematics but should learn how to “do mathematics.” According to the standards, “doing mathematics” is characterized by such activities as looking for and exploring patterns to understand
mathematical structures and underlying relationships. It involves using available resources effectively and appropriately to formulate and solve problems as well as making sense of mathematical ideas, thinking, and reasoning in flexible ways. As the students do mathematics, they should reflect their ability to conjecture, generalize, justify, and communicate their mathematical ideas (Schoenfeld, 1992).

The teachers’ decisions while implementing the curriculum actually influence how the students act and how they perform the instructional tasks. The teachers should create enhanced instructional environments that give students opportunities to think and reason. The tasks given to students should have multiple solution strategies that demand explanation and justification and that can be represented in various ways. Students should therefore be provided with opportunities, encouragement, and assistance to engage in thinking, reasoning, and sense making in the mathematics classroom. Consistent engagement in these practices may lead to a deeper understanding of mathematics, as well as the ability to demonstrate complex problem solving, reasoning, and communication skills on assessment of learning outcomes. This will enhance classroom discussions, which would build students’ capacity for mathematical thinking and reasoning (Stein et al., 1996).

**Instructional Tasks**

The term “task” focuses attention to three aspects of student work: (a) the products students are to formulate such as an essay or solutions to a set of mathematical questions, (b) the operations that are to be used to generate the product such as memorizing a list of words or classifying examples of a concept, and (c) the given or resources available while they are generating a product (Doyle, 1983). Researchers have defined these three aspects of the students’ work differently. Doyle (1983) refers to tasks as academic tasks; Stein et al. (1996)
call tasks mathematical tasks; and Hiebert and Wierne (1993) refer to tasks as instructional tasks. In this study I will be using the lens of instructional tasks to refer to the activities, questions, or problems that the teachers use to enhance an engaging learning environment.

Tasks can be categorized in terms of cognitive operations that are involved in task accomplishment. For instance, tasks can be categorized as: (a) memory tasks in which students are expected to recognize or produce information previously encountered; (b) procedural or routine tasks where students are expected to apply a standardized or predictable formula or algorithm to generate answers; (c) comprehension or understanding tasks in which students are expected to recognize paraphrased versions of information previously encountered, apply procedures to new problems, or decide from among several procedures which one is applicable to a particular problem; and (d) opinion tasks where students are expected to state a preference for something (Doyle, 1983). Stein and Smith (1998) also categorized instructional tasks using the four levels of cognitive demand: (a) memorization, (b) procedures without connections to concepts or meaning, (c) procedures with connections to concepts and meaning, and (d) the doing of mathematics. While Doyle focused on the operations that students generate to find the product, Stein and Smith used these categories to determine what kind of thinking a task will demand of students.

The works that students do are defined in large measure by the nature of task that teachers assign (NCTM, 1991). Research studies have revealed that there are patterns that capture characteristic ways in which tasks unfold in the classroom (Henningsen & Stein, 1997). Some of the tasks that place high level cognitive demand on students can be implemented in such a manner that students think and reason in complex and meaningful ways. This happens only in situations where teachers draw from a number of methods that
support students’ engagement in a manner that maintains the demands of the task. These would either be scaffolding of students’ thinking, modeling of high level thinking and reasoning by the teacher or more capable peers, pressing for explanation, and selecting tasks that built on students’ prior knowledge.

Students’ day-to-day work in a mathematics classroom consists of working on a task, activities, or problems. Teachers affect task and thus student learning. The tasks that teachers assign determine how students come to understand the curriculum domain. Essentially, the task will define and structure the work the students do by setting specifications for products and explaining the process that can be used to accomplish work (Doyle, 1988). The task that the teacher selects and evaluates should match her goals for student learning (Smith & Stein, 1998). If the goal is to increase students’ ability to think and reason, then they should begin with a task that has the potential to engage students at a high level of thinking.

The nature of the tasks that students are exposed to determines what students learn (NCTM, 1991). When selecting a mathematical task, a teacher should consider the age of the students, the grade level, prior knowledge and experiences, and the norms and expectation for work in their classroom. The teacher should also focus on the level of cognitive demand in which he wants the students to engage. Stein and Smith (1998) identify the levels of cognitive demand as memorization, procedures without connections, and procedures with connections to concepts and meaning, and doing the mathematics. These constructs of instructional task are in line with Doyle’s construct of academic task since it focuses on the student’s levels of thinking.

Further research has shown that it is largely defined by the instructional tasks that the students will be given (Doyle, 1983, 1988). Tasks influence learners by directing their
attention to particular aspects of content and by specifying ways of processing information. Tasks differ in the demands they make on comprehension, strategy development, and even procedural skills. Tasks that require different cognitive processes do induce different kinds of learning and description of the tasks do provide a link between teaching and learning.

The standards-based reforms in mathematics education are therefore meant to make marked changes in the kinds of classrooms tasks teachers present to the students. The reforms aim at the reduction of practice exercise on paper and pencil algorithm and increase in meaningful problem solving (NCTM, 1989, 1991). The aim of the current reform is to reduce the emphasis on mechanical drill and to increase the time spent on solving problems where the students have not memorized a solution procedure. In the process of solving the problem, the students can develop the computation procedures rather than being prescribed the computation procedures by the teacher (Hiebert & Wierne, 1993).

Classroom Discourse

Researchers have identified certain principles to characterize desirable forms of classroom discourse. For instance, Scardamalia, Bereiter, McLean, Swallow, and Woodruff (1989) described classroom discourse as “constructive,” referring to the discourse that emerged in their research study with fourth and fifth grade science teachers. In their study, the students collaboratively built a body of knowledge about scientific phenomena and supported and defended publicly their claims, forming a “community of scholarship” in the classroom. Lampert (1989) intended new knowledge to be constructed as a joint venture in the class rather than as a communication from teacher to student.

Similarly, Mendez, et al, (2007) used the Robust Mathematical Discussions (RBD) lens to look closely at the components of students’ discourse. In their study, they used the
RBD lens to get a sense of the mathematical and discursive strength of the discourse with a major focus on representations, generalizations, and justifications as the mathematics dimensions of the RBD. Using the RBD analytic tool, discussion dimensions were also taken to describe desirable forms of classroom discourse, emphasizing the level of students’ involvement in a discussion, the way the student enters the discussion, and how the students build up ideas on one another’s ideas.

Classroom environments where the discursive practices involve student engagement in a constructive dialogue are characteristic of an environment where learning is taking place. These include and not limited to environments where the teacher is not only interested with the answers that students give for mathematical problems, but also gives students an opportunity to defend their answers as well as justifying the numerical figures which they come up with (Lampert, 1990). Within such environment there is a considerable theoretical support over the connection between classroom discourse and student learning, although the empirical data are less compelling (Hiebert & Wierne, 1993). The nature of the teacher’s talk and the kind of questions he asks do have a considerable impact on student learning. The questions that teachers ask shape the flow and the nature of classroom discussions and the cognitive opportunities offered to students (Boaler & Broodie, 2004). As students express their opinions, answer questions, and question other students’ ideas, they elaborate, clarify and reorganize their own thinking (Ball, 1993; Hatano, 1988; Lampert, 1989). When students work collaboratively to solve a problem, they also notice different features of the problem and construct different relationships than they would when working alone (Noddings, 1985; Schoenfeld, 1989).
CHAPTER 3. METHODS

Participants and Methodology

This study was part of a larger study investigating teachers’ use of and decisions about curriculum materials. In order to determine the participants for the study, we consulted with two leaders of school districts located in the Midwest region in the United States. The selection of the districts was done through purposeful sampling. This is a nonrandom method of sampling where the researcher selects information-rich cases for an in-depth study (Patton, 2001). We selected the Ades school district since their schools are using standards-based curriculum materials (Math Trailblazers) and the Demo school district that is not using any standards-based curriculum materials. Instead, the Demo schools use a variety of sources and create their own curriculum. These are two contrasting environments in which we anticipated gathering rich information about teachers’ decisions on curriculum implementation strategies and the type of instructional environments that emanate in the classrooms when teachers make the decisions.

All the teachers who participated in this research study voluntarily agreed to be involved and allowed the researcher to videotape their classes. The students also volunteered through their parents who agreed to sign the family consent form for the children to be involved in the study.

The methodology used in this study was a comparative case study (Bogdan & Bilken, 1998). A case study is a holistic, in-depth examination of a phenomenon, designed to bring out the details from the viewpoint of the participants by using multiple sources of data (Merriam, 1988). This comparative model was chosen to be able to compare two contrasting cases: where teachers use a standards-based curriculum, and where teachers create their own
curriculum. The total number of participants was four—two teachers who have used the standards-based reform curriculum (Math Trailblazers) for five years each, and two teachers who use a combination of resources to create their own curriculum.

**Participating Teachers**

All four teachers taught fourth grade in three urban schools. Pseudonyms for the teachers and the schools have been used for confidentiality purposes. Dinah and Deb teach in Canon elementary school that is in Demo urban school district, where they do not use the standard-based materials. Dinah’s and Deb’s classrooms are supported by school based math leaders, Dave and Dick, who attend planning meetings with the teachers to help them in scheduling what they would teach within a span of 20 days as well as identifying the necessary hands-on activities. They also co-teach with the Dinah and Deb, where they handle small groups as well as teaching some concepts when need arises. The other two teachers are from the Ades school district and use the same standards-based material, but teach in different schools.

Table 1

*Teacher Participants*

<table>
<thead>
<tr>
<th></th>
<th>Ades school district</th>
<th>Demo school district</th>
</tr>
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<tbody>
<tr>
<td>Vero school</td>
<td>Bare school</td>
<td>Canon school</td>
</tr>
<tr>
<td>Teachers</td>
<td>Amy</td>
<td>Anna</td>
</tr>
<tr>
<td></td>
<td>Dinah &amp; Deb</td>
<td></td>
</tr>
</tbody>
</table>
Data Collection

Integrated Mathematics and Pedagogy (IMAP)

We requested the teachers who volunteered to participate in this research study to complete the IMAP web-based beliefs survey (Philip & Schappelle, 2003). This is a beliefs survey that was designed to assess the respondents’ beliefs about mathematics, learning or knowing mathematics, as well as beliefs about how children learn and do mathematics. In this survey the teachers are supposed to use their own words to interpret situations, predict results of particular students’ actions, and then make recommendations. All four of the teachers and the school based math leaders Dave and Dick filled the IMAP survey. Their beliefs were coded using the IMAP coding navigator and scored using the rubrics of the segments (Philip & Schappelle).

Interviews

The teachers were all interviewed using semi structured interviews (Esterberg, 2002). The semi structured interviews allowed participants to share their opinions in their own words. The interviewer had topics she asked, but the participant was given an opportunity to express him or herself in a manner that he/she felt contented with the answer given, and the participant determined the direction of the interview. Three interviews were conducted with each participant: (a) the initial interview before classroom observation; (b) a post-observation interview which was done immediately after the lesson, after school, or in the evening over the telephone or via email; and (c) the end of year interview. The initial interview and the end of school year interview for all the participants were conducted in person.

In the initial interview, we asked the participants to discuss several related issues including: (a) general overall planning of the lessons, (b) curriculum materials used, (c) any
changes made on the curriculum material, (d) any other resources other than the curriculum materials used when preparing the lesson, and (e) how the teacher assessed student learning. In situations where more information was needed, follow-up questions were asked to have the participant expand more on an issue in-depth. The post observation interview was meant to focus the participant on how the lesson was enacted in the classroom and what the participant feels about the whole lesson. Questions like “What surprised you in the lesson? What did you notice? Any change that you made when teaching the lesson?” were asked.

The third interview asked the participant from the Demo school district to reflect on their personal “mathematic story” (Drake & Hufferd-Ackles, 1999). In these interviews the participants were asked to narrate their own personal history in terms of learning and teaching mathematics, pointing out low and high points as well as the people who may have influenced them most, either positively or negatively. The participants from the Ades school district had a focus group interview about the curriculum materials they were using at the end of the school year. The school based math leaders from the Demo school district and the district leader of each district were also interviewed separately. These interviews were meant to clarify the role they play and how they help teachers as they plan and teach the lessons. Some of the fourth grade level’s planning meetings in Demo school district were also audiotape, as well as taking rich detailed field notes since most of the participants had mentioned in their initial interview that they align their teaching during the grade level planning meetings.
Classroom Observations

In 2007–2008 school years, we conducted a series of 3-day observation sessions with each of the participating teachers. In Demo school district, one session was done during fall semester, one during winter semester, and two during spring semester for the participants’ mathematics classroom in the Demo school district. In the Ades school district, one session was done during winter semester and two during spring semester. In each of the observations, one of the investigators videotaped the lessons and also took detailed notes focusing on the mathematics instruction and students’ reaction to the instruction. The researcher focused on recording detailed notes on instructional events and responses to questions associated with mathematical tasks, classroom discourse, and assessment practices.

Data Analysis

Data analysis was done in three stages. In the first stage, I compared the curriculum implementation strategies of the four teachers. Although I knew from the beginning of the research project that teachers from the Ades school district had adopted a standards-based curriculum material, I still evaluated the curriculum implementation strategies and the interpretive activities that each individual teacher was using. Prior research indicates that even teachers who are exposed to the same curriculum materials differ in their interpretive activities (Remillard, 1999; Sherin & Drake, 2004).

To identify a particular teacher’s curriculum implementation strategy, I synthesized data from the Integrating Mathematics and Pedagogy (IMAP) survey, interviews, and observations. In the first stage, I focused on the decisions the teachers made before, during, and after instruction, as well as their beliefs about children’s learning and doing mathematics.
With each of the curriculum implementation strategies, my major focus was on the influence that these strategies have on the nature of instructional tasks.

The second stage involved examining the influence that the curriculum implementation strategies had on teacher-to-student interaction as well as student-to-student interaction. The third stage involved examining the influence that the curriculum implementation strategy had on student learning outcome.

**Coding System**

I developed the coding system based on the literature review on curriculum implementation strategies (Brown & Edelson, 2003; Remillard, 1999, 2005; Remillard & Bryans, 2004; Sherin & Drake, 2004), instructional tasks (Doyle, 1983; Henningsen & Stein, 1997; Hiebert, & Wierne 1993; Smith & Stein, 1998), classroom discourse (Boaler & Broodie, 2004; Lampert, 1989; Mendez et al., 2007), and student learning. To characterize a teacher’s curriculum implementation strategy, I reviewed all the data from a particular teacher, specifically (a) the teacher’s beliefs from the IMAP survey, (b) initial and post observation interviews, and (c) viewing the classroom observation videotapes. From the interviews, I looked for comments that the teacher had made concerning how the lesson was prepared, the curriculum materials used and why, what changes were made on the curriculum material if any, why the teacher made the changes, were other resources used when preparing for the lesson, as well as how they assessed whether learning had taken place.

This was followed by review of the observational data in which I compared the intended curriculum with the enacted curriculum focusing primarily on the nature of the instructional task and the classroom discourse. The notion of instructional task in this study is
similar to Doyle’s’ notion of academic task in that it includes what the students are expected to produce, how they are expected to produce it, and with what resources (Doyle, 1983).

To code the instructional tasks, I was guided by the construct of mathematical instructional tasks (Stein et al., 1996). This framework defined mathematical instructional tasks as a classroom activity whose purpose is to focus students’ attention on a particular mathematical concept, idea, or skill. This study focused on instructional tasks as set up by the teacher, instructional tasks as implemented by the student in the classroom, and the student learning outcome in the two districts.

Task set up and the task implementation were examined in terms of the level of cognitive demand. In particular, the level of cognitive demand was evaluated in terms of the kind of thinking processes entailed in solving the task as announced by the teacher and the thinking processes which students engage in during the implementation phase. The thinking processes that the students engage in ranged from memorization; use of procedures and algorithms (with or without attention to concepts, understanding, or meaning); and the discussion dimensions with a major emphasis on engagement, intensity, and building up one another’s ideas. I also looked at the constructive mathematical and discursive strength of the discourse with a major focus on representations, generalizations, and justifications as reflected in the two setting (Mendez et al., 2007).

**Curriculum Implementation Strategies**

The four teachers had distinct approaches to task selection, enactment, and invention. The task that the teachers selected regardless of the extent to which they differed from what is in the text book represented assumptions that the teachers had about content (what students should learn) and pedagogy (how they should learn it) (Remillard, 1999). Their task
selections were influenced by their ideas about mathematics, students and their learning, teaching context, and the available resources. Their task selection also represented the teachers’ beliefs about teaching and learning mathematics.

**Dinah’s Curriculum Implementation Strategy**

Dinah believes that understanding mathematical concepts is more powerful and more generative than understanding mathematical procedures; if students learn mathematical concepts before they learn procedures, they are more likely to understand the procedures when they do learn them. This was evident from her IMAP survey beliefs where she used her own words and interpreted situations, predicted results of particular students’ actions, and then made recommendations. She showed little evidence that she believes that during interactions related to the learning of mathematics, the teacher should allow the children to do as much of the thinking as possible. This reflected in the way she announced and enacted tasks in the classroom. This also influenced what textbook suggestions she used and how she used them.

In 2007–2008, we had nine classroom observations in Dinah’s class. In most of the observed mathematic classes that she taught, she did not select tasks from the textbook. In the initial interview, she indicated that she only uses the pages referenced in the district curriculum guide to look for problems that the students can do in class. She was, however, quick to mention that she only looks for the portions that are applicable for the lesson of the day. She used the textbook as a source of mathematical and representational ideas from which she adapted and invented her own tasks. The teacher used the Internet and mailbox magazines to get supplemental activities and worksheets that matched the lesson of the day based on the students’ needs. For the lesson preparation, she relied on the planning meeting
where she met for formal consultations with other fourth grade teachers to discuss what they were going to teach. She also had many informal consultations with the school based math leaders, Mr. Dick and Mr. Dave, as well as along-the-corridor discussions with other teachers.

**Deb’s Curriculum Implementation Strategy**

In 2007–2008, we had 10 classroom observations of Deb’s class. Deb did refer to a textbook when preparing for the lesson. For her, reading the text involved making a series of decisions of what to attend to and how to interpret it. She read the content of the lesson from the textbook and put that information on the board. With each new topic introduced, the teacher began by drawing on the textbook as a resource guide and then quickly placing the textbook guidance into her own decisions which responded directly to the students’ needs. In the initial interview, she was quick to comment that she relies a lot on ideas from other teachers, especially school-based math leaders, Mr. Dick and Mr. Dave, as well as the other grade level teachers. If she has to assign any work from the book, it is when the students have gone through the lesson several times. On occasions when she decides to use the textbook, she simplifies the tasks given in the book if they sound confusing to the students. She also uses the practice exercise at the back of the book, especially if it is a paper and pencil exercise.

Like Dinah, Deb relies a lot on the discussion in the planning meetings where they meet to discuss what will be covered within a given span of time. She also does much consultation with Mr. Dick and Mr. Dave, who help her with ideas of how to enact the lesson, the materials that she can use including work sheets and even games. She uses some ideas from teacher resource books. Concerning one of the observed lessons, Deb commented
in the post observation interview that she used a variety of resources to prepare and even to enact the lesson. “I used the curriculum guide and various aspects of yesterday’s textbook. Mr. Dick’s special 5s and 10s chart students filled out. Mail box magazine to enhance ideas, dry erase board, my own creation for turkey trot division sheet.” Deb used these materials as reference to be consistent and coherent with the previous day’s lesson when she had introduced the strategy for dividing by 5s and 10s. She also wanted to coordinate with the division/multiplication chart designed by Mr. Dick. When preparing for this lesson, she had noted that the tasks in the text seemed confusing to those who needed special help, and she also needed more hands on activity as well as showing a variety of ways to solve the problem. She used the textbook but changed the delivery of the problems so that they didn’t look overwhelming to the students.

*Amy’s Curriculum Implementation Strategy*

For general preparation of the lesson, Amy uses the Math Trailblazers’ curriculum material, which the whole Ades school district has adopted as the main curriculum for instruction. This is a standards-based curriculum material which is reform based. She uses the teachers’ manual since it has the supplies that she needs. It really helps her to identify the things for which to look for. She feels that the daily practice problems are engaging when the kids do them before the lesson starts. She said, “Kids do these problems before the lesson starts. Some students do them independently, while others work them in partners. Kids work challenging ones in groups.”

Amy followed the curriculum and the curriculum guide more at the beginning, but as she has gotten more experienced in teaching, she has learned how to make decisions on what she can use from the textbook and what she can leave out. She looks at the materials and
determines what she really needs in a particular lesson. During the beginning of the year interview, Amy indicated that she selectively uses the curriculum materials in accordance with students’ needs. The teachers in the Ades school district have been allowed professional autonomy to look for other materials that connect with what they have in the curriculum. Amy commented, “We do take some of the DPP [referring to the daily practice problems] which are challenging and valid to a lesson. I really liked them. Some of the puzzles and critical thinking problem solving were really good.”

Amy also formally incorporates ideas from other teachers, especially the grade level teachers. The teachers plan the lesson study together (the two fourth grade teachers) which covers three lesson studies within a school year. They hold at least one grade level meeting within the school year, where they share literature connections, across curriculum connections, as well as the problem solving skills.

Anna’s Curriculum Implementation Strategy

Anna believes that children can solve problems in novel ways before being taught how to solve those problems. This was evident from her IMAP beliefs survey which she had completed at the beginning of the school year. She revealed that she believes children can solve problems even before being taught how to do them in class. Like Amy, Anna uses Math Trailblazers curriculum material as a resource guide for instruction. In the 2007–2008 academic year, we had nine classroom observations in her room. For most of the topics that she taught, Anna selected tasks from the textbook. She felt that the textbook has enough activities, and she didn’t want to use other resources.

When preparing for a lesson, Anna looks for an activity that helps the student connect with the day’s lesson, states the problem, and gives the student some time to explore before
the lesson is introduced. Most of the tasks that she gave during the classroom observation came from the Math Trailblazers textbook. Anna provided the following reason for her persistent use of the Trailblazers resources without looking for other materials, although she makes some changes while implementing the lesson:

I use Trailblazers, and we’re trying to stay out of the outside sources since Trailblazers have enough, but I add a little bit to it myself . . . . I change my pacing and move a whole lot slower, although I cannot move very slowly. The change is also affected by how long my math class is. This year I have an hour and half class schedule, one hour for class and 15 minutes for intervention to kids and the other 15 minutes for the kids from special education class. Trailblazers provides some of the intervention, but I don’t like their extension work, so I move out of it. We’re actually using a different extension program, and most cases we use the Kathy Richardson textbook.

In other words, the changes that Anna makes are minimal and mostly related to the time that she uses to teach a particular concept. She also uses other curriculum materials for intervention since she doesn’t like the Math Trailblazers’ intervention work. As she read the materials Anna wondered whether her students would be able to play the game. When asked in the post observation interview what she thought as she prepared for the lesson, she commented, “Will my students be able to play this game? Will they understand the game? How will I manage the groups?”

Anna also changes the materials when preparing for the lesson to fit the students’ needs. In one of the lesson (observed on 1/31/2008), she made a data sheet to help the students record their scores better and help manage the game better. The teacher also modeled how to play the game so that the students would have more game time for
themselves. Anna was quick to comment that “Experience has taught me that teaching a
game goes much better if modeled first.”

During the initial and post-observation interview, all the teachers indicated that they
make changes on the curriculum materials that they use to fit the lesson of the day. Table 2
summarizes the decisions that the four participating teachers make when planning and
enacting the lessons, as well as the changes that they make on the curriculum materials.

Table 2

<table>
<thead>
<tr>
<th>Teachers</th>
<th>Curriculum material used</th>
<th>Changes made during lesson preparation</th>
<th>Changes made when enacting the lesson</th>
<th>Changes made after the lesson is taught</th>
</tr>
</thead>
</table>
| Deb      | Uses a variety of resources [Math central textbook, mailbox magazine, create her own manipulatives as well as internet] | • She reads the textbook book to know what the lesson is  
• Assigns work when she has already taught the lesson  
• Assigns work when she has already taught the lesson  
• Simplifies the activity if it looks confusing | • Assigns work when she has already taught the lesson  
• Simplifies the activity if it looks confusing  
• Changes the way she enacts the lesson if the students didn’t get it |                                                                                                      |
| Dinah    | Uses a variety of resources. [Mailbox magazines, Math central textbook, worksheets from internet as well as creating her own activities] | • She just takes what is applicable for what she is teaching in the textbook  
• She looks for ideas which can help her with application  
• Time  
• Checks for activities and worksheets which would fit the lesson  
• Did not change anything after the lesson |                                                                                                      |                                                                                                      |
| Anna     | Math Trailblazers.                                 | • She skips out some things due to time restrictions  
• Moves a lot smaller  
• Uses Kathy Richardson textbook for intervention  
• Does not like the intervention in the Math trailblazers  
• Models the games and activities  
• Would add different questions depending on what the students do and say | • Leave what they don’t need  
• Does not change anything after the lesson is taught |                                                                                                      |
| Amy      | Math Trailblazers                                  | • Evaluating the material  
• Determine what the students really need |                                                                                                      |                                                                                                      |
Task Enactment and Adaptation

This refers to how the teachers and the students transformed the planned tasks into actual classroom events. This construct is comprised of all interactions in the classroom, planned or unplanned, that influence, shape, or contribute to the enacted curriculum. Teachers’ activities are aimed at initiating and sustaining students’ work with the selected tasks in a manner that will not lower the cognitive demand. Students’ activities and teachers’ actions are critical in the enactment stage because they determine the nature of classroom discourse.

Nature of Instructional Task

Of the 37 videotaped observations, I randomly selected 12 videotapes, an average of three tapes for each teacher. For the two teachers who taught in the Demo school district, I randomly selected one videotape each from fall, winter, and spring semesters for each teacher. For teachers in the Ades school district, three videotaped lessons were randomly selected from winter and spring semesters for each teacher, because videotaping was not done in the fall semester. The lessons were transcribed, and the data were coded. The entire tasks sets in the lesson were used when coding the data.

The coding decisions of the tasks were organized upon the cognitive demand of the task as the teacher set them up and as the teachers and students in class enacted them. I categorized the tasks in terms of whether they are: (a) memory tasks, (b) tasks that involve procedures with connection to concept, and (c) tasks that do not involve procedures with connection to concept. At the implementation stage, I focused my attention at the cognitive processes that students were involved in as they did the task and made judgments over
whether the teachers’ activities as well as the teacher-student interaction lowered or maintained the cognitive demand of the task (Stein et al., 1996)
CHAPTER 4. RESULTS

There were some similarities across classrooms in their general routines. Most lessons began with a probe in the Demo school district and a daily practice problem in the Ades school district. Problems were presented by the teacher, and the students solved the problems and responded to questions about them. Often teachers assigned seatwork, where students did the task in groups of two or more. To get a number of the tasks distributed to students in each classroom, I summed up the number of tasks assigned during the whole class discussion and tasks assigned during the seatwork portions of the 12 targeted lessons.

Table 3

The Number of Tasks Assigned During the Whole Class Discussions and the Seatwork Time

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Number. of Tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deb</td>
<td>20</td>
</tr>
<tr>
<td>Dinah</td>
<td>14</td>
</tr>
<tr>
<td>Anna</td>
<td>5</td>
</tr>
<tr>
<td>Amy</td>
<td>18</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
</tr>
</tbody>
</table>

There were striking differences among the classrooms. In Dinah’s and Amy’s classroom, the teacher did most of the talking. There was a distinct contrast to Anna’s and Deb’s classrooms. In Anna’s classroom, neither the teacher nor the students talked much since the students’ tasks were in the form of activities and not questions. In Deb’s classroom, most of the instruction was in the form of small groups, and the students could do the questions and show the teacher without much discussion. Almost all the remarks made by the
teachers were questions, or they would repeat or rephrase a response provided by a student before they moved to the next question or started direct instruction. In Deb’s and Dinah’s classrooms, most students responded with one or two words, with most of them only giving the answer to the questions. Figure 2 shows the teachers’ words versus students’ words in Deb’s, Dinah’s, Anna’s, and Amy’s classes, respectively.

![Figure 2. Comparison of teachers’ and students’ words](image)

**Deb’s Classroom**

Among the 20 tasks that Deb presented in the lessons, more than 90% did not engage high cognitive thinking process when students were doing the tasks. Most tasks required memorization of facts without connections. There was no evidence of students being actively engaged in solving the tasks set for them, and even when they orally answered the given question, they didn’t seem to have understood the concept. An excerpt from one of the lesson, which was observed during fall semester, illustrates how the interaction between the teacher and the student was carried out:
T: The answer to a multiplication problem is called?
S: [Gave a chorus answer] Product
T: How many of you wrote product?
   (Some students raised their hands)
T: The number that is divided in a division problem is called?
S: Dividend, divisor [some students shout dividends while others say divisor]

These were simple tasks which did not engage the students with high-level thinking.
Teaching behaviors that general literature on academic tasks has found to support high-level student engagement (i.e., scaffolding, modeling high-level performance, consistently pressing students to provide meaningful explanations, frequent conceptual connections, student self-monitoring, as well as giving questions with multiple representations) were not identified in her classroom.

The thinking processes had been reduced to procedures without connection to meaning or understanding. The nature of the tasks given to students was not challenging, or the challenging aspect of the task was removed during the set up stage of the task. During the initial interview at the beginning of the year, when Deb was asked the changes that she makes on the curriculum material, she commented that she simplifies the tasks if they look to be confusing to the students:

If it sounds confusing in the book, we make changes and simplify it, but if it’s okay, I just use it the way it is. I also use the practice exercise at the back if it’s a paper and pencil . . .

The removal of the challenging aspect of the task necessitated lower and less sustained levels of thinking, effort, and reasoning by students. In all the tasks which she enacted in the classroom, she took over difficult pieces of the task and performed them for the students. This was evident in more than 90% of the tasks that she gave within the school year. In one
of the lessons where she spontaneously gave a task on time, she did scaffold students in a manner that reduced the complexity of the task:

T: While we’re waiting, how many minutes do we have in an hour?
S: 60
T: How many seconds in a minute?
S: 60
T: How many minutes in half an hour?
S: 30
T: This is a little bit tricky for some of you; ¼ of an hour?
S: 20
T: Not yet.
S: 10
T: No.
S: 25
T: No.
S: 15
T: Let me show you a quick way to do that. (The teacher draws the clock on the board.)
T: What time is it?
S: Longhand 7 and short hand 11.
T: What time is it? Be very careful. Where are the long hand pointing and the short hand?
S: Because oh . . . (pause). The small hand is in between the 11 and 12.
T: Is it pointing at 11 or in between 11 and 12?
S: In between.
T: What time is it? Is it 5 minutes to 7?
S: No. It’s going to be 11 something.
T: So he is telling me I’m looking at the long hand which tells me its 5 minutes to 7. They may also think its 10 minutes to 1. So sometimes you may think what time of the day you are. Is it going to be 12 something?
The desired outcome of the task was defined by the solution rather than the thinking processes entailed in reaching the solution. There was a classroom-based shift in focus from meaning and understanding towards the completeness or accuracy of answers. This was also evident with the above illustrated excerpt which was representative of most of the interactions in her classroom.

**Dinah’s Classroom**

Among the 14 tasks that Dinah assigned the students in her class, 22% of them did not expect students to engage in high-level thinking. They were memory tasks in which students were expected to recognize and produce information previously encountered. Seventy-eight percent were high-level tasks, which involved doing mathematics or the use of formulas, algorithms, or procedures with connections to concepts, understanding, or meaning. The teacher’s behaviors, however, did not support high-level student engagement, and this led to the decline of cognitive demand. The teacher reduced the complexity of the task by taking over the difficult pieces of the task and performing them for the students. These reduced the cognitive demands of the task, and the students’ cognitive processing was channeled into a more predictable and mechanical way of thinking.

Dinah did not allow an appropriate amount of time for students to discuss the problems and, therefore, denied the students an opportunity to come up with multiple solution strategies for the problems given. In fact, all of the students were supposed to use the problem solving strategies which she had given them in a previous lesson. The following is an excerpt from one of the classroom observations that reflects the kind of tasks she gave as well as the teacher-student interaction during the lesson:
T: Molly was running 2 minutes, then walking for 1 minute. She did this four times. If Molly started her work at 9:00 a.m., what time did she finish? These are the kinds of problems that we are going to be working on today.

T: Boys and girls, this is the problem. What is the thing I need to do first?

S: (Chorus answer) Circle the important facts.

T: That’s true. Circle the important facts.

T: What are the important facts to these problems? Jessica?

Jessica: 2, 1, and 4

T: We’ve talked about these before. Should I just underline 2, 1, and 4? Should I underline, Maglinda?

Maglinda: No.

T: I should include the whole thing so that I don’t get confused. 2 minutes, 1 minute 4 times. Is there anything that is important in that problem that I should be circling?

T: What’s my second step on my 5-finger problem? [Refers to 5 finger problem solving strategy.] Ashelly?

With this kind of discourse, the students did not get an opportunity to model their ideas through mathematical representations, which could have provided evidence for their subject matter knowledge to the teacher. During the post observation interview, when the teacher was asked what surprised her most in the lesson, she was quick to comment:

I really was surprised how poorly so many children did on the written review. We spent time teaching data analysis and probability in small groups, large groups, independent practice, you name it! Most of the kids have been working with graphs since kindergarten. I do see a trend that it was the change of some questions that stumped kids, so we need to talk with kids in a language that is used in testing more often.

At the end of the lesson, Dinah gave her students opportunity to play mathematical related games or “math centers.” These games could be used as high cognitive tasks
engaging students with cognitive processes, which could have led to the doing of mathematics through vigorous discussions. Like the other tasks that she had given in class, however, she gave the students the answers to the questions even before they had attempted to solve them and trusted that they would not check the answers before doing the questions. Not much attention was given to those activities within the lesson, which lowered the discursive strength of the activities. For instance, in one of the observed lessons Dinah announced the following task at the beginning of the lesson for students to do after the whole group discussion:

T: But our “can do” jobs we have some “new centers” [referring to the games she assigns students within the lesson] that focuses mostly on measurement and sets especially for our new students. And I just wanted to go over them with you so that you know that the first center is measurement mats. You remember most of our centers have direction sheets inside of it but just in case. So the measurement center, you take out a map [demonstrates] and you see it has Ahh . . . you gonna measure the width and the length of each one of these colored strips. First I want you to measure in inches and then I want you to measure in centimeters. And on the back it has the answers . Are you going to look at the answers first?

S: No

T: That’s not going to help you. What’s one important thing we have to remember when we measure something? That we all forget to do?

S: Label

This was a good activity that would have led to student discussion about the measurements as they compared the numerical figures, justified their answers, and defended them to their peers. Unfortunately, the task was ignored, and the teacher assumed that the students would use the answers given to certify their answers.
Anna’s Classroom

Conspicuously, Anna’s classroom was quite different from the other teachers’ classrooms. The tasks that she gave her students were mainly activities from the curriculum material supported by the district. She had the lowest number of tasks, but her students used manipulative more than the other classes (Table 3). She has one hour of class, 15 minutes for intervention and 15 minutes for special education students. During the one hour class the students were carrying out activities, discussing among themselves, and deriving conclusions. In the entire lessons which were selected for the analysis of this study, the students did the activities and answered a number of questions from the text book.

T: Question (b) what do you have? If the yellow hexagon is the whole, which block is going to show 1/3?
S1: 1 green triangle
T: What’s going to show 2/3?
S2: 2
T: If the red trapezoid is the whole, what block is going to show 1/3?
S1: 2 green triangles
T: What’s going to show 2/3?
S3: 1 blue triangle
T: Question 15. Show how you can use blocks as many ways as possible.

The overall goal of the lesson was to teach fractions using pattern blocks, and the students were engaged with vigorous discussions. Students explained and justified their answers. All the tasks that she assigned were comprehension and understanding tasks where the students were expected to recognize paraphrased versions of information previously encountered, apply procedures to new problems, or decide from among several procedures which one is applicable to a particular problem. When the students were carrying out the task, Anna was
able to assist them as they reasoned through problems without reducing the complexity of the task. She encouraged the students to always answer their question and follow it up with a justification. She pressed students to explain their solution processes, as well as attaching meaning to numerical figures. The students were participating in the practices of justification, evaluation, and comparison of mathematical claims which are central to the development of mathematical knowledge (Lampert, 1990). An example of her interaction with her students was: “List few things you would be able to measure in meters. List few things you would be able to measure in cm. Be ready to tell me why.”

**Amy’s Classroom**

Of the 18 tasks Amy gave within the observed lessons, 98% were either procedural tasks where students were expected to apply a standardized predictable formula or algorithm to generate answers, or comprehension/understanding tasks in which students were required to recognize paraphrased versions of information previously encountered, apply procedures to new problems, or decide from among several procedures which one is applicable to a particular problem. The tasks required high cognitive thinking, and students were engaged with constructive mathematical discussions.

Like Anna, she used most tasks from the textbook, although her tasks did not require as much time as Anna’s. She gave the students appropriate time to do the task, followed by a whole group discussion. Like Anna she always pressed students to explain their answers and to attach meaning to the numerical figures which they gave. The following is an excerpt to illustrate her interaction with the students:

T: Okay. Who can tell me exactly what your thinking was. I don’t want to hear just the answer; what your thinking is as you work through this problem
S: First I did $8 \times 7 = 56$

T: I have a question for you is it $8 \times 7$ or $8$ tens $\times 7$? There is a difference there. What if I draw this bubble here, and I break ones and tens apart; what should go in that bubble? Just like I did over here, I broke them apart [referring to the example in 1].

T: So you are saying $80 \times 7$ down here, but up here I am going to split it to 80 and 3.

S: Umm, you would put $80 \times 7$.

T: So what is $80 \times 7$? Tena?

Tena: 560.

T: 560. Okay what did you do next? Tena? How did you get 581? You only told me the first step. Did you forget? What about this one [pointing to 7 and 3]? What about $7 \times 3$?

T: And I know here we reversed those numbers.

Amy did scaffold students in a manner that maintained the complexity of the task. The excerpt represents her approach when scaffolding students within the school.
CHAPTER 5. DISCUSSION

The Role of the Teaching Context

The different classroom and school contexts described in the previous chapter played a role in the teachers’ task selection process. The school district where Dinah and Deb teach does not support the use of standards-based curriculum material. Although they did have an old selected curriculum material (Math Central), the teachers are given professional autonomy to select tasks and activities from different resources so long as those activities will meet the learning needs of their students. They did not strictly follow the activities and tasks in the textbook, and, in most cases, referred to them only when they needed some questions to give the students.

In contrast, Anna and Amy teach in a school district where they are required to use a standards-based curriculum (Math Trailblazers) as their core reference during preparation and enactment of the lesson, although they can use other resources to supplement their teaching. These school contexts played a role in teachers’ task selection and implementation as well as their beliefs in how mathematics should be taught and learned. The Math Trailblazers textbooks used by teachers from Ades school district represented the mathematics education reforms in terms of tasks and activities that should be implemented in the classroom.

In this study I have analyzed four teachers from two school districts to compare the influence of curriculum implementation strategies on the nature of instructional tasks and the impact that the decisions teachers make have on classroom discourse. In each discussion, I began with the teacher’s curriculum implementation strategy, illuminating the decisions that teachers make when preparing for the lessons as far as the changes they make on curriculum
materials. Many studies have hinted about the tension which teachers confront when using the materials and attending to students’ actions and responses in the classroom (Remillard, 1991, 1999, 2000; Stein et al., 1996).

This study highlights the significant differences that arise in the nature of tasks assigned to students and the classroom discourse when teachers decide not to use a structured curriculum material versus when they use a structured curriculum material. For the teachers in the Ades school district who used a standards-based curriculum material:

1. The nature of tasks which were assigned to students was of high cognitive demand. These were tasks which engaged students with meaningful mathematical thinking. The students were engaged in the process of framing and solving problems, looking for patterns, making conjectures, explaining constraints, making inferences from data, explaining, and even justifying.

2. Students were given an opportunity to explain their answers, justify, conjecture, and make connections with other concepts. Documented research all points to the importance of students developing deep interconnected understanding of mathematical concepts, procedures, and principles as opposed to the ability to memorize formulas and apply procedures (NCTM, 1989, 1991; National Research Council, 1989).

3. There was a clear indication that teacher’s scaffolding did not reduce the cognitive demand of the task, but maintained the complexity of the task. The teacher would initiate a discussion with an individual student or small groups and thereafter leave them to handle the task.
4. Students were given appropriate time to do the task. Through activities which occupied the whole hour of the lesson, a lot of learning was depicted to have taken place.

The classroom environment of the two participating teachers from the Demo school district represented classroom environments where teachers were creating their own curriculum. The findings indicate:

1. The tasks assigned were not challenging. Most of the tasks required students to perform a memorized procedure in a routine manner.

2. Teachers took over the challenging parts of the task and performed them for the students. This denied the students an opportunity to engage in high-level thinking when doing the tasks.

3. Students were not pressed to provide meaningful explanations to their answers, make conceptual connections, or even model high-level performance.
CHAPTER 6. CONCLUSION

The goal for discussing these two contexts of learning has been to show the disparities that curriculum implementation strategies can bring in the opportunities that we give students to learn through the nature of the instructional tasks that teachers give their students. Although the description of the relationship between the curriculum implementation strategy, the nature of instructional task, and the impact on student learning does not lead directly to prescriptions for instructions, the instructional approach used by the two teachers who utilized the standards-based curriculum material is in line with the major reform efforts in mathematics education (NCTM, 1989, 1991).

From this study, it is evident that the teachers and the two school-based math leaders in the Demo school district put a lot of effort into creating their own curriculum, a task which is challenging compared with using tasks from a structured curriculum material. In their endeavor, they have a responsibility to produce tasks of high cognitive demand as well as to implement them in a manner that engages students with high-level thinking. The teachers who use a structured standards-based curriculum already have tasks of high cognitive demand and are only charged with a responsibility of maintaining high-level thinking during implementation. This study is important to educators and policy makers at the district level who determine what type of curriculum to use as well as whether to use one at all. The teacher educators will be able to evaluate what is happening in their own classrooms and school districts and will be able to assess whether the desired learning outcomes are being achieved using the set of curricula that they have selected.

This will also be helpful to teacher educators as they prepare the pre-service teachers with the curriculum implementation strategies that would assist them in giving students the
best opportunity to learn. Future research is needed to identify tools that would facilitate and equip teachers professionally if they choose to create their own curriculum using multiple resources. This will assist the teachers equally to focus on maintaining the cognitive demand of the tasks as they engage the students during classroom instruction.
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