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Culture of Growth: Teacher Collaboration for the Empowerment of All Students

Kamilla Bahbahani
Old Dominion University

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**CULTURE OF GROWTH: TEACHER COLLABORATION FOR THE
EMPOWERMENT OF ALL STUDENTS**

By

Kamilla Bahbahani

B.A. May 1995, University of British Columbia

M.A. August 1998, University of Guelph

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Approved by:

Dwight W. Allen (Director)

Lynn Doyle (Member)

Alice Wakefield (Member)

ABSTRACT

CULTURE OF GROWTH: TEACHER COLLABORATION FOR THE EMPOWERMENT OF ALL STUDENTS

Kamilla Bahbahani
Old Dominion University, 2004
Director: Dr. Dwight Allen

This dissertation documents an in-depth year long qualitative case study of three elementary school teachers to address the following research question: what characterizes, and what are the major influences on, an integrated, constructivist-oriented approach to elementary math instruction? The researcher, working collaboratively with the teachers, used a combination of interviews, observations, journaling, and informal discourse to learn about what they want to do in their classes, the various pressures they feel for performance and student learning, the forces they balance in making their instructional choices, and the ways in which they make instructional choices and change their approaches over time. From analysis of the data a five-part model emerged. The overarching construct was the school environment, with a culture focused on collaboration and continual improvement, and administration who supported the teachers in developing an innovative and collaborative approach to instruction. Three major aspects of teacher functioning within the framework of the school were identified: Personal Agency; Philosophy; and Beliefs about Students. Personal Agency describes their sense of themselves as agents of change within the school. This includes discussions of how their personal educational history gave rise to their current practice; their sense of responsibility for change; their processes of growth and development as professionals; and their excitement about teaching and their students. Philosophy

encompasses their commitment to theory-based practice and their views on various philosophies of education such as constructivism, direct instruction, and special education. Beliefs about Students addresses their commitment to understanding and respect of student thought processes; an underlying belief that all students, of whatever abilities and challenges, can learn; and the way they create collaborative, supportive classroom learning environments to support student development. These three constructs gave rise to a set of particular instructional approaches and strategies, the fifth construct. Major elements of their instructional approaches include use of questioning and wait time to elicit student thinking; active teaching and inculcation of cognitive strategies for problem solving; and group processes such as math talk, flexible grouping, and peer interaction.

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CHAPTER 1: INTRODUCTION

The report *A Nation at Risk*, released in 1983 (National Commission on Excellence in Education), framed math and science education as priorities for American education. This report, released at the same time as the rise of the current movement for accountability and national standards, promoted content focused standardized tests that allowed easy, comparable measurement of achievement. From that time period, American mathematics education has continued to rely on traditional teaching methods using standardized algorithms for solving problems with a limited emphasis on personal understanding and self-directed learning (Bransford, Brown, & Cocking, 1999; Murray, 1998). This is in contrast with emerging research on learning, which emphasizes integrated, contextual educational experiences as essential to developing deep, transferable understanding (Bransford et al., 1999).

The current federal policy on education (United States Department of Education, 2001) calls for frequent, centralized testing and strict standards of accountability. While these are not inherently in contradiction with effective learning, the types of tests used in standardized testing, owing to the needs of centralized marking and administration, generally emphasize rote learning and do not allow for a holistic picture of student achievement. These methods also are not known to develop higher level thinking skills or promote transfer of learning (Bransford et al., 1999; Shepard, 2001). Based on these and other problems, Thompson (1994) identifies the need for systemic education reform, including an emphasis on “depth of knowledge” and “new relationships between people”; neither of these is an explicit priority of current policy. Brooks and Brooks (1999) talk

about the disconnect between the current wave of national policy and the philosophy of constructivist education. The National Association for the Education of Young Children and the National Council for Teachers of Mathematics' joint statement *Early Childhood Mathematics* (2002) addresses this reform need, identifying the principle that "students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge" (p. 2). This principle implies an active grappling with mathematical concepts, and an internalization of knowledge through this process. One of NAEYC and NCTM's specific recommendations is the use of "... teaching practices that strengthen children's problem-solving and reasoning processes as well as representing, communicating, and connecting mathematical ideas" (p. 3). This again differs from traditional math environments (Battista, 1999; Murray, 1998) and from current federal policy.

Moving down to the level of the state, Virginia's Standards of Learning (SOLs) mirror and magnify the pressures exerted by federal performance expectations. Among the most developed in the nation (The Princeton Review, 2003), the Virginia SOLs and the rigorous curriculum guides associated with them put heavy demands on teachers to teach to the test and rush the curriculum in order to cover all content. Other external pressures such as rigid administrative reviews of performance combine with high stakes testing to make the classroom a stressful place. As a result, teaching for meaning and providing chances for students to question and develop understanding often are lost.

Within this high pressure environment, a beacon of hope gleams. There is an alternative approach that can develop autonomous, creative thinkers who also are capable of demonstrating their skills on standardized learning measures. This dissertation

research goes inside such an alternate universe to document the characteristics and unique approaches to instruction of three exemplary constructivist oriented teachers at one exceptional school in Virginia. As we look at their methods and philosophy, which combine idealistic beliefs about students and education with current research on how we as humans learn best, we can acquire a vision for a new way of teaching that can meet the educational demands of both conservatives and progressives.

Given the multiple pressures and constraints on their time and methods of functioning, how do teachers engage in reflective and collaborative teaching practice that moves them toward a flexible, integrated instructional approach to teaching mathematics? More specifically, what characterizes, and what are the major influences on, an integrated, constructivist-oriented approach to elementary math instruction? This dissertation examines the processes of thinking, learning, change and interaction in which three teachers engage in their attempts to make integrated sense of their philosophies of teaching and learning, research on learning practices, and experiences in their classrooms with math learning.

Summary of the Study

Newsome Park Elementary School, the site of this research, is an urban elementary magnet math, science and technology school in Newport News, Virginia. Their instructional methods emphasize development of innate student reasoning through student discussion, questioning methods, and project-based learning. Within math classes, the emphasis is on the thinking process and on application of thinking strategies to problem solving. These activities are correlated with a significant increase in

standardized test scores for the school over the past seven years. Within math, teachers have been developing and implementing a range of complementary instructional strategies which seem to work together to enhance student understanding of and performance in math. This set of strategies includes a focus on metacognition, the awareness of one's own cognitive processes, and ability to direct them in support of independent learning (Allen & Armour-Thomas, 1993; Desoete, Roeyers, & Buysse, 2001; Carr & Jessup, 1997; Maqsud, 1998; Mayer & Wittrock, 1996; Wolf & Brush, 2000; Zan, 2000), discourse and writing in math (Card, 1998; Cazden, 1986; Meier & Rishel, 1998; Pugalee, 2001), and other strategies. This research will provide insight into methods of teacher interaction and thought that promote reflexive and interactive teaching practices in the context of elementary mathematics.

Framework of the Literature

Three bodies of literature lie at the heart of this dissertation. First and foundationally, philosophy and theories on how people learn form the overall context for a study of teacher choices of instructional methods. Next we move to the research base on teacher professional development and collaboration, examining the factors that influence collaboration, the influence of collaboration on teacher performance and student learning, and the role of administration in supporting that process. The literature includes an examination of the role of the teacher in the classroom, focusing on "teacher as researcher" and models of collaborative research. Finally, we turn to the research on the classroom: what methods of teaching have been found to enhance student learning, focusing on math learning and best approaches to teaching math. The literature will

elucidate the dynamic context in which these teachers are attempting to forge effective classroom practice.

Determining what factors are significant in promoting learning has been a central issue of education through the last century. Early researchers believed that innate ability was what distinguished high from low performing students, and detailed empirical work to measure intelligence – coded down to a number known as IQ (intelligence quotient) – followed from this. Such an approach left little room for educational interventions, only for curricula that met people at their assessed intellectual level (Shepard, 2001). Later researchers believed that institutional or structural factors were the most significant factors in determining outcomes, leading to work on class size and related measures. From there, researchers moved to examining student cognitive and affective characteristics such as attitude towards self and towards subject; and cognitive strategies used in problem-solving (Bransford et al., 1999; Sherman, 1985). These varying factors often have been studied in isolation, and researchers have tried to identify which particular strategies or attitudes are the most important in determining educational outcomes.

One new approach in education is to examine the role of integrated versus fragmented approaches to instruction. Newer research (e.g., Hickey, Moore, & Pellegrino, 2001; Langer, 2001) supports the importance of “whole fabric” approaches to education, where the synthesis of a diverse array of strategies, joined through a common theoretical framework and set of attitudes, results in maximum learning outcomes for students. Isolated strategies have been shown to have only limited effectiveness – it is the seamless integration of a set of strategies that sets the stage for success. However,

integrated pedagogical strategies have not been studied in detail because of the challenges of treatment fidelity in education, as well as the difficulty of focusing on a complex of strategies rather than specific teacher actions. A whole fabric orientation leads to a research paradigm where researchers examine education in the classrooms as an integrated process, rather than attempting to isolate specific strategies and study them apart from their context.

In creating such integrated learning environments, new theory posits a stronger and more central role for teachers as possessors of authentic knowledge about the classroom. Emerging theory focuses on the empowerment of teachers and their role as researchers and generators of knowledge in their classrooms. More work is being done with teachers as collaborative researchers in knowledge generation. New relationships between schools and universities, researchers on various levels, and teachers at public schools, private schools and universities are being examined to meet demands for new kinds of knowledge (Astington, 1997; D'Ambrosio, 1998; Franke, Carpenter, Levi, & Fennema, 2001; Garet, Porter, Desimone, Birman & Yoon, 2001; Menon & Owens, 1994; Parsad, Lewis, & Farris, 2001; Pierce & Hunsaker, 1996; Potter, 2001; Ruiz & Pares, 1997; Wasser & Bresler, 1996; Wenglinsky, 2001). Research often is seen as part of teacher professional development (Burbank & Kauchak, 2003; D'Ambrosio, 1998; Inger, 1993; Sachs, 1999).

In addition to emphasizing a holistic approach to the instructional environment, the literature also focuses on implementing a range of strategies with vigor and attention. In the area of math learning, a large number of strategies can be used in an integrated manner to help students become autonomous, self-directed and enthusiastic math

learners. Some of the strategies employed include enhancing levels of cognition and metacognition through instruction and application (Allen & Armour-Thomas, 1993; Collins 1994; Desoete et al., 2001; Langer, 2001; Mayer & Wittrock, 1996; Mevarech, 1999; National Association for the Education of Young Children and the National Council for Teachers of Mathematics (NAEYC & NCTM), 2002; Project Zero, 2002; Sheffield & Cruikshank, 2001; Sherman, 1985; Sperling, Walls, & Hill, 2000), student discourse on math problems and methods (Cazden, 1986; Roth, 1993; Shepard, 2001; Sheppard & Kanevsky, 1999), writing about math thinking and solution pathways (Blakey & Spence, 1990; Card, 1998; Meier & Rishel, 1998; Pugalee, 2001), and student collaboration (Manion & Alexander, 1997; Mevarech, 1999; Sheppard & Kanevsky, 1999).

Research on math learning has identified a range of strategies that enhance learning. Policy documents by such bodies as the National Association for the Education of Young Children and the National Council for Teachers of Mathematics (2002) identify research-based approaches as their major focus: providing interactive opportunities for children to develop an understanding of math; integrating math into other subject areas; and using play, problem solving, extended project engagement, and relating math to previous knowledge, as components of high quality math instruction. Work by other researchers (DeVries, Zan, Hildebrandt, Edmiaston, & Sales, 2002; Hickey, Moore, & Pellegrino, 2001; Mayer, 2003; Mayer, 2004; Schifter, 1996) identifies different components of math problem solving. Mayer, for example, writes about stages of math problem solving, beginning with Problem Translation from the written word to a mental representation; through integration of knowledge, production of a plan, monitoring of the

implementation of that solution plan, and working out the answer. He writes that only the last phase, known as procedural knowledge, is emphasized in traditional math instruction. Other research has shown the effectiveness of problem- and project-based inquiry in math (Phillips, Phillips, Melton, & Moore, 1994).

Overview of the Study and Methodology

Bringing together these three threads – (a) various philosophies of education that focus on developmental approaches to child learning; (b) teacher professional development and collaboration in a school wide context; and (c) how teachers teach and how students learn, particularly in the area of math – the goal of this research is to develop an understanding of how three teachers move towards one “whole fabric” of instructional strategies focused around effective learning in math for all students. The research question examines what influences and what characterizes the approach to teaching of these teachers, focusing on the administrative school framework in which they work, their personal agency or sense of themselves as responsible for and capable of creating change, their philosophy, beliefs about students, and the actual strategies that are used in the classroom.

To address this broad research question, a qualitative case study methodology was chosen. The researcher, working collaboratively with the teachers, used a combination of interviews, observations, journaling and informal discourse to learn about what they want to do in their classes, the various pressures they feel for performance and student learning, the forces they balance in making their instructional choices, and ways in which they make instructional choices and change their approaches over time. The hope is that

the results of this research will inform teacher practice in the integration of an array of strategies for effective instruction, as well as tell the story of one attempt to create autonomy in teachers. The researcher does not claim that this is the only story of this school; there are other collaborations and interactions occurring that are equally of interest, as well as other ways of telling this story. However, this is one window into an unusual educational environment and an exceptional group of collaborators.

Definition of Terms

Since some terms in this dissertation are open to many interpretations, they are defined here for clarity. As used in this dissertation, constructivism refers to a philosophy of education which says that learning occurs when we construct knowledge for ourselves, building on prior knowledge and making connections with new knowledge. This definition does not prescribe a particular mode of instruction, but it does include the possibility for active teacher involvement in the learning process. Direct instruction is an instructional method where students are shown or told what methods to use in solving problems without encouragement to develop an understanding of the meaning behind those methods, or to devise their own solution methods. Skills-based or skill-based instruction refers to a teaching strategy where students are taught a particular process for solving problems rather than being prompted to develop a process themselves. In this study, skills-based instruction involves the use of questioning and student internalization of the process rather than an entirely prescriptive teaching method. Skills-based instruction can resemble either direct instruction or constructivism, depending on the way in which the lesson is taught.

Choice of Voice

I have chosen to write primarily in the female voice for several reasons. First, I and the three teachers with whom I work are women, so the use of “her” and “she” are more authentic for this research process. Second, since the use of the female voice as the norm is less common than the male, I chose to address this imbalance. Relatedly, since the female voice is less common it tends to attract more attention when used, allowing the reader to think more carefully about the experience being described. Finally, I feel a social responsibility to normalize the female experience in writing.

CHAPTER 2: LITERATURE REVIEW

Introduction

This dissertation examines the processes of thinking, learning, change and interaction in which three teachers engage as they strive to put their beliefs about education into practice in the context of a constructivist oriented school. In collaboration with their colleagues, and working in a particular administrative milieu, their teaching practice continues to grow and evolve as they explore three major dimensions: their sense of self as it relates to being an agent of change and transformation; their own philosophies about education and learning; and their beliefs about the characteristics and capabilities of students. These three elements are integrated within their classrooms as they evolve a set of integrated, seamless strategies that reflect their philosophies and beliefs. Three main bodies of literature will be examined: (a) various philosophies of education that focus on developmental approaches to child learning; (b) teacher professional development and collaboration in a school wide context; and (c) how teachers teach and how students learn, particularly in the area of math.

The three bodies of literature can be divided into different subthemes.

Philosophies of learning and teaching begins with examining the work of the well-known educational psychologists and theorists Dewey, Piaget, and Vygotsky (Acredolo, 1997; Barouillet & Poirier, 1997; Berube, 2000; Bickhard, 1997; Dewey, 1933; Jaramillo, 1996; Kamii & Ewing, 1996; Kamii, 2000; Piaget, 1972, 1973; Singer & Revenson, 1996; Vygotsky, 1978). Next, ideas about education for social change and perspectives of the educators about those they are educating are examined in the work of educational theorist

and practitioner Freire and others (Finn, 1999; Freire, 1993). The review moves on to examine other theories such as theory of mind (Astington, 1997, 1998; Flavell, 1999; Sperling et al., 2000) and the philosophy of constructivism from the perspective of its proponents and critics (Baker, 1999; Battista, 1999; Bereiter, in progress; Conley, 1993; Kamii & Ewing, 1996; Kamii, 2000; Mayer, 2004; Murray, 1998; Phillips et al., 1994; Routman, 2003; Sheffield & Cruikshank, 2001; Stone, 1996; von Glasersfeld, 1991).

Research on teacher professional development and collaboration includes research by a number of writers (Astington, 1997; Burbank & Kauchak, 2003; D'Ambrosio, 1998; Franke, Carpenter, Levi, & Fennema, 2001; Garet, Porter, Desimone, Birman & Yoon, 2001; Inger, 1993; Menon & Owens, 1994; Parsad, Lewis, & Farris, 2001; Pierce & Hunsaker, 1996; Potter, 2001; Sachs, 1999; Ruiz & Pares, 1997; Wasser & Bresler, 1996; Wenglinsky, 2001). They discuss various ways in which professional development for teachers is viewed and integrated with research.

Finally, work on teaching and student learning addresses research on metacognition (Allen & Armour-Thomas, 1993; Boudah & Weiss, 2002; Bransford et al., 1999; Collins 1994; Desoete et al., 2001; Desoete & Roeyers, 2002; NAEYC & NCTM, 2002; Project Zero, 2002; Pugalee, 2001; Sheffield & Cruikshank, 2001; Sherman, 1985; Sperling et al., 2000) as well as math learning (DeVries et al., 2002; Mayer, 2003; Schifter, 1996). Looking at the link between instruction and learning, some research explores the link between pedagogy, cognition and metacognition, and the impact of various instructional strategies on learning (Card, 1998; Cazden, 1986; Hickey et al., 2001; Hoek and others, 1997; Ip, 2001; Langer, 2001; Maqsdud, 1998; Meier & Rishel, 1998; Pugalee, 2001; Routman, 2003; Shepard, 2001; Wolf & Brush, 2000; Zan, 2000).

Other work examines the impact of overall instructional environments on student learning (Anderson & Lee, 1997; Ewey, 1996; Krajcik et al., 2000; Langer, 2001; Mayer & Wittrock, 1996; Schneider et al., 2002; Shepard, 2001; Thomas, 2000; Woods, 1994).

(a) Philosophy and Theories on How People Learn

A number of educational philosophers over the past century have outlined theories of human learning. Three of the key philosophers whose ideas are relevant to the research question are Dewey, Piaget and Vygotsky. They posited innate logical abilities in children and outlined an approach to math education where students work on problems using their own logic and mental processes, and share their understandings with their peers in a facilitated dialogue. Emphasis is placed on logic, reasoning and awareness of process; the teacher functions as facilitator of learning. Within this framework, a variety of cognitive and metacognitive strategies allow students to be active learners (Acredolo, 1997; Barouillet & Poirier, 1997; Berube, 2000; Bickhard, 1997; Dewey, 1933; Jaramillo, 1996; Piaget, 1972, 1973; Vygotsky, 1978).

Dewey's Philosophy

John Dewey, an American philosopher in the early 1900s, focused on education to develop the whole child, which he defined as having intellectual, moral, social and aesthetic dimensions. The main purpose of education, according to Dewey, is to develop the ability to think and understand our experiences in the world. To achieve this purpose, education needs to be based on real world experiences or issues. Both practical and theoretical questions, generated by the learner, can be the subject of education (Berube, 2000; Dewey, 1933).

As an organizing concept, Dewey's key concern was the way that humans think. His book *How We Think* (1933) is a detailed exposition of the different types of mental processes humans engage in, how these relate to scientific reasoning, and how schools can develop these burgeoning processes in students. His book is a justification for the existence of education: that effective human thought, while an innate capacity in humans, does not develop automatically, and can be misdeveloped to produce harmful results for the individual and society. *How We Think* gives great impetus to all movements to educate young people in how to think. He identifies "reflective thinking" as the "better" way of thinking, and defines it as "turning a subject over in the mind and giving it serious and consecutive consideration" (p. 3). As opposed to simply letting the mind wander, reflective thinking is thought directed to understand something. It is willed, controlled, focused, and, thus, has consequence. The first step of such reflective thinking is a state of confusion in the mind of the thinker that demands resolution, a form of cognitive dissonance. The next step is identification of the resources available to resolve that confusion. At this stage, Dewey warns that people "may not be sufficiently *critical* about the ideas that occur to [them]" (p. 16; emphasis in the original), rather than effectively evaluating information they have available to understand and resolve the confusion. This is an area where educational interventions are envisaged as means of developing critical thinking skills in students. Teachers, primarily through questioning techniques, can assist students to develop such a critical understanding.

The need for goal orientation in education is another of Dewey's key ideas. He writes that "the nature of the problem fixes the end of thought, and the end controls the process of thinking" (p. 15). In other words, the type of thinking we do is driven by the

goal we have in mind. If the goal is achieving a good score on a test, the thinking processes engendered will be different (and to Dewey's mind, inferior) than if the goal is understanding in order to resolve a problem we have posed for ourselves.

Dewey has a strong focus on curiosity. Curiosity is an innate human condition that cannot be created, though it can be destroyed. He writes that the job of the teacher is "to provide the materials and conditions by which organic curiosity will be directed into investigations that have an aim and that produce results in a way of increase of knowledge" (p. 40). This gives place of pride to student-initiated questions as a starting point for learning.

Dewey also emphasizes the importance of experience in creating our understanding. Simply sitting and thinking does not make us know: interaction with situations serves to create understanding. As well, random experiences are not always productive whereas carefully guided endeavors can be more so. As he says:

We cannot make ourselves have ideas or not have them any more than we can directly make ourselves have sensations from things. In the one case as in the other, we can put ourselves or be put by others into situations where we are likely to have sensations and ideas in worthwhile ways, in ways that lead on to something else and so insure that the person be developed and recreated by them and not be exhausted by the mere having of them. (p. 41)

In this case, Dewey provides a link to the role of teacher as facilitator. With knowledge of pedagogy and a clear vision for what students need to learn from particular projects, the teacher can guide and frame the learning experience so that student experiences result in useful learning, not frustration.

Piaget's Theory

Piaget focused on stages of child development. His indepth qualitative studies of children's behavior showed that children go through processes of accommodation and assimilation of new knowledge rather than simply acquiring it verbatim (Singer & Revenson, 1996). New concepts that an individual encounters are assimilated into the current cognitive conception of the world until that individual encounters something so different that it severely challenges the current conception. The mental conception then needs to "accommodate" or change to incorporate new information. In doing so, the child actively constructs new knowledge (Kamii & Ewing, 1996).

Piaget identified four major cognitive stages that children move through. These were the sensorimotor stage, where the child sees little distinction between himself and his environment, or of himself as an autonomous being; the preoperational stage, where the child becomes aware of the distinction between self and other, begins to internalize representations of his actions, but lacks a concept of reversibility of actions; the concrete operational stage, where the child can apply such concepts as reversibility and conservation to real problems; and the stage of formal operations, where the hands-on concepts formed in the concrete operational stage become hypothetical and applicable by the child to diverse situations. Piaget did not hypothesize any stages of cognitive development beyond the early teen years. The major cause of movement between the stages is seen as innate developmental processes, although interaction with others and environmental stimuli were seen to promote more rapid advancement through the stages (Kamii & Ewing, 1996; Piaget, 1972, 1973).

Later research (e.g., Suizzo, 2000) has modified some of Piaget's research in some significant ways, notably by lowering the ages at which certain developmental markers are reached. Ongoing work continues to build on his ideas (Acredolo, 1997; Barrouillet & Poirier, 1997; Bickard, 1997). However, most researchers have not discarded the idea of developmental stages, the general characteristics associated with those stages, or a number of the cognitive experiments developed by Piaget.

Vygotsky's Theory

Vygotsky's sociocultural theory emphasizes the social context in which learning takes place as the major influence on human development (Vygotsky, 1978). Ideas are formed through social interaction, specifically, with those who are at a more advanced stage of development. Knowledge is constructed socially, but understanding has to be constructed by each individual. Teachers play an active role in Vygotsky's conception of learning as teachers of thinking processes, but the individual is still the one who constructs her own understanding. Many writers have taken his ideas about the social context of human learning and the role of discourse in learning and applied them to diverse situations, such as adult learning, research methods, the home environment, and diverse instructional environments (Cook et al. 2002; Langer, 2001; Potter, 2001; Roth, 1993). His theory, with its focus on human interaction and the social negotiation of meaning, has been cited as a contributor to constructivist theory (Jaramillo, 1996).

Radical Pedagogy

Freire's (1993) work on social oppression and education provide a social consciousness and context to the collection of theories about how people learn. Working among the urban poor in Brazil, Freire and his associates undertook literacy education

from an explicit radical perspective. Seeing literacy as a symbol of oppression, they did not want to become literate because they felt that they were becoming like their oppressors. Engagement in learning to read needed to be transformed into a social action of benefit to the illiterate before they would have the motive to become literate and thus similar to their oppressors. He approached education with the premise that all people are equal with the same basic right to self-actualize. With this as motive, the literacy program was structured so as to help participants become aware of the context of oppression in which they were working, and the ways that literacy could help them become more complete individuals. Dialogue was the primary instructional method, used to enlighten, make the participant aware of his or her own thoughts, and create a collective consciousness. The impact of this educational program, with its goals of direct social transformation and empowerment of the oppressed masses, was so significant that Freire was exiled from Brazil.

These principles of radical pedagogy were applied by Finn (1999) in his meta-analysis of work on literacy among working class students. Through a comparative analysis of multiple studies he shows how students from minority or lower class backgrounds often have significantly different forms of communication and relationships with authority than wealthier students or the majority of teachers. Such students are more likely to have context laden speech and less likely to question authority. Their literacy is “functional”, not providing them with the tools to ask for what they want in ways that will earn respect. In order for students from these backgrounds to be successful at school and develop “powerful literacy”, they need to be subjected to the same high expectations and creative learning opportunities as students from wealthier mainstream backgrounds.

The type of environment at the school, attitudes of the teacher towards students, and instructional methods therefore play a significant role in student success.

Additional Learning Theories and Philosophies

Theory of mind is another theoretical position on the way children think. It is the third and current stage of theories of children's knowledge as identified by Flavell (1999). The previous stages of (a) Piagetian-based research that emphasized the evolution of perspective taking; and (b) work on metacognition and learning strategies in the 1970s, built a foundation for its development. Beginning in the 1980s, theory of mind looks from infancy on at the development of an understanding of desires and beliefs and how these shape action. Flavell states that theory of mind research, which focuses primarily on preschool children, now dominates the entire field of cognitive psychology. Astington (1997, 1998) emphasizes the importance of children's theory of mind, or their basic understanding of human behavior. Theory of mind examines children's ability to be aware of their thinking and the thoughts and beliefs of others, which influences their ability to reason, interact with others, and learn from multiple sources of information. Activities that encourage thinking about the motivations and feelings of others; questioning methods by teachers or peer to peer about personal choices and beliefs; and modeling of reflective thinking by teachers, all assist to develop children's theory of mind. These approaches resemble some of the thinking methods proposed by Dewey. Theory of mind is a model for the concept of metacognition for young children (Sperling et al., 2000).

Constructivism, another theory of learning, is a newer model for curriculum, instruction and assessment. It reflects new conceptions of human learning, many of

which are based on scientific research on learning theories as well as on the work of prominent educational theorists such as Dewey, Vygotsky, Piaget, and others (Shepard, 2001). In discussions, questions have been raised as to whether Vygotsky is a contributor to constructivism, and as to the seemingly eclectic nature of the philosophy. In fact, the base of constructivism is much wider than is often acknowledged, as many philosophers and theorists describe learning as the construction of knowledge by an individual. Thus, constructivism covers as wide spectrum of forms as it embraces these diverse practitioners. Considering its manifestations in practice, constructivism similarly suggests a wide array of practices, some of which are shared with other philosophies, but all of which further the goal of student construction of knowledge. In the view of Kamii & Ewing (1996), constructivism can be derived directly from Piaget's studies of how children construct knowledge. Kamii (2000) expands on these implications in her book length study of children's development of mathematical principles. Constructivism comes in many forms and degrees, from social to cognitive to radical. For example, Roth (1993) takes a Vygotskian social constructivist perspective rather than that of Piaget's internal negotiation of meanings, or cognitive constructivist. He identifies a constructivist approach to science where science is seen as process by which meaning is generated. Knowledge in this model is not external and absolute, it is held by the individual and created by those participating in the process. Extreme versions of constructivism often are seen to promote unstructured, nondirected, open ended learning, where students are entirely responsible for constructing their own knowledge. Conley (1993) offers one definition of constructivism when noting that, contrary to simplified outsider views on constructivism, its goal is not to make learning fun for students, but to

allow more learning and retention than by other methods. In Sheffield and Cruikshank's (2001) view, constructivist approaches tend to prevent the creation of learning anxiety by presenting math as approachable and empowering students to solve problems.

Constructivism is a theory of learning and not of teaching (DeVries, 2002; Mayer, 2004). Much work is needed, therefore, to translate the theory into concrete practices that would facilitate student learning, and there is wide experimentation by constructivist educators to find these best practices. The types of practices proposed and accepted vary by the form of constructivism, as well as the beliefs of each practitioner. In examining the evolution of constructivist strategies, Battista's (1999) distinction between the general philosophy of constructivism and research-based constructivism that advocates particular instructional strategies provides a helpful guideline. Some constructivist practices are embraced because they accord with theory, whereas others have been shown to be effective in individual classrooms and in larger scale research studies.

There are many works on developing constructivist curriculum and activities (DeVries et al., 2002; von Glasersfeld, 1991) but as yet, no final position on what defines all features of a constructivist teaching approach. The lack of a closed canon for what constitutes constructivist education accounts for some of the contradictory research findings on constructivist teaching. In spite of the diversity of views, some commonalities that have emerged. Use of questioning methods, student-directed activities, and student dialogue are common features of many constructivist classrooms.

One of the core dilemmas of constructivist instruction is balancing teacher directed and student directed activities. How does a teacher decide when to teach strategies, and when to let students discover them on their own? Routman (2003)

emphasizes the need to use a continuum of instructional strategies to maximize student learning, beginning with demonstration and moving through shared demonstration and guided practice to independent practice, where the student directs learning herself. This continuum, which was developed by Routman through extensive classroom experience, still allows for active processing of knowledge by students while providing the support needed as they encounter new material to develop appropriate learning strategies and models. This moderated form of social constructivism maintains an emphasis on students becoming autonomous learners without requiring them to develop all knowledge independently without the assistance of a facilitator or teacher.

As with all learning theories, there are those who disagree with the validity of constructivist education practices. Murray (1998) highlights the controversy over whether the overall poor performance of US students in math is a result of the move towards constructivist math teaching methods, or of the still predominant “skill-and-drill methods.” Stone (1996) is one of the critics of constructivism, classifying it as a form of what he terms “developmentalism.” His main critique is that it is based on a false assumption of the value of natural, undirected development for children, preventing adoption of rigorous learning methods in schools. Baker (1999) picks up this critique, defining developmentalism as a belief that human development moves through clearly defined stages, and that these stages can be equated with progress. She cites some of the limitations of this view, in particular, the resultant focus on who is more capable of development than others and thus a stratification and evaluation of children. Bereiter, in a work in progress published on the internet, offers another critique of constructivism as not differentiating between the learning processes and knowledge that is its building

blocks. As a result, in his view, constructivists engage students in learning activities that are fruitless because students lack the pieces of data needed as raw material to be reconstructed through their actions. Most constructivist educators would disagree with his assessment of constructivism as it reflects a common misconception: that all constructivism consists of open, discovery-based learning without any teacher guidance. While such practices may be used in radical constructivism, social constructivism involves an active role for the teacher. Many constructivist teachers rigorously structure their classrooms and provide extensive scaffolding and support for student learning. Nonetheless, Bereiter's views are commonly held and similar criticisms often are leveled at constructivist educators.

Mayer (2004) provides another critique of one particular instructional method commonly associated with constructivism: discovery learning. His hypothesis in undertaking a meta-analysis was that a variety of teaching strategies can lead to constructivist learning, not simply activities that are entirely student directed. Examining research in three different areas – discovery of problem solving rules, discovery of conservation strategies, and discovery of LOGO programming strategies – he found that in each area, pure discovery learning resulted in lower performance gains for students than their participation in guided learning. He suggests choosing methods of instruction “not on how much doing or discussing is involved but rather on the degree to which they promote appropriate cognitive processing” (p. 17).

(b) Teacher Professional Development and Collaboration in a School Wide Context

Teacher professional development is a standard feature of educational practice. A review by Inger (1993) of the research on teacher collaboration in urban secondary schools found multiple benefits from collaboration, including improved student behavior and achievement, and increased teacher satisfaction and sense of effectiveness. What is new is its emphasis on teacher-centered rather than expert-centered approaches, and on the integration of research into this paradigm. Parsad, Lewis, and Farris (2001) reviewed the National Center on Education Statistics (NCES) Fast Response survey of teachers in the nation. They found that 52 to 69% of teachers regularly engage in collaborative activities such as talking with other teachers, networking with teachers from other schools, planning together, and collaborating on a research topic (52%). Mentoring involved about one fourth of the teachers. Collaboration also was linked with feelings of preparedness by the teachers (18% to 34%, depending on the activity). From this data it is clear that professional collaboration is widespread in the schools. Of particular interest is the finding that about half of the teacher respondents collaborate on research projects. More detailed research into the type and variety of projects and their relative success could provide insights into the characteristics of and prerequisites for effective teacher collaboration.

The importance of focusing on the teacher and her instructional methods is emphasized in a comprehensive report by Wenglinsky (2001), conducted for the Educational Testing Service. His study was based on the 1996 National Assessment of Educational Progress data on mathematics learning among 7,146 eighth grade students. Separate questionnaires administered to their teachers examined their academic training,

types of professional training in the previous ten years, and their use of 21 classroom practices. Using multilevel structural equation modeling to generate factor models and path models, he generated multiple models. While at the school level he found that the socioeconomic characteristics of the students (198.41, $p = .05$, effect size = .76) overshadowed three indicators of teacher characteristics (4.82 to 1.03, $p = .05$ to .10, effect size = .09 to .02), effect sizes for all classroom practices combined to .56, and effect sizes for professional development, to .33. As well, the effect sizes for teacher characteristics totaled .98, suggesting that these have an even higher effect on student performance than SES, with its effect size of .76. The elements of teacher quality most closely correlated with student achievement when SES and class size are factored out are teacher major, professional development in higher order thinking skills and diversity, and practicing hands-on learning and higher order thinking skills in the classroom. He concludes that teacher methods and teacher characteristics are as significant as student socioeconomic background in determining school success. Another important finding is that professional development, in whatever area, seems to have a positive impact on student achievement. In addition, he notes that schools which have a critical mass of teachers who emphasize higher order thinking and allow students to engage in the complexity of math learning will enhance student performance. As an aside, Wenglinsky emphasizes the importance of qualitative research in generating insights into classroom practice which then can be examined in other contexts and subjected to quantitative testing; such insights often are missed in large scale quantitative studies, resulting in a statistical undervaluing of the significance of classroom practices on improving performance.

Pierce and Hunsaker (1996) and others identify the need to have teachers involved in identification of their own professional development needs and in creating materials to fill those needs. Garet et al. (2001) found that professional development activities that covered longer time spans, connected with other professional development activities, and involved active learning were more effective than those of shorter duration, dealing with disconnected content and involving passive transmission of knowledge. Content intensive professional development that did not focus on teaching knowledge and skills had negative impacts teacher performance. Garet et al.'s study was based on 1,027 randomly sampled teachers from across the United States who had participated in one or more activities funded by the federal Eisenhower Professional Development Program. The teachers completed a series of program description and impact measures that the authors based in an extensive review of the literature on teacher professional development. Work by Franke et al. (2001) with math teachers found similar results in terms of the action characteristics of those teachers who experienced what they termed "generative growth," or systemic change in their teaching methods that continued to grow and change with time. Their longitudinal qualitative case study focused on 22 math teachers who had participated in one particular professional development program over a three year period. Looking at data from classroom observations and interviews, conducted several years after the professional development program, Franke et al. found a number of common characteristics for those teachers who had heightened levels of engagement in instructional change. They placed children's thinking about math at the center of their curricular decisions rather than classroom organization, programmatic problems and other issues; used an integrated framework for understanding children's

mathematical thinking and their growth and change over time; saw classroom mathematics as a process of joint inquiry and ongoing learning for them as well as for their students; and integrated these components into a holistic approach to math instruction. These features all echo elements of constructivist learning environments.

A new development in research in education is an emphasis on collaborative research. In this model, both teachers and university researchers participate as equals in all phases of the research, from the design of the research model, through its implementation, to the analysis of data and determination of meaning. This is done in an environment where meaning is created by the group rather than an individual. The theoretical basis of this approach is an application of Vygotsky and Bakhtin's work on discourse and interaction in learning; these activities are primary vehicles for learning and the creation of meaning, and thus are essential elements in research, the goal of which is creating meaning from the world (Potter, 2001). Ruiz and Pares (1997) quote Wasser and Bresler (1996) on the importance of heterogeneity among the beliefs of a group of collaborators as important to gaining a broader perspective on the problem under investigation. Applying game theory to the issue of collaboration, they identify some principles that tend to foster collaboration. Small group size is more likely to encourage cooperation; the existence of short term objectives as well as long term goals, is more likely to promote commitment; open communication and genuine friendship or familiarity among members encourages cooperation.

D'Ambrosio (1998) also advocates the use of teacher research as a method of professional development since it can lead to a deeper level of teacher self-awareness and analysis of student learning than other teacher training programs that focus on skills

acquisition. Her qualitative study of a preservice and inservice teacher research experience showed that both projects enhanced reflective teaching in the participating teachers.

Teacher research itself has been investigated as a means of professional development. Burbank and Kauchak (2003) identify the need for collaborative action research to be used as a model for professional development. Their research paired ten preservice and ten inservice teachers in action research projects in the inservice teacher classrooms. Data included observations, interviews, course work products, and an exit questionnaire (scaled from 1 to 7, strongly disagree to strongly agree). They found that the inservice teachers strongly believed action research improved teaching practices (6.0), including creating sense of community among the teachers and an awareness of student learning; results were weaker (4.7) but also positive for preservice teachers. They evaluated research highly as a means of professional development (6.7 for inservice teachers) as it prompted self-reflection and stimulated them to continue research in their classroom. Finally, the teachers felt that action research teams were an effective way to talk with student teachers about research (5.3) and teaching (6.2). Teamed research thus was shown to be highly effective in this study for breaking down resistance to collaboration and to stimulating professional development and reflectivity.

In spite of the benefits, there are challenges to instituting teacher collaboration and research. Inger (1993) describes some of the challenges facing teachers who want to collaborate. School systems in America are based on “norms of privacy and non-interference,” so that attempts to collaborate can feel like invasions of one’s personal space. Barriers between subject areas and grade levels mean that the pool of teachers

with whom collaboration is acceptable is small. Sachs (1999) identifies some of the challenges associated with developing teacher research, such as bridging the dichotomy between university and school based researchers; selecting an appropriate methodology; and determining priorities for research. She studied two programs that emphasized teacher research, and from this identified a wide range of challenges as well as opportunities for such research.

One case study of collaborative research with a math teacher showed the impact of this approach on her confidence and skills, which in turn led to a more constructivist-based classroom instructional method. Menon and Owens (1994) did collaborative research with one sixth grade math teacher, developing materials together and discussing their observations on the impact of new methods. Although initially lacking confidence in her abilities, the teacher grew to act as an equal researcher with the university researchers, and to trust her own judgments in the classroom. As well, she moved from a teacher centered to student centered instructional environment, with increased use of open ended questioning methods, lessons based on invented rather than taught algorithms, and the encouragement of discourse among the students and a “think/pair/share” strategy that encouraged them to analyze differences in their approaches to the same problems. Menon and Owens’ project was successful both in generating useful research findings, and in empowering the teacher to act as a more autonomous agent in her own classroom.

Methods of teacher training influence the approach to teaching that preservice teachers will take in their own classrooms. Astington (1997) demonstrates another useful application of reflective teaching with her preservice teachers. Questioning and

experiential learning about theory of mind and preschoolers helped the preservice teachers develop a profound understanding of how children learn and know. She states that understanding how students know and learn is vital to understanding how they construct knowledge, and this understanding influences teaching methods. Schifter (1996), based on her study of a teacher who moved towards constructivist methodologies, identifies that the best way to help teachers appreciate this kind of learning (constructivist) is to have them learn that way; the way we were taught influences how we teach.

This research model incorporates some elements of a collaborative framework (teacher involvement in setting the questions to study; their involvement in the reflection and meaning-making process; their autonomy and empowerment as equal researchers). However, in the case of this research project, the final analysis and writing responsibility lie with the university researcher.

(c) Characteristics of Teachers, How They Teach, and How Students Learn

Metacognition

Emerging as a concept in the 1970s (Flavell, 1999), metacognition is the knowledge a learner has of her own learning processes and an ability to monitor and direct these, drawing on a range of cognitive strategies in the accomplishment of learning goals. Its existence as a viable construct has been validated by wide ranging research. For example, Project Zero from Harvard (2002) has conducted extensive research and learning on alternative instructional methods and learning theories. Their studies have found that children's learning involves the development of thinking processes rather than

simple progressive accumulation of knowledge. Because there are many studies on metacognition in diverse content areas – reading is one field in which much research has been done – this paper will focus on the research literature in mathematics since that is the subject area in which the research will be done. As well, the particular strategies linked with teaching metacognition and the phases of metacognition differ across subject areas, so the work in math provides more guidance as to appropriate research approaches.

In the literature, metacognition is seen as a complex of interrelated components or skills that enhance both academic performance and higher level learning such as retention and problem solving. These diverse but interdependent skills transfer to widely ranging situations, and are elicited in varying degrees depending on the problem and situation. Some of the major components are deciding on the nature of problem; prediction; allocating resources; solution monitoring; and reflection and evaluation (Allen & Armour-Thomas, 1993; Desoete et al., 2001; Pugalee, 2001). Pugalee's work with ninth grade math students confirmed Garofalo and Lester's (1985; cited in Pugalee) categorization of metacognition into four phases: orientation, organization, execution and verification. Pugalee used a content analysis approach to analyze written descriptions of algebra problem solutions for 20 ninth grade math students, finding four categories that corresponded to Garofalo and Lester's classification. He then was able to classify the students' statements within these categories and identify which metacognitive behaviors they used in each phase. In the same way that metacognition comprises different skills, it also can exist in relation to different phases of activities. In the subject area of reading, Collins (1994) identifies that students can be metacognitive in relation to four aspects: identifying the influences of text structure on their reading experience and

the creation of meaning; switching between different tasks required from reading; awareness and use of strategies; and awareness by the learner of her own characteristics that affect learning.

More work on the components of metacognition was done by Desoete et al. (2001) in two studies with third grade math students. The first study looked at 80 Dutch children ages 8 and 9 who had average performance at school with no school related problems. They were tested using three tests: the Kortrijk Arithmetic Test of specific math knowledge, a Belgian test that was validated on a sample of Dutch-speaking children; a validated test of reading fluency; and two metacognitive measures of attribution assessment, skills and knowledge that were tested in a pilot study. The tests were followed by interviews on the reasons for the predictions and evaluations, how they planned and monitored after predicting their answers, and why they found certain activities easy or difficult. Their second study focused on children with learning disabilities, working with 59 children of average intelligence who had learning disabilities in math, compared to 26 children of similar intelligence without learning disabilities. The Kortrijk Arithmetic Test was used, as well as two measures of math problem solving ability that were validated in the Netherlands, and a metacognitive questionnaire that the researchers pilot tested. The first study validated three components of metacognition: (1) global metacognition, comprising metacognitive knowledge and skills such as declarative knowledge, conditional knowledge, procedural knowledge, prediction, planning, monitoring, evaluation; (2) offline skills, comprising prediction and reflection/ evaluation, things that occur before and after problem solving; and (3) attribution, or attributing success to effort. Students with above average performance in

math had higher levels of global metacognition and attribution. Desoete and her associates also found that offline skills discriminated between all three groups. The second study used component analysis to confirm the three components of metacognition already identified. Students with severe math disabilities scored lower on global metacognition than those with moderate or no learning disabilities. The same group also had lower performance in offline metacognition than students with moderate learning disabilities. Attribution, on the other hand, did not discriminate between the groups. In this study, therefore, metacognition was found to be correlated with higher math performance.

In the empirical literature, metacognition has been studied in relation to the learning and achievement of diverse groups. This work has attempted to address questions of the relationship between metacognition and ability, and metacognition and performance. Such work can help identify whether the use of metacognition is correlated with advanced thinking, or the absence of it with impairment in performance. Work on gifted and learning disabled students shows a correlation between higher metacognitive levels and giftedness, and an inverse relationship for those with learning disabilities. For example, Desoete et al. (2001) found that students with learning disabilities had lower metacognitive abilities than those without learning disabilities, and that students with higher academic ability had higher levels of metacognition. Other studies identify metacognition as one area where students with learning disabilities have deficits (Boudah & Weiss, 2002; Desoete & Roeyers, 2002).

Levels of metacognition also vary with age. Sperling et al. (2000), in their study of 39 preschool children from two childcare facilities, identified age related increases in

metacognitive abilities in problem solving and theory of mind abilities. They used a series of false belief and measured intention tasks (two false belief and three measured intention) to calculate a theory of mind score, and three problem solving tasks (sorting, matching dominos, and matching puzzles). The problem solving tasks involved prediction and postdiction as well as researcher analysis of strategy use. These results indicate that self-regulation and awareness of one's abilities are linked developmentally to age. Gender differences over the five tests with multiple components were not noted except for one instance. These authors note that there may not be a strong relationship between metacognition in social and academic domains, and among different tasks such as categorizing and false belief tests. The variation they found in metacognitive abilities on different tasks may reflect the validity of tasks used, or may indicate that metacognition does vary by domain. Similarly, Carr and Jessup (1997) note that both boys and girls in their study of 58 first grade children displayed similar levels of metacognition although they applied their metacognitive strategies in different contexts.

Metacognition increasingly is cited as a relevant element of student learning and achievement. Whether directly or indirectly, both policy documents and research identify components of metacognition as crucial to student learning. One significant instance is the National Association for the Education of Young Children and the National Council for Teachers of Mathematics' joint statement *Early Childhood Mathematics* (2002). Throughout the document these two agencies identify the need for metacognitive activities in order to develop an effective understanding of mathematics: for example, to allow opportunities for "children to develop, construct, test, and reflect on their mathematical understandings" (p. 7); or the importance of emphasizing processes such as

“problem-solving, reasoning, communication, connections, and representation” (p. 3).

The National Association for the Education of Young Children and the National Council for Teachers of Mathematics state that these skills are essential, not secondary, elements of effective math learning and performance. Without them, children will not develop a strong foundation of mathematical understanding. The shift in focus presented by these organizations towards student centered and constructivist education is noted by Sheffield and Cruikshank (2001).

Brain Research

Many aspects of current research on effective math learning relate to brain research. In addition to trying to understand how biological and cognitive process operate during learning, many such studies have an explicit focus on long term retention rather than short term recall, transfer of knowledge to other situations, and the rapid brain functioning associated with expert versus novice thought. All these more advanced brain functions have been connected in the research with instructional methods focused on strategy instruction and emphasizing understanding. For example, Bransford et al. (1999) identify many emergent findings in the literature on differences in thinking methods and strategies between experts and novices. Such studies can identify the types of thinking patterns that represent skilled thinking or expertise in a field; however, many of them can not draw conclusions as to how these thinking patterns are developed. They identify some key differences in cognition between experts and novices. One difference was that experts organized a vast store of information in units, or “chunks,” rather than as isolated facts. Revolving around core concepts, their information was both organized and contextualized, thus enabling them to identify key patterns quickly. This pattern

recognition and ordered organization of information allows rapid retrieval of the information. Metacognitive abilities such as being aware of what you are doing, how you are responding to information, and what you know and do not know, are also practiced by experts and enhance their teaching effectiveness as they organize their knowledge to convey it to others.

Teaching Cognitive and Metacognitive Strategies

One body of literature emphasizes the importance of active teaching of learning and thinking strategies to students, rather than expecting them to develop strategies independently. For example, Langer (2001) found that successful English teachers actively taught their students strategies for thinking and doing their work, whereas the less successful ones left those strategies implicit. Mayer and Wittrock (1996) note that teaching thinking skills generally has shown very positive results in improving performance. Such instruction has been shown to be effective in teaching reading, math and other subject areas.

Many studies have shown that active teaching of metacognitive strategies results in increased performance and increased measured metacognitive levels. Shepard (2001), based on her review of the literature on assessment and learning, states that metacognition can be trained in the same way as other cognitive skills. Such instruction can be effective for learners of all school ages, as Collins' (1994) review of the literature on reading and metacognition states. Multiple research projects done through Project Zero at Harvard similarly have found that strategies to teach thinking and increase critical and creative thought produce positive results in student learning (2002). However, both teaching general thinking skills and emphasizing highly specific skills seem to be

ineffective. What does enhance metacognition and performance is instruction work that allows students to automate their performance of lower level cognitive skills such as basic math operations. Transfer of knowledge or skills to new situations is enhanced by focusing on meaning building instructional methods, use of the concept of analogy in teaching, and teaching thinking skills – including metacognitive strategies – directly (Mayer & Wittrock, 1996). For example, Ip's work (2001), using a multiple case, single subject A-B experimental design, found instruction in metacognition and reading to have measurable results for five children with multiple physical handicaps over the eight week intervention. Wolf and Brush's (2000) work on applying the instructional use of a metacognitive scaffold for eight grade social studies students discovered that this group had higher results on an achievement test than a control group. Zan's (2000) experiment led to the conclusion that instruction in metacognitive strategies allowed the experimental group of university students to pass a math test that they had failed repeatedly. Maqsdud (1998) also found that metacognitive instruction resulted in higher metacognitive scores as well as math achievement. Work by Hoek and others (1997) found that instruction in social and cognitive strategies affected results on tests of mathematical reasoning and information processing. The implications of these finds *in toto* are that, first, metacognition is not simply an innate ability but one that can be developed through specific instructional interventions; and second, that increased levels of metacognition on the part of the student may produce increased performance.

Sheppard and Kanevsky (1999) also found that metacognitive training enhanced student abilities to explain their thinking and model their mental thought processes. Working with six gifted students, three each in heterogenous and homogenous ability

classrooms, they provided training to both classes on metacognitive thinking patterns for five days in 45 minute sessions. Students were asked about the idea of creating “mind-machines” to describe their thinking processes, and then placed in small groups of three or four students to discuss their models. This was followed by whole group discussion of the models. The researchers analyzed the activity sheets, videotapes of interviews, and classroom behavior to identify the types of and changes in metacognitive functioning. Based on research based categories and interrater coding, they found that all students improved in their metacognitive abilities.

Other studies have compared metacognitive training with training in strategy use and with cooperative learning to see which activities produce the greatest results for students. Mevarech (1999) studied these three conditions on 174 Israeli seventh grade students to see which combination of factors had the greatest influence on student performance. Students (86 boys and 88 girls) were assigned randomly to classrooms, and classrooms were assigned randomly to one of the three conditions: mixed ability cooperative grouping alone; cooperative grouping plus training in math strategy use for compare problems; and the second condition plus training in metacognitive strategies. Training was administered during math classes five times per week over a two month period. Students were pretested on math and reading ability to form the mixed ability cooperative groups and for baseline data on learning outcomes. Using an ANOVA on the posttest scores, she found that the cooperative group, used as the control group in this study, had the lowest levels of performance, followed by the strategy instruction group, and the metacognitive training group ($F(2, 168) = 4.21, p < .02$). Looking at interaction effects, the students who were in the lower half for math performance did the best in the

metacognitive group and worst in the strategy group. These results indicate, first, that metacognitive training has a statistically significant effect on math performance, more so than more direct algorithmic strategy instruction; and second, that such training benefits students with low math abilities as much as those with high abilities.

Other Research Proven Instructional Methods

Aside from teaching metacognitive strategies, other instructional methods have been linked with enhanced student performance. Writing, either reflections or journal entries, has been found to be an effective way to enhance metacognition in mathematics and other subject areas (Card, 1998; Pugalee, 2001). Card's research in a class of 21 second grade students involved seven weeks of daily writing about math by the students in response to teacher prompts designed to elicit thinking about math problem solving. Three instruments, all developed by the researcher, were reviewed by colleagues and pilot tested for their face and content validity. After the seven weeks she found that the students were performing significantly better in math, with 11 of the 21 students increasing by more than 50% on their math scores. Qualitative data also showed a significantly enhanced ability to articulate their thinking processes, and an increased use of math language. Outlining ways of developing the concept of writing, Meier and Rishel (1998) describe a range of approaches to incorporating writing into math classes based on their own experience with applying writing for math students at different grade levels. Related to this, Blakey and Spence (1990) cite thinking journals as an effective method of developing metacognition.

Similarly, discourse in the classroom has been found to enhance understanding (Cazden, 1986; Shepard, 2001). Roth (1993) describes discourse as a process that goes

further than collaboration, which can imply a maintenance of one's own ideas; he views discourse as a process of collectively constructing knowledge which individuals, having participated in the process, then can internalize. Sheppard and Kanevsky (1999), in their study of training for metacognition in gifted students, also found that those students who were in the homogenous gifted classrooms had more significant gains than those in the heterogenous classes. One possible implication of this finding is that rich classroom dialogue, made possible by a sufficient number of metacognitive students who are able to dialogue about their thinking, enhances learning.

Collaboration among students in the classroom also has been linked to enhanced learning. Many research studies on metacognition and instructional strategies take collaborative learning as one of the baseline conditions they investigate (Mevarech, 1999; Sheppard & Kanevsky, 1999). Manion and Alexander (1997) investigated the relationships among peer collaboration, cognitive strategies and metacognitive understanding. They worked with 97 students at a rural school, approximately equal number of boys and girls in the fourth grade. Seven of these were unable to complete the study. Half of the students were put in a control group, and the other half in a group with peer collaboration. Over three phases, the students were presented with sorting, recall, and metacognitive attribution tasks. The first phase had them categorize cards; in the second, they sorted more complex items and worked collaboratively or individually depending on treatment to remember the cards; in phase III, they were given another set of cards to recall. The researchers anticipated some gain in metacognitive abilities as a result of practicing and collaboration. Looking at the effects of treatment versus sorting, there was a main effect of $F(1, 82) = 6.32, p < .05$. Turning to the relationship between

treatment versus ability to recall, the main effect was $F(1, 84) = 3.41, p = .06$. Finally, results for treatment versus metacognition showed a mean change score of $-.38, z = -1.87$ one-tailed for the treatment group on a Wilcoxon matched-pairs signed-ranks test. For the control group, the mean change score was $-.10, z = -.59$. In other words, working in a collaborative group resulted in significant improvements in abilities to sort, recall items, and demonstrate metacognitive awareness of processes. Collaboration led to an increase in the use of metacognition, including for lower performing students. Collaboration also led to an increase in memory, possibly as students learned more about other memory strategies and internalized the strategies further through dialogue.

Connecting new knowledge with past knowledge is another strategy that enhances learning. Research has found that students actively process information based on their current knowledge and dispositions and develop new understandings based on their old knowledge. This implies the need for instruction that will facilitate links between old knowledge and active processing of the new, so as to allow children to develop new understandings themselves (Project Zero, 2002). Metacognition also exists within specific contexts, meaning that metacognitive abilities are best developed when instruction is based on specific examples in a subject area. At the same time, however, activation of strategies such as looking for patterns, finding context, and reflecting on a problem after completion, can help students transfer what they have learned to new contexts (Bransford et al., 1999; Shepard, 2001). Levine (2004) emphasizes the importance of using real world examples in math problem solving. He notes that such examples can provide encouragement for students to learn as they also promote learning transfer to new situations.

Project-Based Learning

Project-based learning (PBL), a student centered instructional method, connects new knowledge with old. It provides real world experiences and involves such strategies as dialogue with other students, planning, assessing what you know and need to find out, reflecting on what you have done, and describing your process to others. Such learning can address the need identified by Anderson and Lee (1997), who state that in American schools through the 1980s, “most science programs simply did not provide students with opportunities to learn with understanding” (p. 1). As well, what hands-on science learning was included often “failed to connect with students’ own ideas about how the world works” (p. 1). In contrast with such gloomy experiences in science learning, a recent review of over 70 published PBL studies by Thomas (2000) identified that most PBL learning situations had two things in common: students learned the standard content as well as or better than students with more traditional instruction, often outperforming them significantly on standardized tests; and the students showed significant strengths relative to control groups in areas such as problem solving, positive attitudes towards math and science, and ability to apply knowledge in new situations. Other studies of applied project-based learning found similar results in terms of student learning of standard content and increased performance in problem solving abilities and attitude towards the subject matter (Anderson & Lee, 1997; Ewey, 1996; Krajcik et al., 2000; Schneider et al., 2002; Woods, 1994).

The effectiveness of PBL has been studied in school situations, often in the context of science learning. Some narrative case studies have documented in-depth the learning processes that occur during PBL. A PBL approach used in one fifth grade

science class proved successful in helping students create new understandings of science. Three major processes were involved: first, students put forth their own explanations for how a particular phenomenon functioned (in this case, electricity); next, the teacher worked with them to conduct experiments, often designed by students, to test the theories; and finally, the teacher helped them gain their own new understanding of theory if their preconceived notions differed from experimental results. The project units were largely student directed, with facilitation provided by the teacher and researcher. While the teacher and researcher found that such an approach does help students change erroneous beliefs, they also found that personal theories are strongly persistent (Woods, 1994). Looking more carefully some of the characteristics of PBL, Roth (1993) provides a case study describing an approach that he uses with his high school physics classes. Dialogue between the students and teacher reflect that they are striving to come to new understandings of physics problems and to define them in new ways. The teacher grapples with the questions along with the students, thus creating a dynamic in the classroom of progressive and mutual learning. For Roth, the communal aspect of knowledge generation is significant: interpersonal dialogue is a key component to generating new understandings as opposed to simply having individuals sit and think alone, in isolation from both other people and real world experiences. Similar work by Levy (1996) documents a successful attempt at using project-based curriculum development in an elementary classroom, over one year and involving multiple projects and subject areas. These classroom case studies provide insightful descriptions of learning processes in PBL classrooms and transferable ideas for the application of such methods elsewhere.

In addition to in-depth case studies, a number of longitudinal studies of PBL have been implemented. Krajcik et al. (2000) undertook a two year study of inquiry-based learning with middle school students in an urban school district. In their study, project-based units based on national, state and local standards were implemented for 2000 middle school students yearly over the two years. The units were eight to twelve weeks in length and had the central components of PBL: they were based on real world problems, involved student collaboration and discourse, and integrated all investigation around a central research question. Scaffolding was a key element of the delivery mechanism, with teachers trained to “sequence, model, coach, and give feedback.” They found that this approach, based on inquiry and student questions, was more effective in promoting learning in posttests than teacher-directed learning. Specifically, through pre and posttests on knowledge and process, the mean effect size across all units was .87, showing significant gains from the pretest.

A recent study by Schneider et al. (2000) has shown the effectiveness of PBL in enhancing coverage of rote facts, resulting in higher scores on standardized tests than traditional instruction. Their study attempted to address one key criticism thrown at PBL, that it limits the breadth of content to which students are exposed, thus limiting students’ overall knowledge of science and reducing scores on standardized tests. In direct opposition to this claim, the researchers found that inquiry-based learning by 142 high school science students resulted in significantly higher test scores on a national standardized test than for students taught using traditional, teacher directed methods. This is particularly dramatic given the intensity with which PBL was used in this school, where all science courses, from ninth through eleventh grade, were taught as integrated,

inquiry based units lasting from two to four months, rather than as discrete subject areas. In spite of the fact that they did not receive any direct instruction in earth science as a discipline, the students still performed statistically significantly better on a national test covering earth science content than their peers who were taught in noninquiry based earth science classes.

Other instructional approaches aside from PBL have been studied in terms of effective student learning. A study by Langer (2001) illuminates some of the instructional strategies and approaches that enhance learning. She performed a qualitative multiple case study on 25 schools in four states to examine the differences between medium and high performance schools in high school English. Using a Vygotskian perspective of learning as discourse, she found that those schools which focused on authentic and connected learning – what she called integrated, versus simulated or separated, learning – had more successful instruction. This is the same principle underlying project-based learning: that students will learn best when their learning has authentic applications rather than simply being an exercise or pretend scenario. Other characteristics of successful teachers in these high performing schools that she found included integrating test preparation into the curriculum; actively focusing on connections between the lesson content and other knowledge, from different classes or life situations; overt teaching of thinking strategies and use of rubrics and questioning methods to assist students to make visible their learning processes; self-evaluation and reflection; the goal of learning was a deep understanding beyond simple rote learning; and the classrooms had high levels of interaction with an emphasis on “shared cognition,” or codevelopment of understanding and meaning among participants. All of these skills

associated with high performance teachers are explicit instructional strategies in the three classrooms in this dissertation.

Langer also found that the integration of all these elements was essential to producing an environment of high achievement; those schools which had only some of these elements did not make the break through to high achievement. The holistic impact of all the elements produced a seamless web that supported achievement. From this, we can see that it is necessary to look at the entire system of education in a classroom, including the underlying beliefs of the teachers, in order to understand how the students are learning. As Shepard (2001) writes, “no aspect of learning can be understood separate from the whole or separate from its social and cultural context” (p. 1075).

Math Learning

Turning to math learning, there has been a large body of theorizing and research on math learning principles for many years (De Corte, Greer, & Verschaffel, 1996). Sheffield and Cruikshank (2001) note that most elementary students enjoy math and do not suffer from math anxiety. Since negative feelings towards math arise at a later date, it seems clear that early childhood math experiences are critical in forming learner response to mathematics. Battista (1999) states that current methods of teaching math emphasize learning and reproducing patterns, and this is in opposition to research over the past two decades about how students learn math which have emphasized a need for more integrated and holistic approaches. Mayer (2003) identifies four phases of solving math problems: Problem Translation, a linguistic process; Problem Integration, where the separate pieces of knowledge are put together into a model; Solution Planning and Monitoring, where a strategy for addressing the problem is developed and implemented;

and Procedural knowledge, or how to work out the problems and run the computations. Most math programs teach only procedural knowledge, when in fact the other three stages are more difficult for students to execute and form the foundation on which procedural knowledge can be built.

Constructivist educational environments have been investigated in numerous studies. These are environments that are characterized by real world activities, teacher questioning rather than telling, and student directed learning, including a comfort with ambiguity and cognitive disequilibrium. Hickey et al. (2001) conducted research on constructivist oriented elementary math environments to see if these influenced student learning. Using a quasiexperimental design, they looked at 19 fifth grade classrooms in two sets of schools that were closely matched for achievement and socioeconomic status, examining the impact of a real world math computer game combined with varying degrees of school reform that the authors associated with constructivism. They found that problem solving and data interpretation abilities in those classrooms that used the computer game were significantly higher than in the classrooms that did not use the games. They also found that all results of improved performance were greater in the reform oriented schools than in the non-reform oriented schools. In other words, “coordinating both instructional innovation and curricular reforms around a common constructivist perspective is the most effective way of enhancing students’ conceptual understanding of mathematics and their ability to solve complex mathematical problems.” School wide implementation of constructivist practice, therefore, is likely to enhance students’ mathematical understanding.

Use of scaffolding, guided learning and questioning has been found useful in constructivist classrooms. Schifter (1996) writes a qualitative analytical narrative about the experience of two constructivist math teachers in using questioning methods to prompt student directed, student interactive learning of math concepts. One began her teaching career with the philosophy of stepping back and allowing students to direct their learning, with the teacher as the facilitator. The other came to this philosophy through participation in an intensive summer workshop; she saw this method as more connected with the students' methods of learning and worked to integrate the philosophy into her teaching. Through setting up appropriate tasks and asking trigger questions to prompt thinking and comparison of particular issues, the teachers are able to guide students to develop their own understanding of concepts such as standardized measurement. After watching their students engage in these processes, the teachers believe they have identified a way to foster better student understanding than direct instruction. Schifter specifically identifies the importance of questioning in helping students externalize their thinking processes and promote such learning.

Use of experiential learning, manipulatives, and questioning were highlighted in another project. Phillips et al. (1994) describe a project in Iowa where math was taught through Piaget-based concrete tasks. Students used manipulatives and teacher questioning to develop understanding of developmentally- and curricularly-identified key concepts. Using 340 students in Grades 1 to 3 over three years, the longitudinal study showed that the students using the Piaget-based instructional method had significantly higher scores on all measures of math achievement. The results demonstrate that teaching math through methods that involve the student constructing her knowledge can

result in better long term retention and ability to perform than teaching algorithms directly.

Implications of the Literature and Importance of Findings to Research and Practice

This literature review highlights many of the sources of knowledge about student learning, and provides a multisided context for the research. The philosophies and educational theories of Dewey, Piaget, and Vygotsky provide insights into human learning. Freire's work and that of other radical pedagogues illustrates that the social context in which learning occurs, and the beliefs of the teachers towards their students, have a significant influence on student learning. The philosophy of constructivism combines many contemporary, research based approaches to child learning.

Research has identified metacognition, writing, discourse and other strategies as important components of learning in schools. These have been shown to be enhanced by specific instructional methods such as active instruction in strategy use, a project-based approach, and a holistic, integrated learning environment where theory and practice fit together and different strategies form part of a holistic instructional approach. Training in metacognition and strategies benefits students of all ability levels, sometimes showing more benefit for lower performing students than for more advanced students. Teachers have a central role in this picture as active agents who make instructional choices based on a variety of information sources, and have the insight and perspective to conduct research on their practice. All this occurs in a policy environment that, through its focus on an overall curriculum and large scale, standardized testing, pressures teachers to cover large quantities of material quickly without focusing on depth of understanding or long

term retention and learning. As a result, teachers are hampered in their ability to implement what research has shown to be effective practice.

Educators and policy makers need a rationale to offer alternative instructional strategies that both improve immediate academic performance, and develop other abilities in students that enhance long term academic performance and adjustment to society and the workforce. More research on the professional development of teachers in an environment that emphasizes their independent action is needed (Shepard, 2001). Finally, documenting an integrated instructional approach, comprising a set of related instructional strategies, will provide a research-driven template for successful instruction that could be examined by others. Taken together, these pieces provide evidence of a need for a new approach to the conceptualization and delivery of education that will release greater capacity in students, ultimately producing a brighter, more capable populace.

At Newsome Park, these elements coincide in one instructional environment. Many of the reform elements identified are in place and visible through the shared vision of the school which has been forged over the years through collective input from all faculty. The active tensions between government policy, educational philosophy, and individual teacher practice are evident in the functioning of the school. The willingness of the administration and teachers in the school to engage in research allows these processes to be studied, and new learning about negotiating these tensions to be formed.

CHAPTER 3: METHODOLOGY

Purpose

The purpose of this research is to document the influences on and characteristics of a unique approach to teaching, specifically in mathematics instruction, by third and fourth grade teachers. The approach stems from the teachers' sense of personal agency, philosophy, and beliefs about students, and includes elements of reflectivity, personal responsibility, careful attention to student thinking, and faith in the abilities of students. The research has been conducted in three classrooms at Newsome Park in Newport News, Virginia. The broader context of their teaching is an environment of collaboration, research and continual improvement emphasized across the school and encouraged by the administration in an environment of high stakes semester. The three teachers – Sasha, Sydney and Eisah – are committed to involvement in ongoing research to improve their practice as teachers, and to enhance their students' learning.

Setting and Sample Characteristics

The demographic characteristics of the sample classrooms accord reasonably well with the overall characteristics of the school with regard to racial balance, free and reduced lunches, and class sizes. At Newsome Park, the student body of this urban school is 52% African American, 40% Caucasian, and 8% other ethnic groups. These percentages are approximated in the three classrooms, which have 48%, 53% and 55% African American students and 43%, 42% and 35% Caucasian students. Of the 750 students at Newsome Park in kindergarten through Grade 5, 58% are eligible for free or

reduced lunches compared with 48%, 60% and 63% in the three classrooms under investigation. The school has special education students, those with learning disabilities (LD), emotional disturbances (ED), and speech difficulties. They total about 10% of the school population. About 50 of the students come from the “shadow zone”, or the natural draw area around the school. The school has heterogenous ability grouping as opposed to tracking, and students of all ability levels, including special education and support children, are integrated across the classrooms. Class sizes in the school average around 20 students per classroom (Bender, 18 February 2003). The school practices looping, where a teacher stays with the same group of students for two years. Kindergarten and Grade 1, Grades 2 and 3, and Grades 4 and 5 are the three loops in the school. All three teachers are women, of Caucasian European background, in their early twenties to early thirties. Although one of them had another profession before teaching, they are all in their second year of teaching. The data were collected in their second year of collaboration together. Demographic details of their classrooms are listed in Table 1.

The school and particular classrooms in which this research is being conducted have unique features. The school itself has been recognized nationally for its innovative programs. For example, the United States Department of Education (USDOE) in 2001 named Newsome Park a Comprehensive School Reform Demonstration Program Promising Site. In 1998, it was listed as a National School of Character; Eschoolnews highlighted Newsome Park in May 2001; it was recognized by the Lucille and David Packard Foundation in 2001; and was one of nine schools highlighted by USDOE and Stanford Research Institute (SRI) in their international study “Effective Use of

Table 1. Demographics of the Three Classrooms¹

	Classroom 1 (3 rd Grade) Sasha	Classroom 2 (3 rd Grade) Sydney	Classroom 3 (4 th Grade) Eisah
Total Number of Students	19	20	21
Boys	10 (53%)	9 (45%)	10 (48%)
Girls	9 (47%)	11 (55%)	11 (52%)
African-American	10 (53%)	11 (55%)	10 (48%)
Caucasian	8 (42%)	7 (35%)	9 (43%)
Other	1 (5%)	2 (10%)	2 (10%)
Free & Reduced Lunch	12 (63%)	12 (60%)	10 (48%)
Special Education	1	1	1

Technology”. The George Lucas Foundation highlighted the school in the Winter 2001 issue of their *Edutopia* newsletter. As one of only a few constructivist schools in the country, its programs receive much attention. As well, within the Newport News School District, its scores have shown significant improvement, attracting the attention of administrators in the school district. Finally, it would be difficult to justify a clear separation between innovative teacher practice and the context in which it develops

¹ Percentages in table rounded to the nearest whole number; teacher and all other names are pseudonyms.

in the school because of the close interaction between the teachers, administration and students, the concentration of research activity at the school, and the outreach of the school in sharing its programs with other schools. As a result, it exhibits unique features worthy of in-depth study, with both unique features and active participants who are interested in participating in research.

The school has focused on innovation and change in instruction since its origin eight years ago. Some of the issues discussed at the school as important elements in their process of continuing transformation and school improvement – the role of administrators; standards; the impact of collaborative effort – are highlighted by Ferraro (1999) in a summary of the major reform issues in America today. The focus on constant improvement is fueled by the administration's focus on theory and research as triggers for learning and change. Over the history of the school, a number of books have been used as roadmaps for planning organizational and instructional change. The key book is called *Roadmap to Restructuring* by Conley (1993) which details a plethora of aspects that need to be addressed in a comprehensive school wide restructuring program. This motif of complete restructuring, aligning all aspects of school functioning within an integrated paradigm, is the focus of school leadership (Bender, February 10, 2003). Another book by Levy (1996) outlines the independent process of one teacher in restructuring the curriculum and functioning in his classroom. Levy came to the school for an inservice training, and his ideas have been used as a source of ideas for policy and action within the school. Other books referenced include *Building Leadership Capacity in Schools* (Lambert, 1998) and *The Constructivist Leader* (Lambert et al., 1995). All of these sources, and others, provide theoretical support for the continual evolution of

instructional practice and school wide restructuring. They are studied by the administration, referenced in staff meetings, and applied in varying degrees by teachers in the school. Many of the teachers have read some of these books, and most of them are familiar with the major themes they outline. As a result of its saturation in such ideas, the school environment has an expectation of constant reference to research, literature, and theory on school reform and instruction, and of ongoing reflection and change in practice. This learning mode assists in supporting the teachers in school as they experiment within their own classrooms. The integrated and purposeful approach to instructional change reflects Desimone's (2002) review of the research on effective comprehensive school reform, which found that those reform efforts that are more consistent and authoritative have a greater impact.

History of the Project

Phase 1: June to December 2002

Old Dominion University has been collaborating with Newsome Park for a number of years through the faculty in the Darden College of Education. The school officially became a Professional Development School (PDS) of Old Dominion in 2001/2002, partly because of this collaboration. Steven Johnston, the principal of Newsome Park, was very interested in conducting research at his school on the effectiveness of various practices being used. In collaboration with faculty it was decided to offer support for teachers in summer 2002 to develop a research program for the 2002/2003 school year focused on assessment. Teachers were funded for 40 hours in the summer to develop activities and programs focused on assessment for use in their

classrooms, with the idea to spread the practices to as many classes as possible and make them relevant across grade levels.

Two teachers – Sasha Hawley and Eisah Mattei – decided to focus on metacognition and how this helps students learn. They met the researcher, Kamilla Bahbahani, in a meeting on June 18, 2002 at Newsome Park and decided to collaborate. Kamilla and Sasha met on June 25 for over three hours to talk about the research. They agreed the major question of interest was metacognition, how to teach it, how students learn it, how to tell when you are being metacognitive and when you understand something. They worked on a document that provided the first outline of the metacognitive strategies that would be priorities for the students in solving math problems. The next day, Kamilla, Sasha, Eisah and a faculty member met to talk about the research program. The team broke up the work on metacognition between Sasha, Eisah and Kamilla and set up a communication system for the summer to collaborate on development of ideas and materials. Eisah was central coordinator, pulling materials together and creating diagrammatic representations of the ideas. She also wrote up the minutes from the meeting outlining the major ideas. Sasha wrote up the different types of cognition and their relationship to metacognition. Kamilla wrote up the project description and research design.

Eisah and Sasha formalized their strategy and began implementing it from the start of the school year. The major components were a flowchart of the cognitive and metacognitive strategies to be used in math (see Appendix B); revised math talk journal pages that asked students to indicate what “thinking strategies” they used while solving a problem (see Appendix C); and an implementation strategy that outlined seven major

aspects of teacher practice (see Appendix D) The flowchart of cognitive and metacognitive strategies was introduced to the students, but the focus in the first part of the fall semester (September to November) was on the first column of strategies: read and reread, imagine, find important ideas, and make a plan. The other strategies were used as well, but the first part was emphasized so that students would have a manageable set of skills to learn. The implementation strategy included the use of cognitive strategies in classroom discussion; modeling the strategies throughout math talk sessions; reciprocal teaching; and consistent, formalized use of language so that students would begin to feel the patterns of thinking associated with effective problem solving. Through constantly referring to the process of thinking through problems, the teachers hoped that students would use the metacognitive skills as coping strategies when they came to difficult concepts.

Over the fall, various changes were made to their implementation procedures. First, Sasha changed the term “thinking strategies” to “thinking tools” based on a student request. This seemed to be a more a more understandable moniker for the students. Then Sasha and Eisah began using a strategy called “the List” that was developed and successfully implemented by Sydney Bentley, another third grade teacher. This strategy combined goal setting and motivational measures and had great success inspiring students to learn skills in math. The List was created as a way of monitoring what students had learned which skills so that the teacher could focus instruction and decide when to move on, and the students could develop an awareness of what they know and need to work on. Each morning the teacher assigns a short math problem addressing a current skill. Students approach her when they are finished and together decide if they

“have it” or not. If they do, their names go up on the List, a large piece of paper on the board. The students are given other opportunities during the day to work on this skill, and those who “have it” are treated as the class experts who go around and assist those who do not yet understand the process. Extra practice worksheets are available for those who still do not understand and they have the opportunity the next day to demonstrate their mastery. This strategy has been immensely popular with the students and resulted in rapid acquisition of new skills. It is also an example of the need to view these strategies holistically. The List is dependent on creation of a supportive, collaborative community of learners who use effective questioning techniques and are conscious of the processes of problem solving (i.e., are metacognitive learners). Without these elements, the List can become a competitive activity and cause students to withdraw from learning.

Other instructional strategies were experimented with during the fall. Sydney tried offering the students the choice of which math talk problem they wanted to do, placing the choice in the students’ hands. This was adopted by Sasha and Eisah. It had variable degrees of success, and has continued to be used as one variant in math talks. Sydney and then Sasha began experimenting with different groupings for the math talks, grouping students of more similar ability together. This resulted in higher levels of engagement for the students with lower ability levels, but was a challenge for the more advanced students as they did not have a sufficient level of motivation to work to their full capacity if unsupervised. Sasha added a goal setting piece to the math talk journal pages in addition to an announced daily random check of five students’ journal pages. These two elements combined to produce a sudden increase in excitement in math and in diligence in completing the journal pages. After attending the Association for

Constructivist Teaching conference in October, together with Sasha, Kamilla, and other teachers at Newsome Park, Sydney agreed to become involved formally in the research project. The issue of transfer of the metacognitive skills to other subject areas was explored as well by the teachers. They found students beginning to use the terms from math in other subjects. All of these strategies, implemented in an “action research” environment, were worked, reworked, discussed and modified throughout the fall semester.

Phase 2: January to June 2003

As the teachers accelerated their experimentation and learning about classroom practice, Kamilla intensified her research attempts to understand the reason behind the methods they used. Although the focus of the research initially was on the instructional practices used by the teachers, deeper issues began to emerge. Through discussion of these practices, the teachers’ beliefs about teaching, their students, their colleagues and their experience at Newsome Park became evident. It became clear that behind each discrete instructional strategy was a wealth of beliefs reinforcing its use, as well as internal dialogue as teachers attempted to balance conflicting pressures and mental images about what constitutes a good teacher.

The research continued with observations and more frequent teacher interviews and focus groups. The dialogue of the teachers served to expand the research question and interview prompts as they combined discussion of specific strategies with reflections on educational philosophy and the work of their colleagues. The interactive process produced a wealth of data that was analyzed by the researcher over the next nine months.

Sampling

Within the school a variety of approaches to instruction is used within the overall framework of supporting active student learning and self-reflective practice. Purposeful intensity sampling has been used to identify three classrooms where the teachers are actively using an integrated set of instructional strategies with the goal of increasing the levels of autonomy and performance in their students (Creswell, 2002; Patton, 1990). The classrooms were chosen based on the following characteristics: active use of math talk and metacognitive instructional strategies; engagement of the teachers in reflective teaching practice; and their willingness to participate in a research process involving experimenting and learning with their students.

The three teachers are recognized by the school administrators as proficient collaborators. In addition to being competent teachers, they already participate in the overarching assessment research project currently undertaken in the school, and have been called on to make conference and staff development presentations both within their school district and nationally. Eisah has presented at an educational conference in West Virginia, as well as numerous times within the school and school district. Sasha and Sydney traveled to Texas to present at an annual meeting of the Association for Constructivist Teaching. Sasha presented her summative evaluation at a meeting of principals in the school district. Sydney also presented at two district wide trainings on positive discipline. It is important to note that the teachers involved with this project were active participants in the identification of a research area, development of strategies for use in the classroom, collection of data, and some aspects of data analysis. They have

committed fully to involvement in the research project, agreeing along with the researcher to a shared set of responsibilities (see Appendix A).

Sasha, Sydney and Eisah emphasize an integrated set of instructional strategies in their third and fourth grade math classes. Based on their philosophical orientation, beliefs about student capabilities, review of literature, and their own experiences, they have developed a framework for cognitive strategies that they want students to adopt to facilitate their problem solving abilities in math. The framework is operationalized through an evolving set of strategies designed to assist students to internalize the strategies, and supported through other teacher practices that are infused into their classrooms: questioning, think-alouds, flexible grouping, and others. Their pedagogical approach has been developed through reference to the research literature, professional training, collegial interaction, and personal experience. It is based largely on the constructivist educational philosophy and comprises a set of interrelated strategies, skills, and attitudes towards students and math learning. The strategies within this approach consist of both best practices for constructivist education, and new strategies that were devised by the teachers. All of these have been modified by the teachers through experience and dialogue with their colleagues with the explicit goal of enhancing student metacognition.

The current operationalization of their instructional strategy contains many elements. The framework (see Appendix B) has been presented to the students who discuss it in class, have it posted at the front of their math books and on the wall, and refer to it, prompted and unprompted, during math sessions. Each math talk session, usually four per week, revolves around a math talk journal page (see Appendix C) where

the students show their representation of the problem, indicate what strategies they used, and write a reflection on their experience that day and plans for future math talks. Following individual student work on a math problem, a group discussion session provides the opportunity for students individually to present their problem solving methods and discuss among their peers why they “agree or disagree” or what they would “add” to their representations. Dialogue is primarily student to student rather than teacher-centered; when this does not occur naturally, the teachers facilitate it. The teachers prompt discussion of thinking processes with questions such as, “What thinking tools did you use?” The students use this language, and have begun to prompt each other to describe thinking processes rather than just provide and accept solutions as answers. Preliminary observations show that the teachers also model thinking processes when helping students work through problems.

Theoretical Basis of Research Approach

The theoretical approach to this work is that of multiple perspectives and multiple voices. Any situation can be approached from more than one perspective, and each perspective brings a unique and essential understanding to that situation. Feminist literature places a strong emphasis on recognizing the multiplicity of voices in a situation, and providing opportunities for them all to be heard. Edwards and Ribbens (1998) discuss the importance of voice in a wide range of research, and the role of feminist research in recognizing and giving a place for these voices. In their view, the job of the researcher is not to evaluate the relative merits of each position, but rather to allow the multiple perspectives to be voiced. The challenge of representing those voices fully

requires honesty about one's perspective and discussion of emerging research findings during the research process so that dialogue about the perceptions of all participants – university researcher and others – can be explored fully and integrated into the work (Kirsch, 1999).

In this research, the voices of the teachers, students, administrators and the university researcher all are considered and balanced against each other to gain a full understanding of the processes at work. This approach combines constructivist, advocacy, and participatory approaches. From constructivism, the researcher takes the beliefs that the goal of research is to increase understanding, and that it requires the participation of multiple partners who bring their diverse meanings to the construction of this understanding. From the advocacy and participatory approaches it borrows a collaborative approach to research, where the teachers and students work equally with the researcher in developing an understanding of the phenomenon under study (Creswell, 2002).

Work on teachers as researchers, learners, and participants provides a theoretical framework for understanding this particular approach to research. The idea of teacher as researcher is explored in many works, including that of Miller (1990). Miller carries this idea further, however, focusing on the idea of a research team, and of the research process as a constantly evolving dynamic involving redefinition of roles. Its goal is to create a metaphorical space in which dialogue about teaching can occur. Cazden (1986) identifies a need for research in real life classrooms rather than prestructured and research-oriented ones.

The three teachers are “radical pedagogues” (Giroux, 1983, p. 238) in their commitment to eliminating social differences based on race and class, in promoting democracy in the classroom, and in creating links and community with other teachers in their attempts to promote change. However, this is not the framework they choose for themselves, seeing their work simply as helping all their students to learn. The absence of any agenda aside from student empowerment, and the enthusiasm and collaborative focus rather than bitterness and divisiveness, make their work all the more radical. They differ from the radical teacher perspective in their active functioning to create changes from within the administration and lack of attempt to dismantle the existing system, while still believing it needs to be radically transformed.

Greene (1973) argues for a perspective of the teacher as outsider, distanced from the norms and expectations of her cultural group. In this way, a dynamic of questioning and reflectivity is created that can transmit itself to students; without it, a teacher cannot expect her students to engage in self-reflection. She writes,

Our concern throughout this book has been to make that person visible to himself. If the teacher agrees to submerge himself into the system, if he [sic] consents to being defined by others’ views of what he is supposed to be, he gives up his freedom “to see, to understand, and to signify” for himself. If he is immersed and impermeable, he can hardly stir others to define themselves as individuals. (p. 270)

The literature shows the complexity and richness of involving teachers as partners in research.

Research Design

A qualitative case study design using participant observation was chosen as most appropriate to address the questions being researched. Part of the rationale for a qualitative design is that the main goal of the research is to describe the nuances of an interactive process by which the teachers integrate a diverse series of influences into their personal choice of instructional strategies. This process will be identifiable only through hearing the words and personal experience of the teachers involved, rather than isolating and measuring particular variables associated with their performance (Patton, 1990). As well, the teachers involved use adaptive instructional methods and constantly refine their approaches to meet the needs of the students more effectively. With the classroom situation constantly evolving, a static quantitative design would be inappropriate. Qualitative methods are best suited to emerging situations and processes (Patton, 1990).

Case studies often are used when there is a need to study a particular phenomenon in depth. Yin (1981) states that case studies are a unique research methodology necessitated by situations where the boundaries between the context and the issue being studied cannot be drawn distinctly. Eisenhardt (1989) emphasizes that the process of developing theory from a case study requires repeated cycling between analysis of data and development of theory, so that the theory developed is based in the data of a particular situation. Creswell (1998) distinguishes a case study from other forms of qualitative design as being the study of a bounded system, requiring collection of multiple data sources to develop a complete picture of the case being studied. In contrast to an ethnography, the focus is not on the functioning of the entire system but on some aspect of it.

The next key feature of the research design is the use of participant observation. According to Patton (1990), participant observation involves a different approach to research from the “detached researcher” common in quantitative and some forms of qualitative research. Creswell (1998) suggests that it is possible to change perspective from complete involvement to outsider objectivity within the framework of participant observation. Truth is sought through the details of daily life as experience by those being researched, rather than through objective measures conducted by those doing the research. Truth is constructed by the interaction of the researcher with those being researched, with perspectives jostled back and forth to construct a rich, textured description of their experience. The researcher is involved in this iterative process of meaning making; her participation, however, is not viewed as a source of bias, but as a method of gaining insights that could not be observed if she took a more distant perspective. Indeed, some theorists on qualitative research such as Deutscher, Pestello and Pestello (1993) and Dewey believe that trying to understand a phenomenon by isolating its individual elements inherently will produce an incomplete understanding of the reality and totality of the event (Patton, 1990). Finally, the researcher checks her perceptions and observations with those involved and discusses emerging findings and conclusions with the “subjects” of the research to confirm their validity; such an approach is used to ground the conclusions in the lived world of those being researched, although the researcher still retains her responsibility for analysis and interpretation of findings. This is distinct from a collaborative design where the conclusions and research findings would be codeveloped among all participants, representing their consensus or majority agreement about the research.

This research project involves the teachers actively in improving their performance. Such a model of research could be termed action oriented, although it is not action research. The importance of having the teachers involved, and of their own autonomy and creativity, provides a rationale for an evolving research framework (Cook et al., 2002). This is in contrast with designs that look for statistically significant results by standardizing teacher practice. Not only would this be inconsistent with the goal of this inquiry, it would have created an ethical dilemma for the researcher as it would constrain effective teacher practice and remove teachers from the research equation as dynamic participants.

The strength of a naturalistic research design best can be described through Lincoln and Guba's (1985) work with their concept of trustworthiness, rather than the quantitative paradigm concept of validity. The main threat to trustworthiness in this design related to human bias, both by the researcher and by collaborating teachers. A number of methods were used to alleviate this threat. First, the researcher used member checks with the teachers to check researcher observations against teacher perceptions of the same phenomena. Member checks are confirmations of the appropriateness of findings with the "members", or those from whom data is gathered. The researcher presented emerging descriptions of the classroom processes to the teachers and asked them to comment on ways in which these descriptions converged or diverged from their understanding of their teaching and student response to instruction. Periodically, the researcher presented emerging findings to the collaborating teachers and asked for their response as to how accurately these represented their experience. Similar discussions occurred in the focus groups, grounding the researcher's interpretations in the

perspectives of the teacher. All such member checks resulted in confirmation of the emerging ideas, and enabled the research to delve deeper into the issues being described. There were no major disagreements with researcher findings over the year of data collection; what happened instead was that, if a researcher comment did not fully reflect their entire perspective on an issue, the teachers would elaborate, allowing both the teachers and the researcher to gain a more complete perspective on the issue. This process of collective meaning making led to new ways of understanding the data that integrated the perceptions of all teachers and the researcher. The teachers considered the researcher's observations as accurately reflecting their personal experience, and their feedback was considered as a tentative affirmation of the findings. The results (Chapter 4) also were sent to the teachers for their comment. Attempts were made throughout the process to make the research and analysis methods clear to all participants as per Anfara, Brown, and Mangione (2002).

Participant observation was chosen since the goal of the researcher is to develop explanations for the data that are comprehensive enough to encompass divergent perspectives. Differences in perspective were few, and were explored through further dialogue to resolve the issue, identifying either the underlying commonality in perspective or the points on which the teachers disagreed. Coexistence of alternative perspectives was accepted. Fortunately for the researcher, the participating teachers and the researcher reached consensus about the majority of the happenings in the classrooms. This is ideal because it means that the findings are able to accommodate the multiple realities of all those involved in the research. It implies that the findings are more overarching and transferable since they can account for the experience of many within

one explanatory framework. In other words, differences in perspective have been accommodated within a single theoretical explanatory paradigm. This idea is supported by Eisenhardt (1989) who states that the use of multiple investigators in case study situations enhances confidence in the conclusions drawn, since they reflect multiple perspectives rather than the potential bias of a single researcher. The researcher retained the role as primary interpreter, reserving the right to determine the final wording to be used in presenting the findings.

Next, clear audit trails were kept by the researcher, detailing the methods used in research and analysis (Miles & Huberman, 1994). These should make the research process transparent to readers. It also helped the researcher during the research process to stay aware of potential sources of bias and of how the planned research structure was being implemented in reality. One tool for this was a field notebook where details about interviews, observations, focus groups, and other data collection processes were recorded sequentially. This assisted in tracking the different sources of data and provided the researcher with an effective check on the progress of the research. Another was a data collection schedule which outlined the targets for data collection and ensured that appropriate data were collected with respect to time, place and other variables. Because of the variation in the teachers' and researcher's schedules, these schedules continued to evolve over the year. Appendix J shows the data that were collected and the dates of collection.

Research Questions

The research addressed one major question: What influences, and what characterizes the approach to teaching, of three exemplary constructivist oriented teachers? This question is an exploration of ways in which these teachers integrate their sense of self, philosophies, collaboration with colleagues, and beliefs about students, to generate an integrated set of instructional strategies for math.

To understand this issue fully, a number of subthemes were examined:

- What are their beliefs about teaching, their students, their colleagues, and their school?
- What are their working definitions of constructivism and direct instruction?
- What types of professional discourse do they encounter and seek out?
- What influences do the teachers identify on their philosophies of education?
- What influences do the teachers identify on their knowledge of strategies for instruction?
- What do the teachers consider in deciding what strategies to use?
- How does preparation for standardized tests affect their instruction?
- What motivates the teachers to change their instructional approaches, rather than continuing with the methods they already use?
- How do they weigh the needs and demands of multiple audiences for their instruction: students, administration, parents, researchers, peers, others? What role does their personal philosophy play in this process?
- What level of integration of theory and practice do they have?
- Do they use different approaches for different students? Why do they do this?

- Do they note a synergy between the different strategies?
- What are the plans and actual implementation of pedagogical strategies by the teachers?

Additional questions and issues were developed throughout the data collection period as new issues emerged through their activities and their comments. Because of the high level of collaboration among the teachers, and because of the high level of agreement among their different philosophies, statements and practices, the main unit of analysis was of this collaborative group of teachers. Conclusions were drawn about their overall instructional approach, and presented as an integrated case study in Chapter 4.

Human Subjects Review

Appropriate Human Subjects Review procedures were implemented to ensure confidentiality for the participants. An application to the Newport News School District to conduct the research was approved. The research also was approved by Old Dominion University's College of Education Human Subjects Review Committee. The research was recognized as Human Research Exempt according to Virginia Standards for Human Subjects Research, Section A #2, sub-section (c). Although audio recordings of students and teachers were made, these were deemed as exempt since the questions under study are of a general academic nature. No sensitive or potentially incriminatory topics were addressed. It is worth noting that the goal of the research was description rather than evaluation; this helped ensure that the data collected and researcher conclusions focused on descriptions of beliefs and practices rather than evaluating the effectiveness of

individual teachers. As a result of these considerations, it was deemed that the level of risk was not inappropriate to the participants.

Audio recordings are stored by the researcher in a secure location without names. The recordings will be destroyed once research and analysis are completed. Pseudonyms are used for the teachers and students, but permission was granted to use the name of the school and school district throughout the dissertation. The teachers, as active participants in the research process, may copresent with the researcher at conferences or be listed on publications. This level of confidentiality is deemed acceptable by the participants.

Data Sources

Five main data sources are used. The emphasis on teacher responses and beliefs is discussed by Langer (2001), who refers to her previous work to emphasize that successful instruction is based more on how the teacher adheres to particular underlying beliefs about teaching and learning, rather than on the particular instructional methods that are used. Similar beliefs might result in a wide range of instructional practices. One implication of this is that adoption of particular practices by teachers in absence of an appropriate structure of belief may not produce beneficial results. It is as important to look at what teachers believe as what they do in the classroom. For this reason, the research focused on beliefs about learning as well as specific practices. This was combined with interviews, observations of classroom behavior, and researcher field notes to triangulate the data and provide multiple sources of information for addressing the research questions (Creswell, 1998; Patton, 1990).

1) Observations and Audio Taping of Math Talk Sessions in Three Classrooms

Based on teacher input and researcher perspective, class sessions were chosen for observation or recording throughout the year (see Appendix D for an observation protocol). The teachers identified sessions where they planned to use methods they were excited about or where they knew that the class would not be interrupted by other school activities, as well as regular class sessions. Out of respect for the teachers, random visits were not used, although they were extremely flexible in terms of accommodating researcher visits. A form of information-rich sampling known as intensity sampling was used to ensure that promising sessions were recorded. These are contrasted with some more typical math sessions, chosen through confirming or disconfirming case sampling. Information-rich sampling involves choosing cases that contain information that will help address the research question, rather than using a statistical procedure to identify a random sample. Intensity sampling involves choosing cases that show the phenomenon under study to a heightened degree. Confirming or disconfirming case sampling involves choosing cases that can support or raise questions about previous findings (Patton, 1990). In this way, class sessions that promise to illustrate teacher strategy use were chosen for study. These were combined with more ordinary class sessions (disconfirming case sampling) to see if similar methods were used on ordinary instructional days. A total of 32 class sessions were observed over the study period, exceeding the target number of 30 observations. All recordings from these observations were transcribed and analyzed.

2) Informal Discussions with Teachers

Following most classes that the researcher observed, she met with the teacher(s) to discuss what happened during those sessions. The teacher shared her observations about what happened during the session and how it was similar to or different from other sessions; noted highlights in terms of student learning, understanding or exhibition of strategy use; expanded on ideas for modifying methods based on the events of that day; and reflected on questions about instruction and student response. The researcher shared her observations on the types of instructional strategies used; characteristics of student response; and unusual actions by students, such as heightened use of questioning methods or sudden involvement of one student who was previously uninvolved. The researcher took notes on a laptop or made audio recordings during these discussions. Discussions continued in person and by phone and email through the summer and fall, allowing a longer time period for reflection on the data.

3) Formal Interviews with Teachers

The researcher arranged a number of formal interviews with each participating teacher, using a semistructured interview protocol. The interviews followed a dynamic format, fostering open discussion of a wide range of issues in education and within the teachers' classrooms. In addition to issues of choice of instructional methods and influences from other sources on their own and student learning, the interviews explored affective elements such as beliefs about learning and teaching, frustration or satisfaction with the progress of the project, personal educational history and future plans, and other topics (see Appendix F). Approximately five in-depth interviews were conducted with

each teacher over the year long research period (See Appendix J for summary of the data collected). These were held in various locations, primarily the school but also over the phone and in coffee shops. By the end of the research period, all new data confirmed existing explanations derived from analysis, and no further interviews were deemed necessary (Glaser & Strauss, 1967). These interviews were audio taped and transcribed.

4) Teacher Electronic Journals

The participating teachers submitted periodic reflections on their work and student learning via email to the researcher. In addition to open ended thoughts and reflections, a set of question prompts served to facilitate response. Comments covering a wide range of topics were encouraged, those concerning the process of research as well as the details of classroom practice (see Appendix G).

5) Focus Groups with Teachers

A total of five focus groups was held over the year. These allowed teachers to gather together and discuss the development of their teaching strategies and student response to their instruction. They began in the spring and allowed the teachers and researcher to bring together some of the issues that had emerged in the earlier part of the research process. An interview protocol consisting of open ended questions and probes was used (see Appendix H). The questions continued to grow and change throughout the year as new issues emerged and the researcher gained a deeper understanding of how these teachers thought about themselves, their students, their colleagues and their instruction. As well, wherever possible the teachers guided the discussion by sharing

what they were reflecting on at that time. This helped avoid researcher imposition of a framework onto their thinking, allowing their own ideas to emerge. The goal of the sessions was to explore the interactive nature of instructional change for teachers and learners, and to capture the reflective practice of this group of teachers. The sessions were audio taped and transcribed.

Additional data were gathered from administrators, students, and other teachers at the school, such as emails, observed conversations and interviews. This data proved useful in understanding the context within which the teachers worked.

Criteria of Trustworthiness of Findings

As this is a qualitative case study, the main instruments used were the researcher and interview protocols. The researcher used audit trails and member checks to address the issue of researcher bias. By detailing the procedures followed for data collection and analysis, the researcher made possible external validation of the research process as a check on personal bias. The process of reflecting on the research and recording procedures in detail also revealed to the researcher areas of potential bias. An additional tool was member checks, with the researcher sharing emerging findings and codes repeatedly with the teachers and discussing areas of agreement and divergence.

To ensure reliability and validity of the interview protocols (see Appendixes E, F and H), they were reviewed by committee members and other graduate students to verify their content and face validity. Their feedback indicated that the protocols covered an appropriate range of subjects and would allow the researcher to address the research

question. The protocols also were field tested with the teachers to determine their user friendliness and appropriateness. Modifications were made based on these suggestions, with some questions added and others removed. As an additional check on the reliability of the coding scheme, a reliability check by another researcher served to verify the fit of the codes to the data. The researcher read through the codes, discussed the data available, and made some suggestions for codes to be added and merged.

Data Collection Procedures

Data collection took place over the course of one year (June 2002 to June 2003). Interaction with the teachers over a one year period allowed the researcher to document their thinking over time as their ideas and practice evolved. Background information about the school and the assessment project were collected from June to December 2002. These data were coupled with interviews and observations that explored the dynamics of the three classrooms involved and student response to different instructional methods. Analysis of field notes and transcripts of classroom observations and interviews from September to December 2002 provided an initial list of themes of teacher practice and thought, as well as useful data points illustrating their philosophy and practices.

The bulk of the data collection occurred from January to June 2003. Informal discussions, interviews and focus groups with the teachers were spread from the beginning to end of this time period. The researcher frequently debriefed with the teachers after each day spent conducting observation or recording in the classroom. These informal interviews supplemented the longer, formal interviews that were audio taped and transcribed for analysis. The formal interviews, approximately five per

teacher, were spread throughout the time period. As well, five focus groups were conducted. Limited discussions with the teachers continued through the summer and fall 2004 via telephone and email.

The researcher identified, together with the teachers, an appropriate number of math talk sessions to record and observe. These included sessions on different days of the week and those using different types of problems and instructional methods. Based on criteria such as new trends in the classroom, changes in teacher methods, and emerging redundancy in transcript analysis (Glaser & Strauss, 1967), a total of 32 class sessions were observed by the researcher. As well, the teachers submitted electronic journals or emails to the researcher with their descriptions of current activities in their classroom and reflections on the teaching and learning processes. These were submitted whenever the teachers had the time for additional reflections. A summary of the types of data collected and the frequency of collection is listed in Table 2. See Appendix J for a complete list of all the data collected.

Data Analysis Procedures

Data analysis and coding were embedded throughout the research process. From the start of the project, the researcher shared her reflections on the processes she observed with the teachers, who clarified their views and provided new insights into their thought and action. This interactive process produced a data set comprising 73 pieces of data: observations, field notes, emails, formal and informal interviews, and focus groups. This was the body of data that the researcher subjected to formal analysis.

Table 2. Data Collection Matrix

	Participants	Frequency of Collection	Method of Collection	Total Number Collected
Teacher Informal Interview	Teacher & Researcher	When classroom observation occurs	Notes on laptop	20 + (included in observation notes)
Teacher Formal Interview	Teacher & Researcher	Throughout collection period	Audio recording or notes	17
Teacher Focus Group	Teachers & Researcher	Throughout collection period	Audio recording	5
Teacher Electronic Journals	Teachers	Throughout collection period	Email submission	13
Class Observation	Teachers, Students & Researcher	Twice per month per class or more	Audio recording; notes on laptop	33
Additional Data Pieces	Other teachers, field notes	Throughout collection period	Email, notes on laptop	11

Data analysis involved two simultaneous processes: identifying the primary codes and themes that were detailed in the data, and organizing these themes into a coherent model to address the research question. The researcher used a textual analysis approach to identify themes describing the processes in the classrooms (Patton, 1990). This was accomplished through an iterative process of reading and coding the data. The researcher read transcriptions of interviews, field notes, and observation notes repeatedly to identify themes in the data in addition to key themes that had emerged during the year. Themes were listed, transcripts were reread, and new themes identified. The categories in the coding scheme were modified, integrated, reconstructed, and interrelated repeatedly, then collapsed into larger categories based on their similarity, overlap, and ability to explain the data with respect to the research question. The coding scheme went through approximately ten iterations before reaching its final form. The coding scheme was refined through member checks with the teachers and combined with their own insights into classroom and instructional processes (Lincoln & Guba, 1985).

The researcher then attempted to organize this streamlined subset of themes into a coherent model that could describe the teachers' experience and address the research question. Twice during this process the researcher broke apart the entire coding scheme to reconstruct it from the beginning to ensure that the final organization of constructs was logical, repeatable, and defensible. Reference was made to the research literature to see if any preexisting models fit the data. However, none of the existing frameworks seemed to house the data adequately or provide a sufficient explanatory framework. Borko and Putnam (1996) developed a three part conceptual framework for organizing research on teachers. It comprises general pedagogical knowledge and beliefs; subject content

knowledge and beliefs; and pedagogical content knowledge and beliefs. They embed knowledge about students and how students think within these categories. Though useful, this framework focused too much on subject area specifics and not enough on general approaches to teaching and teacher attitudes towards learning to be appropriate for this research. Calderhead's (1996) framework for teachers' knowledge and beliefs provides a clear delineation of the subthemes within three of the five constructs that form the model: Philosophy of Education, Beliefs about Students, and Instructional Approaches and Strategies. However, based on the data it was deemed more appropriate to organize the subthemes somewhat differently, and two other constructs were added: Personal Agency, and School Environment, to diagram more holistically the teachers' experience of teaching in their school. The resultant model comprises the major components of teacher strategies and the processes and influences by which they choose and use the strategies.

After it emerged as a relatively stable product, the coding scheme was subjected to a reliability verification performed by another researcher. A sample of the data was reviewed by a researcher in the College of Education who applied the coding scheme to the data. A goal of 80% match in coding between the two researchers was set. On reading through and coding eight pages of data, an agreement of 79.5% was reached. The two researchers discussed discrepancies in the data coding process and found one code that was responsible for just under half of the discrepancy in coding between the two researchers. That code was revised by the researcher, resulting in a match of over 80% interrater reliability. As a result, the coding scheme was deemed sufficiently

accurate to represent the data. Further modifications of the coding scheme involved collapsing subthemes into more coherent categories.

The majority of the data analysis was performed using a flexible computer program to make the process faster and ensure archiving of both the data set and the emerging analysis structure. The data from observations, field notes, transcriptions of sessions, interviews, and focus groups were entered into the NVivo qualitative analysis program which was used for data coding and analysis. The qualitative analysis software was used to organize the data and assist in identifying themes and interrelationships among the themes. The use of qualitative software for analysis of mathematics education data was supported by Mousley, Sullivan, and Waywood (1998) in their study of math educators' views on what constitutes quality teaching for math. Electronic preservation of the data linked with the coding scheme also can facilitate external verification of coding by allowing others to trace the data-based roots of individual categories identified by the researcher (Mousley et al., 1998).

Most of the data concerning colleague collaboration and teacher philosophy came from the interviews, both through direct statements they made and implications or unstated assumptions behind their comments. From observations of their classrooms came examples of these beliefs, and insight into the concrete ways they translate them into action. Observation also provided insight into the classroom environment. This was not something they referred to in the interviews, but from observation it became evident what kind of learning environment they value and how they create that environment for their students.

Some theoretical considerations were brought to bear during the process of data analysis. Eisenhart's (1999) comments about qualitative research provided the researcher with some conceptual tools for approaching the analysis. She notes that good research should surprise – the interpretations should bring to light things we did not see before. It also tells the story from the perspective of those who live it, thus providing for a deeper understanding what it means than an external observer perspective. Both these characteristics were brought to bear on this research. In discourse analysis, Cazden (1986) emphasizes that there is not a one to one relationship between form and meaning. In other words, transcript analysis requires careful attention to context and “reading between the lines” to put together a complete understanding of what someone means, not just what their words mean. This is obviously a delicate process requiring rigorous analysis rather than recourse to wishful thinking; but it does leave a role for expert knowledge as developed by the researcher or data analyst.

CHAPTER 4: FINDINGS

The Model

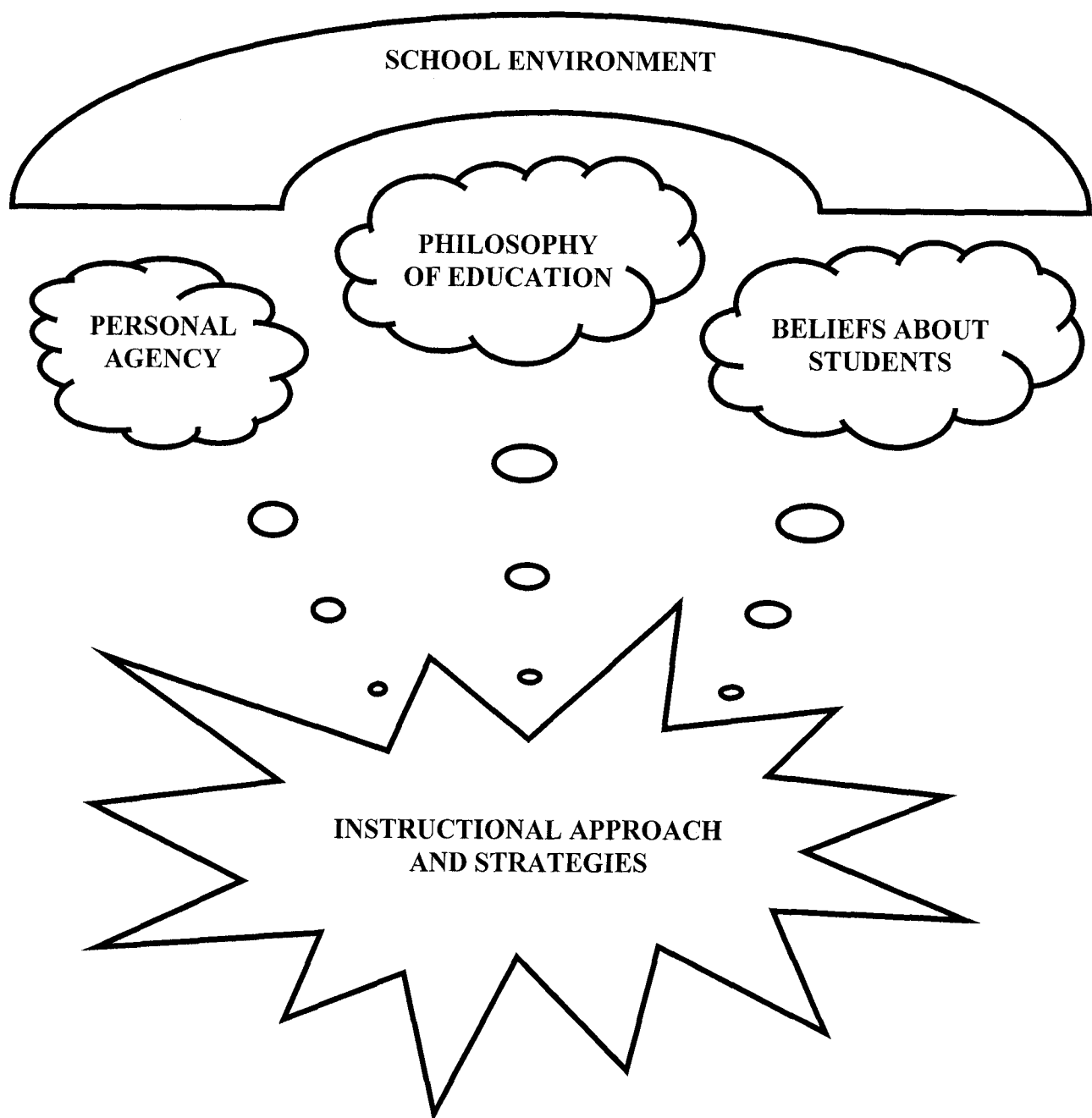
After extensive data analysis, the data were organized into a model to address the research question: What influences, and what characterizes the approach to education of three exemplary constructivist oriented teachers? The resultant model (Diagram 1) synthesizes data gathered from the teachers and other sources to describe the forces that influence their approach to education and the characteristics of their current practice. The context for their practice is the school environment which forms a framework within which they operate. School administration generates a unique culture, with expectations about philosophy of education, the responsibilities of teachers, and instructional approaches and practices. These provide goals towards which the teachers strive, as well as set the boundaries of acceptable professional performance.

Within this framework we find the teachers as three individuals with many shared characteristics. The three major aspects of their functioning are their sense of personal agency, their philosophy of education, and their beliefs about students. Personal Agency encompasses their sense of themselves as change agents within the school with the ability and responsibility to create change in the lives of their students. They consider themselves as active agents in shaping their own practice, and guiding their students' learning. Philosophy of Education covers their views on the goal of education, philosophical and theoretical beliefs about education, and perspectives on a variety of educational approaches such as constructivism, direct instruction, and special education. Beliefs about Students addresses the teachers' beliefs about students and attitudes

towards them. These beliefs include a strong emphasis on understanding student thought and directing instruction around it, and respecting the inherent humanity of each student. Finally, these three aspects of each teacher inform a specific instructional approach and strategies that reflect their attitudes and beliefs. Strategies such as extensive questioning, collaboration, and goal setting are used to promote student achievement. Appendix I outlines the constructs, their components, and the issues explored under each component.

The rest of Chapter 4 details the five constructs, drawing on excerpts from the data to illustrate the themes identified. Some quotations have been repeated as they are relevant to more than one theme.

Diagram 1. Model of Teacher Practice and Change



Construct 1: The School Environment

School Culture

Origins and Driving Spirit

From its inception in 1995, Newsome Park has continued to build on its founding mission. The principal, Steven Johnston, accepted the principalship with the goal of implementing his vision of a constructivist-based school. He and the former Assistant Principal, Tara Coite, worked together from the school's inception through 2002 to move progressively closer to this vision. The new Assistant Principal, Judi Odell, has continued in the same spirit. One teacher says that when it opened, "Newsome Park was looking for what Michael Fullan calls 'change agents'" (Newsome Park Process Email Bridget November 14, 2002). She feels that this is "the attitude that drives most ... in the assessment group", with individuals "ready to take on challenges" (Newsome Park Process Email Bridget November 14, 2002). Another teacher reflects this idea of the school as a place of constant growth, saying that

Newsome Park has been in a constant state of disequilibrium over the last eight years. Since we began as a magnet program, we have tried to find methods for teaching and evaluating that balance what research has shown to be "best practices" with the "drill and kill" strategies that most schools have adopted to cover the SOLs. (Helene Reflections November 25, 2002)

From these descriptions we can see the driving principles of the school: ongoing change, best teaching practices, non-traditional instruction, and continual challenge and growth.

This sense of excitement clearly is visible in the assessment project that the school undertook in the 2002/2003 school year. Steven Johnston says that over the eight years he has been there, the school has focused on “getting our arms around assessment” (Newsome Park Meeting November 13, 2002) as the core of effective instruction. The project brought together key teachers who were focused on a diverse range of topics related to assessment: feedback, metacognition, cognitive strategies, and others. There is a sense of excitement about finally achieving the critical mass necessary to generate school wide transformation of assessment practices.

The general atmosphere in the school is warm, positive, friendly, and safe. Students move through the halls in an orderly fashion; they smile at visitors, ask how they can help, and are generally polite and well behaved. Part of the visual look of the school is its dress code: “No logos, no patterns, like no pattern dresses or anything, everyone has to wear solid colors, no jeans, it’s basically solid colors, but they can wear sneakers” (Eisah Interview No Date). Although the students would rather do without the dress code (Eisah Interview No Date), it supplements the emphasis on developing understanding, personal responsibility, and thinking for oneself to produce an orderly, positive environment. This atmosphere is clearly visible on “Open House” days when students explain their semester long research projects to visitors. They are polite and lucid, and clearly knowledgeable and enthusiastic about the work they have done (Newsome Park Open House Field Notes January 16, 2003).

Emphasis on Research and Collaboration

The school emphasizes theory and research as bases for instructional choices. Eisah illustrates the extent to which theory is part of the school culture in the following comment about theory at the school:

I don't even think until I came to Newsome Park, I don't think I knew that Vygotsky and Piaget were the basis for constructivist theory. 'cause even in the books I would read, I don't think it was thrown in my face like how I needed it to be, that they were there [at the foundation]. (Eisah Interview May 28, 2003)

As a result of the ubiquity of appeals to theory and research, learning continues for teachers once they start teaching at the school. Staff meetings involve discussions of test data, identification of essential areas to focus on, and comparisons of various instructional methods. For example, a school leadership meeting on September 18, 2002, included discussion of a four year trend analysis of school test data; code switching between forms of English used at home and at school; math assessment; word analysis and word logs; and the book *Dimensions of Learning* by Marzano and Pickering (Newsome Park Staff Meeting September 18, 2002). This knowledge-rich environment is a key force in driving ongoing improvement.

The focus on being change agents, on research, and continuing improvement create a culture of learning and growth within the school, attracting teachers of that mindset and helping to promote an expanding spiral of school improvement. This is seen in one comment about the assessment project, that "everyone enjoys the research and the reading and the quest!" (Newsome Park Process Email Bridget November 14, 2002). These teachers would not want to go to a different school lacking the collegial interaction

they have at Newsome Park. For example, Eisah reflects on the importance of working with like-minded individuals in the same school:

And I think that even, when it comes down to it, yeah, they could be outside of your school, you know, and you still could be going through that whole reflective process and it still could work, but when you have someone in the same building, working on the same projects or under the same daily stresses, and are really having that understanding it's so, it definitely is so important, and I think you still would have gotten far 'cause it's in you a lot of that, but the collaboration is so key, and when you have questions in your mind, and clearing them up and going forward. (Focus Group May 14, 2003)

Close collaboration with colleagues is a key to maximizing personal development because of shared understandings that form a platform of understanding, and the increased ease of collaborating. The culture at Newsome Park promotes collaboration and thus allows for more complete professional development. Sasha says that "the reason I feel like I'm a successful teacher today is because I have all these colleagues to reflect with and talk with, and that really pushes my learning" (Focus Group May 14, 2003). She also feels that, "I don't think that I would have learned as much as I did at Newsome Park if I was the only person that was interested in learning" (Focus Group May 14, 2003). And in having so many people to collaborate with, she says, "All you do need is one person, if you have more than that, then you're really lucky, and I feel really lucky" (Focus Group May 14, 2003). Eisah concurs:

I would hate to go somewhere that doesn't have this support. How can you grow and learn if you're not collaborating? The environment of the school makes this

possible, with seminars, professional development, the people in the school, having an active research program. (Eisah Observation Interview May 7, 2003)

The collaborative environment accelerates their learning process and is something they recognize and appreciate about the school.

Differences in Perspective Within the School

While the school culture is one of growth and change, this does not mean that everyone in the school understands this the same way, or is equally committed to the process. There is a high level of dialogue among those teachers and administrators who support the school philosophy as to what best practices should be, and what methods should be pursued versus abandoned. This dialogue, among equally passionate peers, is one of the exciting things about the school. In the “Teachers as Readers” club, for example, teachers come together after school time to share ideas and debate effective practices (Newsome Park Field Notes January 24, 2003). At the other end of the spectrum, however, are those teachers who have not embraced the vision and do not support the push for continual change. One teacher explains this dynamic:

I think that there has always been a core of teachers ready to embrace best practices and that have served as leaders in a more constructivist environment, but we have never really found a way to bring the more complacent teachers on board. On top of that, we have always had a high turnover rate on our faculty, which has always made it difficult to keep the “ball rolling”. We constantly [are] having to train new faculty members in the programs and initiatives we have already implemented. I think this sometimes results in a “watered down” version. (Helene Reflections November 25, 2002)

This sense of frustration sometimes is seen in comments of the three teachers who are the subject of this study. They have sometimes found that their enthusiasm is interpreted as criticism or naïveté. One teacher says,

I hope that many teachers will hear our presentation to the faculty and will want to find out more. I believe that this will happen, but I also know that a substantial number of teachers will not “buy into” any alternative methods. (Helene Reflections November 25, 2002)

In spite of this reality, they generally ignore such responses and put their energy into continuing professional development and collaboration with those who share similar interests.

Personal Stories of Connection to Newsome Park

The three teachers in this case study found at Newsome Park a philosophy and practice that resonated with their own beliefs. Eisah describes her job search experience as one in which she found the right match between her philosophy and a place where she could practice it:

I got on the website for Newsome Park and I read the mission statement and I remember calling my mom, like, “Mom! Read the mission statement!” And I saw they did looping, and I was like, “Oh my God, this is it!” And something else, project-based learning. I saw those three things, and I still didn’t even have a strong knowledge of what the school was but I was like, “I’m going there.” And I came, that was a Wednesday and I was here on a Friday. And I walked into the school and Mr. Johnston was late in coming and so I just started looking at the project boards and was like, this is where I’m supposed to be. And the interview

was very short because the sixth or seventh question he asked was, what is constructivism. I gave him my spiel about what I thought it was and what I saw and he just said, “Do you want a job?” [Sasha: Oh my gosh!] And then we came here. (Focus Group May 14, 2003)

Her process reflects the sense of calling these teachers feel, and the image of Newsome Park as an oasis of possibility in an otherwise deadening educational landscape.

Sasha had some doubts about doing her student teaching at Newsome Park because of a variety of practical considerations, but is glad that she ended up here:

I came in just to visit before everything got rolling and I walked in the room and Charity, who I have now, and Yolanda, and everybody got up and they were like, Miss Hawley, we’ve already heard all about you, and they hugged me and Julie hugged me, and they were engaged in Writer’s Workshop, and I was like, how cool. I always think, if I hadn’t had my student teaching experience in Julie’s classroom, I don’t know what kind of teacher I’d be. (Focus Group May 14, 2003)

From her description of the welcome she experienced and her appreciation of the classroom we can see both the formative nature of her time at Newsome Park, and the sense of connection she felt with the school.

Collaboration and Colleagues

Value Placed on Collaboration

Collaboration with colleagues is highly valued by the three teachers. Sydney states that it is “necessary” (Focus Group June 11, 2003) to personal growth and “it is

always amazing to me how much talking to other teachers can improve your own practice even if you don't pick up any specific strategies" (Sydney E-Journal March 21, 2003). Eisah similarly says that "colleagues are definitely a big part" (Eisah Interview May 12, 2003) of getting ideas for her professional development, and that they "talk a lot and it is very helpful" (Eisah Observation Interview May 7, 2003). Sydney feels she can grow from watching others, regardless of the ability of the person she observes:

I am always amazed at how much I learn from watching others, whether experienced or inexperienced. I get a more clear picture of my own practice including strengths and weaknesses. (Sydney E-Journal May 3, 2003)

Collaboration is a visible aspect of professional functioning, through talking with other teachers, observations, collaborative research projects, and other activities. They accept it as the norm for professional interaction, and believe firmly in its importance. As Sasha says, "I don't think that I would have learned as much as I did at Newsome Park if I was the only person that was interested in learning" (Focus Group May 14, 2003).

In comparison with other methods of professional development, collaboration is one of the most significant elements for these three. In response to a question about the main sources of their learning about educational practice, they had the following to say:

Sydney: I think through experimenting in the classroom, and then listening to other people and what they know and what they do. And watching other people. Yeah, those two things.

Sasha: I think the most for me would be collaborative reflection. Because as much as I'd like to be in everybody's classroom, it's rare. So what most impacted

what I do in the classroom was the collaborative reflection, conversations, you hear little tidbits. Oh, you're doing that, okay, I'm trying it the next day.

Eisah: And through doing the testing, like Sydney said. I'd try things and they'd flop, or I'd try things and I knew I needed to change the way I presented it, so either through the experimenting and through the collaboration. (Focus Group June 11, 2003)

Collaboration is mentioned by all three teachers as a key component of professional learning. Experimentation is another key source of learning, but it is through collaboration that the experimentation assumes meaning. In this way, collective learning can emerge as they share ideas to try in classrooms and compare results under different conditions.

Collaboration is valued above other forms of professional development, such as reading professional literature, which they compare with collaboration in terms of its value as a source of personal growth:

Eisah: I think it's [collaboration] the highest. Like, if I would compare it to reading a book that was really highly recommended to me. I still would say that my teacher collaboration was more important because I would understand better that way.

Sasha: I agree, I think that even above reading a book, and even reading a book means [Eisah: I agree] nothing if you're not collaborating about the book. How do you interpret this.

...

Eisah: Even if I just read a book, the amount of information I get from it is totally nil, compared to if I'm reading a book and Sasha's reading a book and I'm talking to her, or the book club that we had, that takes it so much further, because then I hear Sasha saying did you, like a paragraph may make so much more sense to her, or she visualizes it and then she tells me how she visualizes it and then I can see it, whereas I may never have even remembered that paragraph. (Focus Group June 11, 2003)

This collaboration is visible in the "Teachers as Readers" group that met approximately once per month to talk about selected books on education and ways of implementing them in the classroom (Newsome Park Field Notes January 24, 2003). Teachers used ideas from the book club in their classrooms and shared their learning from the implementation process. From the matter of fact way they talk about collaboration we can see how highly these teachers value their interaction with one another.

Forms of Collaboration: Dialogue and Reading

Collaboration takes many forms which interact with and reinforce each other. For these teachers, the major methods are forms of teacher dialogue – collaborative reflections, face to face, brief hallway conversations, on the phone, email – as well as observation and discussing professional readings. Although they may get ideas from some teachers for "quick ideas or quick implementation or quick little lessons that work really well" (Focus Group May 14, 2003), Eisah distinguishes this from the type of collaboration that promotes "growth as a teacher" (Focus Group May 14, 2003) and which occurs within a smaller group of collaborators. She looks for "quality interaction, not talking about whatever whatever, but quality interaction where you take time to ask

about something you see outside their door or ask someone's opinion about something you're going to do" (Focus Group June 10, 2003). There is a relatively small group of people with whom they collaborate on a daily basis, with around five or six people in the core group, and a larger group of up to ten people with whom they collaborate less frequently. This larger group includes other teachers in the school, administrators, and university professors.

Teacher dialogue is a cornerstone of collaboration because of its ability to generate reflection and stimulate change in practice. Sasha says, "I'm a very verbal learner, I guess, I need to have conversation" (Focus Group May 14, 2003). She learns best through dialogue with others, and comments on the significance of conversations in her development:

I learn best in conversation and that's why Eisah and I talk on the phone so much. And I really feel like that elevates my thinking and my learning, when I'm just talking about it with someone about it. So when you were here [as a researcher in the classroom], you were there and you saw it, I wasn't just telling you about it, you were there and you saw it, and we were bouncing ideas off of each other.

That's what I call it. Collaborative reflection. (Focus Group June 10, 2003)

Through reflection, which is more easily done with someone else, one's ideas about teaching can be evaluated and decisions made about what to do next. Such a collaborative environment among their colleagues mirrors the collaboration they encourage among the students in their classroom. Sasha underscores the significance of collaboration through teacher dialogue as a process for improving her teaching:

Interacting with my peers about this process has helped me to decide how to best change things and new ideas to implement and try. We need to do more of it.

Conversation drives practice. I truly believe that. It's what helps me the most.

(Sasha E-Journal January 22, 2003)

An example of "conversation driving practice" comes in the following entry from Sasha's electronic journal where she illustrates the impact of dialogue on her classroom practice:

Reflecting with my team this past Wed. has impacted me the most in how I am using flexible grouping.... In fact, I have really begun to define it for myself better and so I feel more confident in what I am doing. In fact, it has transferred to my reading groups which has made reader's workshop that much more exciting! (Sasha E-Journal March 18, 2003)

Clearly, dialogue allows her to analyze what she is doing, make decisions about it, and thus feel more confident in her practice.

Within teacher dialogue, the types of comments made play a role in facilitating interaction. Sydney works to be positive and uses questioning, an instructional technique, in her interactions with peers and colleagues:

... another thing I'd say I learned through working with practicum students and student teachers, about how to help other people reflect on their own practice, and I found that I try not to really give my personal opinion about what they're doing but to ask questions, like how have you done this, or how might you push this forward [Eisah: To do collaboration?] Yeah, those sort of things. So I found that very useful, working through that process with them. Trying to figure out how to help someone reflect. (Focus Group June 11, 2003)

Questioning as opposed to telling allows her to foster a spirit of mutual inquiry that encourages others to share. As she uses questions with her students, so she uses them while interacting with her colleagues. Other teachers have responded positively to her interaction with them. Eisah describes that

Katherine [another teacher] had said that when you (Sydney) go into her room, that you always give her positive stuff, you made sure you agreed, you'd always do that. I thought that was really good, always things to work on but also the positive as well. (Focus Group June 11, 2003)

Observation as a Form of Collaboration

Conversation, however, is not the only element of teacher collaboration; observation is an important related activity. Here, Sydney describes the significance that collaboration through observation has played in her own professional change:

I think what was most important for me was the observations, because last year when we were doing a lot of observing I think it really influenced me more than everything else. When we didn't do that I felt lost. I didn't have the same momentum myself as when I could go and watch someone else, I like the way this happens, maybe I can try this, even if I wouldn't do it that way. The visual is more than just talking through it. (Focus Group June 11, 2003)

In other words, observation allows her to go beyond theoretical interaction to gain practical ideas about how to teach. Sasha agrees that observation allows you to take ideas and theories about practice, gain a deeper understanding of them, and come up with ways to take your practice to the next step. She talks about another instance in which observing Eisah's classroom helped her identify a new strategy to use in math talk:

I think that the driving force in [becoming stronger in using strategies] is observing. 'cause until I saw Eisah's lesson and drawing conclusions and making rules, as she called them, with her kids, it didn't really click to me how to solidify the conversation after math talk, and that's what it was. Quick circle map summarizing what we learned. And then revisiting that the next day. And that's really turned around so many, so much. And that's just refining a teaching strategy that we've already outlined. But I think that in order for those teaching strategies or teacher implementation strategies or whatever you want to call them, to make sense and be pushed further you need to observe [Eisah: Or read, I mean ...] or see other teachers using them, or rethink them or reexperiment. (Focus Group May 14, 2003)

Eisah similarly sees the importance of observation as it allows a type of learning she would not gain from just talking with others:

Right, I think that another question you asked me, where do I get my ideas for what I do, and definitely, it all comes from colleague conversation, colleague observations, or any reading that I do where [the author writes], "One day I did this," just like excerpts that I actually can see it in my head. Because I'm just that kind of learner that I need to see the scenario and see it going on. Even through college, when I was reading theories ... the theories would click with me, and I'd be like, yeah, that's right, that's what I think too, but I need to see it implemented in how it works before I can take it forth. (Focus Group May 14, 2003)

Observation as a form of collaboration gives reality to teacher dialogue, promoting changes in practice. Observation allows all teachers to build on the practical experience

of others, and to see the nuances of practice that cannot always be conveyed through dialogue. For example, simply picking up on particular phrases used by another teacher can help one's teaching. As Eisah says, one of the values of observing is,

... just getting different ways to even word things. I word things in math talk and I hear Sasha whenever I'm saying them, because I've heard her word things, I'll use the exact same words, I'll be like, I just sounded like Sasha. (Focus Group May 14, 2003)

Small though this may sound, it is a tangible way to improve practice. Observation thus is another cornerstone of the collaborative process.

Prerequisites for Collaboration: Trust and Common Beliefs

Trust is a basis for collaborative relationships. Without it, the collaboration will be fruitless since "if the trust is not there then you're not likely to accept what they give you anyway" (Sydney from Focus Group June 11, 2003). Sydney can trust others based on trust granted by those whom she respects, saying to Sasha,

... you trusted Eisah so I trusted her. You knew her, then I got to know her and saw the same basic qualities you must have seen in her, so I guess it's part of the networking. I would trust anybody Sasha would trust, I think. (Focus Group June 11, 2003)

Sharing trust and using friend referrals allow the creation of a network of collaboration.

In addition to personal referrals, they also trust others based on beliefs they hold. Rather than identifying those core beliefs as part of a philosophy of education, Sasha describes them as "basic ideas on what is good":

I think it's both, you have one conversation with somebody and you feel you have the same ideals or the same basic theories, like although they might differ in certain areas, but you have the same basic ideas on what is good. And then from that you start to build trust because you know that those basic things are there.

(Focus Group June 11, 2003)

Sydney also feels that rather than trusting someone based on the general philosophy subscribed to by that person, she looks for core beliefs the person holds. As she says,

... to see that someone is very positive about their kids is really important and that helps me to trust them. So if I see that you see the good in your kids, whatever your philosophy is, I think I would feel like I could trust you to look for the good in my kids and then what I'm doing. Whereas if you're a negative person and you blame the kids for everything and on and on and on, I don't think I could trust that person. (Focus Group June 11, 2003)

Focus on this core principle of positivity allows the teachers to build collaborative relationships with others who may have a different philosophy of teaching. This shows their reflections on what constitutes the heart of their philosophy: care for children and focus on the positive. Sydney feels that in education and peer colleague relationships,

... it comes back more to a personal philosophy than a philosophy of education, because we have people who just refuse to try anything and who don't see themselves as the responsible party. So I think that's the roadblock to having a huge community of people who are willing to try things and learn. I just think trust isn't there and there's some kind of personal dynamic that says, "I'm not responsible." (Focus Group June 11, 2003)

A willingness to take responsibility for one's students and instructional practices, and working to make change in the classroom, is thus an additional criterion that Sydney uses to evaluate the potential for collaboration with other teachers.

Part of their spirit of collaboration is maintaining a high level of enthusiasm for other teachers they admire. Eisah says about Sasha, "Her kids are unreal. She is so unbelievable with them. She is such, like, totally incredible. That's awesome" (Eisah Interview May 12, 2003). They also emphasize the respect they feel for other teachers and thus, their willingness to learn from them:

I think really, because that, I make the connection more to, I teach the way I see other teachers teaching, like when I see Julie, when I see Sasha, when I see Sydney, that's a model for me right now, I do teach how I see other people teaching, people who I admire, as opposed to teaching how I was taught, because that was almost too long ago. (Eisah Interview May 12, 2003)

Eisah also comments positively about the special education teachers in the school, saying, "I think they do very appropriate IEPs [Individual Educational Plan] and really well created, developmentally appropriate IEPs" (Eisah Interview May 28, 2003).

Collaboration also gives them ideas and enthusiasm: "I find that one of the most beneficial things, because every time I get together with other teachers to find out what they're ... working on, it's just really reinforcing. Always come back the next day with ideas for how to do things" (Sydney from Focus Group April 2, 2003). Their enthusiasm about other teachers encourages them to continue collaboration.

Barriers to Collaboration: Lack of Trust, Positivity and Reflectivity

The three also identify types of people with whom working would be a waste of time. Collaboration requires close, trust-filled environments, and thus, not all relationships lend themselves to collaboration. With some people, the teachers do not feel the rapport necessary for a collaborative relationship and feel that attempts at collaboration may be detrimental or negative. Sydney says that “even if someone was willing to observe and be observed I wouldn’t necessarily trust their opinions or trust that they would be a safe person to put yourself on display for” (Focus Group June 11, 2003). The teachers feel the need for self-protection in regards to choosing people to collaborate with. Sasha noted,

Feeling safe, number one, that’s the bottom line I guess, number one. I’d encourage Sydney to come in and surprise observe me, because I know she would never leave and say to Eisah, you’d never believe. Sasha screamed at this child. You know what I mean? I just knew she wouldn’t, and I knew she would call me on it too if she saw something that she would write it. So I totally just trusted feeling safe. (Focus Group June 11, 2003)

The levels of closeness and trust they find are crucial to the establishment of collaborative relationships. They want the same type of environment to collaborate in as they try to create in their classrooms. A lack of trust is one reason why they would be hesitant to collaborate with another individual.

There also are reasons why they feel collaborating with some teachers simply would not be useful. Sydney identifies that the level of reflectivity of an individual affects her ability to collaborate with that person:

... there's sort of two different mind sets that people grow up with, that either you're reflective or you're not. And so there's this barrier between teachers who are reflective and those who aren't, at all, they just don't reflect, they only think, "What is wrong with these kids!" And I can't identify with that, but I can identify with the frustration of I feel like I'm trying everything I can possibly try, and they're still not getting it. (Sydney Interview April 30, 2003)

An unwillingness to reflect might be one reason why some people set up barriers that do not allow collaboration with regard to observations. Eisah had this problem on her grade level:

The reason I have the collaboration is that other people are open to it. 'cause there are other people on my grade level who are completely closed to it so it didn't happen, regardless of how much I wanted to do it. (Focus Group June 11, 2003)

Sydney also identifies with the problems of trying to collaborate with people who are not willing to work with you:

We have the same thing with observation, other people don't want to do it, they don't want to observe you and they don't want you to observe them. So you had to have people who are willing to participate and be watched and give feedback. (Focus Group June 11, 2003)

One possible reason why they might not trust someone is if that person held a significantly different philosophy of education from what they adhere to. When asked if "it would be possible to work with, to feel that level of trust with someone who had a different philosophy of education?" (Focus Group June 11, 2003), Sydney responded,

“I’ve not encountered them. The ones I met who didn’t have it, I didn’t trust for other reasons” (Focus Group June 11, 2003). Sasha concurs:

... if you have a certain theory in education it’s very personal, I think, because it also stems from what you believe goodness is, just what you believe with your heart [Kamilla: Human nature?]. Yeah, human nature and what you believe with your heart. So I think that if someone doesn’t believe that you’re willing to accept that but to trust them, I think, would be a huge leap of faith. (Focus Group June 11, 2003)

Working with others who have very different beliefs makes it difficult for them to value the suggestions made by those teachers, and to trust and feel safe in their interactions with those teachers:

So if I see that you see the good in your kids, whatever your philosophy is, I think I would feel like I could trust you to look for the good in my kids and then what I’m doing. Whereas if you’re a negative person and you blame the kids for everything and on and on and on, I don’t think I could trust that person. (Sydney from Focus Group June 11, 2003)

The core value of looking for the good in others thus is essential to collaboration. The value of what negative people have to offer is low:

Which I think goes back to theory, because if you believe that innately kids are bad, like someone last year, then you wouldn’t trust them when they came into your room and they observed you. And you wouldn’t trust them to have reflective conversations with you. And they wouldn’t be valuable either, because they’d be coming from a totally different page. Like their response to you saying,

I'm having a difficult time, I'm having a challenge with Marty and I don't know what to do. And their response might always be well, because they're a kid and their parents suck, and blah blah blah. So you wouldn't value that conversation.

(Sasha from Focus Group June 11, 2003)

The teachers clearly perceive the reality of a disconnect between their views on the world and those of some others with whom they have tried to establish relationships. They identify themselves as reflective, supportive, and focused on seeing the good in other teachers and the students. Based on their experiences, they have chosen not to focus time on working with those who do not share these values. Eisah illustrates the frustration they feel with trying to collaborate with those who do not share these values:

I think about people on my grade level who are a different philosophy from me, there's no point in all those, going in and try to share with them, because I've already tried that, I shut down because we have a different philosophy. So it would be a waste of my time to continue to build that kind of relationship when we're not on the same lines. (Focus Group June 11, 2003)

Their efforts are focused on collaborating with those who meet the core criteria for effective collaborators: "basic beliefs about responsibility"; "have positive ideas about their kids"; and "are you doing what's best for your kids and do you have reasons to back that up" (Focus Group June 11, 2003).

Working with others who come from a different orientation to teaching potentially can be beneficial. Sydney says, "I just think you'd learn from watching someone different from you and having them watch you" (Focus Group June 11, 2003). However, she also says that you might not "accept what they give you" (Focus Group

June 11, 2003) if you do not trust them. Interaction with different others can be helpful in a backwards way, since

... interacting with them on your team probably still reinforces your own beliefs.

You probably still benefit from interacting with them because you go back and say, I'll be damned if they're going to be right. I'm going to make sure I do that.

... Or even just hearing them or seeing them and thinking, I don't want to be like that. (Focus Group June 11, 2003)

Sasha also feels that observing those with a different philosophy does not yield any professional learning benefits:

... the only way it would be beneficial is 'cause you would be, I assume that we would all be, I wonder what can I learn from this, I wonder what I can learn from this, but it wouldn't be, I wonder what I can learn about my own theory, I wonder how I can push my own theory further because of this observation. It would be more like, hmm, this is interesting. It is literally observation without interpretation. (Focus Group June 11, 2003)

A dubious distinction, negative reinforcement of one's own beliefs, is the major benefit of working with others of different teaching philosophies.

The intense focus these teachers have on change, theory and collaboration is not viewed positively by all the teachers in the school. They experience some resentment from teachers. Sasha and Eisah feel sometimes that the other teachers are frustrated with them and they hear comments like "I wish they would talk in plain English" (Sasha Coffee Shop January 11, 2003). This serves to create a feeling of greater distance

between them and those with different philosophies. It does not discourage them from pursuing their activities, but it does temper how they share these with other teachers.

Sharing Expertise Beyond the School: Excitement and Responsibility

The teachers see the benefits of collaboration and learning from others' work. This motivates their involvement in collaborative projects and research, which leads naturally into sharing their expertise with others through presentations and other professional activities such as classroom research. The three of them have been involved in the assessment project from the beginning, and make other presentations such as one "on positive discipline, along with three other Newsome Park teachers" in the school district (Sydney E-Journal March 21, 2003). Sydney and Sasha presented at a national Association for Constructivist Teachers' conference, and Sydney presented at one the previous year as well. Eisah traveled to West Virginia for a teacher's conference there. Eisah and Sasha went to North Carolina for training on a reading system that they then shared with teachers in the school. Sasha presented at a district-wide principal's summit. Sydney participated in two district wide presentations on positive discipline.

They use these opportunities for sharing expertise and collaboration as a source of inspiration. Through interaction with others, and through seeing others respond to their ideas, they are motivated to continue their work. Regarding the presentation on positive discipline that Sydney and other colleagues offered, Sydney says that "just that alone was inspiring" (Sydney E-Journal March 21, 2003). Sharing her expertise is a natural outgrowth of her motivation as a teacher, sense of personal responsibility, and attitude towards learning that motivates her to interact with other professionals. For example, in discussing the assessment project she talks about both her intense involvement in it and

the benefits from working with a team who will share and learn from each other. As she says, “I guess right now, it’s so segmented, I’m so focused on my segment, and I don’t have enough time to explore the other aspects, so I think once we get it together in the whole package, it will be a lot more effective” (Sydney Interview April 30, 2003).

Sharing and learning together is a natural professional activity for them, something they consider the norm. It also allows collective movement towards improved instruction in the entire school.

A corollary of their desire to learn from others is the sense of responsibility they feel to share what they are learning at Newsome Park with others. Sydney talks about this in a conversation we had about constructivism and high-stakes testing:

Kamilla: Do you think you’re finding a way, are you trying to find a way to integrate constructivist philosophy with the demands of high-stakes testing?

Sydney: Yes, yeah. That’s what Sasha and I were trying to get across in our presentation at that conference, which was that, we see this as the reality and we didn’t see anybody else talking about how to do that.

Kamilla: You’re talking about last year at ACT?

Sydney: Right. We see constructivists as saying, don’t worry about that test because that’s not important for kids’ learning, but I don’t feel that’s responsible. So I feel like we have to find a way to mesh the two, and I think we’ll get better at that as we go. (Sydney Interview May 7, 2003)

Here we can see second year teachers highly motivated to share their insights with other professionals. We also see an ability to critique discourse in the field, recognize critical issues, and engage in dialogue on them. Finally, their attitude towards the conference

presentation demonstrates a belief that they have something worth sharing on a professional level.

Importance of Collaboration and Ongoing Development

Collaboration is an area where the teachers hope to continue to develop. Eisah says,

I have been engaging in reflective conversations with different teachers through the assessment team about prompting and questioning. I think that is an area that I can always grow in. (Eisah E-Journal March 31, 2003)

Sydney continues collaboration even beyond the school through an alumni association from her graduate program. They meet periodically to talk about positive discipline and also communicate via email. She appreciates this collaboration as another source of support for implementing her teaching philosophy.

Newsome Park is a milieu in which such collaboration is possible. Sasha emphasizes the key role collaboration plays in their development as a professional, and how fortunate they feel to be at a school that promotes and facilitates collaboration, in her analysis of a presentation she made at a Principal's Summit:

I presented [my summative report] to the principals and they said, you know, what made you such a reflective person? And I said, it was really the colleagues, if they weren't a part of my process I think it would have been much slower. And then [interruption] they said, well, do you think if you were at another school that you, where there wasn't anybody that was interested in reflection, would you have been as successful, and I said, the reason I feel like I'm a successful teacher today is because I have all these colleagues to reflect with and talk with, and that really

pushes my learning. But if I was at one school that didn't have any teachers like that, all it takes is one person who is on the same wavelength and is willing to reflect. (Focus Group May 14, 2003)

Sasha, Eisah and Sydney feel fortunate to have this supportive environment at Newsome Park with multiple people who are "on the same wavelength."

Administration

Characteristics of the Administrators

Administration, from the perspective of these teachers, means primarily the principal of the school, Steven Johnston. Also significant are the former and current assistant principals, Tara Coite and Judi Odell. Steven encourages teachers to get involved in shaping the development of the school, even while he has strong views about the principles and practices that should be promoted. He emphasizes formative assessment, constructivist philosophy, project-based learning, research, and teacher commitment. Rather than being static in his concept of these ideas, however, he believes they are moving targets, open to ongoing revision. He describes his approach this way:

We think we've come across a "fabric" of putting pieces together that interrelate and connect with each other. That's probably one of the major things we've done, is make sure everything we're doing connects with everything else. If it doesn't we're more than happy to abandon it. (Newsome Park Math Talk February 10, 2003)

Sydney emphasizes his openness to process as well as his drive to achieve goals when she says,

I think we're really fortunate to have someone say let's explore it and let's figure out the right way to do it. If he feels he needs to make the decision that that's how we need to do at this school, then I would at least expect he would say, be part of the process. He's told everyone, you can either be part of creating it or you're going to have it mandated. (Focus Group June 11, 2003)

While encouraging and sometimes insisting on teacher involvement, he provides ample time to gear up for involvement, and alternate ways to be involved.

While the principal cares about results, he is more concerned about process and commitment. Newsome Park improved in its standing in the 2001/2002 testing period, but was still short of full accreditation. Steven wants the teachers to focus on achieving full accreditation in the 2002/2003 school year as a key goal. However, he expects accreditation to be achieved through applying understanding-based instructional methods, not through reverting to direct instruction. He also is willing to support and work with teachers as they work towards achieving improved performance. The three of them discuss this in relation to teacher reaction to problems in one's classroom:

Sydney: There's a huge difference between how he responds to people who don't reflect and people who do. Because he was very kind to me in what I consider an awful, tragic situation [low test scores], and I would be very angry at a teacher, I think. But you know, I think that's what most important to him is that you do reflect and take responsibility. [Sasha and Eisah: Responsibility.] And he's responded very positively that was still validating to me.

Eisah: Definitely the same situation [with me]. (Focus Group June 11, 2003)

His priority, even when a teacher performs poorly, is on the willingness of that teacher to engage in a process of constant improvement. His support of reflectivity encourages openness on the part of the teachers which is conducive to dialogue. Willingness to grow and assuming responsibility also elicit his support. In response to Eisah's comment that the administration wants to know what happens in the classroom, Sasha says,

But they first want to know, if there's something bad going on, what you did first, [Eisah: Yeah, definitely.] and then when they start to understand that you're the kind of person who is going to do A to Z first, they already know that.... (Focus Group May 14, 2003)

Administrators as Visionaries and Setters of High Expectations

Steven's vision, energy and expectations inspire the teachers to continue to improve. Sydney says that the assessment project "has been a positive experience" (Focus Group June 11, 2003). They specifically note his impact as the principal:

Eisah: I know that for me I have a weird obsession with expectations, and if I didn't constantly search for how to be a better teacher or how to do this in a better way or how to make learning more effective I would just personally have a conflict with it 'cause I just would know that I wasn't doing the best job and I would need to do a better job. But it does come from within the school too because that expectation exists at a higher level which I fall under. And because I respect Mr. Johnston so much and this school so much, I really respect what he's promoting here, it wouldn't have happened without all the professional development.

Sasha: Or his high expectations.

Eisah: Or his high expectations. But I wouldn't have had those resources, I guess. (Focus Group May 14, 2003)

They recognize the unique situation that exists at the school because of Steven's vision:

I think that you have to have someone with a vision, like Mr. Johnston, and then people will follow that person. I think there are other people, definitely, out there like Mr. Johnston, but they're far and few between. I mean, you have to really look for them. But they're out there, and then once you find those people you will find other followers. (Eisah from Focus Group May 14, 2003)

He is a unique individual whose contribution is clearly recognized by these teachers.

The teachers also acknowledge that their positive response to Mr. Johnston is based on their similarity in values with him. Others might and do respond differently:

Sasha: I think he tried really hard to be positive, but I think that it's hard to interpret whether or not it's positive if you're from the viewpoint of, I don't want to do this. Do you know what I mean? From our end it was positive because we weren't affected by it, we were going to do it anyway. But if we were thinking that this was just not something we were interested in ... I just try and put myself into another person's shoes, if Mr. Johnston were to say, I want you to do programmed instruction, and it's gonna to happen, and I want you to do research on it and we're gonna reflect on it, then I think I would have been offended.

Sydney: Well, I'd have problems with wanting to follow his mandate, but at the same time I think we're really fortunate to have someone say let's explore it and let's figure out the right way to do it. If he feels he needs to make the decision that that's how we need to do at this school, then I would at least expect he would

say, be part of the process. He's told everyone, you can either be part of creating it or you're going to have it mandated.

Sasha: Or, I wouldn't be at his school, I wouldn't be at Newsome Park. If it was programmed instruction. (Focus Group June 11, 2003)

There is a good fit between the philosophy of the school and the personal approach of these three teachers. Within the school, however, not everyone falls in line with the principal's vision. The teachers draw a distinction between those who support the school philosophy and work to make it work, and those who are "along for the ride" and sometimes in opposition to school activities:

Sasha: But he has to find followers that see his vision as well. Because a lot of problems are that he has people that are along for the ride without the same vision.

Kamilla: Along for the ride meaning? They need a job in a school?

Sasha: They're bored but they don't know why.

Eisah: Or they say they're not, they're just not the same thought pattern, they just don't have the same vision. (Newsome Park Math Talk February 10, 2003)

While these teachers credit him with a major role in creating the possibilities for collaboration, experimentation and professional growth in the school, as involved teachers they also are significant players since many of the teachers in the school have not adopted his educational philosophy and do not engage in reflective practice. They are unique even among a group of highly motivated and professional educators.

Administration's Focus on Collaboration and Experimentation

Administration plays a key role in creating spaces for teacher collaboration. Without the expectations of the administration the teachers still would have collaborated since that is an important value to them and since all three of them want to improve as teachers. However, the larger scale activities they have been involved in require the authority wielded by an administrator, who can insist that “there are due dates, there are meetings, and you have products” (Sasha from Focus Group June 11, 2003). Eisah summarizes this view, saying,

... it would have happened on this kind of level, you know, looking at articles, typing things up, let's try this, let's try this, but as far as the assessment team going where it is, it wouldn't have happened. But again, though, we would have had a lot of collaboration and observation. (Focus Group June 11, 2003)

The group also agrees that the current principal holds the majority of the credit for creating the current situation. Sasha feels that, in relation to pushing the assessment project forward,

... anybody could have done that, you know what I mean, but Mr. Johnston was like, this will be a due date, you'll meet on this day, this is my vision for where you all are going. So that's what it was. (Focus Group June 11, 2003)

Administrators as Colleagues and Friends

The administrators, in addition to being in a position of authority, can be a collaborators and peers in the process. The teachers have changed in their perception of their roles over time. In the beginning, Eisah says that she felt

... so insecure, so not confident yet, I'm like, Oh my God, I'm in charge of these twenty-two kids and I have to do a really good job, and there's administrators who I need to do a very good job [for] so they think I'm really cool, and you know what I mean, and colleagues, so the expectation was extremely high and my confidence wasn't high. (Focus Group May 14, 2003)

Sasha remembers that when she started at the school, some of her colleagues looked on the administration as the foe; she says, "I also had a grade level of people that were not very supportive who were telling me the administration was somebody to be scared of." This compounded what she was already feeling: "in the beginning I was scared ... like, I don't want to say anything dumb, you know, and I was scared of the administrators, and that's just a trait that I have which is dumb, but I was just very nervous" (Focus Group May 14, 2003). However, her views have changed. When at a gathering of district principals she told them,

"But if I was at one school that didn't have any teachers like that all it takes is one person who is on the same wavelength and is willing to reflect." And they all started to nod their heads. And I said, "And it only takes one person who values that and you're that one person." And they kind of were like, "Yeah we are, and we do have that control." So as principals, I think they realized how much power they have.

Eisah: Right, and it's so good you made that point 'cause that is so true. (Focus Group May 14, 2003)

The principal and assistant principal are now viewed as collaborators rather than evaluators or figures to fear. Eisah and Sasha specifically talk about how they have grown to see them as people to consult with rather than avoid:

Eisah: Yeah, I was just going to say that, Steven and Judi. I've gone to Judi too, for different questions, specifically about reading because she used to do reading recovery so she has great insight about that. And as far as just things that I can do on my classroom, or just to get insight into what he thinks about it, it's definitely Steven, because he gives you a good honest, really good answers.

Sasha: And I would say that Steven and Judi have become now more of my smaller circle whereas before they were kind of more on the larger circle, like touch base once a month or whatever. (Focus Group May 14, 2003)

In addition to recognizing the knowledge these two individuals have to offer, the teachers' willingness to talk with the administration is at least partially elicited by the response they get. Talking about the new levels of collaboration with administration she is experiencing, Sasha says that,

... recently I don't know what I would do without Steven and Judi, they're so supportive. And they really, I love to bounce ideas off them, I like to keep them in the loop, I like to run in there and say, I just want to let you know how my kids are doing, or do you have any ideas about how I can help this one kid. (Focus Group May 14, 2003)

Eisah seconds this, talking about the positive responses she has gained from them:

They're like your mommy, run home to give her the flower. Like you just want to tell them, this just happened today and it was really cool. As soon as I got these

books in, my kids made these books, I took it straight to Steven, like, “Book.” You’re like a little kid, with “Look what I did.” Because they want so badly to know what’s going on. And once you know that they want to. ‘cause some administrators really don’t care. They just don’t want to hear anything bad. But Steven and Judi, they really want to know what’s going on, they want to know what’s working, what’s not working, and they’re genuine about it, so then after that you just have to go and share. (Focus Group May 14, 2003)

A mutually reinforcing relationship has emerged between the administration and those teachers who want to work with them, facilitating broader collaboration.

Pressures from Administration

Administration – whether on the level of the school, school district or state – is also responsible for some of the stress the teachers feel. The demands for extensive paperwork take time that they would rather use for reflection and planning. They talk about the paperwork, saying, “and I think that, all of this stuff, all of this stuff did nothing for my kids. Built nothing for my kids” (Focus Group June 10, 2003). And again:

It gets thrown out in fifth grade [and no teachers look at it], no one cares about it, the kids don’t benefit from it, yet it took a lot of our time and reflecting would have been great. And this is just one little thing, we have stuff all the time.

(Focus Group June 10, 2003)

Paperwork is deemed useless for the non-results it produces, and negative for the time it wastes that could be used elsewhere.

Summary of Construct 1: School Environment

In sum, the administration has created a framework for school functioning that allows and encourages collaboration and experimentation to flourish. Through a focus on continual improvement, collaboration, reflection, and an open, communicative atmosphere, teachers have been given space to move in and interact with each other as they work to improve their teaching and subsequent student performance. Teacher collaboration is valued, and occurs regularly with those teachers who choose to collaborate and establish trust and positivity as their *modus operandi*. The teachers and administration have established an ethic of mutual collaboration.

Construct 2: Personal Agency

A strong sense of personal agency – of themselves as capable of generating change – is central to the identity of the three teachers. Personal agency refers to a sense of oneself as an active “agent” in shaping one’s reality. Their sense of agency builds off of their reaction to their personal educational history while not being reactionary. They reflected about their educational experiences and made conscious choices about what education meant to them. Their strong sense of personal responsibility, as illustrated by the high standards they set for themselves and their students, drives them to perform as effectively as they can. The guilt they feel occasionally over not meeting those standards is also used as fuel for their continual improvement. To enhance their performance they engage in iterative cycles of action and reflection, allowing them to engage in new practices and continually refine their application. Finally, their excitement and enthusiasm keep them motivated to continue to improve and to enjoy their daily work.

Personal History

Early Educational Memories

All three teachers were taught using primarily direct instruction methods. They have clear memories of the instructional practices used by their teachers. Sydney recalls “always being at our desks” and “working out of books and working individually, I don’t remember any collaboration and I don’t remember being challenged to really think, I remember just, it was basically just rote memorization” (Sydney Interview May 14, 2003). Eisah similarly recalls “very much direct instruction, or comes from the books, very much led by the textbooks. Very much led by the textbook, where we do this page, do that page” (Eisah Interview May 12, 2003). Sasha’s experience in a pull-out math class was of “not being taught the strategies and not being taught anything specific, just given a lot of practice. And nothing ever clicked, and it would never be explained ‘why’” (Sasha Interview June 4, 2003).

While Eisah and Sydney experienced some success under these teaching methods, they also acknowledge that those methods were not universally successful, and even when they did perform well on tests, were no guarantee of successful learning. Eisah says, “I learned pretty well from that, but I think I was just a kid who could make connections to other things” (Eisah Interview May 12, 2003). Other students may not have been so successful. Sydney more specifically talks about how the methods by which she was taught allowed her to perform well but did not develop an understanding of math:

I was a straight A student, I did very well in math, but I think I was one of those students who just was passed through, I don't think anybody ever looked to see if I understood or was I a performer, was I just able to do what was needed to do. And I think that's what it was, when I got into the upper grades I didn't have a clue, I just didn't understand, and I was still able to pull it off then. (Sydney Interview April 30, 2003)

Eisah has a similar description of her academic performance: "I would get As but the next day would be nothing" (Eisah Interview May 12, 2003). They consider performing well without understanding to be an insufficient educational outcome. Sasha describes a hostile academic environment where for

... a large part of my education [I was] very scared, scared of my teacher, scared of my classmates, that they were gonna make fun of me. I thought that I was dumb ... but I felt that I was intelligent, and I got excited about writing, but I felt that in math I was just not as smart. (Sydney Interview May 14, 2003)

For all three teachers, then, school did not produce the full benefits they feel it could have produced in terms of developing deep, transferable understanding of the subjects.

All three of them express some level of dissatisfaction with their education at various points in time. Sasha is particularly vehement regarding her early education:

I remember being a critic of my own education at a very young age. I remember in third grade being very disappointed with my education and specifically critiquing it and having solutions. So I would say, instead of us learning this lesson like this, why couldn't we have learned this lesson in a fun way. And fun to me was through a play or through a story or through a game. But I remember

very specifically saying this could have been sooo much better, it could have been done so differently. (Sasha Interview June 4, 2003)

As early as third grade she was already able to propose curriculum modifications to enhance learning. Sydney also is critical of how she was taught. While she was a good student and able to learn through direct instruction, she says that “that meant I was able to get through those six years of school and when I really needed to have understanding I didn’t have it” (Sydney Interview April 30, 2003). The methods of instruction did not help her gain an understanding; as she notes, in her classes

... there just wasn’t a whole lot of challenging discussion, and there wasn’t a whole lot of project work, other than things you had to do at home which parents might have ended up doing and it didn’t make sense to you. In fact, in high school it was even worse because there were teachers who would go to sleep.

(Sydney Interview May 14, 2003)

In spite of this disappointment she says, “but I loved school, I really loved our teachers, I felt they really connected with us” (Sydney Interview May 14, 2003). Eisah expresses appreciation for her language arts teacher while saying that some of the other teachers were “waugh!!,” (Eisah Interview May 12, 2003) a negative term. She is very clear about her personal choice to teach in a different way.

Early Desire to Teach

In spite of or because of these early experiences, all three of them were interested in education from elementary school. Eisah talks about her early interest in teaching:

When I was a kid I would totally, I loved it when the nuns would give me their old text books and I would like ask them for them. I thought it was the best thing to read the text book to my stuffed animals. (Eisah Interview May 12, 2003)

Sydney also remembers positive impressions of teaching:

... even as a kid I wanted to be a teacher. I really liked school. I felt very happy with it. There never was a time when I thought, oh, this is boring. I just loved it. I think I received validation because I was considered a great student, but it was really, I think, because I was quiet [Kamilla: Exactly!] and I didn't bother anybody and I could memorize. So I felt validated there, I loved it, I did my homework, it was just never a question. So it must have inspired me in some way. (Sydney Interview May 14, 2003)

Sasha was highly conscious of her education and early became a critic of how she was educated. She was full of ideas about alternative methods for teaching and eager to implement them: "I remember in third grade being very disappointed with my education and specifically critiquing it and having solutions" (Sasha Interview June 4, 2003).

Confronting Old Models of Education

While they wanted to teach, the models they encountered growing up presented a potentially formidable obstacle to practicing constructivist instructional methods. For example, Eisah says that "when I was little I thought I would be a text book teacher, 'cause that's what my teachers were" (Eisah Interview May 12, 2003). Her model for teaching was direct instruction. Sydney likewise says, "the images I had in my mind in thinking about becoming a teacher were the images I saw from these other teachers" (Sydney Interview May 14, 2003) who had taught her using rote memorization methods.

She depicts her own challenge to let go of an old mental image of teacher centered instruction:

But I think I probably struggle personally with what this image is of what a teacher's supposed to be, because you've heard me say it in my reflections. I do have an image of how it should be and it's not that way. But I think that's more because I don't feel like I'm quite doing what I need to do the way I want to do it, but I'm also not doing it the other way [Kamilla: The way the image in your head says teachers should be.] Right, and if I was wonderful at what I expect to be doing then I probably wouldn't question it so much, I think. (Sydney Interview May 14, 2003)

As she moves closer to doing "what I need to do the way I want to do it", she expects that this image will fade.

Choice to Embrace a New Model of Education

Although they had early, tenacious mental images of direct instruction methods, when asked about how they made a switch from the direct instruction methods through which they were taught to how they teach now, all three of them identify making a conscious choice to teach in a different way from how they were taught. Here we can see Sasha's choice, made at university, to embrace a theory and practices that differ from her early childhood experiences:

It's funny because I don't really [refer to my early educational experiences] any more because I feel like when I was at the university level I had already made decision about what was good teaching based on that. So everything, my theory and stuff now is based on a theory of what I believe is best for kids. So I don't

really look back on my education as much because I don't feel like it's relevant at all anymore because I feel like I've just made this complete change. If I felt like I was being asked to do anything that was so much like my early childhood education then I might go back to it, but I feel that what we are doing is so different now. But, but it affects ... I can't really explain it, my education affects how I interact with the kids in my classroom today, but before it affected that it affected how I chose to teach and the theory, and so then ... so yeah. Is that making any sense at all? (Sasha Interview June 4, 2003)

In other words, she reflected on her early education and based on those experiences, decided how to teach. Her aversion to traditional methods is seen by her statement, "if it reminded me of my early childhood education, then it probably wasn't good" (Sasha Interview June 4, 2003).

Similarly, in a dialogue with the researcher, Sydney speaks of the training she had at university as a key that changed her approach to instruction:

... the images I had in my mind in thinking about becoming a teacher were the images I saw from these other teachers. But then once I had training in it ... I thought, there's another way to do it that's more effective.

Kamilla: And so how hard was it [Sydney: It wasn't.] to change then?

Sydney: It wasn't. Because it felt right to me. It was almost like a lightbulb going off when I was learning about it, oh, this makes sense to me. So it wasn't that difficult. (Sydney Interview May 14, 2003)

Eisah also talks about this choice she made at university, after growing up with the belief that teachers should teach by reading from text books:

But when I went to school, in the beginning at State University when we were taking education courses they would give us all the different theories, and I always was right there with Vygotsky or with Piaget, and then as we learned more about constructivism, with constructivism. 'cause there were different theories posed at us but they always emphasized constructivism and we were led in that direction, but that was always easy for me to do. (Eisah Interview May 12, 2003)

For all three of them, university training provided exposure to models and theories that they were ready to embrace. They felt comfortable with the theories about human nature and instructional methods that fell under the rubric of “constructivism.” Their choice to abandon their earlier visions of what it means to be a teacher seems easily taken, and their embrace of a new model, whole hearted.

Their Own Experience as a Source for New Model of Education

Another source of their models for teaching comes from their analysis of how they learn themselves. Eisah analyzes how she learned math to develop strategies to work with her students:

Eisah: I think that I have very little attention span, so I know that about myself, so I don't expect my kids to have a very big one. So teaching from the book, or like that, I knew they couldn't handle that. So there needs to be lots of transitions, plus, because I said I knew that I tuned out easily, so I know that I need to be excited about my teaching and I need to have them constantly making connections, or doing tricks so that they remember things, or hands on, as much as I can do it making connections because otherwise the memory was in and out for me.

Kamilla: So you chose instructional strategies based on your knowledge of how you learned, and you assumed or felt that kids would have the same challenges.

Eisah: Just because I knew that I wasn't the best learner, I knew that I needed tricks, something that would keep my attention. So I was like, if that's probably worst case scenario, if I go there, I'll have everybody else. (Eisah Interview May 12, 2003)

Sasha also looks to her own early difficulties in math to help her students. She says that sometimes, "[I] feel I'm a hypocrite because I love math now, but I see myself in the support kids I'm teaching and I get frustrated with them, but I was that, I was who they are" (Sasha Coffee Shop January 11, 2003). She draws on her early challenges to identify strategies her students may need:

We never had enough time in grade school to rely on other people to help explain things and rely on them, and I really try and emphasize that, and I think that's showing a lot of great results.

...

I think that's also why I find it easy to help my support and competent kids. I know what misconceptions they will have. But I'm still surprised at some misconceptions they have. (Sasha Coffee Shop January 11, 2003)

In addition to being able to identify with their struggles, she is also encouraged to help them because, as she says, "I was a bad math student, I feel a lot of gratification because I feel that what I'm doing is good for the kids, they're comfortable" (Sasha Coffee Shop January 11, 2003). Although her own learning needs were not met as a child, she is able to meet those of the students in her classroom.

Mentors as Sources for a New Model of Education

In addition to university training, the three identify teacher role models who influence their vision of what an effective teacher is. Sasha's experience with her mentor teacher at Newsome Park, Julie Jones, has played a key role in her professional development, which she discusses with Eisah:

Sasha: I always think, if I hadn't had my student teaching experience in Julie's classroom, I don't know what kind of teacher I'd be.

Eisah: That's funny too because student teaching, I really wonder for teachers how much student teaching shapes who they are.

Sasha: It really impacted who I am, it really did.

Eisah: Everyone needs to go through Julie's room for student teaching. [Sasha: Yeah, they really do.] Or a Julie look-alike, they do.

Sasha: I copied everything she did, in fact, I ended up leaving her with a southern accent [laughter]. I'm not kidding you, I am not kidding you. (Focus Group May 14, 2003)

Eisah concurs with Sasha about the significant impact of Julie as a mentor. She expands on this when she compares Sasha's experience with her own student teaching:

I'm sure I'd be further along if I had Julie Jones. I mean my mentor was really [good], I was in a completely different atmosphere though, but it was a really good experience, the good thing is she gave me tons of freedom so I got to develop a lot on my own, it wasn't like I was into one strict thing. But hers was a whole other vision. It was a still a very good vision but it wasn't like effective

teaching strategies so I just wonder, I would be so much farther along if I was with Julie Jones. (Focus Group May 14, 2003)

Peers as Sources for a New Model of Education

Eisah also describes how respected peers act as models for effective teaching practice. She draws from their teaching behaviors more than from the mental images of her former teachers:

I make the connection more to, I teach the way I see other teachers teaching, like when I see Julie, when I see Sasha, when I see Sydney, that's a model for me right now, I do teach how I see other people teaching, people who I admire, as opposed to teaching how I was taught, because that was almost too long ago. (Eisah Interview May 12, 2003)

These three sources – university courses, their knowledge of their own learning needs, and observation of effective role models – combine to give them a repertoire of new teaching practices distinct from what they experienced in their own schooling.

Personal Responsibility

Magnitude of their Sense of Responsibility

The three teachers all feel high levels of personal responsibility in their professional work. This begins with a strong sense of themselves as needing to be responsible for their own actions and for performing their job as teachers as effectively as possible, setting high expectations for performance. Part of the sense of responsibility comes from their personality. As Sydney says: "I just feel like, even growing up as a

child, I felt very responsible, I was an only child ...” (Sydney Interview April 30, 2003).

Eisah explains further the drive she feels to perform well:

I know that for me I have a weird obsession with expectations, and if I didn't constantly search for how to be a better teacher or how to do this in a better way or how to make learning more effective I would just personally have a conflict with it 'cause I just would know that I wasn't doing the best job and I would need to do a better job. But it does come from within the school too because that expectation exists at a higher level which I fall under. (Focus Group May 14, 2003)

A sense of responsibility for their actions parlays into a feeling of responsibility for their students' performance. Eisah says,

I think if you have high expectations for yourself you have high expectations for your students. [Sasha repeats] 'cause they are so much of who you are so if they're not at a high level you're not at a high level. 'cause that definitely happens with my kids. (Focus Group May 14, 2003)

They believe that teachers are responsible for teaching in ways that allow their students can learn. If their students do not understand something, they need to find a way to teach it so that they will. Teachers thus are the crucial centerpiece of student learning, bearing a high level of responsibility for student performance. As Eisah says, “Oh my God, this is just my personality, but 100%” (Eisah Interview May 28, 2003); Sydney agrees with this percentage: “Oh, like 100% [laughter]. And beyond” (Sydney Interview May 28, 2003). Sydney further explains the connection between teacher practice and student performance; when asked, “How do you think your instruction influences the students?

What difference does it make?” she responded, “It means everything. I just think the secret is out there, it’s just a matter of reaching them” (Sydney Interview April 30, 2003).

Sydney explains her own sense of this responsibility, which came to the fore as she watched her students taking a standardized test:

I was just thinking about it again today, when I had two seconds during lunch time as I walked around the room and they were taking their SOL test, and I was so, you know, looking for what are they putting on this test, how are they representing what they know, and every once in a while I’d see a crazy response that someone was giving. And I’d immediately take responsibility for that because I feel 100% certain that if they had what they needed from me, they would be successful, all of them would be successful. And so I guess I go through certain phases where I start worrying, well, maybe it’s really not me, maybe they don’t have what they need, but I don’t believe that. And when I saw them in this test taking situation today, and I see all the amazing things that they do and how much they have grown I just feel even more responsible. I think if I was able to give them this, then I must have been able to give them this as well, if I only knew the key to get it to them. (Sydney Interview May 28, 2003)

In this monologue we see the emphasis placed on the teacher as the key instructional instrument. Since she believes all her students are capable of success (“I feel 100% certain that if they had what they needed from me, they would be successful, all of them would be successful”), if they are not successful, it must be because of something she did not do. Teachers need to look for the “key” to reach all students. This is something that Sydney agonizes over:

I really believe at least 99% of them could do it if I could find the key to get them there, I mean, I really believe it's something that I'm not doing that I could do.

Kamilla: Something you're not doing, for example, in the way you ask questions or do math talk, or ...

Sydney: No, I just think I'm missing something, I'm missing something, I'm not tuned into what exactly is it that is the component that's missing for these kids.

And to some degree it seems to be some thing I can't give them, because they tend to respond to individual attention, but it has to be consistent, it has to be ongoing and that just doesn't happen, but I feel certain that given the right thing they could do it. And sometimes I think they actually need more direct instruction than they get from me so I fear that they're missing out because they're not getting that. It's just a big, it's a big struggle. (Sydney Interview April 30, 2003)

From this dialogue we can learn how much time Sydney puts into reflecting on her teaching strategies and how her students are learning. Her sense of responsibility for their performance drives her to continually analyze her instruction and consider new interventions to improve their learning. That she puts effort into it is testified by her final words, "it's just a big, it's a big struggle."

Teacher Responsibility for Student Performance

The personal responsibility they feel means that they rarely, if ever, place full blame on the students for misbehaving or performing poorly. If students have problems, they look to what they are doing as teachers to see what solutions they can offer. For example, Sydney has struggled to get two students in her class to focus during math talk.

They tend to wander around, play with other things, and do not participate. About them, she says, “it’s challenging trying to figure out how to keep both of them pulled in while also accommodating the rest of the class” (Sydney Interview May 15, 2003). A more typical response might be to criticize them as poorly behaved and impose disciplinary sanctions. Her ethic of responsibility differs significantly from a “blame the students” mentality more common in today’s classrooms. Their sense of responsibility drives continual reflection on their teaching methods and pushes their ongoing cycles of action and reflection for improved teaching.

Eisah feels a similar sense of commitment to helping her students learn, even those who may have frustrating personal characteristics:

... there are some times that I want to throw up my hands. But never do I, like I have never had even the idea pop into my head to give up on a child. Have I pulled Alex aside and said, Alex, you’re brilliant and you’re frustrating me right now ‘cause you’re quitting and in this classroom we don’t quit. Throwing up my hands to him almost, yeah. Sometimes they need to have it in their head, like, she believes in me and I’m not producing. So yeah, I’ve never thrown up my hands or even thought about it really. But of course, it’s only my second year. I probably will eventually. Even last year, though, if you’d seen me last year, I had a lot of kids where that probably would have been a possibility but with me it really never was. (Eisah Interview May 28, 2003)

Even with difficult students, Eisah still stays committed to helping them learn, and tries to draw them into collaboration with her to achieve that objective. She also notes that, although after many years on the job she feels she might change her attitude, she already

has demonstrated an ability to stay committed to helping children where other teachers might have given up.

Sydney similarly talks about her frustration with trying to help her students perform well on a consistent basis. When the researcher jokingly suggested she blame their poor performance “on the demographics!” she replied, “I would love to, but I really think it’s my responsibility. I really believe they can do it, but I just don’t necessarily clue into what are we missing? What is it that they’re not getting?” (Sydney Interview April 30, 2003). From these comments we can see a tendency to look to her own actions for explanations when students do not perform well. For example, when some of Sydney’s students performed poorly on a district-wide assessment, she wondered what effect she had on how they did. She had missed the day before the test and when she returned, was told that her students had “behaved horribly.” She wonders if her stress over this affected their performance (Focus Group April 2, 2003). Failure in performance on the part of their students is thus highly personal for these teachers, and a cause of intensive personal reflection.

Responsibility that Students Carry

In spite of the weight of responsibility carried by teachers, students also must shoulder some responsibility. Eisah expresses her view that while she has a large responsibility to help them learn certain skills, the students also have a responsibility to learn:

Well ... I do, I take a lot of responsibility. I don’t take 100, I probably take 60%, maybe a little bit more. Because very much, if I’m not creating an environment that gets them to love learning [they won’t learn]. But the responsibility still does

lie on them to take the initiative and become responsible. At least be open to having that love, but even if they're not then it's my job to bring them around, it really is. And a lot of them come from outside influences with them, their family's not motivated, you know what I mean? It's very hard to break through all that. But in the end it does lie within them to make the decision to do well, to make the decision to work hard. But I can have the ability to set up an environment that makes it more conducive to them deciding to do that. (Eisah Interview May 28, 2003)

From this perspective, teachers' responsibility is to create an environment conducive to student learning, and help them develop a love of learning if it is not instinctive. At the same time, students have the ultimate responsibility to respond to the possibilities created by the teacher. Sydney also feels the same balance: that it is her responsibility to provide them with all the skills they need to learn, but they are responsible for constructing their own knowledge:

I think that I try, well, what I try and reinforce with them over and over is that they're responsible for their learning. That it's not up to me to come to them and say, you don't have what you need, I'm going to give it to you. I see their responsibility as being able to take the initiative to say, I don't really know this and I know I'm supposed to, so how do I get there. But I see it as my responsibility to make sure they have the tools to get there. I don't think a lot of them already have those tools and if no one gives it to them you can't just say, it's all on you, you be the person to figure it all out, that doesn't make any sense. So I think they, first they need all the tools they can possibly get from me that would

allow them to take personal responsibility and to monitor for themselves. And if I haven't given that to them then there's really not much chance they're just going to get it. They're not just going to come and say, oh yeah, I've decided on my own to figure out double digit multiplication. They're not going to. So I feel a huge responsibility. And for whatever reason today, when I just saw them doing really great things it washed over me, it's really, it's 100% me, it's 100% me if they're not successful. (Sydney Interview May 28, 2003)

From these statements we can see that a high sense of personal responsibility for the teachers for how students perform need not detract from students' self-empowerment. The balance of responsibility does not need to be 50/50; it can be 100/100. As the teachers assume more responsibility, this can inspire greater responsibility on the part of the students and create an environment with a high level of motivation for learning.

Limits to their Responsibility for Student Performance

Although they feel fully responsible for teaching so that all students can learn, the teachers also acknowledge that there are limits to this responsibility. There are other powerful forces that affect student learning and performance and some of them cannot be counteracted by one or two years with a particular teacher. Eisah shares advice given to her by Julie, a mentor teacher in the school, about the limits of responsibility:

I remember, Julie used to say, Eisah, you didn't birth 'em. You didn't birth 'em, you can't do [everything.] ... There is four years up until they've been in school, and then ten years they've been alive before they saw me, and I only see them for a year or two in their lives. So there are some times that I want to throw up my

hands. But never do I, like I have never had even the idea pop into my head to give up on a child. (Eisah Interview May 28, 2003)

Sydney seconds this idea; although she feels so highly responsible for how her students perform, there are many other factors influencing them that are beyond her control:

I would think ... maybe here it's unique because we're with them for two years, I had teachers for only one year who had an influence on my life, but I don't know how much this compares with all the other forces they're exposed to, friends, home life, and for some of them, what they experience at home is so drastically different than what they experience here. I'm not sure how much of that would get in the way. They seem to be able to maneuver different worlds. They seem to be able to figure out when do I need to do this and when do I need to do that, which is great, and they need to be able to do that. But it's interesting to think about, but I would imagine, from what I see, their home life influences them far more than what they experience here. (Sydney Interview April 30, 2003)

Responsibility here is balanced within reasonable limits. She feels fully responsible for those things that she can influence, but recognizes that the classroom is only a portion of the total set of influences on any student.

Reflection over Instructional Methods

Their high levels of responsibility are seen in the repeated questioning they go through to evaluate their instruction. For example, in reflecting on an effective lesson she taught, Sasha writes,

I'm questioning the way I taught this lesson. Was it constructive enough? We definitely constructed new meaning together, but we weren't solving a real

problem. They applied this new info to a real problem afterwards. Could I have started the other way around? Would we have understood as much as we did as quickly? (Sasha E-mail April 29, 2003)

Her string of questions reflects a constant drive to evaluate what she is doing in a quest to improve her teaching performance. Sydney feels the same overwhelming emphasis on personal responsibility. With everything she does in her classroom, she asks what she needs to do to help the children learn, why she cannot give more, how can she figure out how to reach a certain child. Speaking about math learning, she says,

I have those same four or five kids, who just, I don't think, I'm not 100% sure that math talk is the way to move them to where they need to be, that's my concern, is that that alone would not be enough to get those kids where they need to be.

(Sydney Interview April 30, 2003)

She takes her responsibility beyond simply the one or two years the students will spend in her classroom, assuming responsibility for their long term learning. She sees how what she does now can affect them down the line:

... that's what I worry for them, that would be doing them a disservice, I don't think they'll be able to make it in school later, even if they're passed through they just won't have the understanding they could have had. But again, the struggle is, these kids who are at such a basic level, what do you do with those kids, do you keep striving for understanding or do you make sure they can perform? (Sydney Interview April 30, 2003)

Her comments reflect a real sense of how her students will do in the future and her drive to use constructivism is for their long term benefit, so they will have a basis of

understanding of core issues and be able to build on this in later grades. This is associated with a feeling of guilt over how she teaches, feeling unable to give them everything they need to develop that understanding.

Guilt

One emotion that comes out of their heightened sense of personal responsibility and high expectations is guilt. Because they feel that so much responsibility for student performance rests on what they do, they internalize student failure and blame themselves for it. One example comes from Sydney's email journal, where she describes the impacts of starting individualized after-school instruction for some of her struggling students: "Having had them for about a year and a half, I feel terrible for not meeting with them in this fashion sooner. Their progress would be so much more significant had I done this sooner" (Sydney E-Journal January 23, 2003). It is ironic that she feels negative about her actions since she actually made the effort to identify their needs and has taken extra time in her schedule to provide them with assistance. She expresses a similar sentiment regarding her work with other poor performing students:

It is really heartbreaking to feel like you should be giving a child so much more. They both need one on one time with think time, manipulatives, and lots of practice with numbers. But I know that I am coming up short when it comes to providing this. (Sydney E-Journal March 21, 2003)

Some feelings of guilt may come from their own character. Eisah says, "I have such a guilty conscience" (Eisah Interview May 12, 2003). Sasha seconds this in describing her friendship with Eisah:

And it takes a good friend to be able to be friends with Eisah and to understand that she is so sensitive so you have to anticipate that she might feel guilty. [Eisah: That's what it is, I won't get mad at anybody, but yeah, I'll feel guilty.] You can't say no, don't feel guilty, you know what I mean, but that's the thing. Julie's the same way, I don't think that woman's ever said no, probably, because she has twenty-seven different things on her plate. (Focus Group May 14, 2003)

Sydney also expresses a need to live up to her own image of what a successful teacher is. Much of this comes from her direct instruction training as a child, but still lingers as a model of an effective teacher in charge:

I think I probably struggle personally with what this image is of what a teacher's supposed to be, because you've heard me say it in my reflections. I do have an image of how it should be and it's not that way. But I think that's more because I don't feel like I'm quite doing what I need to do the way I want to do it, but I'm also not doing it the other way [Kamilla: The way the image in your head says teachers should be.] Right, and if I was wonderful at what I expect to be doing then I probably wouldn't question it so much, I think. (Sydney Interview May 14, 2003)

Guilt appears to be endemic to their sense of responsibility. Sydney summarizes this in one of her comments: "To me it just seems natural that you would always feel guilty and always would try and figure out what I need to do differently, and how did things work today" (Sydney Interview April 30, 2003). Guilt is one of their reactions when they do not live up to their expectations of what an effective teacher is.

Conscious Practitioners

Because of their high sense of responsibility, these teachers are conscious practitioners. They are aware of their actions and constantly work to bring these into alignment with the theoretical principles they have chosen to guide their behavior, rather than relying on programmed responses. Their basic choice of instructional methods has been a conscious decision, based on evaluating available options. For example, Eisah talks about how she chooses models for teaching rather than falling back on mimicking the behavior of her former direct instruction teachers:

I think really, because that, I make the connection more to, I teach the way I see other teachers teaching, like when I see Julie, when I see Sasha, when I see Sydney, that's a model for me right now, I do teach how I see other people teaching, people who I admire, as opposed to teaching how I was taught, because that was almost too long ago. (Eisah Interview May 12, 2003)

When asked specifically about the tendency to teach in the same way one was taught, she says, "There's probably many teachers who do do that, I'm just such a person who looks for examples right now, and I either model them or take ideas from them. I have such a guilty conscience, so I'd feel so guilty being one of my nuns" (Eisah Interview May 12, 2003) who taught straight out of text books.

The biggest challenge the three of them face as conscious practitioners is the temptation to tell things to their students – facts, algorithms, problem solving methods – rather than asking questions and allowing them to think through problems using their own brains. The process of thinking for oneself is key to their philosophy of education and, thus, a priority for instruction. They believe strongly that students remember best

what they discover themselves, and so they make a choice to hold themselves back from giving answers. Sydney describes one situation where she did tell the students some facts, and her own analysis of that situation:

... at some point I think I said, I'm just going to tell you this one point. But they're not going to remember that point that I told them, that's the thing. I don't think that will mean anything to them tomorrow. ... The only thing that will mean something to them is what they figured out. The fact that I said it converts to a fraction with ten or a hundred, I don't think they're going to remember that.

(Sydney Interview May 7, 2003)

Her awareness of how they learn is a guide to her dialogue in the classroom.

At the same time, the temptation to tell students the answers is strong. They all describe this internal struggle, such as Eisah does here: "Yes, I do want to tell them, and it's really hard not to, but I know they'll only learn if they construct the knowledge for themselves. I actively hold myself back from telling them things" (Eisah Observation May 7, 2003). Sydney has experienced a similar struggle when facilitating one math talk: "I was purposely telling myself, don't talk, you know, just let them say something. And I could see that they were struggling with it" (Sydney Interview May 7, 2003). When asked about her approach to "telling," she continued to expand on this temptation:

Well, and the urge is overwhelming to tell them. The urge is just completely overwhelming. And sometimes when you're in a hurry you do think, okay, I just need to write this all on the chart paper and they just need to copy it in their notes and that's it. I just don't believe they learn that way. I mean honestly, I sincerely don't think most of them are going to remember anything I said, they're going to

remember what they said. And so I think that's how they learn, through questions, not answers. If I give them answers they might memorize, but that's not going to mean anything. So the questions are the most important part. So that's why. I feel like I correct myself, when I feel that urge, I automatically try to say no, ask a question. (Sydney Interview May 7, 2003)

Thus, in spite of the “overwhelming” urge to tell students the answers, she resists based on her understanding of how students learn. She replaces telling with questioning.

Part of the struggle comes from the strength of the images that linger from their early education. Sydney has struggled against these images, but also found that her cognitive and emotional acceptance of the value of alternative teaching methods enabled her to choose a different form of practice:

Sydney: ... the images I had in my mind in thinking about becoming a teacher were the images I saw from these other teachers. But then once I had training in it ... I thought, there's another way to do it that's more effective.

Kamilla: And so how hard was it [Sydney: It wasn't] to change then?

Sydney: It wasn't. Because it felt right to me. It was almost like a lightbulb going off when I was learning about it, oh, this makes sense to me. So it wasn't that difficult. (Sydney Interview May 14, 2003)

Over time, some of these practices have become part of their intuitive response, requiring less conscious control of their tendencies. Sasha explains this as it relates to their conscious invocation of cognitive strategies in teaching math:

Right, maybe in the beginning when we were first consciously talking about that, they were already things we did but then we started to think about them explicitly,

maybe it was sort of, we really started to break it down, maybe we did sort of say, I'm going to concentrate, but a lot of times it's just so engrained in what we do, I think recently. (Focus Group May 14, 2003)

Relating to Less Committed Teachers

Relative to their high level of personal responsibility, the three teachers encounter others who do not show the same commitment. Sydney is frustrated when she encounters people “who just refuse to try anything and who don't see themselves as the responsible party” (Focus Group June 11, 2003). She thinks that “that's the roadblock to having a huge community of people who are willing to try things and learn” (Focus Group June 11, 2003). They themselves subscribe to what Eisah calls “the main philosophy of, are you doing what's best for your kids and do you have reasons to back that up. Not are you doing what's best to make your day easy” (Focus Group June 11, 2003). Without this sense of personal responsibility, “trust isn't there and there's some kind of personal dynamic that says, ‘I'm not responsible’” (Sydney in Focus Group June 11, 2003). They find this attitude hard to understand, as Sydney expresses in a conversation with the researcher:

Sydney: But I think most teachers, I would hope, spend all their time worrying what is it I'm not doing? That's a natural part of the job, thinking how can I do this better.

Kamilla: But still, you do hear people blaming the students, I'm doing everything right, why don't they get it?

Sydney: Oh yeah, I do hear that here too, it's not like it's anything shocking, but I just find there's nothing worse than that. But what hope is there if you put it off all on the kids, you might as well not even try, because you can't fix them.

Kamilla: What's the point of education if you can't make a difference!

Sydney: If only certain people can learn! That's a whole other problem, but I would hope that most people don't have that philosophy. (Sydney Interview April 30, 2003)

Her sense of responsibility gives meaning to her job; if she did not believe she could make a difference, there would be no point to teaching.

Cycles of Action and Reflection

The process of activity of these teachers is an iterative cycle of action, reflection, new planning, and new action – in short, recurrent phases of action and reflection. They come to the teaching process as reflective individuals, eager to think about what they do and learn continuously. They put their reflections into action by revising their instructional approaches, and then reflect again on the impact of their revised teaching methods. Sydney summarizes this process, adding an emphasis on her desire to accelerate it: “I think I need to be a little bit more quick doing my reflection, and then moving forward with a change” (Sydney Interview April 30, 2003).

Importance of Reflectivity

The start of the process is reflectivity. Being reflective involves spending time analyzing one's thoughts, motivations, and actions, and the impact these have on others – in this case, primarily students. It is an externalization of what is inside, and is an

ongoing process. Reflection can be done alone, through just thinking or writing; or in collaboration with others, through dialogue, email correspondence; or simply with one person acting as a listening ear. For these teachers, reflection is essential to their functioning and is tied with the idea of continual growth as a professional to meet their teaching responsibilities. It is a process highly valued by the three, and an integral part of their identity. Sasha, talking about what makes a good teacher, says “whether or not you as a teacher are questioning every day what’s really working and questioning your instincts” (Sasha Phone Call May 16, 2003). Eisah, when asked about the value she places on reflectivity, said,

... ‘cause I do see it as so much important. And in fact, I was just writing it in my journal last night how writing, like truly dedicating my journal to reflecting on feelings, not just on events, but really, what did I feel at this point, has really made me feel much more empowered, like I have more control over things in my own life. (Eisah Interview May 28, 2003)

For Sydney, reflectivity lends value to life:

I’m thinking, you know, in terms of whether or not it’s valued, I think as they grow up and become reflective people, they’ll benefit from that in their own lives, whether it be, they’re going to push themselves to excel in their own fields, I think that will just be a natural part of the process. (Sydney Interview April 30, 2003)

She feels that being

... reflective really comes out of a sense of responsibility. I just feel like, even growing up as a child, I felt very responsible, I was an only child.... That’s a

huge part of it to me, as someone who feels responsible, it would not make sense to me not to question everything I do, constantly. So I don't know how much of that is personality, or how much of that was learned based on social experience, and I would imagine it's both. And I don't know how [the students'] experiences would compare with that. (Sydney Interview April 30, 2003)

Reflectivity thus is seen as originating in an individual's character, with the potential to influence all aspects of his or her life. It is linked with feeling responsible in that reflection allows you to monitor and modify your actions.

Possibility of Developing Reflectivity

Reflectivity can be developed, although some people seem more prone to be reflective than others. Sydney talks about how her students might respond to efforts to develop their reflective abilities:

So I don't know how much of that is personality, or how much of that was learned based on social experience, and I would imagine it's both. And I don't know how their experiences would compare with that. You know, I see it in some kids more than others. It's so interesting to know if they all develop it, or if it's only going to be those who already had it operating in their lives, I don't know. (Sydney Interview April 30, 2003)

Sydney also talks about her struggles to help her students be reflective when they come from environments that might not ever promote that type of thinking:

Yeah, well and I think it's that barrier again, I'm not sure how much we can influence them individually when other forces in their life may not ever be encouraging that because a lot of them have experiences where they're basically

told, you just don't look for reasons why, you just accept what is, so I don't know if we can compensate for that. But I think people who are reflective certainly would get out of it. People who don't, I can't figure out what they're missing, why they're not thinking that way. (Sydney Interview April 30, 2003)

The development of reflectivity – variously described as knowing what you know, thinking for yourself, evaluating, or metacognition – is a goal of their instruction, possibly the most challenging aspect given the social and personal challenges some of their students face.

Necessity of Being a Reflective Teacher and Colleague

Reflectivity as a teacher is seen as fundamental to meeting students' needs. The teachers discuss the impact of the organized reflection they participated in with this research project, and emphasize its importance even while they did not make as much time for it as they would have liked to:

Eisah: ... whenever I have a huge list of everything to do it really was, and I hate to say it, but it was at the bottom of the list. So if anything was going to get dropped, that was. Because that wasn't something that was going to hurt my kids in any way, probably it did though, 'cause I would have gained by reflecting, but it wasn't going to hurt them right off the bat so it was at the bottom. So that's really why.... it was more important than all the paperwork. Absolutely, it was more important, it went right under what we had to do for our kids, is where it should have fallen on the list. But it doesn't, because ... I think it's totally important. Absolutely.

Sasha: I think it's so important. And I think that, all of this stuff, all of this stuff [paperwork] did nothing for my kids. Built nothing for my kids.... It gets thrown out in fifth grade [Eisah: No teachers look at it.], no one cares about it, the kids don't benefit from it, yet it took a lot of our time and reflecting would have been great. And this is just one little thing, we have stuff all the time.... It is hard though. 'cause there would be nothing better, I think, and it would be great if from 3:00 to 3:10 it was faculty reflection time.

Eisah: It would not be used, though. Unless you locked us in a room with no access to anything else.

Kamilla: Unless the secretary recorded, okay, this person has sent in their reflections for the day.

Sasha: And then it would be totally falsified. ... If it was 3:00 to 3:10, nationwide reflection time for teachers, and if they promised to get rid of half the stuff they make us do. That would be an ideal environment, I think. (Focus Group June 10, 2003)

Sasha feels that an official recording of reflection time could turn an otherwise valuable activity into another administrative obligation, robbing reflection of its value as a teacher initiated and directed activity. On the other hand, if teachers were given the time and autonomy to reflect and they were relieved of some other administrative responsibilities in order to write reflections, it "would be an ideal environment." They clearly place reflection time at the cornerstone of effective professional development and feel that this should be prioritized. They also link it closely with improved student performance, since

opportunities to reflect allow them to gain insight into practice. And for these teachers, insights must, as a principle, be translated into action.

In addition to how they interact with their students, being reflective is part of their professional interaction with other teachers. For example, Eisah mentions in her electronic journal, “I have been engaging in reflective conversations with different teachers through the assessment team” (Eisah E-Journal March 31, 2003). Sasha talks extensively about “collaborative reflections” as a key component to her ability to think about her teaching and improve:

And I really feel like that elevates my thinking and my learning, when I’m just talking about it with someone about it. So when you were here, you were there and you saw it, I wasn’t just telling you about it, you were there and you saw it, and we were bouncing ideas off of each other. That’s what I call it. Collaborative reflection. (Focus Group June 10, 2003)

Frequent opportunities to reflect on practice with their fellow teachers is of great importance to the three.

This type of reflective collaborative relationship is not always possible with all teachers. There are some who do not value reflectivity, or simply do not practice it:

But it’s frustrating, I can see how people ... I think we talked about this before, there’s sort of two different mind sets that people grow up with, that either you’re reflective or you’re not. And so there’s this barrier between teachers who are reflective and those who aren’t, at all, they just don’t reflect, they only think, what is wrong with these kids! And I can’t identify with that.... (Sydney Interview April 30, 2003)

Because reflection is at the heart of their functioning as teachers, their meaningful professional relationships are primarily with teachers who also engage in reflective thinking. As well, reflectivity is valued as part of the school culture, as seen through this statement of Sydney concerning the principal's response to poor test scores in her classroom:

To me, there's a huge difference between how he responds to people who don't reflect and people who do. Because he was very kind to me in what I consider an awful, tragic situation, and I would be very angry at a teacher, I think. But you know, I think that's what most important to him is that you do reflect and take responsibility. (Focus Group June 11, 2003)

Reflectivity is at the center of their professional practice, individually, in their collaborations with other teachers, and as an institution.

Place for Reflection in the Classroom

Reflection is an important part of the instructional process. Eisah provides a detailed description of the impact assessment plays on instruction. She examines the role of reflection in one math talk done by a student teacher, and reflects on the broader application of reflective processes:

Eisah: To me, I think it's absolutely necessary because... Like Sydney, we were talking about this at the assessment team today, how she had a student teacher come in her room and do this fabulous lesson, like everyone was just so happy, it was just a great lesson on decimals. But when they did the challenge at the end, all of the kids had no clue what had just happened, one-quarter of the kids had understood decimals. I think that that is the key about reflection, you need to

have something at the end, not necessarily a challenge, but where you're coming back and saying look, what did we just learn, what did we just cover. It's to draw conclusions, definitely, to see who has it, who doesn't. A quick one. Beyond a piece of formative assessment that I would usually give, but just really a true reflection, where kids are hearing other kids perspectives and drawing conclusions, those two things I think.

Kamilla: And does that focus in on them internalizing the reflection process, or the insights

Eisah: Internalizing what just happened, taking it a little bit further, clearing up any misconceptions they've just made, I mean, I think that, if they just had a misconception that's fine, let's clear it up right away if we can. So if we're talking about what's going on and they're saying, no, a hexagon has six sides, you know we learned about blah blah blah, and they had a misconception about that, then it would have been cleared up.

Kamilla: So a valuable instructional process.

Eisah: To draw conclusions and to clear up misconceptions. (Eisah Interview May 28, 2003)

Reflection on the part of the students thus allows them to externalize and represent their thoughts, identify their thinking patterns, and make changes that are needed to bring their thoughts in line with truth. It is used regularly by the three teachers to promote these mental process in their students, with the goal of enhancing their ability to be autonomous thinkers. All three focus on being reflective, and also work to elicit

reflectivity from their students. Eisah, discussing journaling as an educational activity, says that she is

... seeing if the kids will pick it up on their own and start to do it on their own, that's probably where I'd go first, rather than making a reflection in a journal mandatory, because I don't think you get true good reflections that way. But as a class, I try to do always, every lesson, whole group reflection. (Eisah Interview May 28, 2003)

Sasha, observing her class, says "that's kind of neat, they're thinking, 'What have I learned, did I truly learn it, how can I explain it to somebody else.' Kind of reflecting as a group" (Sasha Interview April 30, 2003). The goal is to move towards a classroom of reflective individuals, participating in reflective instructional processes.

Value of Action

The other side of the action-reflection cycle is that of action. Their excitement about reflection comes from the way reflection motivates action. They search continually for ways to improve practice, and talk about what they did before, what they do now, and what they hope to do in the future. Through applying insights gained from reflection, they struggle to make real their vision of an effective teacher. Sydney describes her ongoing effort to actualize a new vision of teaching rather than falling back on her lingering mental image of a direct instruction teacher:

I don't feel like I'm quite doing what I need to do the way I want to do it, but I'm also not doing it the other way [Kamilla: The way the image in your head says teachers should be.] Right, and if I was wonderful at what I expect to be doing

then I probably wouldn't question it so much, I think. (Sydney Interview May 14, 2003)

Action – applying the ideas gained from reflection in the classroom – is an ongoing process of making that vision reality.

The assessment project served as one learning opportunity for the teachers. Through this project they applied theory to their teaching and modified their application repeatedly based on their analysis of its impact in their classrooms. The changes in practice resulting from this intensive project are illustrated by Sasha's comments about what she gained:

Sasha: I feel like I've learned a lot about feedback, about giving the kids feedback. And of course, I feel like I was already in the mode of learning about cognition, I was already immersed in that, but feedback, and giving them visual feedback, was totally new to me. And so I feel like that has just become a part of my classroom. ...we talked about furthering it even more so by saying, have you mastered it performance-wise. That's where I see it elevating with me when I'm at University of Newell, because we're going to be more towards performance-based assessment. I am nervous about that, but I feel like where my biggest growth was, because I started from not knowing anything to feeling like I know a lot, is feedback. With cognition I just feel like, I'm excited about it [Eisah: You knew a lot about it], I knew a lot about it, I feel like I honed in on it more and tweaked it and refined it.

Kamilla: So feedback both as just a concept of what it means, as well as practical strategies for doing it?

Sasha: Yes, just the implementation ... and what it means, yeah. And analyzing it more. Because when I evaluate my progress I go from where I started, which was zero, again, didn't know anything, to knowing, I feel like, now, so much. Not like I know everything but I just feel like I do know a lot about it and I do use it every day. I don't think I've done as much research as other people but I think they've done the hard work and I've learned through them. You know, like Sydney. Sydney. (Focus Group June 11, 2003)

Through this reflection, Sasha describes what she has learned, how it has changed her functioning in the classroom, and how she will continue to develop and apply it in a new situation. She describes an iterative process, where she "honed in" on her previous knowledge, "tweaked it and refined it." Her learning came through seeing the work done by others, thus emphasizing the collaborative nature of learning. Her emphasis is on the extent of her growth through engagement in the process.

Willingness to Change Practice

The teachers are open to change in their practice, and thus choose to try new teaching methods regularly. Rather than feeling they already know how to teach, they are constantly looking for ways to improve. We discussed this in one focus group:

Kamilla: So how much of it is not as much where they are but, to be cheesy, the fact that they're going there in terms of professional development?

Eisah: I think I'm a really good example of that, because Sasha and Sydney are so much further along [Sasha and Sydney object]. They are! We're okay to say this, we're very true, it is, I didn't ...

Sasha and Sydney: I think she has a misperception.

Eisah: And they were so very open to me, look at this, look at this, and I was very open to saying, give me more, give me more. But I didn't have as much to say, look at this, look at this. (Focus Group June 11, 2003)

Eisah reiterates the feeling of her steep learning curve while emphasizing how she gained significantly in her knowledge of a wide variety of teaching principles:

I think I probably was definitely the one who grew the most out of the three of us. Because I came, I think, in very much like, "teach me". I think that I knew a little bit about all of them, but not very much about any of them. (Focus Group June 11, 2003)

The teachers engage in ongoing planning and revision of their teaching methods, driven by the cycle of action and reflection. Sydney makes many instructional decisions quickly, either right before a class or even in midstream. For example, in her observation of a student teacher, she came up with the idea of establishing a "challenge" at the end of the lesson to check on how much the students had learned and see if they could generalize their learning (Sydney E-Journal May 3, 2003). In another instance, just before a lesson on probability she created a demonstration, saying, "I just tried to come up with something quick on the theme that would give them some visual" and that "It was just a typical spur of the moment thing. I wanted to have something that I knew they were interested in, something that would look appealing ... So I started looking around for what we have at hand" (Sydney Interview May 15, 2003). Eisah describes this process of ongoing revision of strategies in her comments about how they do math talk:

I don't think, I know I was never taught how to do math talk and I don't think Sasha was really ever, we've kind of taken ideas from Dr. Wakefield from ODU,

what she calls, no, Kamii, I think is the one who first used the words “math talk,” but taken their ideas and just tweaked it to make it work, so really I think we’ve sort of found our own way on it, with the guidance from Wakefield, from Piaget, from Kamii, that has gotten us through that far. So whenever we broke it down, we broke it down, what’s important to help kids make real world connections, what’s important in facilitating a discussion, we broke down scaffolding, we broke those down. (Focus Group May 14, 2003)

Here we can see that even a fundamental process in math learning is subject to ongoing revision. The same approach to experimentation with different methods is seen as Sydney talks about the new strategies she is using this year in reading:

There are so many differences in reading instruction this year mainly involving me being a better teacher. I am more focused on reading instruction, I am working with ability groups and flexible groups, I have instilled enthusiasm for Accelerated Reader, and have allowed for more silent reading practice. (Sydney E-Journal January 23, 2003)

For all of them, the methods they use are revised continuously of necessity, since students’ learning can always be enhanced through better instructional methods.

Improvements from the Action-Reflection Cycle

Through the action-reflection cycles, the three of them feel that their practice has improved in specific ways. Eisah gets many ideas from other teachers for practice in the classroom, is always looking to see what they are doing and excited by it. For example, she actively worked on developing wait time in her class (Eisah Interview May 12, 2003). Questioning is one area where Sydney feels she has grown: “This year I feel much better

able to ask the right questions and to keep questioning and to give the wait time that they need” (Sydney Interview May 7, 2003). Another area in which she feels growth is her general preparation and knowledge of the curriculum:

And just being more prepared, I think as first year teacher you don’t know even what the curriculum is very well. So now after finishing last year I kind of know what things I need to focus on more and which things aren’t so important.

(Sydney Interview May 7, 2003)

Sasha refers to her growth in using feedback:

I feel like I’ve learned a lot about feedback, about giving the kids feedback. And of course, I feel like I was already in the mode of learning about cognition, I was already immersed in that, but feedback, and giving them visual feedback, was totally new to me. And so I feel like that has just become a part of my classroom.

(Focus Group June 11, 2003)

Spontaneous Practice and Cyclical Professional Improvement

Another way of describing the cycles of action and reflection is to say that their professional development is continuous rather than discrete or rigidly structured. They do not believe that they will suddenly become the teachers they need to be, that there is one particular strategy that will solve all their teaching problems, or that their learning will plateau when they become “good enough.” For them, professional development is a lifelong process, requiring continual action and reflection by the teachers. Change occurs both on a daily basis, and over years. Teaching involves balancing multiple strategies and needs; there is no one right way to teach, and how one teaches must evolve over time since changing classroom dynamics, student needs and developmental levels require

continual rebalancing of methods. Since teaching is an art, they do not expect to reach a state where they have learned everything they need. Their professional growth will continue to deepen every year they teach.

Eisah reflects some of these aspects of the art of teaching in a reflection on “aha” moments, those moments where she learns something about teaching. She describes the daily, incremental growth in her professional understanding; and the need to balance multiple aspects of instruction to achieve optimal learning:

Okay. I’m trying to think of good “aha” moments. ‘cause I know I have a lot with specific kids. When I think about my specific kids. ‘cause it’s never that I have a big general “aha” moment, like this is going to work with everybody. I think “aha” moments about wait time, definitely. “Aha” moments about questioning and prompting, definitely. “Aha” moments about Eisah, shut up and just let the kids go, definitely happened. I’ve become much more secure this year with giving kids a lot more ownership and a lot more leadership. And realize that I really need to set guidelines. And to set up the classroom, set the guidelines, and leave them, give them so much more freedom. And we’ve gotten so much more amazing results. (Focus Group June 10, 2003)

Sasha, describing her use of a variety of teaching strategies, illustrates the “art” of teaching. Teachers may have a strategic plan as to the type of teaching methods they want to use. However, their application of strategies in the classroom is dependent on the teacher’s reading of the situation, of the children’s needs, and the type of instruction that will take them to the next level of understanding:

I think that sometimes it's purposeful and sometimes we think about what we need to focus on as far as teaching strategies. But a lot of time it is incorporated at the moment 'cause we know where the kids are and who needs what. And also it's very individualized, I think. But at this point, I think that our kids have internalized the teaching strategies and are helping each other, I think. But sometimes it is very purposeful. (Focus Group May 14, 2003)

Sydney describes a similar "in the moment" responsive process from one of her math talks. While she says she wishes that she would sequence her questions more carefully, saying, "I feel like there should be some grand scheme" (Sydney Interview May 7, 2003), her actual questioning strategy is determined on a moment by moment basis while teaching:

Sydney: I always wait until I actually get into it to make decisions so I really didn't know what questions I was gonna ask, I kind of knew where I wanted it to go. I waited to see what they said.

Kamilla: So you did have some idea of the direction you wanted it to go.

Sydney: Yeah, I just have sketchy idea that they need to get from this point to this point and that they probably have these misconceptions. They're probably going to see this place value thing and they're probably going to think that these numbers are bigger than these numbers [Kamilla: Right, which they did!] or something to that effect. So that's all I have in my mind, is that some of my questions have to get to that misconception and move them forward, but I don't know exactly I'm going to ask them one two three and four, until I sit down with them and hear what they say. (Sydney Interview May 7, 2003)

Sydney feels that “there’s some expectation that a good teacher sits down” and designs a carefully structured questioning sequence:

... it’s just some unspoken rule, if you’re a veteran teacher you’re supposed to have all these things written out. And I guess what I mean is that I think I could do more planning than I do. I do things very spontaneously and I try to follow the kids’ lead but sometimes I think I don’t do quite enough sitting down and actually mapping out, what specifically are their misconceptions, I just think of it all in my head and carry it around and go with it. So that’s really what I mean about having it written out. (Sydney Interview May 7, 2003)

However, when I asked her if she would change her responsive approach over time, she responded,

Honestly, I felt so good about what happened today working with them I don’t think it would. Because I think every child’s gonna have a different viewpoint and I wouldn’t want to ... even though I’ll have a better sense of what the misconceptions might be, I think that will be the difference. I don’t think I’ll change the way I do it, I’ll just kind of wait to interpret where these kids are at. Because next year’s class may be totally different. (Sydney Interview May 7, 2003)

Here we see the art of teaching: that it is not possible to subscribe to a static instructional model if you want to be a successful teacher.

Finally, participation in action and reflection as part of a process of professional development is something valued by the three in principle. Talking about teachers she

admires, Eisah emphasizes the importance of involvement in ongoing professional development:

They're always involved in what's going on, they're always involved in being open to reading books and being in book clubs or being part of any research or being part of a leadership team, or being part of things that are going on, so they're constantly changing and growing as a teacher, even just with interaction with colleagues, even beyond just examining the research and teaching practice. And when I look at teachers who I don't want to be or I don't admire, they're the teachers who really are just being very stagnant. I know that I really want to always be involved in the research. Because of how much I've grown from it, I would be absolutely nowhere if I hadn't done this. (Focus Group June 10, 2003)

Their desire to emulate these role models is connected with their own long term plans for their personal development. They all plan to engage in forms of ongoing development. Two are planning to enter doctoral programs to enhance their theory driven practice. One is particularly committed to school wide ongoing development through organized teacher collaboration and observation. For all three of them, development as professionals will continue through a variety of means.

Excitement and Enthusiasm

Enthusiasm and excitement – about their students, their fellow teachers, and being teachers themselves – infuse all aspects of their functioning. Their excitement is symbiotic with their sense of personal agency, since they know that they can improve how students are taught, and are thrilled at the possibility to engage in those processes.

Enthusiasm and excitement are the fuel that drives their participation in action and reflection. These are expressed through animation on the part of the teacher, through positive reinforcement, and through expressions of enthusiasm for the work of students and colleagues.

Excitement about Students

The teachers are excited about many things. Primarily, they are excited about their students, their thinking and their learning. Respect for their students as independent, thinking beings allows them to be authentically excited about their thoughts. This respect is seen in comments such as Sasha's reflection on her students' thinking processes: "I think it's been going on for a while, they've been actively thinking about how they're storing information. Which is so incredible that they've been doing that without even talking about it" (Sasha Interview April 30, 2003). Sydney comments, "I was amazed by the thought processes of each of the students who were trying to 'solve the puzzle' of decimals yesterday" (Sydney E-Journal May 8, 2003). The respect they have for the students allows them to appreciate the value of their thoughts.

Looking at it in reverse, enthusiasm for students allows the teachers to transcend negative attitudes towards them. Eisah describes the way in which she refocuses potential negativity into positive expectations for her students:

Eisah: So yeah, I've never thrown up my hands or even thought about it really. But of course, it's only my second year. I probably will eventually. Even last year, though, if you'd seen me last year, I had a lot of kids where that probably would have been a possibility but with me it really never was.

Kamilla: Why?

Eisah: Because they're always doing something that is amazing, no matter what. Even if it's just for them that it's amazing. So you're always reassured that this child does love learning, but they just are either putting struggles on themselves, because of their attitudes, or there are real struggles going on. But there is always something that's amazing that if you want to find it, you can find it, with every single kid, that they're doing. Which sort of makes you hold on and say, there's no reason to give up on this child.

Kamilla: Do you think every teacher believes that about every kid?

Eisah: I think every teacher should believe that. You really need to have a positive attitude if you're a teacher. It's so easy to be negative. So easy. 'Cause you have paperwork out the wazoo, you have kids with horrible attitude ... you could talk like that, kids with horrible attitudes, you have parents ... seriously, you could go on and on and on, there's no purpose. It's not gonna get you anywhere. It's gonna make for a bad day for you and everyone around you. So I think a lot of teachers are probably very negative because they've just got it jammed up in them but they shouldn't be. (Eisah Interview May 28, 2003)

The combination of enthusiasm and respect encourage teacher responsiveness and student learning. While acknowledging the multiple factors that can make teaching difficult, Eisah puts the onus on the teachers to decide what their attitude will be. She believes in focusing on the positive in order to be positive about her work and students.

Excitement by the students is seen as a necessary precondition to learning. Eisah describes the challenge she faces in her classroom of finding ways to create more excitement for her lower math group "that falls by the wayside sometimes. And I don't

know why. I don't know, if I had more people who were higher in this group if they'd get them more excited. That's the group I need to focus on" (Eisah Interview No Date).

Examples abound of their positive comments about student performance. For example, Eisah had this to say about her experience with one math talk: "Group one had the whole front board, group two was back here and they totally ran themselves and I just went back and forth. And they did awesome. They really did do awesome" (Eisah Interview No Date). During a math discussion where her students were proposing ways to remember different geometric terms, she complimented them, saying "Excellent tricks!" (Eisah Observation May 7, 2003). Sasha says, "it's so amazing what great teachers they've become" (Sasha Interview May 12, 2003). The teachers gain much excitement from observing their students. Student thinking processes and insights inspire them, as Sydney describes in her reaction to a math talk:

Well actually, for the whole decimal thing I was thinking, oh my gosh. I guess what I kept thinking during the whole thing was, number one, I was so totally amazed, I'm always amazed to hear the things that they say, when they get to do the talking it's just totally amazing. I was purposely telling myself, don't talk, you know, just let them say something. (Sydney Interview May 7, 2003)

Sydney often talks about enjoying listening to her students think, even if not all their thoughts are accurate:

And I think one of them did say that at one point, no, that's not what I was saying. And I was thinking oh, I wish that you were! [Kamilla: Unfortunately!] My lesson needs to this way, so please say that! But I was really excited about it, I really had a good time. And that usually to me, I think, makes a huge difference

in whether they get it. It was really fun to me to hear what they were thinking as they tried to figure out this puzzle. (Sydney Interview May 7, 2003)

Excitement about Learning, Teaching, and Their Colleagues

They are also enthusiastic about learning, having a deep love for learning themselves that they expect from their students. This enthusiasm comes from their own personal approach to teaching. They constantly are trying to learn, which is what they expect from their students. For example, Sasha told her class that probability was the last topic they were covering that year and asked them, “Does that mean our learning stops after this?” The response was a resounding, “NO!” (Sasha Math Talk Observation May 12, 2003). Another example of love of learning comes from one of Sasha’s math talks. After a difficult problem, one in which a student Kristen had an incorrect solution method until the last few minutes of the class, she left saying, “That was one of my favorite math talks! I loved that math talk!” (Newsome Park Math Talk February 10, 2003). Her enthusiasm reflects her love of what she learned and the fact that she could show another student the correct solution method, even though she came up with the wrong answer.

They also are enthusiastic about what they teach, with certain topics bringing out their excitement most. Sasha says, “With cognition I just feel like, I’m excited about it, [Eisah: You knew a lot about it.], I knew a lot about it, I feel like I honed in on it more and tweaked it and refined it” (Focus Group June 11, 2003). Eisah, when asked how things are going with teaching new strategies and approaches in math, said, “[I] really love teaching it” (Eisah Phone Conversation December 6, 2002).

Finally, they are enthusiastic about collaboration with colleagues. They value their colleagues as individuals, and are excited about both what they do, and about

chances to work together with them. For example, Eisah says about Sasha: “I also saw that she was very enthusiastic about learning more, about learning more through colleagues, about wanting to know what you’re doing” (Focus Group June 11, 2003). Recognition of their mutual enthusiasm encouraged them to begin collaborating. At other times, the teachers simply express enthusiasm for the teaching done by others. For example, Eisah comments about Sasha, “She is so unbelievable with them. She is such, like, totally incredible. That’s awesome” (Eisah Interview May 12, 2003).

Related to this, the teachers are enthusiastic about their own development as educators, a force that drives their participation in action and reflection. For example, Sydney expresses her enthusiasm for collaborating with other teachers and sharing her expertise in terms of their impact on her teaching:

It is always amazing to me how much talking to other teachers can improve your own practice even if you don’t pick up any specific strategies. Earlier this week I had a presentation on positive discipline, along with three other Newsome Park teachers. Just that alone was inspiring. The next day I felt so much more positive and ready to give the kids what they needed. (Sydney E-Journal March 21, 2003)

Excitement about others, about how they teach, and about working with them drives their action.

Impact of Teacher Excitement on Student Learning

All of them believe that excitement on the part of the teacher has a significant impact on the classroom environment and student learning. Eisah describes specifically the impact of excitement on teaching:

Being animated keeps their attention. Being animated gets them excited about their learning. If you're monotone and laid back about everything then you're not excited and they're not excited. Then yeah, they're calm and collected but they're not thrilled, you know? (Focus Group May 14, 2003)

Sydney also says succinctly: "There's no doubt in my mind, if I can get excited about a lesson, then they'll be excited about it. And they're more likely then to get it, I think" (Sydney Interview May 7, 2003). Teacher excitement, therefore, is seen as a prerequisite to student learning. Sydney expresses a lot of excitement about her teaching and her students' learning. She knows that her level of excitement influences how her students learn:

Because if I'm excited about it, it makes all the difference. And if I'm not, I think that they know. Or if I'm not strong in it, and I was worried about decimals, I don't like decimals and I don't want to do decimals. So I knew I had to have something they could look at and touch, I needed to have something that would get me excited about it, and that's all I could think about. Sometimes that's all it takes. (Sydney Interview May 7, 2003)

She continues this analysis in a discussion of project-based learning. Here she reflects on the observation that classes that do projects on particular subjects tend to do well on the corresponding SOLs:

I was thinking about it on the way to school this morning that one of the things we had talked about before in the whole school that typically if a class does a social studies project they do very well on their social studies SOLs. Likewise if they do science they tend to do very well and I thought, well, our project is on science but

it only covers one small component. So I can't believe they're going to transfer that to the entire SOL test and pass it. So I was wondering what actually would it be, and I think it's probably that the teacher has enthusiasm for either social studies or science. That probably affects. Because if I'm excited about it, it makes all the difference. And if I'm not, I think that they know. Or if I'm not strong in it. (Sydney Interview May 7, 2003)

Sydney thus recognizes teacher excitement and enthusiasm as a vital teacher attribute.

Eisah feels that her level of enthusiasm, combined with her attempts to make connections to things for the students, helps them attend to the lesson and learn:

... because I said I knew that I tuned out easily, so I know that I need to be excited about my teaching and I need to have them constantly making connections, or doing tricks so that they remember things, or hands on, as much as I can do it making connections because otherwise the memory was in and out for me. (Eisah Interview May 12, 2003)

Sasha also recognizes the role that enthusiasm plays in student learning. She talks here about being “animated” and “hyperactive” and “excited” (Focus Group May 14, 2003).

When asked why animation is an outcome of sensitivity, she explained the following in relation to another teacher:

Because [Eisah: You're sensitive to your audience] you're sensitive to your audience and you want to engage them and you know [Eisah: The more animated you are the more engaged they are.] Yeah. And she was, I don't know, she was missing a little bit of the hyperactiveness, she was missing a little a bit of the excitedness. But I do know, now that I know her better, she has very high

expectations of herself. I think she really developed those characteristics in this classroom. I saw her stand in front of the students a couple of weeks ago, she was extremely animated for her personality. She kept with her high expectations and then transferred those to the students. And she became way more hyperactive, way more excited, way more sensitive, multitasking type of personality. (Focus Group May 14, 2003)

Excitement is a foundation of effective teacher performance, but one that, once generated, often supports itself. Teacher excitement can generate student enthusiasm for learning, which reignites the teacher's initial enthusiasm. This synergy drives the ongoing development of the teachers through upward spiraling cycles of action and reflection. It also inspires the students to work harder, learn more, and feel more motivation from every learning goal they meet.

Summary of Construct 2: Personal Agency

These teachers emerged from a history of direct instruction to embrace a new model of teaching. This was a decision taken consciously, based on what they felt was conducive to enhanced student learning. Their high sense of personal responsibility inspires them to search continually for enhanced instructional methods. It also inspires them with guilt as they strive to meet their goals. To meet their goal of being effective teachers they engage in constant cycles of reflection and revised action which drive their performance forward. Their attempts to change practice are imbued with their enthusiasm for learning and for their students, which simultaneously provide the fuel for further action.

Construct 3: Philosophy of Education

Philosophy of Education is a broad construct describing the philosophical approach to education taken by these teachers. All three teachers place a large weight on philosophy as a key component of instruction. Rather than seeing philosophy simply as a theoretical construct dichotomized from practice, philosophy for them is a dynamic belief system that guides practice. Their philosophies of education are informed by theorists, by research, and by their own practice of education. They see philosophy as central to practice. There are certain principles of education they feel are crucial, such as the development of understanding and metacognition. They also have particular views on direct instruction, constructivism, and special education as manifestations of theory and practice in education.

Philosophy of Education

Relevance of Philosophy to Practice

The teachers consider philosophy to be the foundation and origin of effective instruction. Philosophy forms the thinking landscape in which they operate as practitioners. This is seen in the frequency with which they refer to philosophy and reflect on the implications of various philosophical positions such as constructivism and direct instruction. It is clear from the ubiquity of such references that concern over their philosophical approach undergirds their practice. They also speak specifically about the implications of philosophy, as in this dialogue I had with Sasha:

Kamilla: You definitely feel that philosophy is relevant to teaching?

Sasha: Oh yeah. It's gotta be everything. You've always got to question what you're doing.

Kamilla: So that's how you'd use philosophy, in terms of, this is philosophy and that's the guiding principle by which I evaluate what I do.

Sasha: And allow for your philosophy to change and be tweaked. (Sasha Interview June 4, 2003)

Here, Sasha explicitly states that philosophy has “gotta be everything.” She understands philosophy's power in providing a framework for analysis, reflection and change when she goes on to say, “you've always got to question what you're doing.” As well, she reflects on the dynamic nature of philosophy, saying that you need to “allow for your philosophy to change and be tweaked.” Philosophy thus exists in a dynamic relationship with practice.

Sydney expresses similar sentiments in an E-Journal entry with her reflections on a math lesson on decimals. The children were struggling to understand the concept behind decimals, and had worked through a variety of interactive activities to achieve understanding. However, some of them still did not understand decimals at the level needed to move on to new concepts. In considering what approach she could take to help her students, she wrote the following:

Just wanted to send off a quick reflection about yesterday's math lesson. I was amazed by the thought processes of each of the students who were trying to “solve the puzzle” of decimals yesterday. I think that lesson was indicative of how much time must go into making sure that kids “get” something. I could have used that time to have the kids doing a skill and drill assessment, but I really

believe that this is the way kids reach understanding. I guess my only worry is that some kids, in particular the ones who are weak in math, may need more skill and drill than math talk – but I don't know that answer yet. If so, that would throw into question the idea of having an overall philosophy of learning to begin with. (Sydney E-Journal May 8, 2003)

Here we can see her positioning a question of practice – should she do more drill exercises rather than student-directed discussions – in the light of philosophy.

Pragmatics and theory go hand in hand, and she believes that philosophy should be the guiding force; hence her hesitation to “throw into question the idea of having an overall philosophy of learning to begin with” by resorting to a standard educational practice not endorsed by her philosophy.

Sources of their Philosophical Beliefs

The teachers came to their philosophical positions through the interaction of a number of processes. Early educational experiences, reflections on how they learned themselves, exposure to theorists in university and in their current environment, all played a role in forging their current belief system. Sasha describes a number of these processes in an interview. When asked if she tended to choose instructional methods that resembled what she had experienced as a child, she says:

Actually, quite the opposite, if it matched with what I experienced I thought, this must not be a good idea. So yeah, I was really figuring out. Especially in theory, in theory, we were thinking about the different theorists, you know, what's more Skinnerian, what's more Piagetian, what's Vygotskian, what's more ... you know, all the different kinds of constructivist theory, there's so many different

philosophies, what jives with what you believe in. And a lot of my early childhood experiences played into that. So if it reminded me of my early childhood education, then it probably wasn't good. (Sasha Interview June 4, 2003)

Sasha describes in more detail how she was able to make a break with her past experiences through the application of theory in response to a question about whether she is affected by her early education:

It's funny because I don't really do that any more because I feel like when I was at the university level I had already made a decision about what was good teaching based on that. So everything, my theory and stuff now is based on a theory of what I believe is best for kids. So I don't really look back on my education as much because I don't feel like it's relevant at all anymore because I feel like I've just made this complete change. If I felt like I was being asked to do anything that was so much like my early childhood education then I might go back to it, but I feel that what we are doing is so different now. But, but it affects ... I can't really explain it, my education affects how I interact with the kids in my classroom today, but before it affected that it affected how I chose to teach and the theory, and so then ... so yeah. Is that making any sense at all? (Sasha Interview June 4, 2003)

This explanation illustrates the thinking of someone who has consciously forged a philosophy of education, drawing on diverse experiences. She made a conscious choice about "what was good teaching" by the time she was in university, and this approach was distinct from her early education, about which she says, "I don't feel like it's relevant at

all anymore because I feel like I've just made this complete change.” The philosophy expresses itself in practice in “how [she] interact[s] with the kids in [her] classroom today.” Philosophy, a personally acquired system of beliefs, thus defines how she teaches compared to how she was taught.

In addition to the impact of her early experiences and exposure to research on forming her philosophy, Sasha trusted her intuitive sense of how people learn. She based this in large measure on her own learning processes:

Sasha: I didn't look in the research. I mean, if the research said that 90% of children learned in a certain theory, that didn't make a difference to me.

Afterwards, when I had attached myself to a certain theory and the research supported it, that was kind of neat. But no, if it made sense to me. And a lot of it is, I considered how I learned. And you know what's so funny, I'm going back to the basics of teaching reading, I'm going back to things I always thought before I even got into college, which was, good readers do what I do in my head, and as a teacher you need to tap into how you read as a reader and teach that, not what a book tells you to teach, that you need to teach this strategy and this strategy, and if they're not doing this they don't know this strategy then you need to teach it. No, what you need to teach them is what you do as a reader because it makes the most sense to you. And I feel like ... I don't know where I was going with this, but

Kamilla: In terms of choosing, deciding based on your own sense.

Sasha: Yeah, if in my own sense it makes sense it's how you learn and what you need to do to learn, that's what I attached myself to. (Sasha Interview June 4, 2003)

We can see the amount of time spent reflecting on her philosophy of education, and the number of years that went into its formation. As well, the personal nature of her philosophy is evident as many aspects of her current philosophy directly reflect her own personality and learning style.

When we look at all three teachers, we see that their philosophy is highly personal in two main ways. First, it reflects the learning pathways and past experiences that inspired them to believe a certain way about what constitutes effective education. For example, we can see how Sasha reflected on how she learned as a child and chose a philosophy based on that. Second, it is held closely by them and is a large part of their identity. Sasha describes this, saying,

... if you have a certain theory in education it's very personal, I think, because it also stems from what you believe goodness is, just what you believe with your heart [Kamilla: Human nature?]. Yeah, human nature and what you believe with your heart. (Focus Group June 11, 2003)

Eisah similarly compares a philosophy of education with other deeply-held beliefs: "there are other things that are very personal to you. Like people's religious beliefs or faith, things like that" (Focus Group June 11, 2003). Their stance on education is clearly at the core of their being rather than simply a peripheral intellectual position.

Categorization of their Philosophy

The philosophy they hold falls broadly under the rubric of constructivism. However, their active engagement in forging an ideal philosophy makes simplistic the attempt to describe their philosophical position with a single word. Sasha makes this clear when describing some facets of her own philosophy:

Kamilla: How would you classify that philosophy, or would you?

Sasha: I don't know. I think constructivism is a theory of learning, a developmental process, that kids construct new knowledge, I don't think that's an instructional philosophy ... I don't know, I guess I would, I don't know what I would call it.

Kamilla: Do you want to call it something, or does it feel coherent enough for you to....

Sasha: It feels coherent enough for me that I don't need to call it anything. As long as you know what's best for kids you don't need to call it anything.

Sometimes you trivialize it and trivialize it, because you're admitting it into the world of pedagogy and coined terms. (Sasha Interview June 4, 2003)

Their philosophy is not monolithic, but multidimensional. While all three talk about constructivism as the basic philosophy and theory they espouse, they also distinguish, as Sasha does, constructivism as a philosophy of learning from the actual implications it has for teaching to promote that style of learning. As a result, there is room for continual experimentation and growth to determine what stays and what goes in their philosophy.

Components of their Philosophy – Role and Characteristics of Teachers

One of the first components of their philosophy is their perception of the role of the teacher and appropriate teacher qualities. The teacher is the facilitator of learning, rather than the all-knowing, omniscient informer:

Sasha: And as a teacher I need to let [student control of the environment] happen and I need to help them.

Kamilla: Is that the role as a teacher?

Sasha: I think, as a coach. (Sasha Interview June 4, 2003)

This view of teacher as promoter of learning is echoed by Sydney:

Kamilla: How would you characterize the role of the teacher then?

Sydney: I see it as facilitator, I'm there to facilitate their understanding.

Kamilla: Okay. And how much overall framework do you provide then, how much infrastructure compared to what the kids provide?

Sydney: I think probably still a large part. I think I would probably, ideally I would want to provide less of that, but I think I still provide the structure. And I haven't quite figured out how to make it work without doing that. I think in an ideal situation the kids would really set the parameters in lots of different ways, but based on the constraints that we have, and just the practicality of being able to move twenty kids to where they need to be, I feel the need to set a lot of that structure. (Sydney Interview May 7, 2003)

It is a philosophy of personal responsibility and care for the students. As Eisah says, "it's the main philosophy of, are you doing what's best for your kids and do you have reasons

to back that up. Not are you doing what's best to make your day easy" (Focus Group June 11, 2003). They say again,

Eisah: It's not necessarily just the constructivist theory ...

Sasha: It's just some basic beliefs about responsibility.

Eisah: Or basic personality characteristics. (Focus Group June 11, 2003)

They are very clear about the qualities that make a teacher effective. All the qualities they identify as effective for teaching – sensitivity, hyperactiveness, excitement, high expectations – relate to their ability to excite and motivate their students. They describe these at length in one interview:

Sasha: But if you were to write down all the qualities that the teachers that I think are amazing have, it would be sensitivity, it would be extremely high expectations for themselves.

Kamilla: What about their students? And for their students?

Eisah: I think if you have high expectations for yourself you have high expectations for your students. [Sasha repeats] 'cause they are so much of who you are so if they're not at a high level you're not at a high level. 'cause that definitely happens with my kids.

Sasha: I think so too. This is where sensitivity comes into play because you're so sensitive to how you treat other people, you're so sensitive how people treat you, and you're so sensitive as to how you represent yourself, so that when you teach a lesson not one detail gets by you, or day, because you're so sensitive to everything that you do, so you leave the day knowing everything you did wrong.

Kamilla: What about everything you did right?

Eisah: As far as the mental impact for me? [Sasha: It's hard to remember.] The mental impact of a good teacher that she's outlining can sometimes be harmful, but I think you're totally right. That is, it's the sensitivity, it's the high expectations, it's the love of learning, it's all of that goes into being a good teacher. And the gift of gab. Talk to our kids, talk to everybody else, and not be tired. Hyperactivity works well. I'm not going to say long attention span because that does not exist in my room. (Focus Group May 14, 2003)

They enumerate sensitivity; high expectations for themselves and their students; love of learning; ability to talk with many people and be energized by it; and a high level of energy or "hyperactivity." Of these qualities, sensitivity seems to be particularly important and they spend the most time describing its implications. Sensitivity implies observation of details in the classroom, in yourself, and in your students that allows careful monitoring of the impact of teacher activity. When you are sensitive, "not one detail gets by you" (Sasha). This sensitivity can pose personal challenges for the teachers because "you're so sensitive to everything that you do, so you leave the day knowing everything you did wrong" (Sasha).

One aspect of sensitivity is animation. Sasha and Eisah talk about the relationship between being animated and sensitivity in reference to another teacher:

Sasha: ... when she first came in here, [she] wasn't very animated, which is part of sensitivity.

Kamilla: How do you think that's part of sensitivity?

Sasha: Because [Eisah: You're sensitive to your audience.] you're sensitive to your audience and you want to engage them and you know [Eisah: The more

animated you are the more engaged they are.] Yeah. And she was, I don't know, she was missing a little bit of the hyperactiveness, she was missing a little a bit of the excitedness. But I do know, now that I know her better, she has very high expectations of herself. I think she really developed those characteristics in this classroom. I saw her stand in front of the students a couple of weeks ago, she was extremely animated for her personality. She kept with her high expectations and then transferred those to the students. And she became way more hyperactive, way more excited, way more sensitive, multi-tasking type of personality. (Focus Group May 14, 2003)

Sensitivity, thus, is a core attribute of an effective teacher, giving rise to an awareness of classroom dynamics and an ability to modify oneself and that environment to promote student engagement.

Sensitivity also is related to intuition and a connection with students. Teachers cannot be replaced because of their ability to be responsive to student needs in a way that computers cannot:

Kamilla: Could you have a program to replace a teacher?

Sasha: I don't think you could because so much of it is intuitive. I know when Terry is lost in the middle of a problem. A computer could give a survey, and prompt kids through it, but you still could never be certain if you were on the right track without getting that ... I just don't think a computer could be certain if you were on the right track. And giving the example again of giving kids a problem and two hours to solve it. That's not considering the five kids who would be completely lost because they had no direction, and got lost in the

problem, and couldn't identify it so they couldn't get back to the first set. And the other kids who identified the problem incorrectly.

Kamilla: Can you program a computer to be sensitive or intuitive?

Sasha: I don't know if you noticed in my last lesson ... I keep thinking about Terry, she needs to be the center of attention and valued sometimes. So many times when I call on her, she'll come up and grab the marker and stand at the easel, just be there with the marker. But that's lost. That's lost if there's a computer. (Sasha Phone Call May 16, 2003)

Sensitivity and intuition thus allow a teacher to recognize individual learning needs and respond to them in a time-sensitive manner, providing the information needed to reconnect students to learning.

Energy, variously described as excitement, enthusiasm, animation or hyperactivity, is another core attribute. However, unlike sensitivity, not every good teacher has the same level of hyperactivity. Eisah describes some of the variation possible in this attribute:

And I think that, I was thinking about another teacher in the building who is really a great, great teacher who is very soft-spoken, very, I wouldn't say that she's animated, but she does, I think there's some of the things that Sasha mentioned that you have to have, but there's some things, like, the animation.... My kids are constantly wound but it's 'cause I'm constantly wound. Probably if I wasn't as animated and hyperactive I still could be a great teacher and maybe they wouldn't be. I'm thinking of this other teacher who is so good, she has a calming effect in her room 'cause she's so calm. So I think that just like you learn to work with

your kids, your kids learn to work with you a little bit. So there are some characteristics that you have to have, absolutely, but there's others that you gain in certain ways and you become stronger in, but you just see how they can better affect the kids. Being animated keeps their attention. Being animated gets them excited about their learning. If you're monotone and laid back about everything then you're not excited and they're not excited. Then yeah, they're calm and collected but they're not thrilled, you know? But there are things you can learn along the way, like, tricks. (Focus Group May 14, 2003)

Again, being excited and enthusiastic is seen as crucial to motivating students. However, the degree of hyperactiveness can vary and still promote effective student learning.

They believe that these qualities may be innate, and that some people are naturally better prepared by their characters to be teachers. However, these attributes also can be developed:

Kamilla: Do you think, you talk about those qualities, do you think people can develop them, do you think some people just would be good teachers and others? I guess, what role do you think just who you are plays and what role your training?

Eisah: Well, if a person is not sensitive then I don't think you can develop that, but I don't think that there's a human being out there who cannot be sensitive to a child's needs, but there are people who can be more sensitive. I think everybody is a little bit of all those qualities.

Sasha: Yeah, and I forgot to put the clause in that they're all extremes. [Eisah: The more extreme they are.] I'm extremely sensitive, Julie's extremely sensitive,

I think Eisah is both of us combined extremely sensitive. And it takes a good friend to be able to be friends with Eisah and to understand that she is so sensitive so you have to anticipate that she might feel guilty. [Eisah: That's what it is, I won't get mad at anybody, but yeah, I'll feel guilty.] You can't say no, don't feel guilty, you know what I mean, but that's the thing. Julie's the same way, I don't think that woman's ever said no, probably, because she has twenty-seven different things on her plate. (Focus Group May 14, 2003)

Most people probably have some of the qualities required to be a teacher. However, developing those to a heightened level to enhance effectiveness is possible.

Components of their Philosophy – Views on Students and How They Learn

Another aspect of their philosophy is their views on how students learn about math. Some of these elements are described by Eisah during one interview:

Eisah: I think, what I would say, current philosophy of math is real world problem solvers. They need to see how is division used in the real world, how is measurement used in the real world, so that they see not only the use for it, but actually how to apply it, 'cause if they just know the division process, that doesn't help them. And also to see really where it comes from, I talked about how borrowing, I never understood, how it was ever, where it came from, didn't know where it came from, I just knew to cross this off and do these steps. But really letting kids know how it connects to the real world, but how mathematicians came up with it in the first place. And if I can get them to be those mathematicians, that's the best thing, I mean multiplication, double digit multiplication they totally developed on their own, like they were the mathematicians. But if [I] can [help]

that to happen, that's the best, 'cause then they really understand where it comes from and they keep it for longer.

Kamilla: It's also great how you call them mathematicians, you're very explicit about it.

Eisah: And now it's not enough to say that, I have to describe them, they have long beards, you're writing on the walls ...

Kamilla: I also really liked how you talked about giving them control over their learning being a key thing that you're focused on right now.

Eisah: Yeah, I am, because they know the procedure so well that the more control I give them and the more knowledge I say, you know about the procedures. Like today all day it was unbelievable how much in control they were over their learning and of helping other people, like they just know it. It was amazing.

(Eisah Interview May 12, 2003)

Here Eisah has described a number of elements of her philosophy of math learning: that math needs to be grounded in the real world so that students can relate to it and apply it practically; that students have the ability to solve problems independently as “mathematicians”; and that they need to be given control of their own learning. Eisah outlines some more principles of her current philosophy of math education when asked what she considers most important in teaching math right now:

Getting kids to make connections between what they already know and what they're learning. I think that's true in all learning, but in math, when we're learning, using what they already know so they can make sense of it. They make those connections and then they understand it. My understanding has changed

because when I first became a teacher I taught skills more independently of each other, e.g., similarities and differences between different types of problems. I came with such constructivist thinking where learning was making connections to what you know, but in math, I didn't see such a strong connection to skills.

(Eisah Teacher Formal Interview No Date)

Sasha has concrete views regarding how students learn as well:

Sasha: I think that some of the basic, I don't mean to say strategies but more like philosophies, my basic philosophy of learning, I think every child can learn that way. Different strategies, kids are going to need different strategies based on the way they learn, but in my basic philosophy.

Kamilla: Which is?

Sasha: Which is that kids need to be thinking about their own thinking, they need to know what works for them, and then they need to manipulate the environment so it works for them. And they need to have the power to do that.

Kamilla: So a very active role for the student.

Sasha: Right. And as a teacher I need to let that happen and I need to help them.

(Sasha Interview June 4, 2003)

Here we see similar elements to Eisah's description. The students need to be given control over their own learning so they can "manipulate the environment so it works for them."

Another element of their philosophy is their belief that all students are capable of learning. In relation to special education, Sydney espouses the view that all students can

learn and should be able to learn within a regular classroom. When I asked her if she would want to refer students to special education services, she replied:

Sydney: I wouldn't think I would, only because I think my teaching philosophy would dictate that those kids should be able to operate in the classroom just like anyone else could for the most part. But by the same token, I felt, I didn't start the child study with one of them, he just came in when I started my classroom, he was already processed, but with the other one I struggled with that choice for a long time, because I wasn't even sure if it was right to have her evaluated.

(Sydney Interview May 15, 2003)

Her philosophical stance is that learning is something all students can do within a classroom.

At the same time, Sydney describes the frustration of trying to help students learn. Her engagement in this question, and her inability to identify with those who believe that only some students can learn, come through in her attempts to help all her students perform. We discussed the relationship between teacher responsibility and student learning:

Sydney: But I think most teachers, I would hope, spend all their time worrying what is it I'm not doing? That's a natural part of the job, thinking how can I do this better.

Kamilla: But still, you do hear people blaming the students, I'm doing everything right, why don't they get it?

Sydney: Oh yeah, I do hear that here too, it's not like it's anything shocking, but I just find there's nothing worse than that. But what hope is there if you put it off all on the kids, you might as well not even try, because you can't fix them.

Kamilla: What's the point of education if you can't make a difference!

Sydney: If only certain people can learn! That's a whole other problem, but I would hope that most people don't have that philosophy. But it's frustrating, I can see how people ... I think we talked about this before, there's sort of two different mind sets that people grow up with, that either you're reflective or you're not. And so there's this barrier between teachers who are reflective and those who aren't, at all, they just don't reflect, they only think, what is wrong with these kids! And I can't identify with that, but I can identify with the frustration of I feel like I'm trying everything I can possibly try, and they're still not getting it.

(Sydney Interview April 30, 2003)

Here we see Sydney's emphasis on making efforts to help her students learn, and the frustration of feeling "like I'm trying everything I can possibly try, and they're still not getting it." She connects her efforts to find ways to help her students learn to her ability to be a reflective individual. This is something they strive for themselves, and something they also encourage in their students, as seen by Sydney's comments about being reflective:

Yeah, well and I think it's that barrier again, I'm not sure how much we can influence them individually when other forces in their life may not ever be encouraging that because a lot of them have experiences where they're basically told, you just don't look for reasons why, you just accept what is, so I don't know

if we can compensate for that. But I think people who are reflective certainly would get out of it. People who don't, I can't figure out what they're missing, why they're not thinking that way. To me it just seems natural that you would always feel guilty and always would try and figure out what I need to do differently, and how did things work today. (Sydney Interview April 30, 2003)

The ability to reflect is a process they value highly, in themselves and others. It also plays a role in their ability to acquire and expand on their own philosophy of education, something they take for granted and expect from others.

Views on the Goal of Education: Understanding

In terms of the goal of education, the teachers focus on helping the students gain understanding rather than an ability to perform. They think of students in terms of their understanding; for example, Eisah says that “even if you have a class where it's not a wide range of levels, you still have kids at unique levels and places and understandings” (Eisah Interview May 28, 2003). Sydney says, in reference to direct instruction, “I would rather them be able to understand what they're doing” (Sydney Interview April 30, 2003) than simply be able to perform a skill. Understanding is an internal condition that needs to be achieved by each individual; it cannot be acquired by being told what the answer is. This is why Sydney offers the following rationale for the extended discussion activities she has engaged in to help her students understand decimals:

... in my thinking, I just knew that I had to somehow get them to come to an understanding of decimals. It's not going to do me any good for me to tell them, they're not going to remember it. And it seems like it takes a long time, they still didn't have it yet, but I don't care, because I know that when they do get it, they'll

understand it. So I felt like we were making some progress. (Sydney Interview May 7, 2003)

Through struggling to develop their own understanding of a new concept, she believes that the students will forge a deep and lasting understanding which is, for her, more important than the development of rote skills.

The rationale for a focus on understanding is explained further by Sydney:

... sometimes there are kids who might be successful, they might appear to have a skill if you do a skills-based lesson, yet when they have to do some sort of deeper thinking they're not able to transfer that information that they have to what they get out of the math talk. (Sydney Interview May 28, 2003)

In other words, if students simply have an ability to perform a skill but lack understanding, they will only be able to use that skill in a narrow skills situation. As well, even if they are able to perform a standardized skill, they may lack an ability to explain what they did to another person: "Even if they were kind of able to spit out the facts they couldn't really explain what was happening" (Sydney Interview May 7, 2003).

Nonetheless, although the teachers place a strong emphasis on understanding over skill performance, there is a close link between understanding and the ability to do particular skills, even though it is not a simple direct relationship:

Sydney: I know you can have the skills without the understanding. I've had that, but ... I guess developmentally, they could be developing an understanding of it and not be able to do the skill, but at some point, if they have true understanding, they could perform the skill. I think that would come next, the social knowledge

of it. I guess that's the assumption I'm going on, that if the understanding is there, the skill, they can do the skill. (Sydney Interview April 30, 2003)

Thus, while a student might be able to perform a skill without understanding it, if they understand the concept they will inevitably be able to perform the skill at some point in time.

Understanding is something that develops through having the space to think through things for yourself rather than being told either answers or specified solution methods. This is seen in a comment by Sydney in which she is examining the difficulties of working in large groups with students who do not understand a concept yet: "if they have one on one time to go through their own thinking, they could deal with it very well" (Sydney Interview May 28, 2003). She says further, contrasting her views of inclusion with those of traditional special education teachers: "[they will be better off in a regular classroom] if all kids really learn best by being able to make some choices and have someone facilitate for them" (Sydney Interview May 28, 2003). Sydney explains this perspective in more detail in regard to special education classrooms:

I don't really know 100% but just from what I've seen of it, it's a very rigid, structured environment, they don't have a lot of opportunity to think through things critically and to move about and have freedom of choices. And that may not be the case but that's really what I've seen, and they benefit so much, I mean, they are able to think, they are able to be creative and make choices. They don't need to be sitting at a desk all day long and told, this is what you do from eight to nine, this is what you do from nine to ten. So I would really, I think they would

lose a lot in that environment, and they may actually then be disadvantaged even further. (Sydney Interview May 28, 2003)

As a result of the importance they place on developing understanding, these teachers choose instructional methods based on how they may develop understanding rather than rote performance ability. Sasha gives us one example of this when she says, “I would like to give them more of an opportunity to write math problems and solve them because it helps them to understand the concepts better” (Sasha E-Journal January 22, 2003). Sydney similarly is willing to take the time in her class to allow the students to think through a principle until they develop understanding:

I was amazed by the thought processes of each of the students who were trying to “solve the puzzle” of decimals yesterday. I think that lesson was indicative of how much time must go into making sure that kids “get” something. I could have used that time to have the kids doing a skill and drill assessment, but I really believe that this is the way kids reach understanding. (Sydney E-Journal May 8, 2003)

Sydney expresses the conflict the teachers feel over a drive to help students develop understanding, coupled with the pressure of external tests that demand precision performance:

That’s what I worry for them, that would be doing them a disservice, I don’t think they’ll be able to make it in school later, even if they’re passed through they just won’t have the understanding they could have had. But again, the struggle is these kids who are at such a basic level, what do you do with those kids, do you

keep striving for understanding or do you make sure they can perform? (Sydney Interview April 30, 2003)

Their philosophical emphasis on understanding is thus pitted against the realities of classroom life, testing, and rigid district curriculum maps.

Views on the Goal of Education: Metacognition

Another learning principle they value highly is metacognition, or the ability to be aware of your own thinking and subsequently direct it. Sydney describes the absence of metacognition in some of her support students:

They don't really spend time thinking about their thinking, and they don't spend time, seem to spend a lot of time putting thought into, what are particular problems asking for. They don't seem to break it down in a manageable way. (Sydney Interview May 28, 2003)

Reflectivity is akin to metacognition, as Eisah describes:

I think that in reflection you're very aware of what you're saying and what you're reflecting on, and I think that it's just again, you're very aware of your thoughts so I think it definitely does have a key role in that. Also you are, basically just rehashing what you just did, which comes into a lot of what our cognitive strategies are, about putting yourself in the problem, and reading and rereading, just going over thinking and getting more in depth with your learning.... (Eisah Interview May 28, 2003)

Metacognition involves thinking processes that can assist students to become self-directed learners. For example, Eisah describes the characteristics of her struggling

students in math and how their mental processes contrast with those of more advanced students:

Eisah: It's like they, they don't make connections very easily. And I don't really know ... but they don't, some of them also don't make connections easily in reading either. They don't as quickly gain coping strategies, like I'm stuck ... The advanced math talk, very quickly they gain the strategies and the know-need-how, I need to go back to what they know. And when we talk about preparing for tests, my advanced kids know, we need to go back to what we know, we need to go back to that always. The struggling kids, it's almost like their frustration level gets so high that they don't use the coping strategies, they don't say to themselves, they're ... They're just less cognitive.

Kamilla: Less metacognitive?

Eisah: Yeah, less metacognitive, 'cause they're not cluing into what do I need to be doing right now to help me. They're just like, I'm frustrated, I don't get this. I'm not making a connection, I don't get this.

Kamilla: So in terms of helping them then, how do you use ...

Eisah: I completely model. Okay. So if you're not making a connection, what do you need to do next. Like prompting their metacognitive process, really.

(Eisah Interview May 28, 2003)

The teachers work on developing metacognition in their students and notice changes in their self-monitoring abilities. Sasha writes:

I'm noticing that Brandon (only one besides Erika that didn't pass MEKA) has become more independent in using the cognitive strategies. He is great at making

a plan by starting with what you know, he can sometimes get stuck on how he's going to find out. Everyone can make a plan with scaffolding; however, I have three kids consistently who think they should first plus and if that doesn't work they should minus. This is really frustrating because they may know how to estimate but when faced with a word problem, they just add and get the wrong answer. (Sasha E-Journal January 22, 2003)

Here Sasha describes how a student has applied cognitive strategies to become metacognitive, in charge of his own learning. She struggles with trying to help other students develop a similar realization that they need to use strategies to help them.

Within their math classes, a variety of evidences of metacognition are displayed by the students. In Eisah's class, the students figure out formulae themselves and share them with other students. They comment on whether or not they understand the process in a particular math problem (Eisah Math Talk Observation Notes, April 30, 2003).

Sasha's math classes display a similar range of metacognitive activities, with students talking about their thinking, comparing what they get for an answer with what others get, talking about what they used to think and what they now think, and identifying what they don't know or where they got stuck (Sasha Observation June 10, 2003).

One fascinating manifestation of student movement towards metacognition appeared in Sasha's classes towards the end of the year. A number of students started offering their personal analogies of how they store, connect, and access information in their brains (All Observation April 28, 2003). Sasha describes this experience in more detail:

Today some neat conversations came up about storing new information in our brains. Damian said “storing that in my dictionary!” and pointed to his head. Frank said, “I need a new drawer in my brain for this stuff about decimals!” ... I think I’m going to change the way I talk about storing new information. Maybe make it more explicit. Even make the connections more explicit. For instance, we talked about how our new drawer on decimals might be in the dresser that is all about place value along with multiplication, regrouping and fractions because all of those skills have to do with place value. It was so cool.... (Sasha Email April 29, 2003)

In a subsequent interview, she expanded on the uniqueness of this process:

I don’t know why they exceeded my expectations. I guess I never expected them to start vocalizing how they’re storing their information, which is very recent. I mean, since you came and observed the other day, that was brand new, it was sparked by one kid, but then everybody else ... it almost seemed like they’d been talking about it for months, which makes me think everybody has been thinking about it for months, it was just that we hadn’t spoken about it. I think it’s been going on for a while, they’ve been actively thinking about how they’re storing information. Which is so incredible that they’ve been doing that without even talking about it. Of course ... I think that’s the most recent evolution of what we’ve been doing, so I think that there are still kids at the lower end of the spectrum, who aren’t there yet, so are still working on being cognitively aware, but I think in the grand scheme of kids, amongst the higher kids who are more cognitive, I don’t want to say higher, but the kids who are more competent. I just

can't believe they're talking about where they're storing information [Kamilla: That's huge.], and other information that it's related to. And in the moment as we're learning together, they're actually physically pulling it from the air and putting it in their head locking it with a key. (Sasha Interview April 30, 2003)

These comments illustrate Sasha's perception of the innateness of metacognitive abilities on the part of the students: they have "been thinking about it for months" independently, without teacher prompting or observation. She also believes that this manifestation of metacognition is of tremendous value to the students, as she explains when asked to comment on its benefits for them:

I think it's going to be amazingly beneficial because when you're talking about attention controls, that's like the number one thing for learners, is being able to have attention control. And there's so many aspects of attention control, it could be sleep deficit, it could be just your mind focuses on everything and they have no filtration system. It could be they have a wandering mind, like say we're talking about tides and they start thinking about the beach and sunglasses and sunblock. It could be that they have a kinesthetic, like they just need to touch things, so they're not looking at you, they just touch things. It could be so many attention things. That's like the utmost attention control, if you not only are listening, you're processing things, you're taking it from short term memory into working memory too, and then into long term memory, because you're storing it, and you're doing it in thirty seconds. That's just incredible to me. I never did that as a learner, I still don't consciously do that, and the fact that five kids were doing that the other day during math talk. I'm just looking at the carpet because I'm just

imagining them there. And Frank just came into my class (Sasha Interview April 30, 2003)

They see metacognition as an invaluable mental process for their students, something that will allow them to maintain focus on what they are working on, to store information actively, to learn consistently. More dialogue from one of Sasha's class discussions about mental models is found in Appendix K.

The teachers make efforts to elicit metacognition from their students. For example, Eisah works on giving kids strategies so when they are stuck, they can get unstuck. Her goal is to help them cope with getting stuck and being challenged so that they can work on math problems independently. Within the classroom, she sees them becoming aware of their own thinking and verbalizing it, one manifestation of metacognition (Eisah Phone Conversation December 6, 2002). Another goal is to help students take responsibility for identifying areas where they need work and follow through on appropriate practice, all driven by their own assessment of their needs (Newsome Park Field Notes June 26, 2002). Sasha uses flexible grouping to encourage her students to self-assess their ability level and learning needs (Sasha E-Journal March 18, 2003). She also uses extended questioning sequences to help them think through problem solving processes; and encourages them to explain and explain further their thinking, digging deeper for understanding and asking other students to expand on what they say (Sasha Observation May 15, 2003). Sydney engages her students in dialogue about their own knowledge. She often prompts them to consider what they know and relate it to instructional goals, as seen in this comment she made during one math talk: "And remember what we said, if you can figure out what's wrong with this picture, you

understand fractions, but if you can't understand what's wrong, you may not be where you want to be" (Sydney Math Talk Observation No Date). The simple skill of recognizing what one does and does not know can be difficult to internalize. She also has them estimate how long it will take to solve problems (Sydney Observation May 15, 2003).

Another way she does this is by engaging the students in discussion about how they solved a particular problem. This is seen in a postmortem discussion of one math talk problem:

Sydney: Okay, let me ask you a question you might not be able to answer. Why do you think you couldn't do this last time but you did it this time?

Horatio: We talked about it first.

Sydney: Okay, so you think talking about it first helped. What else?

Childress: I think we kind of put it together when Mr. Teacher did this; we learned and had fun and giggled at the same time.

Sydney: Oh, so this time is a little more interesting than last time, when you just had to go off with your sheet.

Childress: Mr. Teacher made it more fun, with music and dancing.

Mia: I think because we did a fun demonstration where people ... well, I have two things. My first thing is I think we have more success this time because we talked about it and did like a fun demonstration, and my second thing is I think some people weren't listening and this time something like involving the jewels and stuff, they were listening.

Sydney: So we think we need more demonstrations to help us with listening.

(Sydney Observation May 15, 2003)

Here students are engaged actively in assessing their own learning needs. Prompting active thinking about how they learn is one key approach emphasized by the three teachers. Finally, metacognition also defines their relationship to themselves as teachers, with constant awareness of what they are doing and thinking, attempts to self-monitor, and ability to guide their own thinking and learning.

Challenge of Relating to Other Teachers with Different Philosophies

Stepping back to philosophy as a whole, this is how they distinguish themselves as teachers and define themselves relative to other practitioners. As a result of their own identification with their philosophy, they evaluate other practitioners on the basis of their philosophies. For example, Sasha describes her automatic interpretation of other teachers' philosophies of education and how becoming aware of how they think influences her interaction with them:

I think it's both, you have one conversation with somebody and you feel you have the same ideals or the same basic theories, like although they might differ in certain areas, but you have the same basic ideas on what is good. And then from that you start to build trust because you know that those basic things are there.

(Focus Group June 11, 2003)

While identifying commonalities in philosophy can promote bonding and collaboration, noticing differences can result in conflict. Sydney expresses the negative views, shared by all three, about how they interpret and respond to others with different philosophical orientations:

Sydney: But interacting with them on your team probably still reinforces your own beliefs. You probably still benefit from interacting with them because you go back and say, I'll be damned if they're going to be right. I'm going to make sure I do that.

Eisah: Right, that's the truth.

Sydney: Or even just hearing them or seeing them and thinking, I don't want to be like that. (Focus Group June 11, 2003)

While this suggests an environment antagonistic to collaboration, identification of "others" with respect to perspectives on teaching also serves to reinforce their adherence to their own philosophy. It also can drive experimentation and practice: as Sydney says, when she sees someone use a method that she considers inappropriate, she resolves not to follow their example but rather to try something different herself.

While they tend to categorize people on the basis of their philosophies of education, they do not seem to have a unitary idea of philosophy, recognizing that philosophy consists of different components and perspectives. While they have their own philosophy, they do not apply it blindly but continually evaluate it and allow it to expand. For example, Eisah emphasizes that their reaction to others' philosophies is not a simplistic generalization: philosophy is a multifaceted phenomenon, and they can respect one aspect of an individual's philosophy while not accepting another element of their approach:

Also, I'm realizing it's not as cut and dry as direct instruction and constructivism, because for example, the teacher who is very direct instruction came into my classroom, but I really respected them in another area, I really respected their

classroom management, I really respected their level of questioning in their classroom. Yeah, for example, Trisha, who has a great level of questioning, came into my room and said something about my questioning, because I respect her in that area, I would listen, so I don't know if it's as cut and dry as different philosophy, but I'd have to respect them in different areas to give weight to what they say.

Sasha: I agree. (Focus Group June 11, 2003)

Here we see Eisah's acknowledgement of the validity of some practices of another teacher, even while she does not subscribe to the entire spectrum of beliefs held by that individual. As a result of situational acceptance of another teacher's beliefs, it is possible to learn from a diverse spectrum of practitioners. These teachers can make individual choices about who they will listen to, and about what, based on the "respect" they have for those individuals.

Sydney, Sasha and Eisah further elaborate on the dynamics of their interaction with teachers of different philosophical orientations. In this dialogue, they note the skepticism they have about collaborating with practitioners who come from different philosophies and why collaboration is difficult when someone has different beliefs. The conversation started with the question of whether they could trust someone who had a different educational philosophy:

Sydney: I've not encountered them. The ones I met who didn't have it, I didn't trust for other reasons. I don't know!

Sasha: I don't know, my tendency is to say no. Because if you have a certain theory in education it's very personal, I think, because it also stems from what

you believe goodness is, just what you believe with your heart [Kamilla: Human nature?]. Yeah, human nature and what you believe with your heart. So I think that if someone doesn't believe that you're willing to accept that but to trust them, I think, would be a huge leap of faith. (Focus Group June 11, 2003)

From their back and forth stating and restating it is possible to see the limits of peer interaction imposed by a clash in philosophy. While "if someone doesn't believe [what you believe] you're willing to accept that", this live and let live approach does not necessarily generate the trust required for collaboration; as Sasha says, "to trust them ... would be a huge leap of faith."

However, the question of whether or not to trust someone is more complex than whether or not they espouse a particular philosophy. Sydney explains the type of philosophy needed as a basis for trust and thus collaboration:

... another thing for me was to see that someone is very positive about their kids is really important and that helps me to trust them. So if I see that you see the good in your kids, whatever your philosophy is, I think I would feel like I could trust you to look for the good in my kids and then what I'm doing. Whereas if you're a negative person and you blame the kids for everything and on and on and on, I don't think I could trust that person. (Focus Group June 11, 2003)

Such a position could be found in people who espouse widely varying approaches. Thus, the character of a philosophical approach is again found to be multifaceted.

The conversation continues as Eisah explains further the complexity of attempting to collaborate with someone of a very different philosophy:

Eisah: What I just thought about, in the building, or as colleagues you trust them, and I think that the ultimate answer has to be yes. Because when you're talking about colleagues, we're in a school, our main reason for being here is our kids. So any philosophy that we differ on ... it's almost a waste of my time to go into someone's room who has a completely different philosophy than me, to trust them, to confide in them, to ask them to observe me, when my main objective in being here is to do the best for my kids. It would be a waste of my time. Because I think about people on my grade level who are a different philosophy from me, there's no point in all those, going in and try to share with them, because I've already tried that, I shut down because we have a different philosophy. So it would be a waste of my time to continue to build that kind of relationship when we're not on the same lines. Because when you take a step back there are other things that are very personal to you. Like people's religious beliefs or faith, things like that. Because people have different beliefs, it's not like you don't associate with them. But that's because that's not the most top thing every day. I don't know, I'm trying to make a connection. But outside of the school building, if there was a teacher ...

Kamilla: You don't have to actually put the beliefs into practice?

Eisah: I guess that's it. (Focus Group June 11, 2003)

Working with someone of a different orientation creates pressure and tense situations for these teachers. They express their frustration in such words as these from Eisah:

I think about people on my grade level who are a different philosophy from me, there's no point in all those, going in and try to share with them, because I've

already tried that, I shut down because we have a different philosophy. (Focus Group June 11, 2003)

The difference in approach posed by a different philosophy can create an impasse as some aspects of the different philosophical positions are found to be mutually exclusive. The types of explanations and advice offered by someone coming from a widely different philosophy are so different as to be useless, as explained by Sasha in reference to attempted reflective conversations with individuals from a different philosophical bent:

... they wouldn't be valuable either, because they'd be coming from a totally different page. Like their response to you saying, I'm having a difficult time, I'm having a challenge with Marty and I don't know what to do. And their response might always be well, because they're a kid and their parents suck, and blah blah blah. So you wouldn't value that conversation. (Focus Group June 11, 2003)

As a result of these clashes in perspective, the desire to collaborate is shut down as their views are ridiculed or discarded. As Eisah says, "I shut down because we have a different philosophy". They subsequently continue to work and collaborate with those who share their views, since, as Eisah says about attempted collaboration with non-sympathetic teachers, "it would be a waste of my time to continue to build that kind of relationship when we're not on the same lines." The core of their collaborative team is those who embrace wholeheartedly a philosophical approach of student centered learning and teaching for understanding.

Direct Instruction

Views of Direct Instruction: Early Experiences and Basic Conceptions

Direct instruction is the primary method by which all three teachers were taught in their elementary years. Whether manifest as teaching that was “run and led by text books” (Eisah Interview May 12, 2003), Sydney’s comment that, “my recollection is always being at our desks” (Sydney Interview May 14, 2003), or Sasha saying, “if anything, I was taught a few procedures but not even that. I was more or less just given worksheets” (Sasha Interview June 4, 2003), all three of them were steeped in direct instruction. They express a great deal of frustration over this. Sasha says, “I remember not being taught the strategies and not being taught anything specific, just given a lot of practice. And nothing ever clicked, and it would never be explained ‘why’” (Sasha Interview 4 June 2003). Sydney similarly comments, “I don’t remember any collaboration and I don’t remember being challenged to really think, I remember just, it was basically just rote memorization” (Sydney Interview May 14, 2003). Although they could have accepted direct instruction as the appropriate teacher behavior, all three ended up viewing the experience negatively. Sydney and Sasha specifically mention being “disappointed” as children because of the way they were taught (Sydney Interview May 14, 2003; Sasha Interview June 4, 2003). Their reaction to their primary educational experience inspired them with initial and lasting negative views of direct instruction.

Although their instinctive response to the term “direct instruction” is a visceral avoidance of the term and methods associated with it, to leave their reaction at that would be a misleading simplification. Their understanding of the term is broad and sometimes contradictory, and they also spend time agonizing over situations in which direct

instruction methods seem to be most appropriate, or methods that they find enjoyable and useful in their classroom. Direct instruction, therefore, is the yin of constructivism's yang; where one is invoked, it will inevitably be contrasted with the other, and the dilemma of where the boundaries between the two lie will be explored.

Their definitions of direct instruction begin with noting rigid formal processes. Sydney describes the type of direct instruction she sees in special education classes: "a lot of times you're just throwing facts out at them, but they have no concept of that, so later when they have to actually apply those skills they're not going to be able do it" (Sydney Interview April 30, 2003). This approach she views as simplistic and of little benefit to the children since they will not be able to apply what they were supposed to have learned. Sasha tends to define direct instruction as a rigid imposition of procedures onto student thinking:

Sasha: I view direct instruction as, here's a problem today, see the problem?

Great, this is step one, now you do it, this is step two, now you do it, this is step three, now you do it. Okay, that's the way I want you to do this every single day. ... [What I did was] I said, this is the way I solved it. And I didn't even say anybody had to do it that way.

Eisah: So just take out the words "you have to do it this way," is that what makes it direct instruction to you?

Sasha: Not only that, but I didn't say, I did this step first, now you do this step first. Good, now I'm doing the second step, now you do it.

Eisah: Yeah, but other people who we think do direct instruction, do things like that, they just do it every day. That's what makes them more direct instruction teachers. (Focus Group June 10, 2003)

Sasha's view is of a traditional, programmed direct instruction classroom where students are not encouraged to develop thought processes for themselves. Later, she says

I think direct instruction, and this is just my interpretation of it because of research on Skinner, is so much like programmed instruction where you are directly saying, this is how you will do it, and this is the first step now you do the first step it, and this is the second step.... (Focus Group June 10, 2003)

Eisah agrees, saying,

That's direct instruction at its height, absolutely. ... step one is this, step two is this, you must do it this way, I must see this on your paper, I must see you doing subtraction this way, that is direct instruction in its purest form. (Focus Group June 10, 2003)

In this model, there is no room for student creative thought, or student evolution of their own solution methods. Since the goal of their instruction is for students to become autonomous thinkers, they want to avoid this type of instruction.

Elements of Direct Instruction: Skills-based Instruction and Teacher Modeling

One aspect of direct instruction is what they call "skills-based instruction." This focuses on building performance skills, but does not necessarily emphasize student conceptual understanding of the concept (Sydney Interview April 30, 2003). Teachers, often using questions, lead students through the thought process or standard algorithm used to solve a particular type of problem. Skills-based lessons are used by all three

teachers (Eisah describing how she might use questioning while introducing a new concept and decimals, May 7, 2003; Sasha talking about scaffolding and ladders, April 30, 2003). Sydney here describes what such a lesson might look like:

... a more direct instruction kind of thing, so I would do a very quick lesson, it wouldn't be fifteen minutes probably, where I just kind of hit them with a skill. And I might still question them through that process but I'm basically giving them some information that they need to have, and then I would send them off for a quick challenge to show that they can demonstrate that they got it. And it's very quick, but it's direct, it's not me just wondering, what do you think the answer might be, I'm basically saying this would be the process you would use to get to that answer. (Sydney Interview April 30, 2003)

This approach is faster than a more exploratory "wondering" learning process which can be more time consuming. Sydney describes the distinction in another way, saying her usual method is "hearing other children's thinking" through math talk dialogue, while when she says skills-based, it refers to "a very focused discussion about their own thinking" (Sydney Interview May 28 2003). Such type of direct instruction is accepted by the teachers as a normal part of instruction.

Teacher modeling – showing students what to do by their actions – may or may not be considered part of direct instruction, as seen in this dialogue between Sasha and Eisah:

Sasha: If anything, modeling might be a part of direct instruction, but modeling in itself, I don't think, is direct instruction. [Eisah: It's a form of it.] I don't think modeling is a form of direct instruction, I think that modeling can be a part

of direct instruction but I don't think that modeling in isolation is direct instruction.

Eisah: So you think that there's direct instruction and constructivist teaching and modeling is in both. Teacher modeling is a part of both.

Sasha: Mm hmm. (Focus Group #2, June 10, 2003)

Sasha here isolates modeling as a strategy from any particular philosophy, feeling it could be used in both constructivist and direct instruction situations. Eisah, however, finds a role for direct instruction within the rubric of constructivism and thus is comfortable with classifying modeling as a form of direct instruction:

I just see teacher modeling as the form direct instruction takes in constructivist teaching. When you say direct instruction, there's a place for it in constructivism and it's through teacher modeling. (Focus Group June 10, 2003)

Eisah also says,

I definitely have always agreed there is a place for direct instruction in constructivist teaching, but it's never step one you do this, step two you do this, the form that it takes is through modeling. It's just part of the guidance I think that you offer in constructivism, is that you sometimes step in and say, this is the path we're going to take, this is another path you can take. It's just part of the teacher interaction. (Focus Group June 10, 2003)

In their dialogue, the source of disagreement seems to be over the impact of teacher action. Since modeling can be done on a spectrum from sharing to prescription, it could fall under both constructivism and direct instruction. Modeling that goes "step one you do this" is direct instruction; modeling that offers "another path you can take" could be

part of constructivism. If a teacher showing her own thinking processes encourages students to absorb these and copy them without independent thought, that modeling might be classified as direct instruction. If modeling, in contrast, pushes students to explore their own thinking, it could be constructivist.

A final difference between constructivist and direct instruction modeling relates to whether it is done by the students or the teacher.

Eisah: I mean, I understand that you're saying it's another way, so that's what makes it not direct instruction, some of it, this is just another way, I'm not having you do it this way, it's true but, it's closer to direct instruction than having the kids do it. [Sasha makes a motion to indicate she disagrees]. It's not closer to direct instruction? Than having the kids discover it on their own?

Sasha: Well yeah, of course having each individual child discover it on their own is the best way to do it, but um (Focus Group June 10, 2003)

Sasha feels that showing the class her thinking processes need not force them to adopt these processes. She says, "a child explaining to another child is the same thing, I think, as a teacher explaining it to another child" (Focus Group June 10, 2003). In contrast, Eisah believes that by having a teacher represent a solution method, the students automatically will interpret that method as the required process.

To Use or Not to Use: Direct Instruction with Struggling Students

The teachers have mixed feelings about using direct instruction approaches. This dilemma comes from working with their struggling students. They all notice a small group of students in their class who seem to lack the necessary knowledge and cognitive base in order to learn (Notes from Sydney Interview May 28, 2003). While they know

that all students can learn, they see that those who are part of the lower “core group” often need something extra. They need to acquire the basic skills needed to do a math talk, and need to be told things directly so they can build up a base of “facts” and knowledge that they can then manipulate to solve math talk problems (Sasha Coffee Shop January 11, 2003; Notes from Sydney Interview May 28, 2003). They suspect that the students lack this base because they had a deprived upbringing, and therefore, it is something they need to be given. The dilemma arises over how you give them this knowledge. Can they learn it through experiential or problem-based methods, or do they need direct instruction? While spending individual time with them helps, they often find that more direct instruction approaches seem to produce learning rewards (Sydney E-Journal May 8, 2003; Notes from Sydney Interview May 28, 2003). Sydney says, “I don’t think I would ever abandon skill-based teaching because they sometimes, particular kids need specific direction. They need some help with that” (Sydney Interview April 30, 2003). She also says, about the small group of struggling students in her class, “And sometimes I think they actually need more direct instruction than they get from me so I fear that they’re missing out because they’re not getting that” (Sydney Interview April 30, 2003). Sasha feels that some kids may need direct instruction before they can construct knowledge for themselves (Sasha Phone Call May 16, 2003). In sum, although they have philosophical reservations about direct instruction, practical experience has shown that it may help struggling students get to a point where they have enough points of reference in their heads that they can think independently.

While they notice the enhanced performance of some students when they try direct instruction approaches, they feel a lot of internal pressure to teach using only

constructivist approaches. Sasha went through detailed self-assessments of her instructional methods, trying to find the best way to meet the needs of her students. She spent much time reflecting on the validity of heavily directed or scaffolded lessons, which remind her of direct instruction approaches but seem to produce accelerated student learning:

One of my reflections a long time ago with you was, is it okay to teach a lesson on a new concept that's not totally exploration, that you're building the understanding with the kids by asking open ended questions, by reinforcing what they know to help them connect to a new idea, like baby steps, We know this, so how's that apply here, now we know this, how's that apply here, and so then what, give them the big bang, here's the conclusion. Some of my math talks have been like, I feel like as we get further into the third grade there's so much content, that doing it the other way, giving them a problem, letting them struggle, come to disequilibrium, and coming together at the end of math talk, bringing it together, comparing and contrasting different solutions, that works well too. But I feel like, sometimes I have to do that the other way around because it's faster, it's more efficient, and I can keep all the kids engaged because we're doing it all together. Whereas the other, at the end of the hour the other way I had some kids who were just totally exhausted and frustrated. Because fifteen minutes spent struggling is like forty-five minutes spent being engaged. So I don't know. I find myself flip-flopping back and forth when I know that they will not understand this concept. Like decimals. It was so hard yesterday. Because it's never okay for me to just say, this is the way it is. The end. We have to come to some concept of why. So

if I just give them a problem that was totally exploration ... I don't know. (Sasha Interview April 30, 2003)

Here we see the two sides of the issue: the personal preference for a constructivist, disequilibrium approach, contrasted with the increased speed and efficiency of a more directed instructional method. Sasha illustrates this conflict further in a phone conversation:

As a constructivist teacher you're often asking yourself, is this too directive? I had a panic attack, if I'm introducing social knowledge in the beginning is this direct instruction? There's days when I think that's okay, they need this knowledge like what probability means so that they can do the rest of the work. I see great examples where there are lessons where kids construct all their knowledge and wonder if I could do that. (Sasha Phone Call May 16, 2003)

The depth of her engagement in this dilemma is apparent in the "panic attack" she experienced over telling them standardized knowledge at the beginning of class. The question of how much to guide and how much to allow students to direct is one that is constantly renegotiated. In general, they feel that guided instruction is needed sometimes and for some students, but struggle to make this realization fit with a more rigid definition of constructivism that still remains in their heads

Advantages of Direct Instruction

As well as the speed of direct instruction, and the fact that they can see that their support students are engaged, there also are things they enjoy about direct instruction that draws them to it. Sasha, for example, finds some types of direct instruction satisfying

because she sees students resolve misunderstandings they have and learn how to approach particular problems:

I like teaching things that I had a hard time with 'cause I think that, and this is a part of direct instruction, this is something I was thinking about, I like being a constructivist teacher because of open ended questions, but I also like direct instruction because I can sympathize with how they're thinking and the different ways they misunderstand the problems. (Sasha Coffee Shop January 11, 2003)

The balance between direct instruction and constructivism is a topic that they continue to debate in an effort to find instructional methods that are both philosophically satisfying and practically effective.

Disadvantages of Standardized Tests

Standardized tests, a structured external assessment of student learning, are seen as directly correlated with direct instruction. Like their attitudes towards direct instruction in general, the teachers have mixed views on standardized tests. On the one hand, the tests often are seen as a negative influence on their instruction. They impose deadlines on student learning when the teachers feel their students may need more time exploring a concept to achieve true understanding. Sydney describes this conflict:

And also, how are you going to meet your end goal in time, because you have realistic goals, you have to meet these testing requirements, and while I would always rather they have understanding first and then develop the social knowledge, it's just not always possible, sometimes they just need to at least be able to perform that skill. So I worry about that all the time, it's really a big concern for me. (Sydney Interview April 30, 2003)

Sydney clearly feels that the testing exerts a time pressure that may not be achievable if students are to learn concepts and truly internalize them. “The frustrating thing to me is I feel that, you need to get to this point by tomorrow, and it looks like you’re not going to get there for another three weeks” (Sydney Interview May 7, 2003). Eisah also notes the challenge posed by test deadlines, although she does not feel it plays a significant role in her instructional style:

In math, probably the only way it affects it is that I have to push on because the MEKA is every nine weeks. Even if the kids need an extra week in area, we don’t have it. So sometimes I have to push on and remediate during lunch or after school when maybe if that test wasn’t there I would keep on going on area for a couple of days and not remediate as much. So that might be the only way it affects it. But it doesn’t change my style. (Eisah Interview May 12, 2003)

Although the time pressure imposed by tests can create internal conflict, it does not completely rule over their teaching.

A second disadvantage of standardized tests is that they are seen as testing only rote skills performance rather than deeper levels of understanding or transfer. Sydney talks about standardized tests and how she feels they do not necessarily show “understanding” since a student can perform a rote skill but not understand the concept behind it (Sydney Interview May 28, 2003):

Sydney: And I don’t know if it happens as much in reverse, I’d have to sit down to really think about , if a child displays some understanding in math talk but then they can’t do it on a skills-based test. Because that happens some times too, I would guess.

Kamilla: But the other one is more common, that they can do the rote skill but they...?

Sydney: I think so, they can do the rote skills but they can't do the thinking that goes along with it, yeah. (Sydney Interview May 28, 2003)

This dialogue represents the opposite perspective of the unspoken theory that underlies direct instruction classrooms: that if you drill the basic skills hard enough understanding will emerge from this. In Sydney's perspective, children need the conceptual understanding before they can do the skill.

Preparing for Standardized Tests

At the same time, the need for students to know a large body of rote facts does affect some of the review activities in which the teachers engage. Eisah, who spoke the most specifically about her review strategies, uses a wide range of interactive activities to review for the end of year social studies SOL test including games that promote creative thought, but also flash cards and activities focused on memorization. Sydney and Sasha also use a variety of content review activities, some of which they consider beneficial for overall student learning, and some of which are specific to promoting learning of facts for tests (Sydney Interview April 30, 2003, Focus Group May 14, 2003). Sydney says about her test preparation strategies, "I'm just trying to cover more material instead of being very focused on getting the understanding for something" (Sydney Interview May 28, 2003). However, in all their preparation they focus on student analytical thinking, critical reading, problem solving, and application of strategies (Sydney Interview May 7, 2003; Focus Group May 14, 2003). Sydney talks about the dilemma of needing to use some

traditional instructional methods, but trying to make them valuable for the students beyond simply rote test learning:

I haven't found the exact balance that I feel good about because what I've been finding, they have to do a lot of actual test taking in order to get ready to take this test which leads to a lot of traditional time. But I've tried to set it up in a way that still feels fun to them and it still feels like they have some control over that situation. (Sydney Interview May 7, 2003)

Another aspect of test preparation is simply practicing taking the tests to provide practice in sustained attention and test taking (Eisah E-Journal March 31, 2003; Focus Group May 14, 2003). Figuring out what instructional methods to use to help students perform on tests while adhering to a particular set of practices they believe to be best is an ongoing process.

Other problems associated with tests include student movement between different classrooms to prepare for different tests which disrupts instructional time and forces teachers to work with constantly varying student groups rather than having the time to get to know students better and build on their learning needs (Eisah Interview May 28, 2003). As well, tests produce high pressure situations for the students which can impede learning. Eisah frequently refers to this, talking about her stress level and how the students are feeling the pressure (Eisah E-Journal March 31, 2003, Eisah Interview May 28, 2003), seconded by Sydney (Focus Group April 2, 2003).

Pressure for students to perform on tests combines with their experience of slow student learning to make them wonder if some form of direct instruction is needed for students who come to school lacking exposure to enough "facts" or foundational

knowledge to have a context for learning. They consider this theoretically, but also in reference to the learning needs of specific students. The factors they consider are illustrated in this dialogue between Sasha and Eisah:

Sasha: Mm hmm. And then I think that Erika needs direct instruction one on one when she doesn't understand the concept of something but she needs to represent that on a test tomorrow. Do you know what I'm saying? But other than that I don't think that direct instruction has any place in this.

Eisah: If there was no test would you give her direct instruction?

Sasha: Umm ... not likely. Because there is nothing that is telling me that she needs to skip understanding and conceptual learning [Eisah: Right, to get to that.] to go to procedural learning. You know what I mean? The only reason I would teach her direct instruction for procedural knowledge is because that would be a discredit to her because she would get a bad grade. When I know I have the power [Eisah: To just give it to her and she'll get it.] to give it to her, she'll get it and go get an A or whatever she needs to succeed in that way. But that's only where I am now.

Eisah: I know. But I always think about that too and I struggle with it so much because I'm surrounded by teachers who do do direct instruction, so in trying to validate in my brain that what they're doing is okay because they're getting these test scores I think about, okay, direct instruction maybe does have a part in what I do and that's what I do whenever I do teacher modeling, trying to give it almost like a hidden secret name. But I think I just need to think about that some more. [Sasha: Oh, everybody needs to think about it.] And I'll never come to a decision

about it probably. Because still in any way, I don't model like the guidelines of teacher modeling can go, and I don't do direct instruction like direct instruction is outlined, so.... (Focus Group #2, June 10, 2003)

Sydney also thinks about these dual pressures: internal focus on helping children achieve understanding, and external pressure to help them perform on tests:

I don't know if there are certain kids who maybe just require that. At least to get them to the point that they can perform, because ... Even though I'm shooting for understanding, overall life improvement, somebody else is looking for can they perform on these test, so I think they're being done a disservice if they're not given access to these skills they need just to perform on these tests. (Sydney Interview April 30, 2003)

Tests, thus, impose a constant pressure for which students are answerable to their students, their conscience, and also possibly the administration. Although they would rather be able to focus on students' understanding, the pressure of time and evidence of test results pushes them to use more traditional instructional methods.

Value of Standardized Tests

Nonetheless, in spite of the negative views they have about standardized tests, they are not all bad. Although some constructivists deny the validity of any standardized measures, these teachers feel that such tests can provide valuable assessment information about student learning, even while their instructional emphasis is on understanding rather than rote performance. Sydney describes this perspective: "We see constructivists as saying, don't worry about that test because that's not important for kids' learning, but I don't feel that's responsible. So I feel like we have to find a way to mesh the two, and I

think we'll get better at that as we go" (Sydney Interview May 7, 2003). Sydney believes that her students are capable of performing on tests: "I think they CAN be successful" (Sydney Interview April 30, 2003) and "I think the kids can still be successful on it and I can feel good about my teaching, but I haven't found the exact balance that I feel good about" (Sydney Interview May 7, 2003). She also says, in reference to their test performance, "I feel 100% certain that if they had what they needed from me, they would be successful, all of them would be successful" (Sydney Interview May 28, 2003). Within the school, the administration also believes that the methods used by these teachers and those with similar methods in the school are responsible for their better test performance, and so is insisting that all teachers use some of their methods (Sasha Coffee Shop January 11, 2003). Sydney refers to standardized tests as a way of checking that her students are advancing in reading. She believes these will help reinforce her own perception of where the students are. Standardized tests may be one way to provide benchmarks for student progress (Sydney E-Journal January 23, 2003). In addition, preparation for tests need not promote rote learning. Eisah's comments about how they prepared for one math test show that you can prepare so as to promote understanding:

The students took two MOCK Meka tests this week. The first was a total assessment of basic skills from the nine weeks. The kids took this test using some games that Sasha developed. They did very well and I heard a lot of discussion and debates regarding math process. It is amazing how far along my students have come in being independent, self regulated learners. They have developed such a sense of personal ownership over their math understanding and over other students understanding. They want to explain their thinking to others ... without

the continuous prompting from me as in the beginning of the year. (Eisah E-Journal March 31, 2003)

Similarly, Sasha uses a variety of review procedures for tests that promote understanding, such as focusing on reading analysis skills, generating one's own answer to a question drawing on what one knows, and applying synonyms and antonyms to the text they will read (All Observation March 7, 2003).

Finally, both Sasha and Sydney cite external tests as motivations for students working together and taking ownership of each other's learning, acknowledging their positive impact on student learning (Sasha Interview April 30, 2003; Sydney Interview April 30, 2003). Eisah notes how her students have shown heightened motivation in response to the pressure:

So there's lots of pressure, some kids are feeling it, some kids are really doing a lot about it. Like they're getting these races up there, which are like these flashcard things, they're studying every night, and they're coming to me and telling me this without me prompting them to do it. So some kids are really jumping up to the challenge. Other kids are like, man. (Eisah Interview May 28, 2003)

She has "seen sort of a team thing going on" (Eisah Interview May 28, 2003) where students look for ways to help those who are struggling to learn. She also sees that in addition to enhanced one on one relationships between students, "when we prepare for tests is when I really see them taking class ownership 'cause the focus is that our class has to do well" (Eisah Interview May 28, 2003). Tests thus can forge stronger class bonds as the students work together to help the entire class succeed. Eisah supports this

idea by saying things like, “we have a reputation to keep up, kids. We’re superstars in this school, if you haven’t noticed” (Eisah Interview May 28, 2003). Relatedly, Sydney notes that

... last year when we got to the third quarter, and our class had really low scores, and we decided we really need to do something, we need to figure out who knows what and who doesn’t. That’s really how the whole feedback thing started. They really took ownership for each other and they would just come and look and see who needs help, and they would go help that person (Sydney Interview April 30, 2003)

Standardized tests thus pose a wide range of challenges as well as opportunities for student and teacher learning. While they can create pressure for direct instruction teaching methods, they also stimulate efforts to show how constructivist teaching methods can help students perform on wide-ranging assessments.

Constructivism

Attitudes Towards Constructivism

Constructivism is the theory that inspires most of these teachers’ work. Their references to Vygotsky and Piaget, zones of proximal development, social knowledge and disequilibrium, and student construction of knowledge all show the principles they apply in their teaching. In university they learned about the theory of constructivism, but for all of them, constructivism matched their previous views about learning and was easy to adopt. They identify with it readily as an appropriate goal, referring casually to being “knowledge-based constructivist teacher[s]” (Sasha from Focus Group June 11, 2003).

Sydney also describes constructivism as the goal for her teaching: “not radical constructivism, but yeah, within the parameters that we have, I think that is the best way to teach” (Sydney Interview May 7, 2003). They believe in it, and as a result, their descriptions of it often are conflated with concepts of effective teaching.

Constructivism is contrasted frequently with direct instruction as a denigrated instructional model. The rationale for their preference of constructivism is illuminated by Sasha’s comparison of the different educational goals of the two methods:

A second question, is there a better way, it depends on what your end goal is. If your goal is to foster kids who are self-regulated learners and aren’t dependent on an outside person to impart information onto them solely as a way of learning, then direct instruction is not the best way of learning. But if you want to create kids that don’t question authority and don’t question anything, but that are really good at following instructions and really good at soaking up information from an outside, one sided source, then you’re doing a great job with direct instruction.

(Sasha Phone Call May 16, 2003)

Since for these teachers philosophy informs instructional practices, it follows that those practices have concrete effects on the students. The teachers have particular desired outcomes for their students – for them to become “self-regulated learners” who “aren’t dependent on an outside person to impart information onto them solely as a way of learning” – and in their view, these goals are best achieved through constructivism.

Components and Benefits of Constructivism

So what is constructivism to these teachers that it can accomplish such lofty goals and inspire such loyalty? Constructivism is a diverse concept, covering the spectrum

from radical through cognitive to social. Sasha describes some of the different forms of constructivism:

... some people think everything needs to be constructed by complete exploration, some people believe that taking an initial idea and scaffolding that into something more is constructivism; others believe it's just kids constructing new knowledge no matter how they do it, rather than teachers telling them new knowledge and not connecting it to anything they know. (Sasha Phone Call May 16, 2003)

Rather than being extremists, these teachers embrace a pragmatic commitment to constructivism. They acknowledge the theoretical appeal of radical constructivism, but also recognize DeVries' distinction that constructivism is a theory of learning, not teaching. As a result, they feel freed to explore a wide variety of instructional methods and are not bound by unidimensional conceptions of what being a constructivist teacher means. For example, Sasha and Eisah dialogue on the possible interactions between constructivism and direct instruction (Newsome Park Research March 7, 2003) without feeling that they are betraying their philosophical allegiance. Another example comes from the "Teachers as Readers" group that meets outside school. Discussing the relationship between the four stages of learning described by Routman (2003) (from demonstration to shared demonstration to facilitated practice to independence) and constructivism, some teachers said that that no students learn things fully on their own and that all learning involved those four stages (Newsome Park Field Notes January 24, 2003). This is a radical statement from a group of self-proclaimed constructivists which shows their intellectual flexibility and willingness to explore multiple concepts in search of a working definition of constructivist teaching. The three teachers explore all of these

variants of constructivism and use them to provide inspiration for their teaching. The nuances of various approaches are explored by them in detail through their reflections and engagement in a variety of experimental practices.

Sasha says constructivism is “having a conversation and trying to construct new knowledge together.” In such a conversation, students

... would raise their hands and try and contribute what they knew, and other kids would dispute it or whatever, and they were all trying to figure it out and contributing what they knew. And they didn’t even think twice about asking me to explain it. (Sasha Interview April 30, 2003)

She also says that

... the basis of constructivism is to let kids represent things in ways that make sense of what they are doing. Kamii says that you just have them do certain activities until they get it. You’re not doing your job as a teacher if you’re just waiting for a kid to get it ... [need to keep] asking questions that would challenge their conception. ... “so according to you, this would be true,” then they say no, but ... so you keep on challenging them to examine their conceptions. (Sasha Phone Call May 16, 2003)

For Sasha, constructivism is a child-centered philosophy where students externalize their thinking. The teacher is the facilitator of this process, pushing them with questions to allow them to address inconsistencies in their thinking.

Constructivism is also something that is intrinsically satisfying to the participants.

Sasha talks again about their interaction in the classroom:

I think that is ... that's the thing, it's something great about being able to struggle and be at a disequilibrium. Kids really want to be able to figure that kind of stuff out. ... We were all sitting there and we were all waiting to come to a conclusion. Maybe that has to be the basis of the philosophy. If they think that you're just going to tell them how it works and how to do it, why try and think, why waste your time and energy if you know the teacher is going to tell you how to do it.

(Sasha Interview April 30, 2003)

Here she identifies some components of constructivism. The students were trying to “construct new knowledge together” and did this through using their own thinking processes and through peer interaction. They are motivated by their intellectual disequilibrium and by knowing that the teacher would not tell them the answer; if they wanted to know, they had to figure it out for themselves.

Sydney offers her own evaluation of what constructivist teaching is when asked how “constructivist” she felt a particular lesson was:

I think it's pretty constructivist for me, it's in my comfort zone, because I'm really going for understanding and I'm trying to have the kids reach that point by themselves with just a little bit facilitation from me, and that's what I consider constructivist. It's not going to get them to go home tonight and do these problems in the book and do it perfectly in this standard form, but hopefully if we spend some time getting this understanding they'll be able to do those things next.

So I consider that pretty constructivist. (Sydney Interview May 7, 2003)

Sydney here describes constructivism as focused on understanding as the goal of instruction, achieved through student independent thought facilitated where necessary by

the teacher. This process produces the understanding that can be expressed subsequently in “standard form,” taking the students from understanding to social knowledge.

Eisah has her own perspective on what comprises constructivism that shares much with Sydney’s and Sasha’s definitions:

People have a view of constructivism that they’re giving kids and letting them explore it and develop learning completely on their own. And we know that’s not how you do it. You pull learning from lots of different resources, we wouldn’t evolve anywhere if you totally relied on yourself. I think people view constructivism as kids really totally in charge of their own learning, you just make this environment that facilitates learning. And that’s part of constructivism, you do include that, but you need to further push and guide and prompt and question and go from there, but I do think that’s some people’s view on it. (Focus Group May 14, 2003)

For Eisah, then, her type of constructivism involves an active teacher who will “push and guide and prompt and question” in a social environment where learning comes from interacting with others. Learning does not develop in a vacuum, even though it does need to be constructed individually.

Challenge of Being a Constructivist Teacher: Hard Preparation and Spontaneity

From these descriptions it is clear that radical constructivism, where students are left entirely on their own to construct knowledge, is eschewed by the teachers. Sasha describes their more balanced view on knowledge construction:

I think that even in an ideal world, where kids construct all their knowledge without support, that’s not ideal. Kids construct new knowledge based on prior

knowledge through experiences. That leaves so much room for different modes of instruction. So many it's incredible. Which really lends itself to all different types of learners, individualized instruction, peer teaching, peer coaching, whereas direct instruction to me means imparting knowledge to children without any kind of connection at all. (Sasha Phone Call May 16, 2003)

Students do not learn in a vacuum; teachers play a definite role in the learning process. This is emphasized in Sydney's description of Stephen Levy's approach to constructivism:

... one of the authors who we've read ... Steven Levy, have you read *Starting from Scratch*? And for me that's a perfect example of starting from square one and kids construct everything. And he was saying when he came here, if he's doing the kids, or if the kids are taking something in a certain direction, he has to have spent so much time researching that subject, he has to sit down and write all the misconceptions that he might have, or that someone else might have. You know, so he might have a whole six page write-up on that topic, which I don't do, and I think ultimately, that's what you need to do, you need to know that subject inside and out to figure out what their misconceptions might be. And Sasha and I tried doing that last year to some degree, but it was just so overwhelmingly difficult we couldn't do it. (Sydney Interview May 7, 2003)

Being effective constructivist teachers is a serious responsibility for them. They give a lot of thought to what constructivism means in practice. Rather than being an easy way out, through having the students do the work, constructivism in fact implies a greater effort by the teachers in understanding what their students know and struggle with,

identifying potential misconceptions in their thinking, coming up with questions to ask to help them think through these misconceptions, and finding diverse ways to scaffold their learning to develop understanding. Eisah describes some of this work in an interview:

Kamilla: Right. How important is it, do you feel, to have that idea of where you, in addition to being open to it, have an idea of where you want to guide them to?

Eisah: I think that is a problem with people who are not good constructivist teachers, is that they start with a big question or they start with this big idea, but they're not either, (a), the expert on that yet, or they don't really have a goal in mind for the kids. I think you have to have a final result, it can change, but you have to have a point that you're headed for because your job is to guide them there. They are doing it, they are actively learning, they are finding all the resources, but I need to have a goal in mind for them to head. And that goal can change depending on the information they're finding or the connections they're making. Especially in content areas. Now with math, if I start out with the idea in my head I want them to get how to do area, that point's not going to change, they're gonna eventually going to eventually come to area, hopefully. (Focus Group May 14, 2003)

From Eisah's analysis we can see that her version of a constructivist teacher has good knowledge of the subject area, a clear learning goal, and some concrete ideas to guide exploration. Sydney reiterates her comments on the role of a teacher in preparing to help her students to learn:

I think [constructivism] is the best way to teach. But I think it takes a lot of skill to do that, and it takes a lot of ability to figure out misconceptions and to plan

more thoroughly than I do. I tend to jump in and wait and see where they're gonna go and then maybe figure out what some of their misconceptions are, but I'd rather be able to do that in advance. (Sydney Interview May 7, 2003)

She also notes:

I think with the constructivist teaching, so much has to happen up front, and then you also have to be completely spontaneous, you have to be able to go in whatever direction it goes, and I think that takes a lot of thought, a lot of reflection. (Sydney Interview May 7, 2003)

Teaching constructively requires preparation, an awareness of student thinking, and planning to meet those learning needs. To interact effectively in the social formation of knowledge, the teacher must delve into student thinking in advance and use this knowledge to intervene effectively in the learning process through comments and questions.

Social Aspect of Learning and Teacher Involvement

The importance of teachers is seen through their focus on social constructivism. This brand of constructivism is seen in the shared construction of knowledge through math talk and teacher discussions. Sasha describes her views on the social formation of knowledge, and the role a teacher plays in promoting the dialogue and interaction that lead to knowledge construction:

Kamilla: Why is the teacher important?

Sasha: I think because I believe in social constructivism, and this might be because the way I learn is through socializing and discussion, but I believe that people develop and solidify concepts through discussion, and the teacher is there

to facilitate that discussion, amongst other things. But I don't think you can replace that with a computer. I think if I were to envision a carefully manipulated environment where kids could learn. I'm envisioning my classroom without me, and I'm on a TV screen, and every morning they're presented with a problem and told they have two hours to solve it. Why do they need a teacher in the room? Because where is a conclusion. Even if everybody were able to come to a conclusion, who would sit everyone down and say, let's learn from what everyone discovered. (Sasha Phone Call May 16, 2003)

Teachers have a clear role in constant monitoring of student thinking and learning, where they will use this knowledge to intervene to promote student learning through facilitating discussion and questioning.

Eisah talks further about the actual learning process and the role the teacher plays while they are exploring ideas:

Eisah: Oh, you mean multiplying length times width? How they get there is okay, 'cause my fifth graders last year started out by actually cutting out squares of a foot by a foot, and measuring that square by square, and that was fine, but eventually they do make the connection with the multiplication chart, and how to do 2×2 is 4, and they were using that. ... But you do always have a final, I think you do. But it can change, and the way you get there can be a hundred different ways. I don't usually have an idea in my mind of how they're gonna to get there. Sometimes, I guess. Like I come up with, for area, if they weren't gonna to get the formula, if they weren't going to get length times width, how can I get them there? And I did come up with, that I could draw, I could try to ask them, how

many blocks are here, open-ended questions, that's where the scaffolding comes in.

Kamilla: So definitely with a goal in mind, some openness about process but if you think it's going to be challenging, then maybe some ideas about intermediate steps that might get them there?

Eisah: Or just things I can bring in to further prompt them. And that's part of the guiding part of it. (Focus Group May 14, 2003)

Through Eisah's description we can see that teachers intervene in a variety of ways: by establishing instructional goals, flexibly guiding students, and preparing alternate scaffolding questions and activities based on multiple possible misconceptions to lead them towards the learning goal.

The Challenging Appeal of Constructivism

Constructivism appeals to them for many reasons. Eisah says that "other [theorists] just didn't make as much sense to me" (Eisah Interview May 28, 2003) as Piaget and Vygotsky when she was studying in college. The intuitive logic of constructivist principles is important to all of them. As well, the challenge and frontier nature of constructivism also were appealing to Eisah: "Teaching in a constructivist way is much more challenging so I bought into that, I always think that the harder way is the better way and things like that. So all those things are what made me buy into it. It was different influences. But that's the way it was presented, in a cutting edge kind of way" (Eisah Interview May 28, 2003). Eisah was drawn to this challenge.

The challenge of being a good constructivist teacher is emphasized by Sasha, who considers the difficulties of sifting through diverse strategies to produce a coherent instructional approach to promote student learning:

It's harder to be a constructivist teacher [than a direct instruction teacher] because even though I claim to be one, I always ask myself am I being as constructivist as I can be, and it's hard to define in each moment am I being constructivist.

Whereas in comparison with direct instruction what that is. If you're telling kids what to do, it's way easier to define what that is so it's probably easier to implement. (Sasha Phone Call May 16, 2003)

Sasha also describes the challenge of being an effective constructivist teacher given the subtlety of difference to radically different methods:

Routman explains the fine line, and it comes down to, it's a really fine line. She outlines a lesson, and one version is more bringing the information from the children and less giving the information, and vice versa. It's so funny because it was the same lesson but delivered differently. How fine is that? That's what drives teachers like me crazy because it's such a fine line, but you can see what a difference it makes ... As a constructivist teacher you're often asking yourself, is this too directive? I had a panic attack, if I'm introducing social knowledge in the beginning is this direct instruction? (Sasha Phone Call May 16, 2003)

Teaching as a constructivist is a constant balancing act, incorporating diverse strategies, many of which have not yet been fully developed, some of which may not, with time, come to be useful, and some where it is not clear if they actually meet the goals of constructivist teaching.

Special Education

Attitudes Towards Special Education Students

The three teachers do not have extensive experience with special education students but they have some. Eisah worked with emotionally disturbed children for her student teaching, and each of them has had one or more special education students in their classrooms at various times. As well, there are special education students in the school but they have limited contact with them (Sydney Interview May 28, 2003). Their attitudes towards all their students are based on recognizing their inherent value and individuality rather than classifying them as members of any group. Their recognition of the individual potential of all their students is seen through this dialogue with Sasha about Frank, a new student in her classroom who is classified as special education:

Sasha: ... he's a genius, but in the beginning he told me that he's stupid in math, he told me that he's dumb, and that he's not a quick learner.

Kamilla: Who told him that?

Sasha: I don't think anybody told him that, in those words, but he was shown that for some reason. And the sad thing is, this kid is a genius, he's autistic, he has Aspergers, and kids who have Aspergers normally have a very high IQ and he does, which means, if you have a high IQ you usually have a high cognitive ability. So I think he came into my class already having a natural high cognitive ability. It's just amazing to me that he's already taken it to, not only is he doing it but he's articulating it, and it's just incredible. (Sasha Interview April 30, 2003)

Here we can see Sasha focusing on Frank's capacity rather than his challenges. We see her enthusiasm for what he can do, rather than frustration over what he finds difficult. Finally, we can see her emphasis on his individuality, the unique thinking and doing that make him who he is, rather than a generic description of him as "special ed."

All these attitudes exemplify the approach taken by the teachers towards all of their students, regardless of ability or disability. Such an attitude puts students with special learning needs within the spectrum of their classroom, rather than isolating them as a strange category of students about whom they know nothing and for whom they can do nothing. Special education students are people with needs that resemble those of other students. They may require additional assistance, but the differences in their needs, relative to other students, are primarily quantitative rather than qualitative: more repetition, more one on one attention. Eisah describes her vision for classroom instruction to meet special needs:

Eisah: There has to be differentiated instruction, absolutely, there has to be flexible grouping, there has to be constant assessment and this is where you need to go from here. You have to know where all kids are at all times. If they're all on different levels, you have to. And really giving them the self-regulated learning and understanding that this is what you need to do next, what are you gonna, this is where you're at, what are you gonna do next, regardless of where they are. Because even if you have a class where it's not a wide range of levels, you still have kids at unique levels and places and understandings, so all of those things so ... you have to use differentiated instruction.

Kamilla: Does special ed then fit just on a continuum of differentiated abilities?

Eisah: Mm hmm. (Eisah Interview May 28, 2003)

In this description we can see that special education fits on a continuum of student needs. Special education students are students too. In Eisah's view, teachers can best meet their needs by applying effectively the same strategies used to reach all students: be aware of their unique needs, differentiate instruction to meet those needs, and as much as possible, put the students in charge of their own learning. By reaching out to the exceptional students, a teacher will better meet the needs of all students.

Inclusion as the Norm with Challenges

Closely connected with their belief that special education students are students like all others is their focus on inclusion. While rarely mentioning inclusion specifically, the teachers have a basic expectation that they can and should meet the needs of the majority of their students within their classroom. This comes through repeatedly in discussions with all three teachers; for example, Eisah says:

I don't know if they should be included for all classes, I think it really needs to be appropriate. But I do think that inclusion always needs to be an option for every child who's special ed, but it needs to be looked at on an individual case. (Eisah Interview May 28, 2003)

Sydney similarly comments, "my teaching philosophy would dictate that those kids should be able to operate in the classroom just like anyone else could for the most part" (Sydney Interview May 28, 2003). The focus on inclusion reflects a number of beliefs: that students have inherent worth and deserve to be with their peers; that all students are different in various ways; that special education students are the same types of people as other students; and that a teacher's responsibility is to differentiate to meet the needs of

all students. At the same time, because special education students require additional support and sometimes different instructional methods, meeting all those needs in a busy classroom can be difficult. These two positions – the idea of inclusion as the norm, and of its challenges – are inseparable when the teachers talk about special education. Parts from a dialogue with Sydney illustrate their close connection. She starts out by talking about how she feels these students need some extra attention they are not receiving in her classroom, although she is loathe to have them placed in a separated special education classroom:

Kamilla: How do you feel about working with kids who have been identified [as special ed] in the classroom?

Sydney: That's a good question. I'm not sure if it's because of the way things operate here, I don't really feel they need to be in a different classroom environment for the entire day. But I also feel like, to a large degree, those two [who have learning disabilities] are part of my core group of five. They need something more individualized that they're not getting from me and I think they could be equally successful if they had that. I think they've shown that. When I work one on one with them after school and during the day, they can get it and they do learn. It might take longer, or it might take them a different way and they'll get that. So I have mixed feelings about it because I really would not want to see them cooped in a classroom with two other kids all day every day. Yet I feel they need something else that they're not necessarily getting here. (Sydney Interview May 28, 2003)

Sydney's sense of responsibility for their learning drives her to consider how they would learn best. While she feels they may need more individualized attention than she can provide, she also feels that the closed environment of a special education classroom might be worse for their learning.

In spite of her misgivings over her ability to provide that needed support, however, she is in favor of inclusion:

Kamilla: And so, philosophically, the concept of inclusion, how do you feel about that?

Sydney: It's hard to say, only because I don't have experience with kids with other issues. These kids in particular, I just would think 100% they should be in the general ed classroom. And I guess that would probably be true for all kids, if all kids really learn best by being able to make some choices and have someone facilitate for them, then I would think all kids would benefit from that but I think special educators tend to disagree with that and I don't know if I have enough expertise to make that decision. (Sydney Interview May 28, 2003)

In spite of her misgivings, Sydney comes down squarely on the side of meeting all students' needs in a regular classroom. She feels they provide the type of motivational learning environment that is of benefit to all students. Even in situations where children have severe learning needs, Sydney still feels that every effort should be made to meet those needs within a regular classroom:

Sydney: So I guess in that sense I probably would still refer kids if I had that intuitive sense that there may be something else here. And in her case, that came

out to be the case, I mean that sort of validated that that was. But I would never have advocated for her to be taken out of the classroom.

Kamilla: Would you then just want to see, you'd refer so that special needs would be identified [Sydney: Right.], but you'd still in general maybe want to see those needs met in the classroom?

Sydney: Oh definitely, I think it's to her advantage to have even a 504 plan where somebody with some expertise would say, this is a requirement for her, she always needs to have her tests read to her, it's not an option, but I didn't feel qualified to, on some level I did feel qualified, but I just felt like there needed to be some higher power that said, yes, she does need this in place. Here it's not, I don't think it's as important because we don't really need 504 plans if teachers are doing what they're supposed to do here. You should already be adjusting for what those kids need. (Sydney Interview May 28, 2003)

We can see Sydney's emphasis on inclusion in her statement that a student with special needs should "definitely" have those needs met in a regular classroom setting. She feels it is the responsibility of teachers to adjust to student needs, whatever those may be, and special education needs are just one of many types of student challenges. While she feels a lack of expertise about special education, she still feels that teachers "should already be adjusting for what those kids need," whether or not those needs have been identified by an external professional.

Exceptions to Inclusion

One exception to the norm of inclusion is provided by Eisah. Based on her experiences with emotionally disturbed students, she feels that those with extreme

emotional difficulties need to be taught in a separate environment so as to maintain a safe learning experience for other students:

I think that inclusion is wonderful until it gets to the part where kids are emotionally disturbed, because there were so many times when so many kids were really put in an unsafe place because kids were so emotionally disturbed and hurting themselves, hurting other people. If it's not a safe place, learning cannot take place as effectively as it should. ... So really I just think that as long as they're not emotionally disturbed, inclusion is wonderful. (Eisah Interview May 28, 2003)

This is the one exception she draws to the norm of inclusion, and it is based on her own experience with the negative impact of emotional outbursts in a classroom.

How to Meet the Needs of Special Education Students in the Classroom

One unresolved issue in the discussion of special education remains for these teachers: how to meet the unique learning needs of these students. On the one hand, they believe that for all students, the meaning-building and independence-oriented constructivist teaching methods they use will be of benefit. On the other hand, they see that these are not enough, and wonder if there is something else that needs to be done to help the students learn. Sydney illustrates some of the thinking they go through in her comments about direct instruction:

Well, again, I'm torn about it because I don't come to it thinking that that's the best way kids learn. I would rather them be able to understand what they're doing. Because I think that with direct instruction, a lot of times you're just throwing facts out at them, but they have no concept of that, so later when they

have to actually apply those skills they're not going to be able to do it. But then again, I ... sometimes I wonder if it's more of a special education issue, they tend to do a lot more direct instruction and I don't know if there are certain kids who maybe just require that. At least to get them to the point that they can perform, because ... Even though I'm shooting for understanding, overall life improvement, somebody else is looking for can they perform on these tests, so I think they're being done a disservice if they're not given access to these skills they need just to perform on these tests. (Sydney Interview April 30, 2003)

Philosophically, Sydney does not believe that direct instruction works, either for short term learning or for "overall life improvement." However, she feels she lacks sufficient understanding of the needs of some of her lower performing students and special education students to say that direct instruction is not what they need. This debate is central to the conflict they feel about direct instruction.

Negative Aspects of Separate Special Education

As a balance to the challenges they see with inclusion, these teachers note a number of negative aspects of separated special education instruction, in both separate classrooms and pull-out programs. Segregation of special education students is looked at negatively by the teachers. One disadvantage they note is the rigid structure and lack of creativity they feel such classrooms cultivate:

Kamilla: So what's the major disadvantage you feel they would experience if they were [Sydney: In the other classroom?] Yeah.

Sydney: Well, I'm just saying this from a vantage point, I don't really know 100% but just from what I've seen of it, it's a very rigid, structured environment,

they don't have a lot of opportunity to think through things critically and to move about and have freedom of choices. And that may not be the case but that's really what I've seen, and they benefit so much, I mean, they are able to think, they are able to be creative and make choices. They don't need to be sitting at a desk all day long and told, this is what you do from eight to nine, this is what you do from nine to ten. So I would really, I think they would lose a lot in that environment, and they may actually then be disadvantaged even further. (Sydney Interview May 28, 2003)

Here Sydney describes what she feels is a preferred instructional environment: one with movement, freedom to make choices for oneself, and primarily to "think critically" and independently. She feels these are important for all students, not just mainstream students, and so placing a child in a classroom with a "rigid, structured environment" may slow down his or her development so she will be "disadvantaged even further." Inclusion, therefore, rather than impinging on the effectiveness of special education interventions, will actually enhance student growth, provided the right educational supports are also provided.

Eisah describes another disadvantage of pull-out special education programs as relating to students' overall learning:

And then I'm thinking of kids who are just so, so low, as far as like reading. But see, there's so much research that even says like pulling kids out, pull-out programs just aren't, because there's so much time lost. They're missing something in the classroom, they are walking from place to place, there's at least,

with kids, fifteen minutes gone, and so, I just don't know how beneficial they are.

(Eisah Interview May 28, 2003)

In addition to the programs possibly slowing their progress, the time involved in moving students around the school building slows their learning. As well, student self esteem can suffer:

Kamilla: If those [special education support programs] were delivered in the classroom, how would that work?

Eisah: Like if those same programs, like whatever, reading recovery, whatever, were brought to the classroom? By me, or by another teacher? [Kamilla: By another teacher. If you had other support, teachers.] Then it's just a matter of, oh, look, she's being pulled to the back to the room with Miss Shaker or whatever. But of course they're still leaving, though, and people know they're leaving, but they don't really know why. But then the good thing is, people leave for advanced and for low things. Art enrichment, Sams, that's all advanced, but then they leave for reading recovery, which is all low, so ...

Kamilla: So your other concern is about ...

Eisah: Is just outward self-esteem, coming from outward appearances. (Eisah Interview May 28, 2003)

Students are aware of the value given to the groups they are assigned to. Separating students can result in criticism by others or self-denigration, both of which are detrimental to student self image and learning. The implication is that programs need to address the needs of all students.

Finally, pulling out children for special education or for any program can disadvantage the classroom. When students are taken out for programs, intellectual diversity in the classroom is lost. This limits the learning potential of the students as a whole. Eisah describes her frustration that her advanced math students get pulled out for separate instruction:

I hate that they get taken out, I really wish that they would stay. Because I think that although they're being challenged extremely, they're doing only fifth grade math in the advanced class, so they're really really getting a good challenge, I really think because math builds upon itself they could get that same challenge here as long as I was always aware of what was going on in fifth grade, which I am 'cause I teach fifth grade next year. So as long as I'm always aware of that I think it's really harmful to have them out of our math class because my kids are very much on grade level or below, we don't have the extreme of the above and the below, which would really be ... it would really be helpful for a lot of reasons. ... So I think it's more harmful than good to have them out of here. (Eisah

Interview May 28, 2003)

Like pulling out special education students, pulling out advanced students is seen as both detrimental and unnecessary. Eisah feels she can meet their needs in the classroom, the same way she could meet special education needs. As well, the class as a whole benefits by having "the extreme of the above and the below which would really ... be helpful" for student learning. By the way she equates her advanced math students with special needs students, we can see again that she and the other teachers view all students as individuals who can be reached by an effective teacher.

Administration's Role in Special Education

Finally, the administration at Newsome Park plays a role in their experience with special education. Eisah describes the general atmosphere at the school in this regard:

I think that, I mean, if you talk to special ed teachers, it's completely different at Newsome Park. From my whole perspective there is a lot of inclusion. It's back and forth though, like they're in the room for math, and then they're out of the room for reading, then they're in the room ... They do push for it. I think they do very appropriate IEPs and really well created, developmentally appropriate IEPs. From their perspective, though, I don't think it's all that great. I think we're cramming down ... [Kamilla: From the perspective of the kids?] Of the teachers. They always like, I think special ed teachers always have the opinion they're getting a bum rap. (Eisah Interview May 28, 2003)

Eisah illustrates her support for the special education teachers, the focus on inclusion in the school, and the types of collaboration among special education and regular teachers at the school. All of these produce a supportive environment for inclusion.

Sydney also notes that inclusion is accepted as the philosophical approach at the school:

Sydney: I guess, my impression overall is that it's always been accepted that they don't need to have many kids separated from the general population, that most kids should be able to be successful in a regular classroom, and we don't really have a lot of special ed children who are confined to those particular rooms. And I don't know how many actually go for services and that sort of thing, but I really feel comfortable with the philosophy here as I see it. It makes sense to me.

Kamilla: Do you think you came here with that philosophy?

Sydney: Mm hmm. Yeah, I think it just fit with what I already thought. (Sydney Interview May 28, 2003)

Although there are some special education students who are taught separately, the expectation is that the majority of the students should be able to have their needs met within a regular classroom. While Sydney wonders if inclusion would be possible with students with severe disabilities, she also feels that the particular style of education at Newsome Park conduces to effective inclusion of diverse learning needs:

I'm saying all this from a naive vantage point because this is my only real experience. I've witnessed other classrooms where there were inclusion situations and there were kids with obviously much more severe impairments. And I know that the teachers were unhappy about it, it was a distraction to all the other kids. So I'm speaking without ever having had that experience, and I'm sure there would be cases where I would not be equipped to handle a certain situation. But again, I don't know, that was a very traditional school system so they were expecting the kids to operate in a very rigid way and they couldn't. Yet they were keeping them in this inclusion situation so everybody was miserable. So I'm not really sure if that's really the set up of the learning and the school system, or if it's more that those kids really need something different. (Sydney Interview May 28, 2003)

Although the needs of special education students may be different than those of other students, and although separate education may be required for students with severe disabilities, Sydney recognizes that the general approach to education in the school

allows inclusion to meet the majority of students' special needs. This is coupled with a recognition that some of those needs may require specialized instructional methods.

Sydney also illustrates the norm of inclusion in the school culture by her comments about how teachers at Newsome Park already make adjustments in their teaching for student needs:

Sydney: Here it's not, I don't think it's as important because we don't really need 504 plans if teachers are doing what they're supposed to do here. You should already be adjusting for what those kids need. ... But in other environments I think it would be necessary to have a 504 plan in place to make sure the teacher makes those accommodations. (Sydney Interview May 28, 2003)

Most of Newsome Park's teachers, from her perspective, already use appropriate instructional strategies that allow inclusion to be the norm.

However, in spite of the support of the administration for inclusion, it still requires extra work by teachers. When asked what type of support she would get from the school if she tried to do inclusion, Eisah identified that it would still be a lot of work for her and the other teachers involved:

Eisah: Yeah. It would be in my hands. Unless, you mean as far as them being pulled out and like going to someone else? From my perspective, I think that I don't know ... 'cause you're basically sharing a student at that point. You don't know what the other teacher's covering, you're not working that closely with them. It would have to be very close, in order for it to be successful, I'd have to be working very closely with that special ed teacher. We would have to have a very good relationship, I'd have to know what's going on in their room, what's

going on in my room and then it would be successful for the child. ... Yeah. I think it needs to be a close relationship for it to work at all. Full inclusion, it's all up to you.

Kamilla: Do you think it would be the same at a different school?

Eisah: It's all up to you as far as then, fourth grade, but see, then, in fifth grade there is still reading recovery going on... and things like Tattoo, which is a once a week math tutoring. I would sign kids up for any of those open resources.

Kamilla: Right. But you would still have responsibility in the classroom of doing that differentiation for all of the needs [Eisah: Right]. (Eisah Interview May 28, 2003)

Eisah illustrates the increased work of inclusion. If you are doing it without support, you have a lot of extra work ("full inclusion, it's all up to you"). If you are working with other teachers, it also requires work to coordinate and support the development of that child. Inclusion is a challenging instructional approach.

Summary of Construct 3: Philosophy of Education

These teachers believe that our mental constructs are the driving force for action. For them, philosophy is thus the foundation of education, and choosing and implementing one's philosophy of education, vital to becoming an effective teacher. They view direct instruction with skepticism since it focuses on filling students with knowledge rather than allowing their own understandings to emerge and be forged. Constructivism is more closely aligned with their beliefs although they still work to determine what a constructivist model of teaching would look like. The education of students with special

needs is understood as part of the continuum of teacher responsibility for meeting diverse needs in the classroom. In all their reflections on philosophy they link their idealistic adherence to philosophy, concern over authentic student learning, and their real experiences in the classroom.

Construct 4: Beliefs About Students

Students are the major focus of these teachers' professional activities. Rather than thinking about their teaching evaluations or their image relative to colleagues and the administration, their energy goes into evaluating their students' development and thinking of ways to help them learn more effectively and quickly. Their reflections fall into three main areas: analyzing their students' thought processes; strong beliefs about the ability of their students to learn across ability level; and creating effective group dynamics within the classroom through group work and through attitudes towards student collaboration and the classroom environment.

How Students Think

Attention to Student Thought

The three teachers value their students' thought processes. They see part of their job as teachers as understanding what students think and believe, misconceptions they may have about upcoming topics, their processes of mental analysis, and their cognitive development. They actively analyze their students' thinking although, as Sydney says modestly, "I'm not sure I understand the entire workings of their mind" (Sydney

Interview May 28, 2003). Within the classroom, as Sasha says, “I think we’ve always encouraged conversation about our thinking” (Sasha Interview April 30, 2003) as a valuable aspect of learning.

They pay close attention to their students’ thinking and subsequent learning needs, as emphasized by Sasha:

I think that sometimes it’s purposeful and sometimes we think about what we need to focus on as far as teaching strategies. But a lot of time it is incorporated at the moment ‘cause we know where the kids are and who needs what. And also it’s very individualized, I think. (Focus Group May 14, 2003)

Her comments illustrate the focus, depth of understanding, and responsiveness the teachers display. They are aware of the importance of knowing how their students think so they can prepare in advance how they will teach. They incorporate teaching strategies to enhance student thinking, sometimes “purposeful[ly].” As well, they have a deep knowledge of the individual thinking processes of each child, allowing them to apply strategies “at the moment” based on students’ perceived needs.

Eisah pays close attention to the mental characteristics of her students. When asked about the characteristics of her strong students she said,

Eisah: They make connections, really, they make connections more easily.

[Kamilla: The ones who are more advanced?] Advanced. They make connections more easily, they come up with those tricks, but I think that’s just because I have such a focus on those tricks, like, and able to remember things, able to compartmentalize things, really, sort information, make connections with information. They’re also usually more verbal ... I take that back, they’re not

more verbal. ... so making connections more easily and being able to compartmentalize information.

Kamilla: So the way they put information into their brains.

Eisah: Yeah, they sort it. 'cause they really do sort it, and that's how they make those connections, because they're making connections between sorts and within sorts they organize it. (Eisah Interview May 28, 2003)

The main characteristics she notes are cognitive and metacognitive processes: making connections between different topics and techniques, and being able to store information effectively and in an organized way in their brains. It is clear she has thought about these characteristics, and places an emphasis on how they think over how they act, their personalities, or the amount of "facts" they know.

Value Placed on Student Thinking: Reciprocal Excitement

Beyond simply noticing their students' thinking, the teachers are impressed by their thought processes. They learn from them and get excited listening to their thinking. Sydney describes one reaction she had as they talked through one math talk problem:

I was so totally amazed, I'm always amazed to hear the things that they say, when they get to do the talking it's just totally amazing. I was purposely telling myself, don't talk, you know, just let them say something. (Sydney Interview May 7, 2003)

This level of respect for their thought processes encourages her to help her students explore their own thinking. As Sasha says, "I wish I could be a kid in this classroom because I figure there's probably so much underground stuff because I bet there's all these more brilliant things than what I see" (Sasha Interview April 30, 2003). She made a

similar comment when reviewing her students' discussion of a math talk problem on probability: "And the fact that almost all of them were able to say, yeah, it definitely was not an educated guess, it was just basically that I wanted to win. Which really blew me away" (Sasha Interview May 12, 2003). The ability of students this young to verbalize the difference between their instinctual desire to win and the rationality of probability in guessing impresses her. Sydney comments as well, "I was amazed by the thought processes of each of the students who were trying to 'solve the puzzle' of decimals yesterday" (Sydney E-Journal May 8, 2003). Reflections on the minds of their students inspires the teachers.

In return, their excitement inspires students to value their thinking as well. In Sasha's classroom, her students have internalized the importance of thinking to the point that they prompt each other to use their minds:

I remember at one point we were adding and subtracting fractions, and Terry was struggling. And Kristen said, "Terry, the answer is whatever," and Terry goes "Oh!" And Daniel goes, "No, it's not 'Oh,' Terry, you don't get it! Kristen, you have to explain why." And it was so neat. It wasn't neat because Daniel really pretty much flipped out on Kristen, he kind of stood up and screamed at her, but I think it's 'cause he was frustrated because he feels like, as a team, we're way beyond "Oh, that's the answer," and you always have to explain why. He said, "It's never okay just to give the answer, you have to explain why." How amazing that he's passionate about explaining his thinking, while most kids are getting passionate about, they want Kool-aid for lunch. (Sasha Interview April 30, 2003)

From this example we can see the excitement generated in the students by an emphasis on thinking. Through their experiences in Sasha's classroom, the students have learned to value the use of their own minds, and feel the need to understand what they are doing rather than simply perform tasks.

The teachers rely on the creativity of their students' thinking to move the class forward. Eisah emphasizes that it is student thinking and responses that drive her classes:

Kamilla: How much do you guys just hope and pray and trust that some bright kid in your class is going to make the connection [laughter] when you come to do the math talk?

Eisah: I rely on it. You rely on it! Because otherwise, you need some kid to make that connection. But, not only you rely on it, though, but you plan for it.

That if I say it in this way, that David's going to pick this up, because I saw him yesterday. (Focus Group June 10, 2003)

At the same time that she expects students to be able to figure out new ideas, she is willing to plan ways to help elicit inspiration if the students do not make the connections on their own. She knows they have the ability to figure out connections to new topics if given the right support, and she is aware enough of their thinking processes to know what the right support is for each child.

Activating Student Thinking as Key to Learning

For the teachers, knowing how students think is vital to helping students learn. They believe that activating their thinking is the key to improving student understanding and performance, rather than providing them with information to help them solve problems. Sasha encourages them to use their own thinking as they discuss a math talk

problem about turning decimals to fractions, using questions. She says to the class, “if you have an ‘aha’ moment, go ahead and do it,” thus placing student thought and insight as the center of their work rather than insisting that they wait until the teacher finishes her explanation before beginning their independent thinking processes (All Observation Notes April 28, 2003). Eisah emphasizes the importance of students taking over thinking strategies and making them their own. When asked how she viewed their relationship to some of the cognitive strategies they use in the classroom, she replied:

Eisah: I think complete ownership. I just have to make them own it. Like Bella, it’s completely, whenever I say they adopt what I’m doing, it really is theirs now, and that’s what I need to get them to do. And I can say, out of this situation, you will see this outside of this situation, you need to use those, but, until it becomes naturally adopted by them and owned by them it won’t be.

Kamilla: And do you think saying that type of thing, you know, you’ll see this in this situation....

Eisah: It will help that, I think. They would really see it’s theirs. They would really see it’s theirs, and that I’m not always there to prompt them, and that it is important. They need to see the importance of adopting it more. (Eisah Interview No Date)

Eisah emphasizes the personalization of learning: that students need to see strategies as part of who they are rather than simply as part of what the teacher expects from them. Through making a strategy theirs they will be able to use it more effectively, without “prompting” by the teacher. Similarly, in responding to my inquiry about how she used questioning to guide students through a math talk about decimals, Sydney said that:

... there was some point, I think, when I actually stopped it and said, okay, how can I put this question so that I can get you thinking in this ... at some point I think I said, I'm just going to tell you this one point. But they're not going to remember that point that I told them, that's the thing. I don't think that will mean anything to them tomorrow. ... The only thing that will mean something to them is what they figured out. The fact that I said it converts to a fraction with ten or a hundred, I don't think they're going to remember that. (Sydney Interview May 7, 2003)

Sydney draws attention to the importance of students engaging their own minds to figure out solutions to their questions. She believes that this process leads to a personalization of knowledge that promotes internalization and retention. Later on, Sydney describes even more explicitly her aversion to “telling” her students things rather than letting them think through their questions:

And sometimes when you're in a hurry you do think, okay, I just need to write this all on the chart paper and they just need to copy it in their notes and that's it. I just don't believe they learn that way. I mean honestly, I sincerely don't think most of them are going to remember anything I said, they're going to remember what they said. And so I think that's how they learn, through questions, not answers. If I give them answers they might memorize, but that's not going to mean anything. So the questions are the most important part. So that's why. (Sydney Interview May 7, 2003)

Here we can see her stating that student learning is dependent on expression of their own thinking since “they're going to remember what they said,” not what the teacher said.

Only by personalizing, internalizing, and then expressing their own thinking will knowledge become theirs to keep and use in other situations. For all the teachers, student thinking is vital to learning. To promote this, teachers have a responsibility to use teaching methods like questioning to encourage student thinking processes. Thus, they consciously avoid instructional methods based on direct instruction from teachers, believing that these methods simply do not work.

Developing Cognitive and Metacognitive Strategies

At the same time that students need to think for themselves, part of their thinking needs to be the development of cognitive and metacognitive strategies that guide effective thinking. These include such processes as goal setting, careful reading and analysis of a text, identifying what they know and what the problem is asking for (“know, need, how”), and mapping out a plan for solving a problem and showing all the steps in their thinking. These strategies are gained through becoming aware of the strategies, repeated practice, and application in diverse circumstances. Eisah describes how repeatedly prompting one student with the question, “What do you need to do next?” helped her internalize those steps and apply them to become an independent learner:

Eisah: Yeah, and you’re not even saying anything specific. Her mom kept on saying, she doesn’t understand word problems, she can’t do word problems at home, then when she was in here and I was doing that prompting, what do you need to do next, she had it, so I knew that really, it’s just a trick that they need to do. So now I’ve pulled way back, Bella always used to come to my club, but she hasn’t come lately, she figured out unlike denominators on her own, but I think

she is starting to use those on her own. Either that or we're coming to things that are her strength. Either way. (Eisah Interview No Date)

Here we can see that while the teacher is leading a student towards a particular thinking process, the goal of that process is for the student to be able to think for herself and figure out new topics on her own. Through prompting her to apply the thinking process, the student was able to adopt and apply this for herself. Sydney also notes the importance of students learning to prompt themselves as a way to work through problems (Sasha Interview April 30, 2003).

Eisah further illustrates the importance of student practice of strategies in enhancing their longterm retention of those strategies when asked if she thought students would continue to use them after leaving Newsome Park:

Eisah: I don't know at all! I think if they have it for two years, I'm hoping that it does. I think that, I really think that without thinking about it, they do do it. Like, when they're looking at their important ideas, they already know what they know 'cause they read it, so they think what do I need to do. Really, whenever we meet as a group we're just mapping it out to organize it. Do I think that they're going to write "know, need, how," no I don't. But I think that they do have it in their brain, that I need to look at these important ideas and say, what do I need to do with them. And then how am I going to do that. I think that they transfer it. Because really, that's how we got it, is just by looking at them and saying what they would normally do. So they just see it better.

Kamilla: Yeah. And you feel that consciousness, that making the subconscious conscious is an important process?

Eisah: Yeah, right, yeah. [Kamilla: Thank you!] Thank God you're articulate about it! (Eisah Interview No Date)

The strategies, according to Eisah, are simply an explicit representation of normal and effective thinking processes. By making them explicit through introducing them to the students and discussing them in class, they are able to become aware of the strategies and begin to apply them. Eisah is comfortable with student personalization of the strategies; as she said, they don't need to write "know, need, how" at the top of every problem. However, they do need to apply the principles behind the strategies. And by engaging the entire class in the search for effective strategies, and consciously focusing their attention on how strategies enhance performance, they hope that the strategies will stick with the students long term and become part of their automatic mental processes. As she says,

I think they take the skills with them, but I think they make them theirs, which I want them to, but I think they make them theirs, so it's not so much attached to this context but they use them outside of it. (Eisah Interview No Date)

Misconceptions in Thinking

Through careful analysis of how their students think, the teachers all identify and focus on what they call "misconceptions" in students' understandings. One of their jobs as teachers is to identify these potential misconceptions and guide students away from them to correct conceptions. Sydney expects that as she gets more experience as a teacher, "I'll have a better sense of what the misconceptions might be" (Sydney Interview May 7, 2003). Eisah uses her current knowledge of their misconceptions to inform her teaching:

What I have learned to go into is thinking about what the misconceptions they're gonna have about to this question and then trying to make sure I guide them away from those misconceptions so I try and think of those. (Focus Group May 14, 2003)

Trying to be aware of how students think and where they will go awry in their thinking is a major responsibility, as Sasha indicates:

I think that's also why I find it easy to help my support and competent kids. I know what misconceptions they will have. But I'm still surprised at some misconceptions they have. (Sasha Coffee Shop January 11, 2003)

Attempting to clear up misconceptions is something that is ongoing through a variety of instructional strategies. Eisah uses the presentation time in math talk to allow some of this to happen:

... sometimes I'll still pick people, like if it was a really common misconception they had, then I'll put them up there, because probably a lot of kids did that and some kids will change it. (Eisah Interview April 30, 2003)

Class discussion of a misconception can allow it to be explored by a large number of students, shedding light on a problem in reasoning. Through a math talk format, "they clear up their misconceptions by listening" but also benefit by the discussion which allows them to "bounce off" ideas with each other and "which is the main part of math talk" (Eisah Interview June 5, 2003).

Helping the Struggling Core to Think: Developing Cognition and Metacognition

The teachers diagnose a break in their classrooms between those who seem able to learn and those who struggle with new concepts. Sasha says, "I notice that there's a

core group of kids, and sometimes it's everybody, but usually every day there's about five kids whose brains aren't stimulated until after lunch" (Focus Group May 14, 2003).

Sydney also talks about a similar group of students:

I have those same four or five kids, who just, I don't think, I'm not 100% sure that math talk is the way to move them to where they need to be, that's my concern, is that that alone would not be enough to get those kids where they need to be.

(Sydney Interview April 30, 2003)

In visiting other classes, Sydney similarly notices that "you have a core of students who don't get it, and a lot of kids who do" (Sydney Interview April 30, 2003). These are the students, variously referred to as poor, challenged, or support, who consistently perform poorly and whose thinking processes do not reflect the cognitive strategies that are the basis of effective analysis and problem solving.

The teachers spend more time analyzing the thinking deficits of this core group of challenged students than their more advanced ones, possibly reflecting the level of responsibility they feel to help all students perform at an acceptable level. The teachers struggle to understand how they think, and to find ways to connect with how their minds work in order to stimulate higher order thought. Even if it is hard to determine what will connect with a certain child, "it's the teacher's job to find out how you can make those connections across the board for that child" (Sydney Interview May 28, 2003).

For the ones who struggle, the main challenge seems to be in their cognitive processes. Sasha quotes one student, saying "I've talked with her about why she doesn't think about the questions I ask and she says, it's just too hard to think" (Sasha Interview

May 12, 2003). Thinking independently, let alone thinking well, is a new skill for some students. Sydney similarly describes the mental challenges of such students:

... there also are kids who are really weak in number sense altogether so they tend to just be at a total loss when they sit down to do a math task and they just, they don't even know where to begin. So I think that those are the ones who struggle the most, they don't see the relationship between that problem solving and what is necessary for that skill. (Sydney Interview April 30, 2003)

Sydney notes their lack of a cognitive grasp of material, saying,

Yeah, they don't really have what I would consider a strong ... strong cognitive base, and metacognitive. They don't really spend time thinking about their thinking, and they don't spend time, seem to spend a lot of time putting thought into, what are particular problems asking for. They don't seem to break it down in a manageable way. Whereas other kids seem to do that very naturally....
(Sydney Interview May 28, 2003)

With a limited cognitive grasp of the material, they also lack a metacognitive understanding of their own grasp of the material. Students with a higher cognitive ability

... have an automatic understanding of whether they have something or not, they know whether they can key into important things or not. Whereas the kids who really struggle with it, they don't seem to be able to assess that for themselves, they may think they've mastered it completely, and I don't know what to say to help them realize they're not, they're not really tuned into that very well. (Sydney Interview May 28, 2003)

Thus, cognition, metacognition and a sense of what they know are closely linked.

Lacking high levels of metacognition, these students struggle to orient themselves to the demands of math word problems:

... that was the other thing I was going to say, in some cases they don't know what the problem [is], they don't know what they know, and they're not catching the clues that would indicate that we know we have to add here because it's saying this. (Sydney Interview May 28, 2003)

This group of support students has difficulties picking up details from problems they read and thus, difficulty orienting themselves and monitoring their thinking.

Students with lower cognitive abilities lack sufficient knowledge to direct their own thinking processes. Although they are taught steps to think through to help them solve problems, they are unable to implement these themselves and require prompting and other support. With their limited cognitive processes, they do not understand the steps others go through to generate a solution. As a result, "some kids are still waiting for the answer to pop into their heads" (Sasha Coffee Shop January 11, 2003) without knowing about the thought processes that come before an answer. They still need assistance to think independently:

Kamilla: In your math talks, do you focus a lot on the "know what you know, what you need to know" [Sydney: Yeah.]. And so even going through that, is that something they're able to do on their own?

Sydney: No, and I think that some of the other teachers have seen that too, in that those kids still continue to need support. They still need to go to see that visually

or they need you to say that to take them through it, in which case then they may be able to solve the problem, but they tend not to go to that on their own.

Kamilla: Right, so if you were to sit with them, okay, what do we know in this problem, with prompting would they be able to identify it in general?

Sydney: Right, that was the other thing I was going to say, in some cases they don't know what the problem, they don't what they know, and they're not catching the clues that would indicate that we know we have to add here because it's saying this. But I think that comes back to number sense, they don't have a good clear sense of how numbers operate together. (Sydney Interview May 28, 2003)

Support students thus often lack a basic orientation to the problem in terms of cognitive grasp of the topic and the problem solving process. Lacking an overall understanding, they need guidance to take them through thinking processes so that they know where to begin and what steps to follow. They cannot find sufficient clues within the problem to guide their work.

Eisah similarly notes a number of the challenges her support students face. When asked to describe their characteristics she said,

Eisah: ... they don't make connections very easily. And I don't really know ... but they don't, some of them also don't make connections easily in reading either. They don't as quickly gain coping strategies, like I'm stuck.... The advanced math talk, very quickly they gain the strategies and the "know, need, how," I need to go back to what they know. And when we talk about preparing for tests, my advanced kids know, we need to go back to what we know, we need to go back to

that always. The struggling kids, it's almost like their frustration level gets so high that they don't use the coping strategies, they don't say to themselves, they're ... They're just less cognitive.

Kamilla: Less metacognitive?

Eisah: Yeah, less metacognitive, 'cause they're not cluing into what do I need to be doing right now to help me. They're just like, I'm frustrated, I don't get this.

I'm not making a connection, I don't get this. (Eisah Interview May 28, 2003)

Eisah identifies some similar cognitive issues as Sydney does. These students lack an ability to make connections among different topics, or to apply some of the cognitive strategies to help them when they are stuck. They are unable to step outside of themselves and consciously monitor and direct their thinking processes, possibly because their frustration over their inability to make any sense of the problem obliterates any reflective thinking processes.

Sasha also notices the thinking challenges facing her support students. Here she talks about her frustration over their limited ability to retain information over any period of time:

... we learned quarter after, quarter to ... we worked on this before the break, and came to an authentic understanding of the idea. They really understood it. But now that we've come back after the break, they didn't remember it. I asked them "how much is a quarter of a dollar" and they didn't get it. Even though they authentically learn something and it means so much to them, it's like ... I know that when I learn something, I soak it in and it becomes lifelong. There's some switch in my brain that turns on to active mode, and I don't know how to turn on

that switch for them. How to teach them to activate their minds? I'm tired of just saying, "put on your thinking caps." (Sasha Coffee Shop January 11, 2003)

Sasha laments that her students do not "switch on" their minds. She feels that this active engagement in learning is what is necessary for internalization and retention, and is, in fact, a precondition for memory. Without the ability to take in information in an intelligent way, information will not be perceived or absorbed, so there will be nothing to remember; unless something is understood, it cannot be remembered. This ability is related to attention, as explained by Sasha:

That's like the utmost attention control, if you not only are listening, you're processing things, you're taking it from short term memory into working memory to and then into long term memory, because you're storing it, and you're doing it in thirty seconds. That's just incredible to me. I never did that as a learner, I still don't consciously do that, and the fact that five kids were doing that the other day during math talk. (Sasha Interview April 30, 2003)

The conscious mental processes involved enable students store information effectively and use it long term. Sydney notes, as Sasha did, that an inability to attend and focus is related to difficulties in learning. Talking about math, she says that "the group that struggles the most, the things they have in common, interestingly enough, are, well, they all really have difficulty attending and focusing" (Sydney Interview May 28, 2003).

Expanding on this concept, Sydney pays attention to difficulties with attention and memory in her support students. She observes that there can be tremendous variation in whether or not students attend to what she says and remember it. She is not sure why certain things are remembered or not: "some things they remember, there's a connection

for them, and they remember it whether you say it one time or a million times” (Sydney Interview May 28, 2003). As well, some students seem better at this than others, and it also seems to vary by topic:

Sydney: And I think all of those five [poor performing] kids have very good memories for the things that make sense to them. It’s just the other stuff they need to hear over and over and over. And I don’t know why that is. I’m thinking it’s the connection too, they don’t see the connection in the things that need repeating.

Kamilla: And how to figure out what they’ll make a connection to.

Sydney: And it’s different for every child, you know? It’s not as if you can just say, they’ll always relate to something that has to do with history or people, it’s just not. With some kids it is numbers, they’re going to remember immediately.

(Sydney Interview May 28, 2003)

Whether or not they remember seems related to whether or not they make a connection with the topic, although this is something that may be difficult for a teacher to identify.

Sasha finds the same dichotomized motivation and memory ability with one of her students:

The thing is, though, I see ... I disagree [that my poorly performing student is unmotivated], because I see him very motivated about learning in a group. I see him very motivated about learning independently about certain things. Like Africa or baseball or certain things he just loves. Famous Americans. But when I’m asking him to prompt himself for higher level cognitive thinking, asking himself questions, making predictions, reading for understanding, monitoring his

thoughts, basically, he doesn't do it, he's not transferring it. (Sasha Interview April 30, 2003)

Sasha is willing to dig beyond his generally poor performance on assessments to identify his strengths and interests. Rather than limiting her analysis of his mental ability to his performance on standard measures like tests and assignments, she looks at the entire range of his thinking and notes his mental behavior in other activities. Students also differ in their long and short term memory capacities. Sydney had one student who had a "short term memory issue ... she can get it in there long term but just can't recall it short term" (Sydney Interview May 28, 2003). Memory is a multifaceted capacity and is experienced differently by each student.

Another example of student difficulties in reading and understanding problems is Sydney's analysis of some students who stayed with her to work through part of a problem because they could not figure it out on their own:

... with the couple who stayed on the carpet with me because they said that they still needed more information, they are still not likely to use any sort of questioning strategy, even though the questions are right there on the sheet, it does not occur to them automatically to look at those questions and say, this is supposed to help me figure it out. They still need a lot of direction and guidance, that's what stood out the most to me. (Sydney Interview May 15, 2003)

Lack of basic abilities to read, question, and gather answers to their questions therefore hampers their ability to think for themselves. Sydney sees meeting this deficit as one of her roles as a teacher:

I see their responsibility as being able to take the initiative to say, I don't really know this and I know I'm supposed to, so how do I get there. But I see it as my responsibility to make sure they have the tools to get there. I don't think a lot of them already have those tools and if no one gives it to them you can't just say, it's all on you, you be the person to figure it all out, that doesn't make any sense. So I think they, first they need all the tools they can possibly get from me that would allow them to take personal responsibility and to monitor for themselves. And if I haven't given that to them then there's really not much chance they're just going to get it. (Sydney Interview May 28, 2003)

From the statements above we can see Sydney's views on learning: that the ability to be an effective learner and problem solver is not an either/ or category; it is built with various mental tools that guide thinking. These tools can be acquired, which is the role of education. And those students who need the most guidance in acquiring those mental tools are the ones who have the least ability to think for themselves.

Addressing Instruction to Student Thinking

For the teachers, analysis of student thinking is not an end in itself. From their analysis comes ideas for instructional strategies. When their students let them know of their learning needs, they are appreciative of this rather than seeing it as an affront to their teaching methods. This is described here by Sydney:

So I think, I guess what I envision when I'm working with them is that, they have such a strong deficit that they need a lot of number practice and they don't get that all the time because they're being moved from one skill to the next to the next and they're forever getting lost when they just really need that basic number sense. ...

It is really heartbreaking to feel like you should be giving a child so much more, they both need one on one time with think time, manipulatives, and lots of practice with numbers. (Sydney Interview May 28, 2003)

Intensive review of math concepts using a variety games is one strategy she uses.

Another is repeating and rephrasing what students say. She also continues to emphasize developing thinking during test preparation, a time when worksheets and drill exercises are expected in traditional classrooms. She says that even when they are reviewing a wide range of material, they're "still talking about thinking through and making logical choices as opposed to focusing on the actual content" (Sydney Interview May 28, 2003). Similarly, Sasha is inspired by her students' discussions of how they store information in their brains and says,

Why are we as teachers not getting that story from kids, and if we are, why aren't we doing that with everybody, and if we are, why aren't we using those kids as an example and say, how could you start building your story. (Sasha Interview April 30, 2003)

Sasha is eager to build off of the insights and cognitive development she sees in her classroom so that authentic student thinking can be a model for other students.

Similarly, Sydney talks a lot about strategies, showing a strong attention to her students' learning and thinking processes and an awareness of where they are at in their thinking. She uses this information to devise instruction to take them to the next stage of understanding (Sydney Interview May 15, 2003). This is evident again in Sydney's comments about the decision to move to a whole group math talk again:

We discussed it this morning and said, we all need to do something with probability and this is a problem some of us have tried before and some haven't had a chance, so let's see if we can do it. (Sydney Interview May 15, 2003)

She is willing to take their suggestions for instructional approaches; for example, when "they were expressing that they really feel they need to have a quiz in the morning because it keeps them focused" (Sydney Interview May 7, 2003) she was willing to implement this, at least moderately. And importantly, she thought to ask them in the first place.

Eisah is continually impressed by her students' thinking, never more so than when they were discussing the topic of war in one social studies period:

... today we were doing a bubble map about what is worth fighting for, with our project, or what are good reasons for fighting, and I thought they would say freedom, or to save people that are being hurt, but they came up with even better ones about like to protect your family or to fight disease, fighting for land, just different things that they have seen but that I didn't really think of right away.

(Focus Group May 14, 2003)

Eisah values their ideas and works to build off of them.

Telling Strategies Versus Eliciting

One place this difference in approach is seen is in the delight the teachers express in how some of their students discovered how to do double digit multiplication on their own, coupled with the fact that they see this as a predictable and possible step for students. Sasha talks about how her students have been working towards teaching themselves how to do double digit multiplication:

Well, it's amazing how many to me how many can now, work on creating the bridge to help them understand how to double digit multiply. So many more kids than I thought, not just my blue kids, I call them, not just Daniel, Faith, Marty, Telesia, Dawn, but other kids. But like Wallace. Got it today. I think Wilbur will get it by, I'm not sure, but he'll get it. (Focus Group June 10, 2003)

Here we have a significant number of students in a classroom figuring out for themselves how to do a more advanced math technique. In another instance, Eisah notes that "double digit multiplication they totally developed on their own" (Eisah Interview May 12, 2003), showing their ability to think independently and derive new knowledge without needing to be taught traditional algorithms. Another example is offered by Eisah, who says that one student "figured out unlike denominators on her own" (Eisah Interview No Date). The attitude is also exemplified by Eisah's descriptions of her students as "mathematicians" who are capable of deriving math concepts on their own:

... double digit multiplication they totally developed on their own, like they were the mathematicians. ... And now it's not enough to say that [they are mathematicians], I have to describe them, they have long beards, you're writing on the walls.... (Eisah Interview May 12, 2003)

Similarly, Sasha says about one student, "he's my most advanced mathematician" (Focus Group June 10, 2003).

In sum, the teachers place a high emphasis on student thinking. They spend time analyzing and delighting in student thought, responding to it with appropriate instructional interventions, valuing it as the most rewarding component of student

learning, and eliciting it to promote that learning, both in the short term and for their long term autonomy.

All Students Can Learn

All Students are Capable of Learning

These teachers believe that all students are capable of learning. They are unique individuals with their own capacities, abilities and challenges. Multiple methods may be required to help them learn, but they are all capable of learning. The responsibility of a teacher is to facilitate that learning, to find the key that will allow them to grasp concepts and become autonomous thinkers. Sydney talks about this belief, shared by all three, that all students can learn if provided with the teacher support needed:

I really believe at least 99% of them could do it if I could find the key to get them there, I mean, I really believe it's something that I'm not doing that I could do. ... I just think I'm missing some thing, I'm missing something, I'm not tuned into what exactly is it that is the component that's missing for these kids. And to some degree it seems to be some thing I can't give them, because they tend to respond to individual attention, but it has to be consistent, it has to be ongoing and that just doesn't happen, but I feel certain that given the right thing they could do it.

(Sydney Interview April 30, 2003)

Sydney's emphasis on the ability of every single student is clear in her comments.

Further, Sydney and I dialogue about attitudes towards students and their abilities:

Kamilla: What's the point of education if you can't make a difference!

Sydney: If only certain people can learn! That's a whole other problem, but I would hope that most people don't have that philosophy. (Sydney Interview April 30, 2003)

All three teachers are vehement about the fact that believing in their students is natural, it is fundamental to their mission, and it is a cornerstone of their teaching philosophy.

Teachers' Responsibility to Facilitate Learning

Because of their belief in the innate ability of all their students, the teachers take responsibility for how their students learn rather than thinking it is the students' fault if they have difficulty paying attention, learning, or performing. They take responsibility for student learning rather than blaming students for poor performance (Focus Group April 2, 2003). Watching her students take a test, Sydney reflects on her beliefs that all her students are capable of learning and performing. This serves to re-emphasize the level of responsibility she has for their learning:

... every once in a while I'd see a crazy response that someone was giving. And I'd immediately take responsibility for that because I feel 100% certain that if they had what they needed from me, they would be successful, all of them would be successful. (Sydney Interview May 28, 2003)

Sydney's implicit belief in the abilities of all her students inspires her assumption of personal responsibility for their performance. If they do not perform as well as she would like, she worries about her teaching methods:

And sometimes I think they actually need more direct instruction than they get from me so I fear that they're missing out because they're not getting that. It's just a big, it's a big struggle. (Sydney Interview April 30, 2003)

She is also inspired by their progress through the efforts she makes to help them learn:

Today, I felt so validated when one of my students showed more progress in math. I have been staying after school with her each Friday for the past five or six weeks. Last week was the first time that I noticed a change in her own confidence which I believed was her biggest obstacle. She said with a gigantic smile “I’m making progress!” I could see how inspired she felt by her own success. (Sydney E-Journal January 23, 2003)

The responsibility she feels for their learning produces both guilt and euphoria as the students variously struggle and progress. Further on in this journal entry, Sydney talks extensively about how, through repeated effort and after-school practice, a couple of students are catching up with the rest of the class. She expresses her belief in their ability to learn in spite of their struggles.

The teachers put a great deal of effort into helping all their students. Sydney talks about the efforts she made with one student:

I can’t begin to calculate how many countless hours I spend trying not only to figure out how to reach her, but also how to find the time to reach her in the ways that will work for her. (Sydney E-Journal March 21, 2003)

Her devotion to the task of helping a single student learn is evident in this entry. In another journal entry about one math class on decimals she says, “I think that lesson was indicative of how much time must go into making sure that kids ‘get’ something” (Sydney E-Journal May 8, 2003). Helping all students learn requires effort in planning and execution, which are accepted as the norm for teacher action since their mission is to help all students in the classroom, not simply the ones who are easy to teach.

Working with Struggling Students

Nonetheless, in spite of their positive efforts to reach all students and their belief in their abilities, some students do not fare as well as others. Sydney talks about this in a mild form, referring to the small group of lower performing students in her class: “with math talk, I’m not sure if they’re developmentally ready to catch all of those mistakes in thinking that people make” (Sydney Interview April 30, 2003). Some students are simply not at the level they need to be to learn what is required on a particular grade level or for a particular topic, even if teaching methods may play a role in what they can learn.

Looking at a more extreme case, Sydney writes about one of her students,

My other after school student, Johanna, is continuing to flounder. I have included her name for possible retention, which I have mixed feelings about.

Unfortunately, I am not seeing the kind of progress that seems necessary for success in spite of all of the additional time and help thus far. I am continuing to search for ways to reach her. (Sydney E-Journal January 23, 2003)

Recognizing the difficulties some students have, however, is different from believing that those students cannot learn at all. Students may simply need extra assistance or something that their teachers are not able to provide, given the constraints of the classroom. Sydney is acutely aware of the limits of her influence given her multiple responsibilities as a teacher. She notes about two of her students that “they need something more individualized that they’re not getting from me and I think they could be equally successful if they had that” (Sydney Interview May 28, 2003). The goal of all teaching is to find those strategies so that all students can be “equally successful.”

Teaching Techniques to Meet the Needs of All Students

The teachers use a variety of techniques in order to meet the unique needs of their students. Sydney says, “I struggle with it because I think there’s a best way to learn. But I also realize that kids have different needs and different things” (Sydney Interview April 30, 2003), acknowledging the need for a diversity of instructional approaches. She talks in more detail about the two major types of strategies used:

They seem to respond really well to the skill-based things, and I think because it’s quick and dirty and then they get on with what they need to do. But they also for the most part respond pretty well to the math talk. I have those same four or five kids, who just, I don’t think, I’m not 100% sure that math talk is the way to move them to where they need to be, that’s my concern, is that that alone would not be enough to get those kids where they need to be. (Sydney Interview April 30, 2003)

Math talk is one method used, but it is not seen as sufficient. Some direct skills-based instruction seems important for helping some challenged students learn concepts and move forward. Given her emphasis on taking cues from how students respond, and her desire to help all students, Sydney is willing to use a variety of methods, including skills-based, in her classroom. However, she clarifies the type of instruction she means by skills-based:

I don’t really want to say that skills-based instruction that’s the important component so much as they need something focused and directed, it needs to be one on one, that really seems to be the only thing that helps their math, and the extended practice. (Sydney Interview May 28, 2003)

In the end, she balances this by saying, “I would never abandon skill-based teaching because they sometimes, particular kids need specific direction” (Sydney Interview April 30, 2003). Sydney also uses visual demonstrations and manipulative objects to promote learning, saying,

I’m sure they all respond to seeing colorful things and seeing a visual demonstration, that that’s more hands-on, and minds-on, really ... but I don’t think they all need that. I think some can learn just as well without it but there are a lot who really need it. (Sydney Interview May 15, 2003)

Visual demonstrations and colorful objects are thus another way to help her more challenged students.

The teachers also talk about students’ differential reaction to particular instruction methods and how that affects learning. Eisah thinks a lot about the different ability levels in her class and how they respond differently to her teaching methods. She tries to use methods that will influence the most children but is aware that some of them still will not respond (Eisah Interview May 12, 2003). Again, while believing that all students can learn, Sydney does not believe that they all learn in the same way. Thus, she pays attention to how they respond to certain techniques, and looks for more appropriate ones when a certain method is not helping her students:

I think when they’re in this discussion that, I don’t want to say over their heads, but they’re not ready to clue in to what is being said there, pick up the key components, it’s just wasted time for them, that’s my big fear, is that they’re often sitting there getting absolutely nothing, in fact they’re losing [Kamilla: Got it!], losing ground, because they’re like, I have NO idea what these people are talking

about. Whereas if they have one on one time to go through their own thinking, they could deal with it very well. (Sydney Interview May 28, 2003)

Rather than getting upset at the fact that these students are not participating in class discussion, Sydney identifies the difficulties that that particular method poses for them. She then identifies an alternative instructional method, full of confidence that if taught using an appropriate method, they will be capable of learning and performing. She comments similarly about two of her students who have been identified as learning disabled:

They need something more individualized that they're not getting from me and I think they could be equally successful if they had that. I think they've shown that. When I work one on one with them after school and during the day, they can get it and they do learn. It might take longer, or it might take them a different way and they'll get that. (Sydney Interview May 28, 2003)

Here again we see her explicit belief that these students can learn; they simply need an alternate method of approaching the problems. She describes what she uses for one low performing student and the impact it has had:

Her response to one on one instruction (which often involved simple counting activities, and little direct teaching) has reinforced the belief that many of my students need this type of instruction if they are to be successful. (Sydney E-Journal January 23, 2003)

Her reflections on teaching and the response of students to her methods reinforce each other as she searches for ways to help them learn.

Sydney also uses specific methods in testing to enhance performance:

I refused to NOT read the test to my students - particularly the students who are reading well below grade level. We worked problem by problem and I made sure that the atmosphere was conducive to focusing on the problems. (Sydney Email December 14, 2002)

Reading a test is a standard accommodation for some special education students, but is not always applied. Sydney believes that they all have the ability to perform if they are given the right situation, and so she makes sure she does whatever she can – reading the test, creating a calm atmosphere in the classroom – to allow them to express what they know on the test.

Emphasize their Strengths, Respect their Diversity

These teachers emphasize the positive. Sydney comments about one math session, “All of the students were successful with the most basic problem” (Sydney E-Journal January 23, 2003), putting the emphasis on what they were able to do rather than what they could not. Sydney also looks at how her students have progressed over time, and takes hope for their future development from this:

... of course you don't know what's going to happen in the future, but I see signs in them over time, even over a two year period, and I see them a lot more socially adept, more able to think about their own behavior, their thought process, and move forward from there, so that's one of the huge benefits. (Sydney Interview April 30, 2003)

Over the two years, progress has occurred across multiple dimensions. As well, the teachers make a point of noticing and complimenting their students when they behave well (for example, Eisah Math Talk Observation April 9, 2003).

The fact that students solve problems in a variety of ways, and that those multiple solution methods are acceptable to the teachers, serves to reinforce their belief that all students can learn. Student knowledge is represented in multiple ways, all of which are acceptable to the teachers. The math talk format, which they all love, involves individualized student representations of individualized thinking processes. Sydney refers to “variation in ways of solving the more challenging problems” (Sydney E-Journal January 23, 2003) in her class as a positive feature. They also respect the diversity of answers that are possible rather than expecting a particular type of response. For example, in one focused math discussion Sydney asked the students to draw a square and divide it into four quadrants. This was done in different ways by different students:

Sydney: Look at Jeannie’s and look at Patricia’s, they both divided it into four but they did it different ways. Can both ways work?

Students: Yes!

Sydney: Okay, because Jeannie chose to do it this way. Can they both show fourths? [Students: Yes!] Oh, and you have yours divided into fourths.

DeShawn divided his into fourths a different way. He divided his in half this way, then he divided it into half that way so he had four different parts. [Student: Oh, cool!] So there are lots of different ways to do that. All right, now draw another square beside it. (Sydney Math Talk Observation No Date)

In this situation she expressed very clear acceptance of different representations and asked the class to affirm the validity of these different approaches (“Can both ways work?” “Yes!”). Sasha similarly recognizes her class for honoring a diversity of solution methods to a math talk problem:

They were really good today about honoring different ways of solving it and kept saying, today my goal is not to draw pictures but if I have to I'm going to. I really liked that. (Focus Group June 10, 2003)

The teachers are clearly conscious of the diversity in ability in their classroom. Given their emphasis on knowing the thinking patterns of all their students, it would be strange if they thought they all had the same ability level. They make comments like Eisah does, "group one is my higher group, they are more articulate, they are more cognitive.... It's my group two that falls by the wayside sometimes" (Eisah Interview No Date). However, no judgment is attached to such comments. She follows up this statement by saying, "[group two is] the group I need to focus on" (Eisah Interview No Date). Eisah also says about some of her other students,

What about Alison? [Kamilla: Oh my God!]. She's probably my second lowest kid in this class [Kamilla: Really!] but she like loves to be that teacher. And even though she gets so confused sometimes and she sometimes can't make connections so easily, she works so hard to do it, and that helps her so much to do it. But she is so, she is like the perseverer kid of the class. But it doesn't work for all kids, though, you see like three or four kids, some tune out. Leonardo, tunes out constantly, my Leonardo. But he does, he's the kid who tunes out but is still listening, but that's sometimes what's frustrating about the two groups going at the same time. (Eisah Interview April 30, 2003)

We can see that while she is aware of the intellectual challenges facing some of her students, she still recognizes their strengths (facilitating learning for others and persevering through difficulties; listening to what others are saying). She says further

about Alison, “Alison is absolutely unbelievable in math talk, and she really has taken so much of a leadership role” (Eisah Interview May 28, 2003). In spite of their variation in ability, all students can learn and contribute in the classroom.

Classroom Environment

Working With Students to Create a Supportive Environment

All three teachers emphasize creating a supportive learning environment in their classrooms. This is one of their fundamental premises, recognizing it as a prerequisite for learning. As a result of its ubiquity, it is not often mentioned as a specific strategy. They are particularly conscious of their students’ feelings, emphasizing inclusion, manners, treating their children with respect, and listening skills. At the core of a positive class environment is respect for the validity of being and perception of each child. They act as if they are peers with the students rather than creating a hierarchical system. The respect they accord the children, and the quality of modeling they do, is seen in the way Eisah interrupted one of her classes:

I’m sorry I need to interrupt you while you’re thinking, but I need to tell you something. I know you’re excited to do math talk again, and because we’re doing something new, but I really need you to pay attention and listen while people are thinking. (Eisah Observation June 5, 2003)

Acknowledging their feelings, respecting their mental processes, she provides appropriate guidance to promote an atmosphere where all the students can learn.

Their attitude towards the classroom is shown by the frequency with which they ask questions of their students to find out what their needs are, how they perceive the

classroom environment, and what they want and need to make it work better. For example, Eisah held a class discussion for students to review their experience with a big group math talk. In their dialogue, students commented on the impacts of working in groups; they noticed and disapproved of arguing; and they were in favor of arrangements encouraging more dialogue and opportunities to talk and communicate. This indicates a high degree of awareness of what environments make them comfortable and promote learning (Eisah Math Talk Observation April 30, 2003). Being asked for their views, and having these views actually applied to the organization of the classroom, serves to empower the students and validate their worth. Another time, she called a group meeting to talk about quitting and negative attitudes so that the students could address things that were happening in the classroom (Eisah Interview April 30, 2003). By calling on the students to voice the standard, the teachers expect that it will become more internalized.

Eisah uses this technique of asking students to voice what is appropriate on another occasion to address student behavior during math talk. When she asks, “What does it take to be a fifth grader?” the students respond, “Listen when someone’s talking ... Come back to the carpet when you ask ... Follow the rules of our classroom ... The two of them should be on the carpet” (Eisah Observation June 5, 2003). After the lesson she enlists them further to discuss what happened, asking “What were some good choices kids made when I did that?” Students responded variously, “Some people went to their seats very quietly and didn’t make any noise ... some people listened to your directions and didn’t lay there screaming ... walk to your desk quietly and brought their clipboards.” She acknowledges all of these responses, saying, “Absolutely. Those all were best choices, and the students who did that were behaving like fifth graders” (Eisah

Observation May 7, 2003). This turns what could be a condemnatory discussion of what students did what wrong into a positive analysis of how the students can learn to be more adult in their behavior choices.

Balancing Teacher Direction and Student Leadership

Given the value placed on their views, students often lead what is going on in the classroom. Sydney explains the general philosophy when she says, “in an ideal situation the kids would really set the parameters in lots of different ways” (Sydney Interview May 7, 2003). While Eisah refers to a more explicit role for teachers, this still is something she has worked to develop, and she reflects on her progress over the year:

“Aha” moments about Eisah, shut up and just let the kids go, definitely happened. I’ve become much more secure this year with giving kids a lot more ownership and a lot more leadership. And realize that I really need to set guidelines. And to set up the classroom, set the guidelines, and leave them, give them so much more freedom. And we’ve gotten so much more amazing results. (Focus Group June 10, 2003)

Teaching effectively requires a balance between teacher direction and student leadership. The dynamic relationship between these two forces frees the students to be independent learners within appropriate parameters. When given both guidelines and freedom, the students respond by developing independent thought. The following extended dialogue, relayed by Sasha about one of her math classes, illustrates the type of student-directed interaction that occurs when students know that their thinking matters:

Sasha: ... she showed her progression of 8×5 to 8×6 and 8×7 , and then I said,

“That’s what good teachers do, we talked about teaching math and you never tell

somebody but you remind them of what they know.” So I said, “That’s a really good multiplication trick.” And everyone said, “Yeah, that’s what I do,” and Dawn said, “That’s what I do, except that I already know that 7×6 is 42 so I started at 7×6 .” And then we talked about how that makes sense. And of course, Terry is on cloud nine ... and she’s like, “Whuh?” ... And she’s like, “Well, my dad says to start at 7×3 .” And Kristen says, “Why would you do that if you know 7×5 ?” And she goes, “Well, my daddy doesn’t go to school, he’s starting school over again,” and she has a huge long spiel, “and my dad doesn’t do it that way.” And Kristen is like, “You’re not your dad. You are you! You are Terry and you can do what you want to do.” Then Erika chimes in, “Yeah, ‘cause everybody learns differently and your dad learns differently than you.” And so yada yada yada. And Terry is like, “Oh,” she had the biggest attitude today.... So anyways, “What strategy would you use?” And she goes back to, “Starting over.” “Well, is that a strategy? Erasing everything and starting over?” “No.” “Terry, what would you use as a strategy for 7×7 . Terry, what would you use as a strategy?” Terry: “ 7×3 .” And Kristen goes, “Why would you do that when you know 7×5 ?” Eisah: Does she know 7×5 ? Sasha: Yeah, Kristen goes, “Do you KNOW 7×5 ?” And Terry goes, “Yeah!” Total attitude today. “‘cause it’s like, 5, 10, 15, 20, 25, 30, 35!” So Kristen goes, “So why would you do that?” So she goes off and figures out 7×7 , at least I think she did. It was a really good math talk. (Focus Group June 10, 2003)

Here we see students guiding other students through solution methods, arguing with each other about appropriate thinking strategies, and encouraging each other to think more

logically. Throughout this dialogue, Sasha was primarily observing, not directing, allowing the students to express and self-correct their thinking.

In another instance, we can see the same type of dialogue in Eisah's math talk discussion:

Isaiah: I want to agree with your representation and I want to add. Put a zero under the seven. [He calls on Bella and asks], Why did you subtract?

Careena explains why.

Bella: How much more means to subtract?

Careena confirms how much needs to be subtracted.

Bernadette compliments her on putting the zero by the .360

Alex disagrees. Expands, then says, "I don't understand."

Other students explain why they did that, saying in chorus, "You have to keep the decimals lined up." (Newsome Park Math Talk February 10, 2003)

Through interactions such as this, misconceptions are cleared up, collective understanding is generated, and students learn to value their own thinking and that of their peers.

Open Sharing of Thinking

The supportive environment encourages the students to share their learning without fear of being wrong. This is clear in students' eagerness to present their ideas to their classmates:

Eisah: ... they come up to me and they want to know, how is this, can I represent? If they say anything, it's usually "Can I put it up? Can I put it up?"

So that's ...

Kamilla: Right, interesting, I was wondering, 'cause I was just watching and for a while they were like really queuing up! And they were just so excited

Eisah: Oh my God, they like run! But you'll see, as I start to choose kids up here, some of them get, they're upset, that they didn't get chosen, so then they're like, "I don't even care, I don't even care what you think!"

Kamilla: That's so great that they like to share their work

Eisah: Oh my God, they love it, it's like the spotlight. But it is cool, because most kids, like are, it's just the oral speaking part, but these kids, because of the math talk, they have a lot of practice oral speaking. (Eisah Interview April 30, 2003)

Whether or not they have the correct answer, they want to share what they did with the rest of the class.

In another instance, after a math talk ends in Eisah's class, two students sit with another couple of students who missed math talk to go through and explain the problem again. They did this spontaneously, although they were supposed to be getting ready for reading games (Eisah Math Talk Observation April 30, 2003). Relatedly, Sydney emphasizes the need to develop a collective understanding of a topic. When she takes the class through a question-based discussion of a math problem, she looks for agreement from the class about particular facts or principles before moving on. Until most of the class can agree that something is true, she does not go forward (Sydney Math Talk Observation April 10, 2003).

Eisah also draws on her students to come up with ideas to share. In these notes from one of her math discussions we can see her eliciting student ideas for memorization strategies for geometric terms:

Student: Enter sounds like inter so intersecting.

Eisah: So they enter each other at different angles?

Student: Yeah.

Eisah: Interesting! Does this help anyone else?

Student explains one way of connecting the word square with perpendicular.

Eisah: I can see you're on a good track for this, keep on working on it so you can make that connection.

Student: It starts with per, that's like perfect, like perfect square.

Eisah: That's a cool one!

Student goes up and shows her idea for how to remember: I know a way to think of a compass rose, a compass rose is circular so for perpendicular, so to remind you of circle use a circle.

Eisah: So something with predictions? He's seeing the word "icular" and thinking of the word "circular" so he's thinking of how the compass rose is a circular. That's a great trick! If you guys have come up with

Student: North & East, and there's an N & E in the word.

Eisah reiterates this.

Student with another idea.

Eisah: Excellent tricks! (Eisah Observation May 7, 2003)

By encouraging her students to share their ideas and by valuing them, Eisah helps create an environment of sharing and collaboration in the classroom.

Supportive Emotional Environment: Feelings, Friendship, Cooperation, Humor

The teachers emphasize not only the cognitive growth of their students through an effective learning atmosphere, but also their emotional wellbeing. They are aware of the nuances within the environment and have their finger on the mood of the class. Eisah notes the stress level in her classroom associated with upcoming standardized tests:

In my class, I think that some of them are very stressed. Not very stressed, they feel the pressure, they're feeling the pressure. ... So there's lots of pressure, some kids are feeling it, some kids are really doing a lot about it. (Eisah Interview May 28, 2003)

The pressure in the classroom from the tests is something Eisah tries to account for in her teaching. To address the emotional state of her classroom, Sydney starts each day with a sharing circle where they share "happies," "sads," "get on my nerves," and "weirds" (All Observation April 28, 2003). This allows students to express their feelings and concerns, creates bonds among the students and with the teacher, and provides a forum for addressing emotional issues that otherwise might interfere with learning. She also uses a class meeting format during one math talk to allow students to talk about their frustration with the topic:

Today during math talk the class was working on division. We all became frustrated after working hard for some time. We had a brief class meeting to process our feelings because both the students and I were frustrated. They, because they couldn't understand why their calculations were leading them astray,

and I because I couldn't figure out how they were arriving at their calculations. We talked about how we needed to take a short break from division because we were struggling with it as a class and why we were all feeling this way. I explained to the students why I get frustrated and why that is no reflection on them it's simply a difficult thing for us to get. (Sydney E-Journal March 21, 2003)

By offering students an opportunity to talk about their feelings, and by sharing her own, Sydney creates a dynamic of support and sharing in the classroom. On another occasion, Eisah compliments Sydney on her management of a delicate classroom discussion on interpersonal conflicts:

Sydney did such a great job of, after that was all said and they had already tried to work it all out she said, you know what? But I heard you use the words "I'm not like you." And right away ... And she brought it out as a negative thing to have said, in a really good way, though. I was kind of impressed with that. 'cause so many times, especially my fourth, and whenever they become fifth graders, they have those sassy remarks and you need to do it in a positive way to tell them that that didn't get them anywhere, didn't get them any good place, they didn't make the point they were trying to make. (Focus Group June 10, 2003)

The teacher plays a key role in setting the emotional tone for the classroom, and this role is highly valued by the teachers.

Friendship and positive relationships among students also are important and are seen in their emphasis on friendship in the classroom. This is something the students

discussed in Sasha's class as they debriefed on a math talk problem addressing probability:

... we talked about how, what that means about working in a group. And Marty said, you know everybody's working together if you're all treating each other like friends, or you know the person that helps you is really your true friend.

[Kamilla: The people who help you with it are really friends.] Yeah, that's what he said. I liked how that came up too, because some of the kids do have a hard time working together. (Sasha Interview May 12, 2003)

The students link academic collaboration with friendship. When she questioned them about what they learned from working together, they had further comments to make:

Sasha: So what does this teach you about working in a group?

Student: It's fun and you learn more.

Sasha: What do you learn about working together?

Students: The people who help you with it are really friends ... Sometimes when you teach somebody something you learn ... Working with a group means that you have to work together, you just don't work as an independent individual, you have to think about others, when you help it shows you really want to be part of this family.

Sasha: And did it contribute to the success of this game if you worked together?

Students: Mm hmm. (Sasha Math Talk Observation May 12, 2003)

The students place a high importance on the quality of their interaction, the responsibility to help others and work well with them, and the enhanced learning that comes from working with others.

Another aspect of the affective classroom environment is humor. The teachers joke with students, sometimes teasing, sometimes sarcastic. Sasha sarcastically challenges her student Terry since she knows that reverse psychology motivates her (Sasha Math Talk September 30, 2002). Eisah teases them as they work to identify important ideas in a math talk problem. She asks them if it is important that the girl in the problem had a birthday, that she got a box, or if, “for example, what if I said she came home from school and there was a big box on her doorstep, that she was really scared by it, is that important?” The students respond, “No!” (Eisah Math Talk Observation May 7, 2003). In another instance, Eisah tells her students that they are “superstars”, with a big reputation across the school for their performance:

I’m like, we have a reputation to keep up, kids. We’re superstars in this school, if you haven’t noticed. And they think it’s totally true, because people are always coming in here, but people are coming in everywhere. We’re rock stars, and we have a reputation to keep up. We need to do well on this. We need to show them that our way of learning is the best way. Poor kids! (Eisah Interview May 28, 2003)

The humor is in the exaggeration of their capabilities, but it also reflects her genuine belief in their capacity. Sydney also jokes with her class:

Student: We have one more month to learn this!

Sydney: Yes you do. You have one more month to learn it, or else!

Student: Or else what?

Sydney: Or you will fall off the edge of the earth. [Student: Cool!] You will fall into the earthquake hole that we learned about. (Sydney Observation May 7, 2003)

The students laugh at this dry humor.

Importance and Quality of Group Interactions in the Classroom

Beyond individual behavior and learning, the teachers emphasize group interactions that go on in the classroom. The teachers display distinctive attitudes towards what should characterize student interaction and an effective class environment. Since they see their students as capable individuals, they believe in the importance of student interaction; respect their students' ideas and needs and use these to inform their work as teachers; and work to create a class environment which has space for students to express their needs, feelings, and individuality. As a result, the students have a high level of interaction in the classroom. They frequently engage with other students, discussing their work, going over to help others, and offering advice and suggestions. Teaching others or telling them how to do work is very common, and some thing that Sasha emphasizes:

We never had enough time in grade school to rely on other people to help explain things and rely on them, and I really try and emphasize that, and I think that's showing a lot of great results. Morning work, it's your responsibility to find someone who can help you, and if you've done well, it's your responsibility to find someone to help. (Sasha Coffee Shop January 11, 2003)

In their interactions, the students generally are encouraging rather than critical. However, their honesty brings them to identify the negative as well as positive aspects of others'

behavior. For example, one student said to another, “You don’t make good choices, I’m not helping you up” (Sydney Math Talk Observation April 10, 2003). This was said in a moderate tone and was taken mildly by the recipient. The classroom environment allows for a relatively high level of freedom for interaction by the students, and the majority of interactions seem driven by desires to learn and to help.

They work a lot in groups, which the teachers see as useful for intellectual as well as interpersonal development. Eisah comments about how groups are working in her classroom: “I’m hearing a lot of great discussion in the small groups amongst the kids about how they got their answers, why they think that” (Eisah Interview May 28, 2003). Through the extensive group work, and through the modeling set by the teachers, the students think of themselves as a class rather than a random collection of individuals. There is a team spirit, a collective identity, and a strong desire to reach out and help the other students in the class to learn. Eisah comments on how the upcoming tests have illustrated this interaction in her classroom:

Eisah: I see kids stepping up and helping other kids practice and things like that. They’re taking a lot more ownership over it. I see Adele, ‘cause Cliff was really frustrated with how the cards were worded, he said they were hard for him to understand, which is so true but that’s so true because he has to get used to how they are worded, so I watched her talk him into it, she said, let’s start with race #6 ‘cause that’s an easy one, so starting with one that he could do well on. So I have seen sort of a team thing going on.

Kamilla: Any more or less compared to before that?

Eisah: I think with the idea that we've got to band together and do well on this probably is more apparent. It's like, because I treat them as a team, and as a class we need to do well, not Alex you need to do well, but as a class we need to do well, they do share ownership of it. So other than the regular school day, when we prepare for tests is when I really see them taking class ownership 'cause the focus is that our class has to do well. (Eisah Interview May 28, 2003)

Eisah's statements document the types of outreach practiced by her students. She also acknowledges the role that her leadership plays in creating the context for that environment because she "treat[s] them as a team", resulting in "share[d] ownership" of their results.

The desire to help others is also manifest in caring behaviors by the students towards each other. One day in Sydney's class, when one of the boys was feeling sick, some of the other students treated him compassionately, putting an arm around him to comfort him, telling him about times they have felt bad too, and explaining how he was feeling to others (Newsome Park Field Notes January 24, 2003).

Bonds Among Students and Teachers

The respect and caring the teachers have for their students are reciprocated. The students show strong bonds of attachment and love for their teachers. In Sydney's class, one girl was upset because she could not stay after school that day for tutoring, an activity that might not seem like something to look forward to. Sydney consoles her that maybe they can meet another day after school. Another student came up and said, "I love you!" to which she responded, "Thank you! I love you, too!" (All Observation March 7,

2003). Because of the strong emotional connection, the students value time together with the teacher and opportunities to interact and build closer relationships:

Even small group time, they beg for that time, whether they're doing well or not doing well, so I know they really are responsive to that. And again, having a connection to them, I don't think they would feel that way if we didn't have a strong connection, and then they're able to see in this one on one time that something valuable is coming out of that, that it's strengthening the connection ... the focus just is on them, I think that's the difference. (Sydney Interview April 30, 2003)

Sydney appreciates all her students and wants to create positive relationships with each of them. Sasha has established a relationship of friends with her students. She says,

... maybe it's just the way my relationship is with them, I don't hesitate to act like a child. I don't hesitate to be myself. And they know I'm weird and they know I'm just as much a child as they can be sometimes. (Focus Group June 10, 2003)

Stemming from this friendship, she has close relationships with all her students. Sasha and Marty provide another example of the close bond between the teachers and students. Marty became very upset when he learned that Sasha was going to another school and expressed this through some behavior problems in the classroom. In response, she "wrote him a letter today about how I love him and how unique he is and how important he is" and they continued to work through his emotions together (Focus Group June 10, 2003). The emphasis on the emotional environment generates a closeness within the classroom.

Climate of Mutual Respect

One other significant element in the classroom is the climate of mutual respect that the teachers feel and generate. The teachers learn from their students. They are prepared to be surprised by things they do, and respect their individual thinking rather than seeing it as a distraction or simply “wrong thinking.” For example, in one math talk where the students had to create sundaes using different combinations, Sydney says that she “didn’t anticipate anyone coming up with the question of, can you leave out toppings, can you mix ice creams” and this “added in a whole other dimension” that she “didn’t see coming” (Sydney Interview May 15, 2003). An alternate response might have been frustration that the students did not assume the same hidden rules to the problem that she had assumed. In another case, the students’ response to a visual demonstration she did in a lesson on probability inspired Sydney to use such methods more frequently in her class:

I thought it was really, it really meant a lot to me to hear them verbalize things that I didn’t necessarily think they could say in terms of what makes a better lesson for them. The fact that they so agreed that they need some kind of visual demonstration is just, you know, it’s like a lightbulb going off that should have gone off a long time ago that I pretty much need to do that for everything.

(Sydney Interview May 15, 2003)

Eisah also relies on her students’ involvement to make instruction work:

Kamilla: And it’s interesting how you say it becomes automatic, that’s basically what you’re trying to get the kids to do with the strategies you have been doing.

Eisah: That's true, trying to make them very cognitive and aware of the procedure and how this procedure helps their learning, yeah. (Focus Group May 14, 2003)

In another instance, Sydney pays attention to their thinking processes and does not dismiss them as insufficient. She accepts where they are at and the internal logic of those processes for the students involved in them:

Sydney: There were two girls who went off who typically, they don't come to that conclusion on their own and they were doing something totally different.

Kamilla: The ones who were using colors?

Sydney: No, these two girls were making a list of, I don't know if you remember the one little girl tried to explain what it is that the problem was asking and she started talking about people mixing things, standing on a counter mixing, so they were going through steps in a process of people actually mixing things and what the people were doing, so that's where they were at, and it wasn't clear to me whether they were eventually going to come to using the combinations they make and they needed those steps? So I'll have to go back and look at them tonight and see. (Sydney Interview May 15, 2003)

The actions of the students described above could have been dismissed outright as showing a lack of understanding or use of inappropriate methods. Instead, she wonders what their logic was and plans to put more time into learning about it rather than dismissing it and teaching them the "right" way to solve the problem.

They also show a high level of respect for their individual learning styles, notably for students who would probably otherwise simply be labeled "problem students." For

example, in the behavior of her student DeShawn, Sydney describes actions that would annoy most teachers: "... he zones out on every subject, every part of the day. He likes to focus on things, he likes to stare at himself in the mirror, he likes to play with magnets, he can play with magnets for hours and hours" (Sydney Interview May 15, 2003).

However, her reaction to these things is even-handed and expressed with respect for his individual approach to the world:

So he really has certain things he gets something out of and those are the things he tends to gravitate towards. Once he starts writing, which it takes hours for him to start writing, he doesn't want to stop writing. (Sydney Interview May 15, 2003)

Rather than criticizing him for his behaviors, she analyzes them objectively and looks for the strengths from which she can build her instructional approach with this student.

Sasha displays a similar tolerance for varied student ability as she describes one student in her class:

Actually, I have one kid that I'm really worried about. And it's funny because it's what he doesn't do independently but what he can do in the group. What he can do in a group is ask amazing questions and be totally actively engaged. His brain is making all these amazing connections. They're not always positive correlations but at least he's making correlations. But what he does independently is just ... I just worry about him because it's so low. (Sasha Interview April 30, 2003)

Another aspect of this mutual respect is the teachers' respect for their students as teachers. Eisah values their ability to explain things to other students, and feels that these can be as valuable for teaching other students as her own explanations. In describing who she picks to represent math talk problems she says, "Now I try to pick a person who

really understands it and really has it so that they can explain it really well like almost like a teacher” (Eisah Interview April 30, 2003).

The teachers also are willing to acknowledge what they do not know or what they did wrong. After one math talk problem, Eisah explained to the class that she had made the problem more challenging than it needed to be, and while they were doing it she realized it was too hard, which was why she did an “emergency exit” from math talk (Eisah Observation May 7, 2003). In another situation, when a student says to Eisah, “Teachers should never have trouble,” Eisah responds, “So I should never ever make mistakes? I should be perfect?” (Eisah Observation May 7, 2003). Sydney similarly says to the class, “I just need to tell you guys, ‘cause I’m a teacher and it bothers me, I misspelled the word hundredths. I left out the second ‘d’. Could you write it in?” (Sydney Observation May 7, 2003). Sasha does something similar in one of her math talks, saying, “I have a question, can anybody pick out a mistake I made in the word teachers?” Students correct the apostrophe mistake she made (Sasha Math Talk September 30, 2002). Making a mistake is okay, because they are all in it together.

Creating an environment in which they are learning along with their students is key to these teachers. Sasha talks about this dynamic of mutual learning:

... when the kids hear your struggle they realize other people are struggling with helping them to learn, not only are they struggling themselves to try to help themselves learn but you’re struggling trying to help them learn and then they think, oh, well we’re kind of in the same boat, and I think you’re right, that they don’t really realize all the time. (Focus Group May 14, 2003)

The class environment is the milieu where all teacher beliefs about learning and students are manifest. The application of these beliefs serves to create an inclusive, welcoming environment where students have the chance to develop their unique perspectives, interact with other students, and learn and grow to the best of their capacity.

High Stakes Testing Promotes Classroom Bonding

Testing periods, ironically, are one occasion when the classroom bonds become even closer. Eisah explains why when she says, “So other than the regular school day, when we prepare for tests is when I really see them taking class ownership ‘cause the focus is that our class has to do well” (Eisah Interview May 28, 2003). This is similar to Sydney talking about how her class banded together when they were not performing well and had to improve their test scores:

They really took ownership for each other and they would just come and look and see who needs help, and they would go help that person, so they were doing more skill-based kind of things but I think they were successful then. (Sydney Interview April 30, 2003).

Sasha also talks about how tests encourage her students develop cognitive strategies:

... testing kind of helps, it helps that we have these huge tests we’re accountable for, kids really feel accountable for each other ... they really have pulled together and focused, and pulling together and helping each other helps them to focus on, why do I get it? And that kind of solidifies why have I learned this, how have I learned it, can I take it and teach somebody else what I’ve learned. (Sasha Interview April 30, 2003)

In other words, the pressure of the tests encourages students to use their best thinking and analysis skills. The tests help them to focus on these skills because the skills are what have been emphasized all year as the important part of what they are learning, rather than memorization of facts. Sasha emphasizes this further, saying,

... you'd think with all this testing, these four tests coming up in three and a half weeks, you'd think we wouldn't have time, but it's such a huge a part of what we do every day and all the time, even when we're doing these dumb practice tests, or, you know, doing engaging, fun lessons, we're still saying in the end, what do we have, what don't we have, how can we get it, how can we learn more, what can we do. (Sasha Interview April 30, 2003)

After two years in her classroom, the students as much as Sasha push towards learning and understanding in all activities, even practice multiple choice tests.

Active Creation of Class Environment: Modeling, Internalizing, Encouraging

The class environment does not evolve simply through positive attitudes on the part of the teachers. They use careful guiding and facilitating behavior to set the expectations and mold student behavior. However, their guidance is based on encouraging the students to internalize effective models of behavior and become self-regulated, rather than imposing external controls on them. This is similar to their attitudes towards academic learning: students need to internalize and apply thought processes themselves if they are truly to learn and use knowledge. Eisah, for example, reminds her students to internalize a decision to not talk, emphasizing the personal choice aspect of behavior (All Observation April 28, 2003). They all use careful prompting to encourage appropriate behavior (All Observation March 7, 2003). Another method used

is identifying students who are behaving well as examples for others to model, such as in this example: “You’ll let me know that you’re ready to start the discussion when you look like Bella or Paulette, Alex or Antone” (Eisah Observation June 9, 2003). An additional strategy, used often by Sasha, is to call them to good behavior by saying “thank you for XYZ,” XYZ being the behavior she wants from them (Sasha Math Talk Observation May 12, 2003). As well, on another occasion, Sydney encourages them to move to another part of the classroom so that they will be in a good place to concentrate on working. In this way she guides them towards appropriate behavior that will support their learning (Sydney Observation June 5, 2003).

One manifestation of their model of behavioral guidance is an emphasis on “choices” in behavior. They talk about behavioral choices and making better choices, thus encouraging the students to assume responsibility for their behavior (All Observation April 28, 2003). Eisah talks with her class about “mak[ing] the best learning choices” (Eisah Observation June 5, 2003), something she continually encourages. Sydney explains that choices are important “if all kids really learn best by being able to make some choices and have someone facilitate for them” (Sydney Interview May 28, 2003).

Summary of Construct 4: Beliefs About Students

The teachers spend large amounts of energy reflecting on their students’ thought processes. These inspire them and provide them with insights into instructional methods that can meet students’ learning needs. They strive to elicit student understanding through questioning, believing that student independent thought is the basis of learning.

As well, they respect the diversity of representations offered by the students and try to understand them rather than expect all students to think and represent ideas in the same way. They believe strongly that all students are capable of learning if taught in an appropriate way. As a result, much of their energy goes into identifying appropriate instructional methods for their diverse students. This is manifest in a classroom environment that emphasizes respect for individual needs and independent thought, collective learning, and collaboration. In such an environment, teacher direction is balanced by student input, and teachers are learners as much as the students.

Construct 5: Instructional Approach and Strategies

The teachers' personal agency, philosophy of education, and beliefs about students all incline them towards a particular approach to instruction, implemented through specific strategies. They use a wide variety of instructional strategies to enhance student learning. These include methods of talking with students, such as questioning, repeating and rephrasing, and think-alouds; group instructional methods like math talk, flexible grouping and peer tutors; and integration of instructional aids and technology.

Interacting With Students

The teachers choose methods of interacting with their students that encourage the students to think for themselves and move towards autonomous learning.

Questioning

One major strategy is questioning, often combined with prompting. Questions are important because, as Sydney says, “I think that’s how they learn, through questions, not answers” (Sydney Interview May 7, 2003). Eisah describes the importance of effective questioning methods when she says that “a master teacher is such an expert in questioning students at the right time, using the right language to prompt thinking and connections” (Eisah E-Journal March 31, 2003). As a result of this perspective, they use a very question-based method of guiding students towards understanding versus telling students the answers. Eisha comments about the value of such methods:

... when I’m asking them questions, it’s not, they don’t turn their learning off as much ‘cause they’re really thinking, so even eventually if I’m prompting them as I’m asking questions, at least to get them to make that connection on their own, I know they’re actively thinking. When I just tell them something to get them actively thinking, they probably won’t retain it as long and they might not be actively thinking. (Eisah Interview May 12, 2003)

Questioning thus encourages active learning, which they see as vital to retention.

The teachers also emphasize the importance of questioning as a scaffolding technique that helps students connect what they know to move towards new knowledge:

But still keeping in mind that kids need to be able to construct new knowledge based on prior knowledge, whether it’s with you guiding them through that process, or whether it’s them doing it totally independently, or whether it’s them doing it with a partner. Keeping that in mind. Never telling them this is the steps that you do it, but just reminding them of what you know. Then asking them

different questions, “If you know this,” then taking them further along this ladder until they’ve reached to the conclusion. (Sasha Interview April 30, 2003)

While some students are able to construct new knowledge “totally independently,” others need the assistance of a teacher or partner. This other can ask questions and remind the student of what they know, allowing them to build on this in creating an answer.

Some of Sydney’s comments from one math talk provide an example of the types of questions they use:

Sydney: Um, not that I know of. You only have four parts. Mark, did that lead you to a question? Thomas?

...

Sydney: I don’t know. She could make up whatever problem she wanted, I think. As long as it made sense.

Student comment about 12.

Sydney: Where’s the 12 come from, though? But look at her non-colored in boxes. She has six not colored in and six more not colored in. So she’s saying, how many more are not colored in. So the way she has it written, that’s correct. But there’s something terribly amiss about this picture. There’s something that ought to be there. Her problem says $\frac{6}{4}$ plus $\frac{6}{4}$ equals $\frac{12}{4}$. Which it would if the problem were different.

Student: Ooh, I know what you’re saying!

Sydney: Mac, what is amiss about this problem?

Mac: Um, I think um, I think because um when it says fourths, I think ... because I was gonna say like, she didn’t shade in $\frac{6}{4}$ like $\frac{6}{4}$.

Sydney: Right, so she didn't have six boxes. If she had left only four boxes not shaded, it couldn't say six. But she didn't shade in six so she couldn't use six.

(Sydney Math Talk Observation No Date)

Sydney begins here by encouraging them to ask questions, calling on individual students who seem to have ideas. She also uses rephrasing and summarizing; these help clarify the questioning method and inspire response from the children. While rephrasing, Sydney did not tell them anything that they had not themselves already described, but she encouraged them to look further into the situation.

Another example of open-ended questioning comes from one of Sasha's math discussions:

Sasha: What does this decimal do for us as mathematicians who are always thinking about math rules, rules in math that help us?

Students: It spreads the numbers apart ... A decimal separates one part from the whole ... determines if it's one or one hundred (determines place value). (All

Observation April 28, 2003)

Sasha first of all sets up her students to succeed by affirming their ability to do math and by letting them know that they have information about decimals that is useful. She then allows for multiple responses rather than settling on the first answer offered by a student. After writing up their responses on the board and letting them think about them, she proceeds to question them further, asking, "Who has another idea?" (All Observation April 28, 2003). She continues the questioning at the end of the lesson, when she asks the students to summarize what they have learned. This allows them to externalize their knowledge and repeat what they have learned, both techniques to promote retention. It

also serves to reinforce their sense of themselves as capable of useful thought, since they are the ones who present knowledge to the class.

Questioning rather than telling is rampant in these three classrooms. Whatever the knowledge is that the students need, the teachers attempt to elicit it through questions rather than convey it through their own words. Here we see Sasha's class struggling with the concept of odd and even as they create groups for a math talk activity on probability:

Sasha: Who do you think would be in the odd-numbered team?

Student: 1, 3 and 5.

Sasha: 1, 3 and 5. Who do you think would be on the even-numbered team?

Bretana?

Bretana [Slowly]: 4... 2...

Sasha: 4 and 2. Do you think any other numbers will be there?

Student: 2, 4, 5

Sasha: Do you think 2, 4, 5 are even numbers? What do you guys think? We need to decide about this.

Student: How you can tell it's an even number if you can put it into equal groups. Like if I was going to be a four you would know because you could put two in each group.

Sasha: So you could put an equal amount in each group and it would be fair.

That makes sense to me. So what do you guys think? (Sasha Observation May 15, 2003)

Deciding who would be on what team, and the difference between odd and even numbers, is something that most teachers would tell their students to save time. After all,

by third grade this is something they should know already, and if they do not, telling them seems to be the most efficient way. However, Sasha here engages her students in talking about this issue, allowing them to struggle with the concept and explain it to each other.

Explain Their Thinking

Related to the use of questioning rather than telling, the teachers often ask students to explain their thinking rather than either assuming what they meant, or accepting their solution as an answer rather than looking for their thinking process. This is often done through questioning so that students can explain rather than listen to the teacher talk. They believe that through dialogue and talking out their thinking, students come to understanding. This is something Sasha talks about directly with her class:

Sasha: One thing I've learned in my research is that kids learn the best when they elaborate.

Student: That's when you question?

Sasha. Yes, questioning is part of it, and this is a good example of how one student is elaborating on something he likes and he is learning by elaborating on it. (Sasha Math Talk Observation May 12, 2003)

As a result of their belief that learning that comes from talking, interactive classroom activities, like math talk or peer tutoring, are valued by teachers. Students respond to this questioning, as Sydney notes in her E-Journal after one math class: "Even the students who are less likely to participate in discussion were anxious to explain their thinking" (Sydney E-Journal January 23, 2003). The following example illustrates how Sydney prompts students to explain their thinking to her and to other students:

Student: I don't get why she put the 12 out there.

Sydney: Now can you explain the 12 part?

Jeannie: I forgot about the ones and I added the sixes together to make 12, then at the end I took the ones and I added them.

Sydney: This is very interesting, why she put the sixes together to make 12?

Student explains

Sydney: He's explaining that she put all her ones together because she put them together to make 12. Then she knew she had to deal with the tens. (Sydney

Observation June 5, 2003)

Sydney provides positive feedback to and links between the different comments made by students. Once students have explained their thinking, Sydney goes on to ask them to explain their solutions to each other:

Sydney: Let's try another money amount. What if you had 75 cents out of a dollar, who could make that into a fraction?

Student writes: $75/1.00$

Sydney: Boyd, how would you explain to Daron why you didn't use a decimal in the fraction?

Student: 'cause here it's dollars so you have to put decimal but here it's just a number.

Sydney: So when it's money you need to use a decimal, but in a fraction it's just a number? (Sydney Observation June 5, 2003)

Sydney prompts the students to expand on their thinking, and to direct their explanations to one another rather than to her. This method is used to encourage students to think

reflectively about their thinking processes and learn through comparison. Students often will contrast their thinking with that of other students, as with one student who said, “I think the second part is challenging, but I disagree with Lora, just because there’s a 20 and 8 up there, doesn’t mean it’s 28” (Sydney Observation June 5, 2003). If the students themselves do not compare, the teachers often will, sometimes drawing on fictional students in other classrooms who figured out new ways to solve problems. They are careful, however, to make the distinction between comparing solutions and comparing students, since the atmosphere is that of mutual learning rather than competition.

Prompting

Another aspect of questioning is prompting. Eisah emphasizes prompting in her responses to student requests for information. She uses questions that will help them figure out what they need to do to get the answer. In one case, when a student asked what the date was, Eisah responded, “Where can you look to figure that out?” (All Observation April 28, 2003). This is a conscious strategy for which she offers the following rationale:

I want to find the exact times to prompt students and then find ways to get them to begin prompting themselves. I have learned to ask kids, “What can you ask yourself to help you?” rather than, “What step do you need to do next?” or, “What process is this problem asking you to do?” I want them to ask those second examples on their own. (Eisah E-Journal March 31, 2003)

In her prompting, Eisah moves beyond simply prompting the students to think about the next step in a process. She prompts them to become metacognitive by reflecting on how they can direct their own thinking without asking assistance from someone else. Through

applying this method, she has found that students have begun to internalize the things she prompts them for, specifically the use of cognitive strategies. They now are applying these independently as a result of the earlier prompting (Eisah Phone Conversation December 6, 2002; Eisah Reflection April 29, 2003). Sasha also uses this approach, and says that when you use it, "... you're encouraging a certain level of cognition among kids who don't, or have lapsed, don't have that level of cognition yet where they can be asking themselves those questions" (Focus Group June 10, 2003). She feels that prompting is a useful technique, and tries to help her students learn to prompt themselves (Sasha Interview April 30, 2003).

Eisah describes two questioning or prompting methods she uses. The first involves repeating information as a question until the students make a connection between what she is saying and the problem; the second, inverse of the first, has her asking questions about a particular issue in as many ways as possible:

... either I'll say, like with area, this many rows, this many times, this many rows, this many times, I said over and over again, exact same words because they needed to hear the repetition to make them click on "multiplication." But usually it's that I word it as many different ways, and I keep going until I see more hands, 'cause otherwise I just get my top of the nest kids and constantly answering, the other kids just fall, they zone out. (Eisah Interview May 12, 2003)

Eisah's two methods meet diverse student needs, including those of her less able students. Each method has a different effect, and different students at different times need different kinds of questions. This is something that Sasha notes:

I don't think it even means that every single time the same kids will be asking themselves questions. I think it's more like, one day Charity will be asking herself all the questions she needs to be successful and the next day she'll be totally lost and need you to help her. (Focus Group June 10, 2003)

Given the different ways even a single student will respond to a particular instructional method, teachers need to use a variety of methods to help all their students. Sometimes, through hearing a question repeated, they will clue in to the concept, as in Eisah's example where hearing "this many times, this many rows" stimulates some children to think of multiplication. Other times, certain questions will reach only certain students, so there is a need to ask the question in other ways to allow more students to pick up on what is being asked. Through using these methods, the teachers provide a forum where all students can contribute their ideas, not simply those whose minds work like the teacher's or who are quick to spot connections between ideas.

Premeditated versus Spontaneous Questioning

The teachers use a combination of proactive and responsive methods in their questioning. They try ahead of time to determine what misconceptions the students might have, and create potential questions to uncover these misconceptions. This is a major part of Sydney's planning for her classes (Sydney Interview May 7, 2003). Eisah also tries to project what their misconceptions will be in advance so she can "guide them away from those misconceptions" (Focus Group May 14, 2003). As well as planning in advance, the teachers use spontaneous questioning to help students spot their own misconceptions:

... I'll say, re-look at this part, what do think about this, how'd you get, like with Roger, how'd you, 'cause he was totally off, and I said, how did you get this, so then they'll have talk to me about it and they might have to fix it. (Eisah Interview April 30, 2003)

Through asking Roger questions about his response, Eisah is able to focus his thinking on the mistakes in logic he has made so he can self-correct. Encouraging him to vocalize his response to the questions also stimulates his thinking since through vocalization he can hear the logic or illogic of his answers. Sydney explains the need for questions in addressing misconceptions:

I just have sketchy idea that they need to get from this point to this point and that they probably have these misconceptions. They're probably going to see this place value thing and they're probably going to think that these numbers are bigger than these numbers [Kamilla: Right, which they did!] or something to that effect. So that's all I have in my mind, is that some of my questions have to get to that misconception and move them forward, but I don't know exactly I'm going to ask them one two three and four, until I sit down with them and hear what they say. (Sydney Interview May 7, 2003)

Planning what to ask to help students identify misconceptions is crucial. However, at the same time as they plan what questions to ask, they also are intuitive and responsive questioners of their students. As Sydney describes above, their initial planning generates useful questions to ask their students; they draw on this bank of thought prompts in creative ways based on their minute by minute analysis of the actions and comments of the students. Another example of their flexibility in questioning in the classroom comes

from Sydney, in response to a question from me about whether she organized and sequenced her questions ahead of time:

No, I never do that. I wish I could say I did, I feel like there should be some grand scheme, but I tend to spend a lot of time randomly thinking about it, when I'm driving home, when I'm driving to school, but I always wait until I actually get into it to make decisions so I really didn't know what questions I was gonna ask, I kind of knew where I wanted it to go. I waited to see what they said.

(Sydney Interview May 7, 2003)

Her questioning methods thus allow her to build on her knowledge of student behavior while still being responsive to their individual thinking patterns.

There are other elements to their questioning method, such as calling on quiet students to respond (Sydney Math Talk Observation April 10, 2003); using student names in questions; encouraging questions; repeating questions; and allowing time for students to think of responses.

Wait Time

Waiting for responses to questions, or wait time, is another important part of questioning. This involves giving students time to think before responding, and giving students more than one opportunity to come up with a response to a question. This is something about which Eisah says, "I have to be conscious..." (Eisah Interview May 12, 2003). Eisah sometimes inserts questions into her wait time, thus providing additional cues to students who may not yet have a clear enough concept of what they are considering (Eisah Observation May 7, 2003). Sasha uses this effectively as her students discuss a science problem, wandering far away from the topic of friction to talk about

social equity. Through her patient questioning and waiting for responses, the students eventually came to an understanding of the issue underlying their experiment (Newsome Park Field Notes January 24, 2003). Sydney says, “This year I feel much better able to ask the right questions and to keep questioning and to give the wait time that they need” (Sydney Interview May 7, 2003), thus identifying wait time as a crucial part of questioning. The following dialogue from Sydney’s math class provides another example of the relationship between wait time and questioning:

Sydney: What’s the pattern you see here? [pause] Let me give [student] some time to look at it, because she’s trying to study it. [long pause]

Asks one student: Have you discovered a pattern here?

Student: Oh yes! (Sydney Observation May 7, 2003)

Wait time is valued because they believe it allows students the opportunity to work through thinking processes in their heads. The wait time offered in the previous quotation illustrates Sydney’s respect for those processes as well as the thoughts that emerge.

Repetition and Rephrasing

Repetition and rephrasing can take many forms. In this context, repetition has two meanings. It refers to having students work through certain mathematical processes multiple times. Traditionally this was done through worksheets or quizzes, where students showed their ability to perform certain computations. Now other methods are used as well: extended practice of certain problems, sometimes combined with discussion of solution pathways; working through problems using student-derived rather than prescribed algorithms; one on one discussion with an adult about thinking processes

and steps involved in a problem; math games, either individually or in a group; use of manipulatives to explore certain concepts; and others (Sydney Interview April 30, 2003; Eisah Interview May 28, 2003). This can be important because, as Sydney says, “the more you’re exposed to it the more you do come to an understanding, and we have those lightbulb moments where you think, ah, that’s what that meant all along, finally it clicks” (Sydney Interview April 30, 2003).

Repetition also is used by teachers when they repeat questions more than once to allow students to think more deeply about what is being asked. About this type of repetition, Eisah says, “as far as repetition of a similar question worded in different ways, coming from different perspectives, resulting in the same answer, is really important” (Eisah Interview May 28, 2003). This second use of repetition is similar to rephrasing, a more unitary concept. Rephrasing refers to the restatement of something a student has said in different words, with the intent of clarifying the statement for oneself or the student. Eisah discusses her use of rephrasing:

Eisah: Yes, I use rephrasing to help the students hear. Sometimes when they answer the others don’t hear what they’re saying.

Kamilla: Do you also use it to clarify their points?

Eisah: Well yes, I use it for that too. I try not to shape what they’re saying.

(Eisah Observation and Interview Notes May 7, 2003)

Eisah’s rephrasing helps students in the class hear what other students said, as well as provide clarity on for their ideas. However, she works to keep herself from “shaping” what they said, but rather, simply restating it in clearer words. Sydney provides a further explanation of the need for rephrasing:

... [sometimes] somebody's trying to convey something verbally but they don't necessarily have the verbal skills to convey that so that the other students can understand it. So I just find that spitting it back out in a way that's going to make sense to the other people makes all the difference. Then that really might make it click for somebody. But usually I find if I just leave it up to the child to say something people might miss something valuable because they said it in such a way that it was fuzzy. Like I didn't even understand what the little girl was saying. And I think I reiterated what she was saying, but even if I wasn't I was going to reiterate it that way so they could hear, I think this is what she was saying. (Sydney Interview May 7, 2003)

Rephrasing is particularly important when students lack the "verbal skills" needed to make their ideas apparent to others. Sydney's rephrasing can provide this clarity, and focus student attention on what other students are saying. As well, since students are "easily distracted," repetition and rephrasing seem to be "the best way to hit on the valuable nugget that a student was giving. And it seems to help" (Sydney Interview May 7, 2003).

Finally, sometimes rephrasing helps students understand what they mean themselves. This happened in Sydney's class:

I think Lora said, I don't know the words to say what I'm trying to say. I think they realize that. So just to hear someone else say it in a way that makes sense, like oh yeah, that's what I'm mean. Or no, sometimes they'll say no, that's not what I mean. (Sydney Interview May 7, 2003).

Even if the rephrasing is not accepted by the student, the teacher still continues to try to understand the student logic:

Jeannie: I saw something which, I understood, when we did it on the one paper on the back, on one of them, you know how you said that the bigger number goes here and the smaller number goes here and it starts going this way and goes in back.

Sydney: Okay, so you're saying everything seems to start with one, it goes ones, tens, ones, tens. Is that what you're saying?

Jeannie: No

Sydney: What are you saying? (Sydney Observation May 7, 2003)

Here the attempt at rephrasing was not accepted by the student. However, had Sydney not rephrased, she would have assumed that the student meant what she as the teacher thought. This illustrates another advantage of a rephrasing process: it allows teachers to learn what students are thinking. Rephrasing, and being true to the words one hears from the students, opens respectful dialogue, allows the teacher to gauge student understanding, and helps students clarify their own conceptions. As well, it provides the student with an opportunity to explain her idea further and clarify for herself what she means.

To Repeat or Not To Repeat: How to Cover Facts Effectively

Repetition of concepts is a difficult task for these teachers because they try to avoid drilling their students with facts. Sydney explains the dilemma they face as they look for philosophically appropriate ways to expose students to new concepts. On the one hand, she agrees that "probably, that repetitive exposure [through drilling] could have

that effect” (Sydney Interview April 30, 2003) of helping students come to an understanding. On the other hand,

... the problem comes in in the classroom in that you don’t want to keep kids sitting at their desks doing a skill and drill all day, because they don’t respond well to that, but again you’re torn, because if it’s going to help them get to the understanding you want to do it, but you need to do it in a way that makes it interesting for them. (Sydney Interview April 30, 2003)

Since some form of repetition is valuable for learning, she uses repetition and rephrasing frequently while trying to do it creatively so that learning is still fun and internally directed for her students. She has used math games, manipulatives, and focused discussions for this, as well as worksheets on occasion. Eisah emphasizes the principle that practice is important, but teachers need to focus more on building understanding than an ability to generate automatic responses to questions:

As far as math repetition, they do need practice, but math isn’t so much as memorization, other than like multiplication facts. It’s not so much of memorization as understanding the process. So I don’t think it has much a place, I think it’s more of a continuum of understanding the process. It’s not memorization of facts. (Eisah Interview May 28, 2003)

She goes on to criticize “skill and drill” methods:

And with multiplication facts, I never drilled multiplication facts, ‘cause I just think that there’s no place for that. If you know 4×3 , great, but do you need to know 4×1 , 4×2 , 4×3 , 4×4 , and in under twenty seconds like they used to do? I

think there's no place for that. Especially with calculators. (Eisah Interview May 28, 2003)

Repetition and practice are fine, as long as students are practicing useful concepts.

Drilling students so that they can perform rote activities, such as writing down the responses to simplistic math equations "in under twenty seconds," has no place in a classroom. In contrast with drilling facts, however, practicing cognitive strategies can lead to their internalization. Eisah feels that repetition can lead to "... complete ownership. I just have to make them own it. Like Bella, it's completely, whenever I say they adopt what I'm doing, it really is theirs now, and that's what I need to get them to do" (Eisah Interview No Date).

Finally, the teachers have mixed feelings on the need for repetition with their support kids. Sydney says that "all these kids who need a lot of support, it's imperative for them, they need to hear it over and over and over" (Sydney Interview May 28, 2003). However, even for them she is not certain that this is always needed since sometimes they remember things they only heard once. She thinks that "all of those five kids have very good memories for the things that make sense to them. It's just the other stuff they need to hear over and over and over" (Sydney Interview May 28, 2003). The need for repetition relates to their memory abilities, which in turn relates to their level of connection to a topic; she hypothesizes that "they don't see the connection in the things that need repeating" (Sydney Interview May 28, 2003).

Think-alouds and Teacher Modeling

To provide their students with models of appropriate thinking, the teachers use think-alouds to talk through a model thinking process for their students. Sydney explains what this is:

I try to use that as often as possible, just really to model for them, you don't just get it out of thin air, there's a process that you go through, even if that becomes automatic and you don't think about it, you still go through the same process to get to the end result. So yeah, I try to do that as often as possible. (Sydney Interview May 28, 2003)

Think-alouds model a thinking process rather than provide a solution. Through conscious effort to use a process repeatedly, students can make it part of their automatic functioning, thus making it easier for them to solve problems. Think-alouds also are open rather than prescriptive, as Eisah explains:

... [think-alouds are] not necessarily, think like this, but when I'm stuck, here's some good things I can ask myself. Or when I am helping somebody who's stuck, here's good things I can ask them, or when I'm trying to make connections, like modeling all different scenarios and have other kids model scenarios.... (Focus Group May 14, 2003)

Sasha provides an example of what a think-aloud looks like:

So ... when we're talking about probability, how do we use that to help us? I'd like to let your brains think about that for five seconds. How would we do that. My brain is thinking, hmm, how would I do that? What would be the part in

probability, and what would be the whole? Anybody have an idea or just want to take a stab at it? (Sasha Observation May 15, 2003)

We see her setting up the situation with a question, and then, as Eisah describes, verbalizing the questions she is asking herself. She then throws the question back to the class to encourage them to continue the thinking process.

Think-alouds for Struggling Students

Think-alouds are particularly useful for students with low metacognitive levels who do not know what their minds need to be doing as they attempt to solve a problem. They can assist students to make those connections between ideas, as Eisah explains: “I completely model. Okay. So if you’re not making a connection, what do you need to do next. Like prompting their metacognitive process, really” (Eisah Interview May 28, 2003). Eisah prefers to use think-alouds only when her students are struggling to solve a particular problem:

... with kids who are struggling, that’s when I use them. That is mostly when I use them. If the kids aren’t struggling, I want them so much to explore it on their own and take it and let them do the think-alouds. ‘cause if they understand it, the kids don’t need me to do the think-alouds, they can do them. Here’s what Adam’s thinking and here’s what Careena’s thinking, and those sort of things. When they’re struggling is when I do a think aloud. Whenever I don’t get this, this is what I do, or, what really helped me is to connect this with this. So I model when they’re struggling. (Eisah Interview May 28, 2003)

Through think-alouds, struggling students have examples of thinking they can adopt. For students who are more advanced, Eisah feels that this could constrain their thinking;

however, for those who have no idea where to begin, a think-aloud can provide them a starting tool to build from.

In addition to modeling cognitive processes, the teachers use think-alouds to model emotional and behavioral choices. Through doing this, they encourage their students to assume responsibility for their behavior. In one example, Eisah says, “I know I’m wound up today, so I just made a decision to settle down” (All Observation April 28, 2003). By sharing conscious reflections on her behavior, she facilitates student reflections on their own actions.

Rationale for Individualized Instruction

These teachers’ experience has shown them that many weaker students need smaller group interaction in order to learn. This could be as focused as one on one interaction with the teacher, or simply working in a smaller group. They “get much more engaged if it’s just the one on one with no other distractions ... but they also do okay in a smaller group” (Sydney Interview May 15, 2003). Sasha identifies that she has “five kids that really need one on one attention” (Focus Group May 14, 2003) if they are to succeed. Sydney thinks that these students “really need one on one individual attention to be the most successful, they need someone to sit down with them and do repetitive things with them” (Sydney Interview April 30, 2003). She also notes that “they tend to respond to individual attention, but it has to be consistent, it has to be ongoing, and that just doesn’t happen” (Sydney Interview April 30, 2003) in a busy classroom. Eisah feels that more individualized attention could help her students who “tune out”; she wishes she could “just pull them out with me” (Eisah Interview April 30, 2003). For the core of students who struggle to learn, individual instruction proves vital.

Individualized instruction meets children's needs that cannot be met in a large group. Some children simply "can't get focused in that big group. It's too many people" (Sydney Interview May 15, 2003). Large group settings seem to be detrimental for some students for a variety of reasons:

I think when they're in this discussion that, I don't want to say over their heads, but they're not ready to clue in to what is being said there, pick up the key components, it's just wasted time for them, that's my big fear, is that they're often sitting there getting absolutely nothing, in fact they're losing [Kamilla: Got it!], losing ground, because they're like, I have NO idea what these people are talking about. Whereas if they have one on one time to go through their own thinking, they could deal with it very well. (Sydney Interview May 28, 2003)

In large groups, there are more opportunities to lose track of the train of logic, and fewer incentives to keep focused. Their lack of attention in large group settings is particularly problematic as they are the students who are furthest behind. When they are working closely with a facilitator, the students have the focus to explore their own thinking. On the other hand, when working in a group, they seem to "go into another zone, they just get their minds into something else and they're gone" (Sydney Interview May 15, 2003).

Individual time makes focusing easier. For the children who are either shy or spend more time thinking before coming up with an answer, one on one time with the teacher seems to work because there is "no one else to kind of beat them to the punch line" (Sydney Interview May 15, 2003). It also allows for "some sort of one on one direct discussion about, this is what's involved in what you're doing here" (Sydney Interview May 28, 2003) which seems to be necessary for some students. The impact of

individualized instruction comes from the connections it fosters with students. As Sydney says,

... having a connection to them, I don't think they would feel that way if we didn't have a strong connection, and then they're able to see in this one on one time that something valuable is coming out of that, that it's strengthening the connection ... the focus just is on them, I think that's the difference. (Sydney Interview April 30, 2003)

Challenge and Benefits of Individualized Instruction

Meeting the need for individual attention is difficult. While Sydney prioritizes changing her instruction to “spend individualized time with kids” (Sydney Interview April 30, 2003), this is challenging in a classroom with around twenty diverse students. Eisah struggles to meet with her students individually to talk about their math representations:

I can't meet with every kid to see their math talk when we do whole group. In the two groups I can see every kid's math talk. This is when I sort of try and get around and at least look at every math talk but I can't have everyone explain it all theirs me. (Eisah Interview April 30, 2003)

Sydney describes this struggle over trying to provide more individual time for struggling students: “I can't do that in the classroom, and I also can't do that with the entire class sometimes. So it's really a balancing act, trying to find how can I reach these kids without abandoning the rest of kids” (Sydney Interview April 30, 2003). Sydney feels high levels of guilt about her inability to provide more individualized instruction. She says that “it is really heartbreaking to feel like you should be giving a child so much more

than she gets during the day” (Sydney E-Journal March 21, 2003). Another strategy that is used is to provide tutoring after school. Sasha and Eisah run after school clubs for social studies open for either specially invited students or all who are interested to attend (Focus Group May 14, 2003).

In spite of the struggles to implement it, they have seen the tremendous benefits from providing individual instruction. Sasha notes the success that individual conferences in reading have had for some of her students:

With Jonathan, I had one reading conference with him, I emphasized if you tried reading in your mind with expression you’ll understand the characters better, and he was telling the class about this just recently, that he hears the different characters reading in different voices in his head so he can understand them. And his reading has improved. (Sasha Phone Call May 16, 2003)

She also notes how one student recalled a grammatical concept from a one on one discussion over a year ago, and applied it to her writing (Sasha Phone Call May 16, 2003). Things that students learn in personalized sessions are retained more effectively.

Sydney also has noticed the benefit to her students from individual instruction. Looking at the time she gives to individual work sessions after school, Sydney says that “at least one of the students continues to show growth and it simply validates that she needs so much more than she gets during the day” (Sydney E-Journal March 21, 2003). She also notes that “it’s true, even in their reading or writing, that the more they meet with me the better they do” (Sydney Interview April 30, 2003). Because of the results that have been gained through individual instruction, she believes that,

... individualized instruction is probably the ultimate, because all the kids benefit from that, and to me there just doesn't seem to be anything more powerful.

There's nothing more powerful than figuring out how to differentiate for all these kids, but then also to give them that individualized time. (Sydney Interview April 30, 2003)

Sydney works on improving her ability to provide that individual time. She notes that "it's still a process of trying to figure out, that's my goal, how do I make that work, how can I make instruction even more individualized, how can I make sure that kids get that individual conference time" (Sydney Interview April 30, 2003).

Formative Assessment

Through the use of all the strategies above, the teachers engage in formative assessment within their classrooms to have a real time grasp of their students' thinking and learning. They use formative assessment as a key to figuring out what their students know, helping the students become aware of this, and using assessment information to modify instruction. They use it casually and informally in their work, such as this example where Sydney describes her work with a student teacher who taught a lesson on decimals:

She brought in colorful activities and created a human decimal game so that the kids could have some fun with it. The only shortcoming was the assessment. I could tell that she had the impression that the kids "had it" and she was ready to close out the activity. So I suggested that we try a quick challenge to get an idea of who actually had it. First she worked through a sample problem with the class

and it became terribly apparent that most of the students had NO CLUE. (Sydney E-Journal May 3, 2003)

Sydney came up with the idea to do an assessment to confirm her intuitive sense that the students still did not understand the topic. She developed it on the spot, and used the information from this quick assessment to guide her subsequent classes on decimals, aware that most students still did not understand the concept.

Formative assessment is widespread and related to ongoing revision and planning as the teachers use information they gather from watching students learn to revise how they are teaching, what, and when. It is also seen in their use of questioning, such as at the beginning or end of a math talk, to figure out where to go next.

Cognitive Strategies

Cognitive strategies are a key element of cognitive constructivism that is emphasized by these teachers. They are firm believers that the mind can be developed to use patterns of thinking that will enhance performance.

Thinking Strategies: Origin and Evolution

Through the course of more than one year, these teachers worked on identifying, organizing, and streamlining a framework of cognitive strategies that could be used by students in all grades to facilitate effective math problem solving. The goal is to give the students strategies they can use when they get “stuck” so they can get “unstuck” (Eisah Phone Conversation December 6, 2002). “In order to help them cope with being challenged we constantly refer to thinking tools as helping strategies and go back to ‘what you know’” (Eisah Phone Conversation December 6, 2002). The strategies, also

called cognitive strategies or thinking tools, were selected for their ability to help students orient themselves to a process of solving problems (Appendix B). The strategies were modified repeatedly, and specific versions for each grade loop were developed (Sasha Coffee Shop January 11, 2003). The teachers expect that their application will promote metacognition as students step back from immersion in math problems to thinking about what they are doing and how they can do it better.

At the beginning of the year, the entire set of strategies was presented to the students and they were given a copy for their notebooks. The teachers focused on the first group of strategies, about five of them, adding more throughout the year as these earlier ones were mastered (Eisah Phone Conversation December 6, 2002). The strategies are posted in each of the classrooms (Sasha Math Talk Observation October 7, 2002), and select strategies are listed at the top of math talk journal pages so students can identify which strategies they have used at the end of the class. Students are encouraged to refer to the visual charts in the classrooms. As Eisah confirms to her class, “This is a great thing to do when you don’t know what to do next. I see students when they’re stuck going over to look at the chart” (All Observation April 28, 2003). Over the course of the year, as students internalized the earlier steps, the teachers added the next group of steps (Eisah Phone Conversation December 6, 2002).

As the strategies evolved over the year, different versions for the grade levels were developed. Grades 2 and 3, Sasha and Sydney’s grades, focused on finding important ideas, making a plan, and searching for a quicker way. Grades 4 and 5, Eisah’s grades, emphasized hypothesizing about what the solution might be, trying to think of different ways to reach a solution, and discussing with your classmates whether you

agree, disagree or choose to add to their ideas using proof (Sasha Coffee Shop January 11, 2003). As the students move through the grades they are able to integrate earlier strategies more fully into their functioning, and to build on them and become more complex thinkers through application of further strategies.

Details of the Thinking Strategies: Know, Need, How

A variety of strategies is incorporated into a framework for the students. The primary strategy is what they call “know, need, how.” This refers to having students identify prior knowledge and new information from the problem; what the problem is asking them to find; and how they will find it, or what solution method is indicated by the problem. Eisah emphasizes the importance of these preliminary steps: “... they need that. I still very much rely on the ‘know, need, how,’ because when they’re really struggling they can’t get anywhere unless they recognize what they know. I totally rely on that so much” (Eisah Interview May 12, 2003). They use this strategy so frequently that as Sasha explains how to help other students more effectively, the class is able to finish her sentence:

Sasha: When we come back tomorrow, I want you to continue this higher level math talk, but I want you to do it on your own. And it’s okay if you work with others, but I want you to do it by reminding them of what they ...

Class: Know. (Sasha Observation June 9, 2003)

“Know, need, how” is closely linked with the rereading strategy, which is discussed in detail later, as it focuses student attention on the details of word problems. It is also connected with finding important ideas, or identifying the key words in the problem that will be needed to shape a solution. This strategy follows immediately on

reading and rereading of the problem. Eisah uses the phrase “inch by inch it’s a cinch; mile by mile it’ll take a while” to emphasize to her students the importance of identifying important ideas and building on them to find a solution (Eisah Observation June 5, 2003). In observation notes from one of Sasha’s math talks, we can see her guiding the students through identification of the most important information:

Melvin identifies the most important information. He says “A factory packs eight pencils in a carton.” Sasha: Is this the most important information? Melvin: Yes. Sasha: Is it most important that a factory packs it? Dawn: Eight pencils in a box [is the most important information]. (Newsome Park Math Talk February 10, 2003)

Through teacher questioning, students strip away descriptive information to define the problem and the needed solution.

Details of the Thinking Strategies: Rereading

An emphasis on rereading, also called close reading or careful reading, of the problem is a fundamental strategy used. It is a major need, particularly for the less cognitive students who do not seem able to decode word problems. When Sydney asked one student, “What about the problem lets you know that you need to add?” the student replied “that the problem doesn’t help her know what to do, so she adds because she knows how to do that” (Sydney E-Journal March 21, 2003). Such comments indicate the need for students to learn the basic skill of reading and understanding. In contrast, another student, when asked “What makes you think you want to subtract in that problem?” replied, “Because it says, ‘how many’ is the clue for me, because how many says it’s subtracting instead of adding” (Sydney Observation June 5, 2003). She had

applied the rereading concept and picked out vital information. Rereading is linked with the idea of developing an orientation to the problem to guide them in solving it. Many support students do not know how to find the clues to a problem in the words used, and rereading aims to develop this ability.

To help students come to this level of comprehension of word problems, the teachers begin math talk with reading and rereading the problem out loud. This is followed by discussion of the important ideas in the problem. One aspect of rereading is underlining, used to highlight key pieces of information and clues that tell the students how to solve the problem. It is strongly encouraged by the teachers:

Eisah: A lot of them underline on their paper though, now. And they read it first, they always read it before they write their goal. But a lot of them are underlining on their paper. Not a lot of them are underlining their morning work. And see, I'm trying to get that transfer. I'm like, we do it in math talk for a reason!

Kamilla: Are you consciously encouraging them to do that?

Eisah: If they come to me and say, I don't understand this, I say, well, I don't see any underlining. And they go back. So that's what I always do. (Eisah Interview No Date)

Underlining is the individual process associated with discussion of the important ideas in the problem. It is the analytical component of reading, where students break apart the paragraph to isolate the key concepts. Eisah jokes with her class about what ideas are important and which are not, encouraging them to learn to make the distinction themselves and to use underlining to help them do this (Eisah Observation May 7, 2003).

Notes from a discussion in Sasha's class illustrate how more advanced students emphasize careful reading of questions:

Student: If you didn't get this right then you should read the question carefully because it may have what part is NOT shaded.

Sasha: That's key, that's so key.

Student: You can also use the "not" strategy and take out what part of it is not shaded.

Sasha: That's great. (All Observation April 28, 2003)

The students here identify some of the skills associated with careful reading of a problem, using key words like "not" to decode the meaning.

Rereading is the cognitive strategy most often mentioned by the students in math talk (for example, All Observation March 7, 2003). It is emphasized as the first step to take when trying to solve a problem, and is vital for all subsequent work on the problem.

Details of the Thinking Strategies: Goal Setting

Setting goals is another thinking strategy that is used. The teachers recognize it as important and strive to incorporate it each session, as Eisah shows in her comments: "I know that myself, I really focus on doing goal setting as far as, if I didn't focus enough on goal setting or the follow-up of goal setting, I really focus on that the next day" (Focus Group May 14, 2003). Goal setting provides a way for students to be metacognitive about their own development by identifying what they are capable of and what they need to work on. As one student states, "If you don't have a goal then that means you don't know what, like, if you need to work on something you don't know what thing to work on because you don't have a goal" (Sasha Observation June 5, 2003). Goal setting has

been integrated into math talk, with students usually setting goals on their math talk journal pages before beginning work on the problem since, as Sasha says, “our goal is to direct our learning” (Sasha Observation May 15, 2003). At the end of the problem, they are asked to identify if they have met their goal and set a new goal, as seen in this example from the end of one of Sasha’s math talks. She asks, “I want to know if you achieved your goal,” followed by the question, “If you didn’t, did you learn something you can use?” (Sasha Observation June 10, 2003). Students are aware of the importance of goals in evaluating learning, stating, “... when you finish with the math talk, you can see after checking over your work if you accomplished your goal” (Sasha Observation June 5, 2003). By encouraging the students to create and monitor goals continually, the teachers expect that they will become better able to take responsibility for their learning. Goal setting also can help them focus attention on the skills they need to develop, thus enhancing retention.

The teachers provide specific guidance on goal setting, both when to goal set and what comprises an effective goal. Sasha prompts her class as to when to set a goal, pausing during one math talk to say, “I’d like you to stop right now and make a goal during math talk for today” (Sasha Observation June 10, 2003), and during another to say, “I’m going to give you some time to make quality goals that have all the characteristics that were discussed” (Sasha Observation May 15, 2003). Eisah also stops to have her class write goals before starting on their math talk (Eisah Math Talk Observation April 30, 2003). Sometimes the class share and discuss their goals before moving on (Eisah Math Talk Observation April 9, 2003). Eisah provides both positive feedback and prompting about types of goals as they work on them:

Take one, pass it around, write down your goal. Good job, Bernadette's getting her goal down already. I think you guys stay up at night thinking of goals for reading and math. ... This is kind of a different kind of math talk. We're thinking of skill goals/ feeling goals/ strategy goals, we're thinking of specific goals so we can see if we accomplished them. (Eisah Observation May 7, 2003)

Eisah provides multiple points of encouragement, saying "good job" and commenting that they probably "stay up at night thinking of goals." Once the goals are created, she also provides for extensive questioning and discussion so that goals can be evaluated and modified by the students. With repeated practice in creating their own goals, she hopes that they will internalize this process. This excerpt from a questioning process shows how she guides them through questions towards an evaluation of their goals:

Student: [My goal is] to do the best I can.

Eisah: And what does that take?

Student: To try the best you can do, and if you get it wrong it's okay.

Eisah: Can you be a little more specific?

Student: Working hard.

Eisah: How do you work hard?

Student: By paying attention.

Eisah: Do you think that's more specific than working hard?

Student: Yeah. (Eisah Observation May 7, 2003)

Through her questions, the student digs deeper into her evaluation of what skill she wants to practice during the math talk.

The teachers also are specific about what makes a good goal. Sasha tells her class, “Before you leave the carpet you’ll have made a goal that’s specific, achievable ...” (All Observation April 28, 2003). Eisah’s students are able to describe “feeling goals, thinking tool goals” that would see them set personal objectives for monitoring their feelings and applying specific thinking tools during the upcoming math talk (Newsome Park Math Talk February 10, 2003). Behavioral goals are another element. In this dialogue from a math talk in Sasha’s class, we see her prompting her students to set their own behavioral goals:

Sasha: What I wanted you to do now was to come up with a behavior goal for the afternoon, because you’re a little bit out of control right now.

Yolanda: To be in fourth grade during math talk.

Daniel: My goal is to sit close and be a fourth grader and to look at other people when they’re speaking.

Sasha: I had to fill out your evaluation cards for your permanent record. One of the things I had to evaluate you on was how you listen. Do they listen by watching and responding to others. That means you’re evaluated every year by how you listen and respond to others.

Charity: My goal today is to sit criss-crossed and try to meet your expectations during math talk.

Sasha: Yesterday we all got a check for expectations. One of the things you wanted to work on was to looking at each other while you were talking, and to pay attention. (Sasha Observation June 10, 2003)

Through her comments and questions, Sasha is able to elicit a variety of behavioral goals relating to listening, interaction with other students, and noise level in the classroom.

Another session of Sasha's math talk sees more student discussion about the attributes of a good goal:

Sasha: What do we need to do before we do predictions?

Students: Make a goal.

Sasha: But what goes into making a goal? Do we do things half way in this class? [Students: No!] What goes into making a good goal?

Dawn: It's realistic.

Sasha: What does that mean, it's realistic?

Kristen: You can be successful at it and it can really happen. Like, you can't say I'll read a thousand pages in five minutes.

Sasha: Great example! What else do we want our goals to be?

Wallace: Challenging.

Sasha: Yeah, challenging!

Wallace: And measurable.

Sasha: What does measurable mean? ...

Paula: You can prove that you met your goal.

Sasha: That makes sense to me. How can you prove it? How can you prove it in math talk?

Kristen: Then you would show your knowledge of how you got it and then you have to think of it and say, did I make that goal or didn't I.

Sasha: Okay. What are some other things that need to go into a goal?

Wallace: ... don't remember, it starts with an S.

Sasha: Can we help Wallace?

Student: Specific.

Sasha: What does specific mean?

Faith: There's actually two that start with an S, specific and stated.

Sasha: Okay, that's great. What is a specific goal?

Dawn: Specific goal is a direct goal with a lot of details and tells really what you want to do with a goal.

Erika: Before you make a goal you really need to think 'cause it really needs to be accurate for you.

Sasha: What does that mean to you?

Erika: It needs to be good for you.

Sasha: That's interesting, what does that mean, be good for you?

Erika: Like if Terry copied off Kristen for her goal, she wouldn't know because it's not her goal.

Melvin: Your goal should be challenging because if it's not challenging, why should you do it?

Kristen: State the date, when you want it completed by.

Erika: And I have something you shouldn't do about the goal. Like if you do math talk first and then when you get to the end you do the goal.

Sasha: That makes sense to me, 'cause our goal is to direct our learning. Erika, I love how you're being so reflective. That really helps us in our learning. What does this mean to you?

Kristen: Like if you do a test and didn't write down the answer, but when you're marking you write it down, then that's cheating. (Sasha Observation May 15, 2003)

Students by this time in the year have internalized the criteria for an effective goal and are able to discuss this. These criteria include being realistic, challenging and measurable, with a clear completion date; specific and stated; appropriate to the learning needs of the individual; and generated before they work on the problem, so that the goal can direct learning. Regular discussion of these criteria help students refine their goal setting processes. To help their students see the importance of setting goals constantly, the teachers also model goal setting. During one math talk discussion, Sasha shares, "by the way, I met my goal. I read with four people. I met my goal, and I did it by the end of reader's workshop" (All Observation April 28, 2003).

Students have absorbed the concept of goal setting. Eisah notes that they have the ability to create effective goals:

Today their goals were about being a master, I think they knew we're going onto decimals tomorrow, but their goals have been much more, yesterday their goals were totally skill and cognitive strategy oriented, but I was really impressed.

(Eisah Interview No Date)

Goal setting has become standard behavior for these students. A final selection from one of Sasha's math talks shows the quality of goals created by the students, as well as the role the teacher still plays in guiding them to evaluate continually their goals:

Sasha: I'd like you to stop right now and make a goal during math talk for today.

Terry: Not to use pictures and to use number equations.

Student: To focus on math talk and listen and to look at the person who's talking.

Sasha: Just to look, or to listen?

Student: To listen.

Erika: To use pictures, 'cause last time I messed up.

Sasha: So you mean to draw accurate pictures, and then maybe use numbers?

Erika: Yeah.

Daniel: Do all ways to solve the problem. Yeah, words, numbers, all ways.

Sasha: Will that move your learning forward, or keep it right here?

Daniel: Probably move it forward.

Dawn: My goal is almost the same as Terry, not to use pictures, but I might if it's really hard for me.

Paula: To find a quicker way.

Kristen: It's kind of strange, but I want to first find a longer way, and then use that knowledge to find a quicker way.

Sasha: So you might start with a longer way and then use that knowledge to find a quicker way.

Kristal: First make a hypothesis and then use it.

Wilbur: What I'm going to do is try to, put it in a word problem and then to check it I might put it in a fact family.

Wallace: To help others and concentrate and don't play around.... (Sasha Observation June 10, 2003)

The students here have created highly personal goals, related to their own learning needs. They have incorporated cognitive strategies, and have identified how striving to achieve these goals will carry their learning forward.

Details of the Thinking Strategies: Imagining

Visualizing, imagining, or creating a mental picture is another strategy used.

Sasha prompts one of her students to create a mental picture of the problem:

The trick, Wallace, is we always refer to what we know to help us. What mental image do you refer to when you're thinking of fractions? What's the picture in your head you use if you have to go back to square one? (Sasha in All Observation April 28, 2003)

On another occasion, she explains in more detail what visualizing means: "While I read this problem to you, I'd love it if you would visualize it. That means to make pictures in your mind like a movie" (Sasha Observation June 9, 2003). Mental pictures are a way to synthesize important ideas. They encourage the students to put the pieces in place to create a coherent image that will help them create a plan to solve the problem.

Details of the Thinking Strategies: Planning

These strategies come together as students make a plan. Making a plan is a way to coordinate the previous strategies. To make an effective plan, students need to read and reread the problem, identify important information, imagine the situation, and be clear about "know, need, how." Making a plan is repeatedly emphasized by the teachers (Sasha Math Talk September 23, 2002; Sasha Math Talk Observation September 19, 2003; Sasha Math Talk Observation October 7, 2002; Eisah Math Talk Observation April 9, 2003). After going through the reading, rereading and important ideas stages they

often make comments like Eisah does here: “Those who have a plan, go to your desks; don’t stay here if you have a plan” (Eisah Math Talk September 30, 2002). Part of the plan for a solution is creating a hypothesis. In this strategy, the students evaluate what they know to project what the answer might be (Newsome Park Math Talk February 10, 2003). Predicting is another word used synonymously with hypothesize, and is used in this example by Sasha as she explains the importance of predicting to her class: “we have to make a prediction because mathematicians always make predictions just like scientists. So you have to predict which group is going to win” (Sasha Observation May 15, 2003).

Teaching the Strategies

In order for the strategies to support autonomous student problem solving, students need to internalize the steps. To reach this goal, more instruction in the steps is used (Sasha Coffee Shop January 11, 2003) as well as extensive prompting (Sasha Math Talk Observation September 19, 2003; Eisah Math Talk September 30, 2002; Sydney Observation May 7, 2003). Guided prompting during math talk to stimulate students to identify and respond to the cognitive strategies is used extensively by all three. Such prompting also is combined with brief instruction on the strategies when needed. The goal of such prompting is to familiarize the students with the strategies to the point that they will be able to express them independently. Sydney emphasizes its importance:

I think that some of the other teachers have seen that too, in that those kids still continue to need support. They still need to go to see that visually or they need you to say that to take them through it, in which case then they may be able to

solve the problem, but they tend not to go to that on their own. (Sydney Interview May 28, 2003)

Teacher prompting thus leads students through a sequence of steps they may not follow otherwise, even if they can use them if reminded by a teacher or a visual prompt.

Sometimes the teachers also explicitly remind their students of the need to use the strategies, as Sasha does here: “What I want you to do is figure out this problem using your thinking strategies foremost. Read and reread foremost, then try and make a picture in your head. Then use words, tallies or pictures to solve it” (Sasha Observation June 10, 2003).

Beyond prompting, Eisah experimented with meta-prompting, asking her students to ask themselves what they need to ask themselves rather than simply asking them what they need to do next: “I have learned to ask kids ‘what can you ask yourself to help you?’ rather than ‘what step do you need to do next’ or ‘what process is this problem asking you to do’” (Eisah E-Journal March 31, 2003). This has been particularly effective with students who know the steps and how to fulfill them but have difficulties applying them independently (Eisah Reflection April 29, 2003). Such a process has helped students become even more metacognitive thinkers as they apply the strategies independently.

During math talk sessions, as the teachers prompt students to identify strategies, students are able to name, describe, and respond to them (Sasha Math Talk September 23, 2002; Sasha Observation June 5, 2003). These notes from an observation of Eisah’s math talk show the types of prompting for strategy identification, and show the ways that students are applying the strategies:

Eisah asks student to read problem. Asked what strategy was used.

Student: Read and reread.

Eisah asked what other thinking strategy they might use.

Student: Imagine

Eisah asked her to expand, and student talked about what she imagined.

Student described the numbers, then said, "I don't know how they'd fit all those people in a church!"

Eisah asked for another thinking tool.

Student: Make a plan.

Eisah: Do you have one?

Student: Get a bigger church!

Eisah asked for clarification for what "make a plan" is about.

Student: Helps you find a way to solve a problem.

Eisah points out another thinking tool, finding important ideas, and asks them to find important ideas.

Student expands on the "imagine" idea, describing where else they could hold a big wedding like that.

Eisah asks again for important ideas.

Kayla identifies the numbers of guests from the groom's and bride's families as important.

Eisah asks for another important idea.

Aida asks question: How come that many people can be in one family. Eisah answers jokingly.

Eisah asks for another important idea. Alex identifies term “estimate.” Eisah asks if that is the whole idea, and he expands and identifies that it talks about hundreds’ place value.

Eisah: If you have a plan, go to your desk. If you don’t, stay with me. (Eisah Math Talk September 30, 2002)

With Eisah’s guidance, students are engaging multiple cognitive strategies in a short time period. They are reading and rereading the problem to understand what is said; identifying important ideas that will be used to solve the problem; imagining the situation so they have a mental image to support their thinking process; and creating a plan to solve the problem. Multiple students are involved in filling in these steps, resulting in active engagement in the process.

Sasha uses a similar process, as seen in this excerpt from one of her math talks:

Sasha: I love how what you’re doing is connecting a past experience we had with what might be new. She said the past experience we had was what, Daniel?

Daniel: ... uh, with fractions?

Sasha: What do you guys think, what was the last thing we did with probability?

Terry, what was the last thing we did?

Pause.

Sasha: What was the last problem we did? What was the last experience we had with probability? Wallace?

Student: It was like a picture.

Sasha: It was like a picture ... what were we checking? What was that like?

Terry?

Terry: 'cause the colors show here what we did last time, but now we're doing it with numbers?

Sasha [to the class]: She thinks instead of colors we're going to use numbers.

Terry: Because here on the [spinning] wheel instead of colors there's numbers.

Sasha: I love how you're making predictions. You're brain never stops working, does it?

Terry: Nope. (Sasha Observation May 15, 2003)

Sasha here provides encouragement for her students as they identify and apply the strategies. She notes the use of "know" by complimenting a student on connecting new information with past information they have learned. She further prompts them as they work to identify all the details of their past experience that can be applied to the current one. Finally, she acknowledges how they use this information to figure out what will happen next by complimenting a student for "making predictions."

Over time, the students have begun to internalize the strategies. Sasha says, "before I taught these cognitive strategies some did these all the time, some did them sometimes, and some never did" (Sasha Phone Call May 16, 2003). Now, however, their use is widespread. When asked by the teacher, they are able to share the steps and explain how they are using them. In Eisah's class, when "I say to them, what are we doing on the plan. And they say, 'know, need, how.' And they seem to do that" (Eisah Interview No Date). The students talk about their use of strategies, such as these comments from one of Sasha's math classes as students talk about what they did during one math talk:

Student: I read it until I understood it but I couldn't so I talked with someone.

Student: If I don't understand it after I try and try then I'll just put the information from the problem into a representation.

Student: I had kind of a rough time in the beginning, that's why I was listening so much. That's why the reason I was listening so much when you were talking. I had a hard time but I kept rereading until I got it but I didn't, so I didn't ask for help but I just made a plan.

Student: I kind of had a rough time, I had it all right, but I was thinking of thinking strategies we used to have, and my goal used to be to think about the thinking strategies we had, then I had a hard time with the divisioning.... (Sasha Observation June 5, 2003)

Students refer explicitly to the strategies they used, and how these helped them grapple with the problem and get "unstuck" when they did not know what to do next.

Student Modification and Transfer of Strategies

Beyond internalizing the strategies, they also are modifying them as they see fit.

Sasha comments on this process:

I think that kids who are using cognitive strategies are using them because they're meaningful to them and have already started changing them in their own ways.

One person changing a flow map to a tree map, another is adding a hypothesis box, another is keeping what she knows in her head.... (Sasha Phone Call May 16, 2003)

The cognitive strategies are ever evolving, which is possible only as they are called into use actively. Sasha expresses her joy at the way they have enhanced student learning:

What an amazing week. All my students have been doing so well in math. I started to get teary eyed on Thursday when my lowest math group all made a plan and used each cog. strat. Each kid was successful. I remember in 2nd grade those 5 kids who were always so lost and overwhelmed. And even in 3rd grade they were inconsistent in their progress because they weren't always using a systematic thought process. "Know," they actually tell each other – are you crazy you need to make a plan! I changed my math talk around after looking at what 3rd grade did with my template. They thought it would be better if first the math talk was listed, then the goal, then the strategies and that the strategies be listed as questions so that the kids could prompt themselves for thinking. Also, as apart of the reflection, Liz suggested asking the question: Why did I choose to add, sub, mult or divide? and the kids are really writing some amazing things down about that! I'm not sure why, but their AH HA moments are so much more clear.

(Sasha Reflections February 15, 2003)

Sasha's classroom has internalized the cognitive strategies, resulting in notable improvements in performance. They are prompting each other to use the strategies, and modifying them to be more useful.

The students also are learning to transfer the strategies to different subject areas (Eisah Phone Conversation December 6, 2002). Eisah says, "I think they're doing really good, I redid their reading sheet to be more cognitive and not just skills but more cognitive. And they're making that connection" (Eisah Interview No Date). As well, Eisah notes that as a result of using the strategies, her students "have become more

confident, work better and faster” (Eisah Phone Conversation December 6, 2002). Sasha also comments significantly on the impact of the strategies:

... with the thinking strategies laid out the way they are on the math talk is helping kids to be more autonomous in problem solving. Often I'll say: when you've done all the thinking strategies, then I'll come over and help you ... I'm finding rarely do my kids say: I don't know how to get started or I just don't get it. Now, because of the thinking strategies they can articulate exactly where they are stuck because they can't get any further in their thought process. This is great and I am seeing a huge improvement in their ability to succeed on math test questions because of this I think. (Sasha E-Journal March 18, 2003)

The effectiveness of focusing on cognitive strategies has been noticed by the teachers and the students. They attribute their improvement in math performance to the systematic use of these strategies throughout the year. They also cite them as the source of increased student autonomy.

Group Processes

The teachers place a large emphasis on collaboration and group processes in their classrooms. Students learn through interaction with others in an environment of respect. They work to foster this collaborative, respectful environment through a variety of strategies for group work (math talk; flexible grouping; peer tutors) as well as through attitudes towards student collaboration (encouraging student interaction; respect for students; supportive class environment).

Math Talk Definition and Value

Math talk is a particular approach to teaching math shared by all three teachers and promoted throughout the school. Math talk, as implemented by them, is a highly reflective and interactive learning process that focuses explicitly on the development of cognitive thinking strategies and incorporates a variety into the math talk process.

Sydney defines math talk thus:

I think it's the kids getting a chance to talk about ... [Kamilla: math!] math ideas.

Yeah, I mean literally. It's them doing the talking, not me. It's not me explaining something, it's us discussing something as a problem or a puzzle to be figured out. That's what I see it as, it's getting a sense of other people's ideas and helping to formulate your own ideas through that. (Sydney Interview May 7, 2003)

In this description we can see many of the concepts associated with math talk: that it is a student-centered process; based on student thinking; and involving sharing of ideas and group interaction. Its goal is to "formulate your own ideas" by building on them and other people's. It is neatly summarized by one student's description of math talk: "It's where we talk about math" (Sydney Observation May 15, 2003). Sydney also describes it as, "I'm trying to listen to them talk about these mathematical ideas and hear what they would say" (Sydney Interview May 7, 2003).

Math talk is highly valued by the teachers because, in addition to allowing them to develop good math skills, it teaches them many things beyond math:

I think they get a lot out of that beyond just picking up particular skills. They learn a lot about problem solving, critical thinking, they ... they kind of get a, they become better able to express what they're thinking, and to feel comfortable

with their way of thinking, but also hear that there are other ways to do things that may or may not be as good. So I just think that all those are so powerful in addition to what they get out of it in terms of math. (Sydney Interview April 30, 2003)

Math talk thus encompasses the intellectual and the social, developing an ability to think clearly and to interact with others simultaneously. It incorporates all the cognitive strategies described previously, with a strong emphasis on rereading and goal setting. And as Sydney says, “I love math talk and I think it’s just beautiful, I think the things that come out of it are so powerful” (Sydney Interview May 28, 2003).

Math Talk Process and Evolution

Math talk follows a simple process. It begins as students set goals for themselves, read and reread a problem as a group, identify important ideas, and make individual plans to address the problem. They then work on their own, sometimes in pairs, or in a teacher facilitated group to work out their own “representation,” or unique way of showing their solution method to the problem. This can involve combinations of numbers, pictures and words. The group then comes together and students have the chance to share their representations, which are critiqued by other students who can agree, disagree or add to what their peers have done. This stage of the process is ideally directed by the children who call on each other to offer their ideas and share expertise. However, the teachers prompt when the students seem stuck or have difficulty following the steps (Eisah Math Talk September 30, 2002). Eisah has had effective sessions with students as facilitators of representation sharing (Eisah Interview No Date).

Math talk combines individual cognitive processes with social learning. Eisah here emphasizes the social nature of the math talk experience:

All students definitely benefit from math talk, but maybe not as far as at the same level. The kids who are more extroverted benefit more. My introverted kids, they do listen and they gain things from it, but the whole point of math talk is you hearing other people's ideas, bouncing your ideas off their ideas, taking ownership over their ideas but mixing them with your own, clearing up your own misconceptions, and the kids who are more introverted don't get to do that. They clear up their misconceptions by listening, but they don't do the bounce off, the discussion part, which is the main part of math talk. (Eisah Interview June 5, 2003)

Through social interaction the students learn about expressing their ideas, hearing others, and using dialogue to come to new understandings. Those students who are able to engage in the process more fully benefit more from it. Math talk thus provides a forum for students to discuss their mathematical ideas, share their solution methods, and develop their understanding of math in a dynamic learning environment.

As with other aspects of instruction, the teachers work to expand their implementation of math talk. Sydney says,

When I think of math talk, I think of the way I was trained to do it and we deviated from that so much this year in trying to experiment. But I consider it math talk, yeah. Because I'm trying to listen to them talk about these mathematical ideas and hear what they would say. So it doesn't feel like the

formal structure that I was given for it completely, they're not representing their thinking, but you know.... (Sydney Interview May 7, 2003)

Math talk has been adapted and developed through practice and experimentation. Their implementation of it continues to grow. One feature they have developed is the concept of multiple exit and entry points. This allows students to go off and work independently as soon as they have a plan for how they will solve the problem. This puts the children in charge of assessing what they know; in other words, it elicits metacognition. As well, students who begin working on a plan but get stuck can return to the teacher facilitated group or to a peer for more assistance. Eisah says that multiple exit and entry points help reduce frustration, particularly for the advanced kids who want to get to work right away (Eisah Phone Conversation December 6, 2002).

However much math talk changes, many of the basic components like the visual representation are retained. They also emphasize real world elements in math talk problems. In one example, Sydney uses pizza as the subject for a problem on fractions:

So imagine this please, imagine I had a pizza, and it was Pizza Hut because that's what I like best. [Student: I like Chanello's! Sydney: Yours can be from Chanello's then!] And when I got it on Tuesday night I ate two fourths of it. So I just cut it into fourths and I ate two fourths of that on Tuesday. Okay. So on Wednesday night I still have two fourths left, which is what Lora wrote. On Wednesday I'm gonna eat two fourths more. So how much will be left? (Sydney Math Talk Observation No Date)

Sydney provides an example that the students will find easy to visualize. Eisah describes the real world element of math talk in more detail:

Because I think it's a teaching strategy that we make sure that we engage math talk and connect it to real world. I think that's definitely a teaching strategy. We constantly, when we're making our math talk problems, which is preplanning, we're making sure it's actually a real world, as best we can, make it a real world problem or real world connection, I think that's a teaching strategy. (Focus Group May 14, 2003)

Other strategies also are incorporated into math talk by its very nature, as Eisah goes on to describe: "The think-aloud ... think-aloud, reciprocal teaching, modeling, scaffolding, all those are things that are completely built into math talk. That we have to do" (Focus Group May 14, 2003). Some other "specific strategies that we put in our math talk outlines, it's definitely modeling, scaffolding, reciprocal teaching, where they're doing the teaching and they have control, goal setting" (Eisah in Focus Group May 14, 2003). As well, strategies such as "questioning and prompting ... [are] so engrained in math talk" (Eisah in Focus Group May 14, 2003).

Flexible Grouping: Characteristics

The teachers experimented with flexible grouping this year. Flexible grouping, or ability grouping, involves having students work in groups rather than as a whole class. The membership in the groups, however, is not homogenous: there needs to be some diversity of ability level, usually high to middle, and middle to low (Sasha E-Journal March 18, 2003). As well, groups are not static (hence flexible) and membership changes over time. Sometimes the teachers decide who is in what group; sometimes the students can choose themselves; sometimes it is ability based, and other times, topic based. In this way, students have more opportunity to interact in a smaller group; they

are more often with students of similar ability, so that they are neither bored nor overwhelmed by the group discussion; and they have some choice in where they work, thus promoting both self-awareness of their abilities and reduced labeling of themselves as falling into one ability category. Sasha summarizes what flexible grouping means: “I think that’s what flexible grouping really is, because you’re being flexible in how you’re making your groups, it’s by choice, it’s by teacher, and it’s whole” (Sasha Interview April 30, 2003).

Flexible groups can be created based on a variety of criteria. Eisah considers student selected, groups based on different skill levels, or teacher selected as three possibilities (Focus Group April 2, 2003). Sydney has worked with three groups simultaneously in her classroom (Focus Group April 2, 2003). Sasha has tried having two broad ability groups, groups based on performance on morning work, and student selected groups. She has noted that some students select inappropriate problems to work on for a variety of reasons:

- they want to be w/a friend
- they want a challenge (which is often too much so that they get frustrated)
- they don't want a challenge (which is often too easy so that they are done quickly and become behavior challenges)
- they need to read the problems over and over again until they understand them and can choose the best for them. (Sasha E-Journal March 18, 2003)

Student selection of groups is not always ideal, but can be important in promoting autonomy and metacognition as students are pushed to take responsibility for their own

learning and to recognize their learning needs and current constraints. Sasha summarizes some of the ways flexible groups can be formed:

My conclusion about grouping is that it is flexible as long as the purpose for grouping is always changing. ie “today I am going to choose the groups because our morning work indicates that some people need one type of problem and others need another...” or “today I’d like you to choose the problem most appropriate for you. How would you go about choosing an appropriate problem for yourself?” Sometimes I’ll even have a whole group lesson and I’ll tell them the purpose is because we are learning a new skill... I’m finding more kids are getting more individual attention and more are being successful. (Sasha E-Journal March 18, 2003)

Such flexibility in how groups are organized in the classroom both meets multiple instructional goals, and provides for excitement in the classroom as criteria and groupings change regularly.

Scheduling, Monitoring, and Facilitating Flexible Groups

Scheduling and monitoring of flexible groups are two connected issues. The teachers frequently have found problems when groups were left to self-monitor. Sasha had a problem with her advanced group becoming unruly when left on its own so she rearranged her schedule to be able to work with each group individually (Sasha Coffee Shop January 11, 2003). At the same time, Eisah and her class found that whole group math talks were unruly and difficult for all involved (Eisah Interview No Date). Flexible grouping, when one of the groups is able to self-monitor or be supervised by another adult, allows the teacher more space to focus on the learning needs of a smaller group.

The teacher can help students avoid getting lost by intervening and asking questions (Eisah Teacher Formal Interview). It is also good for students with poor language abilities who find it easier to function in a smaller group (Eisah Phone Conversation December 6, 2002). Having student facilitators as opposed to teachers is another possibility, but those facilitators need certain qualities:

... [they don't have to be] strong in skill level, because Alison is one of my best facilitators and she's one of the lowest kids. Just knowledge in the procedure and really sticking to it, getting other kids to, having good cooperation skills and problem solving skills, really. (Eisah Interview May 12, 2003)

The student facilitators, therefore, functioning as temporary teachers, need to be able to create a cooperative learning environment and keep the group focused on the goal of solving the problem. Eisah also notes the possibilities with some effective groups, and the challenge that some groups have if they do not have sufficient ability among the group members:

They, like you, did the "know, need, how," they facilitated and ran a club. It was so cool. This group in front totally exceeded all my expectations. They just took the challenge. It's my group two that falls by the wayside sometimes. And I don't know why. I don't know, if I had more people who were higher in this group if they'd get them more excited. That's the group I need to focus on. (Eisah Interview No Date)

Effective facilitation is a crucial component to assisting the groups, particularly those where there is insufficient cognitive ability.

Benefits of Flexible Grouping

In spite of the difficulties, when flexible grouping works, it works wonders in the class. Eisah says it has “totally transformed” her room (Focus Group April 2, 2003), and Sasha is “seeing a huge improvement in their ability to succeed on math test questions because of this” (Sasha E-Journal March 18, 2003). Eisah describes one of her experiences with flexible grouping:

On Monday I gave them, we only had an hour for math again, we didn’t have the two hour slot, had to switch, so I gave them both the math talks, and this is the first time I did this, I picked two facilitators, it was phenomenal. Group one had the whole front board, group two was back here and they totally ran themselves and I just went back and forth. And they did awesome. They really did do awesome. (Eisah Interview No Date)

Smaller groups with effective facilitators therefore are able to explore a diversity of ideas and learn concepts effectively. Eisah has noted the following in considering how flexible grouping has affected her math class:

... flexible groups has really helped; it allows them to pay attention more. They are working on problems more suited to their skill level. The problems cover the same skill but at a different difficulty. They like it because there are different entry and exit points, they can stay with me for extra help and there is a reduced frustration level. They enjoy math more because they have less frustration.

(Eisah Phone Conversation December 6, 2002)

She also said, “as soon as I did the flexible grouping I was like, this is great! Kids are understanding faster, better, talking more, everything” (Eisah Interview No Date).

However, there is the challenge when two groups are running at the same time of keeping on top of the students who have difficulty concentrating:

But it doesn't work for all kids, though, you see like three or four kids, some tune out. Leonardo, [he] tunes out constantly, my Leonardo. But he does, he's the kid who tunes out but is still listening, but that's sometimes what's frustrating about the two groups going at the same time. (Eisah Interview April 30, 2003)

Flexible grouping has been shown to be highly valuable for stimulating student thought, but needs to be carefully monitored and arranged so as to avoid leaving less able students behind.

Peer Tutors

Students are eager to help their peers, often going up to other students and offering to help (Sasha Observation June 10, 2003). This is expressed formally in peer tutoring, and is based on a number of pedagogical principles. The first is the idea that you can learn most effectively when teaching. The second principle is that teaching others empowers you to be in charge of your own learning. Last year, when Sydney's class needed to increase test scores, the whole class took on responsibility for the performance of each student. Sydney says that

... they really took ownership for each other and they would just come and look and see who needs help, and they would go help that person, so they were doing more skill based kind of things but I think they were successful then. (Sydney Interview April 30, 2003)

Through the need to improve performance, students felt responsible for their own and others' learning and took active steps to facilitate their performance.

A third principle is that students sometimes can learn better when taught by a peer than by someone whom they might consider an intimidating superior, such as a teacher. While Eisah thinks this is an important dynamic, Sydney and Sasha are unsure if this actually happens in reality. As peers with similar thinking patterns, students may be able to explain things to other students better than a teacher can. Sydney acknowledges this point: “So I think there is, there’s something to be said for it, because they really hear their own language when they talk to other kids. Kids can sometimes reach each other so much better” (Sydney Interview April 30, 2003). Eisah and Sasha debate this point extensively:

Sasha: ... a child explaining to another child is the same thing, I think, as a teacher explaining it to another child.

Eisah: It’s not completely the same, ‘cause that’s a peer who is experiencing the same thing.

Sasha: It’s a knowledgeable other.

Eisah: But it’s also a peer, not someone who graduated from college.

Sasha: I don’t think it matters. ‘cause I could ask the same exact questions as Melvin would ask.

Eisah: Yeah, you could. If you could ask the same exact question of somebody who didn’t understand it, and Melvin asked the same exact question of someone who didn’t understand it ...

Sasha: It would just be more meaningful to Melvin.

Eisah: It wouldn’t be more meaningful for a child to feel more confident they could get it ‘cause a peer got it?

Sasha: No, it would be more meaningful to Melvin. A kid who's being taught, it doesn't matter who he's taught by.

Eisah: I disagree. I think that if you have kids teaching kids, that they make a connection with, that this is really an attainable goal. If I'm really struggling this is much more attainable because I see other kids getting it and they're trying all different things.

Sasha: If they don't already believe that, I agree, if they don't already have that self-confidence [Eisah: That's what I'm talking about.], but if most kids already have that confidence they can get it then I don't think it matters who's asking them that question. Like if Melvin were to say, well, you know 8×5 , and if Kamilla were to say, well, you know 8×5 , and it's with Kristen and she already has an extreme amount of self-confidence, she's going to solve the problem anyway, I don't think it matters if it's Kamilla or if it's Melvin.

Eisah: That's what I'm talking about, though, that part of it, and I think it makes it, they see it as more attainable if they are struggling.

Sasha: Right, like Brandon, if Melvin asks him what's 8×5 , then I ask him what's 8×5 , then he'd shut down. (Focus Group June 10, 2003)

From one perspective, Eisah feels that peers have the dialogue needed to stimulate a certain type of thinking in their peers. From another perspective, sometimes students have not developed the ability to prompt their peers to encourage them to think; they may simply use direct instruction methods and tell them the answers. Sasha feels that the latter is more common, and that, if you have a truly egalitarian relationship in the classroom, students will be as empowered taking advice from a teacher as they would be

from a peer. Peer tutors thus may not be any more effective than a teacher doing direct instruction. Simply because they are peers does not mean that they will encourage other students to develop understanding and their own thinking processes. As well, Sydney is “not sure if they’re developmentally ready to catch all of those mistakes in thinking that people make” (Sydney Interview April 30, 2003). As a result, they may not notice why someone cannot figure out a certain problem, and be unable to help. Because of these issues, Sydney remains in a quandary about instructional uses of peer tutors. She says, “I love the things I see from it, but sometimes I really doubt that it’s the way to really reach everybody in the most effective way” (Sydney Interview April 30, 2003).

Part of a dialogue between Melvin and Brandon in one tutoring situation shows the types of prompts that go on in tutoring:

You know there’s 20 boxes, so write 20 boxes; and you know there’s 4 big books in each box. Big books. So $20 * 4$, what do you think that equals? Look that over. $4*0$ does not equal 4. $4*1$, it does, but $4*0$ does not. $4*2 =$ what?

...

Now. We forgot this part. There are 4 small boxes times 4 small books. Now can you add those two? $80 + 16$? What does it come to?

...

Okay. Good job. So now, you have to write a sentence about it. That’s the hard part. (Sasha Observation June 9, 2003)

Here we see two students working intensively together, solving an entire problem. The tutor both asks questions and prompts the tutee on the steps to be followed.

Regardless of whether peers are intrinsically better suited to teach each other, young students require assistance to be fully effective as tutors. Sydney talks about her attempts to help them become effective tutors:

I try to reinforce with the kids how to help somebody in their thinking, and I see them developing that skill, but as of right now, not all of them have it, and so it's not always beneficial for them to do that sort of peer tutoring. Because they're very likely to say, oh no, this is the answer, and this is how I got it, and this is why ... maybe something clicks, but again, for the kids who need the most work I'm not sure if that's really the ultimate way. (Sydney Interview April 30, 2003)

Peer tutors are encouraged to help each other by asking questions, not telling answers.

Sasha cues one student who is attempting to tutor by reminding her, "can you help her by asking questions, not giving her the answer?" While this reminder is not 100% effective, another student does ask her tutee "what do you do next?" (Sasha Math Talk Observation October 7, 2002).

Instructional Aids and Technology

The teachers see the need for instructional aids and technology in three major areas. First, the concept of "representation" is key in math talk, where the heart of the session is student discussion of individual visual representations of math talks. This has been internalized by the students who expect to be able to write down their thinking. In fact, during one math discussion where Sydney did not have the paper ready, she says,

I noticed some of them wanted to write it down right away and I wasn't prepared there with paper because I didn't think they'd want to. I was going to say, they

didn't have the visual representation but they took charge and did that if they needed to. So that was, that component was there too. (Sydney Interview May 7, 2003)

Representations are done usually on white boards with erasable markers, and sometimes just on paper or math talk journal pages. For their representations, students are encouraged to use whatever visual representations they choose, from pictures through charts through equations through line marks. Math talk journal pages are the most common instructional aid in the classroom, followed by flipcharts with the math talk problems, used in conjunction with the journal pages when the entire class works through the problem.

Second, the teachers use visual demonstrations of difficult math concepts to help students understand. Sydney recognizes the importance of visual aids in promoting her students' learning, saying, "So I knew I had to have something they could look at and touch, I needed to have something that would get me excited about it, and that's all I could think about. Sometimes that's all it takes" (Sydney Interview May 7, 2003). For the topics of decimals and fractions she used visual aids: brightly colored sheets of paper for each place value for decimals; and beads, or "jewels," in a jar for fractions. Sydney is spontaneous and creative in how she chooses visual aids for this goal. Regarding the choice of the jewels in the jar activity, she says that

... it was just a typical spur of the moment thing. I wanted to have something that I knew they were interested in, something that would look appealing, and then I just, in thinking about it, remembered how they have to do the beans in the jar, and they have specific questions about that. So I started looking around for what

we have at hand that could be beans and we have the jewels, and everybody likes the jewels and we happened to have a bucket so it just all came together. (Sydney Interview May 15, 2003)

She similarly created an activity using brightly colored paper to represent decimal places the day before a lesson on decimals (Sydney Interview May 7, 2003). Eisah used manipulatives for doing decimals, and Sasha used them at the start of second grade and throughout the year (Focus Group June 10, 2003). When asked how helpful they were, Eisah replied that they were, “Definitely with the decimals, ‘cause it’s so hard to understand” (Focus Group June 10, 2003).

Finally, documentation is an important aspect of professional development for the teachers. The assessment project which has been ongoing at the school has emphasized documenting student learning and teacher performance (Newsome Park Meeting November 13, 2002; Focus Group April 2, 2003). For these purposes Sydney is excited about video recording as a way to capture the development of her class. She used it with her student teacher to record a lesson she taught (Sydney E-Journal May 3, 2003). The main technological tool used is a digital camera. The teachers use this to record some of their math talks for their own viewing or to show to the students. Video taping of lessons allows for teacher learning as well as promoting collaboration with other teachers. When Eisah video taped a class discussion in Sydney’s class, for example, she gained insight into her approach to creating a welcoming class environment, and this was shared with other teachers as well (Focus Group June 10, 2003). Sasha recognizes the value of video taping to capture and share exciting learning moments, such as when one of her students made a connection between fractions and decimals. She says, “Yeah. That’s why

everything needs to be recorded” (Sasha Interview May 12, 2003). Sydney used a video camera to record a student teacher’s lesson for them to review (Sydney E-Journal May 3, 2003). As well as video cameras, computers are used by children to produce products for display, to take tests, and to do extra projects.

The teachers use some additional instructional strategies. One is math games, where a group of students would play games that reinforce math concepts. Another is manipulation of objects and hands-on activities. (All Observation April 28, 2003)

Summary of Construct 5: Instructional Approach and Strategies

Through systematic application of these strategies, a culture of learning emerges in the classroom. The students are empowered to see themselves as real learners, thinkers, mathematicians, who value peer comments, ask questions of each other to learn from their peers, set goals of helping others, and meet up informally to explain things to others. In other words, it is a community of learners: they believe they can learn, that they can share their learning, and that they can learn from others. There is an absence of the idea of external expert, personal inability to construct knowledge, waiting for the answer, waiting for justification from the teacher or approval for a right answer; although the queuing up to get responses approved suggests that they still look for it. The use of students as teachers and facilitators goes a long way towards promoting this climate, within math talk, flexible groups, and as peer tutors. Instructional aids provide material support for carrying out this learning.

CHAPTER FIVE: CONCLUSIONS

Legislation and the current policy environment have placed a wide set of divergent demands on today's teachers. Creating spaces for collaborative research, thus, is profoundly difficult in the current economic and legislative environment (Brooks & Brooks, 1999; Ferraro, 1999; Thompson, 1994). Federal and state demands for high levels of accountability; prescribed, proscribed and fact-intensive curriculum guides; and standardized tests, de facto create a pressure for teaching to the test and make teaching innovation and the exercise of professional judgment difficult, if they are allowed at all (Battista, 1999; Murray, 1998; Shepard, 2001). As well, the difficult conditions in urban school systems mitigate against effective practice. However, within this milieu, the three teachers at the heart of this research demonstrate that collaboration and teacher best practices are possible, even in such a potentially restrictive environment. The school makes a difference; their collaboration with colleagues makes a difference; and ultimately, they choose to teach in a way that makes a difference.

Summary of Findings

Construct 1, the school culture, provides the framework within which the teachers express their own attitudes and practice their instructional strategies. The school was founded with a focus on linking assessment with instruction and putting the theory of constructivism into practice in the classroom. The emphasis is on research and collaboration as normal components of school functioning; all teachers are expected to be involved. Although many are in support of the school philosophy, there are some who

either do not believe in its value or are challenged to put it into practice. For these three teachers, however, there is a comfortable connection between their own beliefs and those of the school, and they feel fortunate to be working in an environment that allows them to practice what they believe.

Collaboration and relationships with colleagues are a key element of the school culture. The teachers place a high value on collaboration for gaining ideas to improve their performance and providing perspective, enthusiasm, and chances to reflect. They collaborate through a variety of mechanisms: continual dialogue, in person, on the phone and by email; professional reading and discussion; and observation of other teachers, usually coupled with conversations about things they observe. However important collaboration is, it is not possible without a sense of trust between the teachers and knowledge that they share common beliefs about looking for the good in others and believing in the students. When another teacher is not trusted, looks for the negative in others, or is unable to be a reflective practitioner, the teachers find collaboration difficult or impossible. Their collaboration also extends beyond the boundaries of the school, with professional presentations within the school, across the school district, and nationally. Their excitement about their learning and sense of responsibility to share the insights gained from Newsome Park's unique experience drive these professional activities. Finally, they recognize collaboration and continual professional development as integral parts of their identity as teachers.

The administration plays a signal role in setting school culture. The administrators are visionaries with high expectations for themselves, the teachers, and the students. These expectations set the tone for teacher activity in the school.

Administration is crucial to encouraging collaboration and experimentation in the classroom, making it the centerpiece of professional development and highlighting teacher learning. Far from being distant authorities, the administrators are seen as colleagues and friends by the teachers. This role took a while to become established, but the teachers now see them as collaborators in the process of enhancing student performance in a continually evolving instructional environment. Pressures from the administration at multiple levels include such things as standardized tests and curriculum expectations. However, these are viewed within the school as ways to benchmark progress rather than impossible hurdles that predetermine instructional methods.

Construct 2 examines the sense of personal agency felt by these teachers. Their personal history plays a key role in their agency. Their early educational memories are of direct instructional methods that did not inspire them or contribute to effective learning. At the same time, all three thought about education at an early age and had an interest in teaching. As they moved towards becoming teachers they confronted the old models of education they had inherited from their upbringing and chose to embrace a new model based on developing understanding in students. This new model, falling under the broad rubric of constructivism, focuses on the teacher as facilitator and the student as active processor of information and experiences in the production of her own knowledge. In forging their new model of education, they drew on their own experience as learners, inspiring mentors, and exceptional peer teachers for ideas about overall approaches to teaching and specific strategies harmonious with those approaches.

The teachers have a high sense of personal responsibility for their professional actions as teachers and for their students' performance. They feel largely responsible for

how their students learn, believing that the primary and initial responsibility lies with the teacher to provide an environment in which learning can occur, as well as sufficient motivation to inspire learning. Simultaneously, they also recognize the role that students must play and work to empower them to assume full responsibility for their learning. However, they recognize that ultimately they cannot control their students. Feeling responsible, they reflect extensively over their actions in an effort to identify what they are doing that works and what they can improve to help their students. This responsibility also drives feelings of guilt over their inability to meet the impossibly high standards they set for themselves, and attempts to be conscious practitioners, constantly monitoring their performance on the spot to ensure that their minute to minute actions live up to the standards they have set. Finally, their high personal responsibility sometimes makes it difficult for them to relate to other teachers who blame others for students' lack of success. This is something they find both hard to understand, and difficult to work with.

To achieve the high goals they set for themselves, these teachers engage in constant cycles of action and reflection. They place a premium on reflectivity, believing it is a natural function of healthy thought and something that can be developed, even if some people are more prone to being reflective than others. As teachers, they feel that reflectivity is vital as it allows them to monitor their actions and thus identify what they need to change in their practice. In relation to their colleagues, as well, reflectivity allows them to collaborate effectively. Within the classroom, reflectivity promotes learning and student internalization of ideas. Action based on the insights from reflection is the logical next step for them. They are more than willing to change their practice, and

note numerous improvements to their performance from participation in the action-reflection cycle. Much of this change is spontaneous, as they make instructional decisions on the spot. They feel that professional development is cyclical and continuous.

The final aspect of their personal agency is the excitement and enthusiasm they feel about all aspects of their work. They are excited about the thought processes of their students and the breakthroughs in learning they see. They are enthusiastic about their own teaching and learning, and convey that to their students. The work of their colleagues is another source of enthusiasm as they see the exemplary methods they use. This excitement is, for them, more than simply part of a favorable work environment; they have seen that their excitement has a positive impact on student learning and enhances student attention and retention.

Construct 3 explores the philosophy of the teachers in a number of arenas. Beginning with their philosophy of education, which the teachers see as fundamental to their practice, the teachers cite multiple sources for their philosophical beliefs. Their early educational experiences with direct instruction drove them to look for alternate forms of teaching. Exposure to constructivist theory in university and their reflections on how they learned most effectively combined to confirm them in a cognitive, learner-centered, understanding-oriented philosophy of education. While this philosophy falls under the rubric of constructivism, they are not wedded to this as a label for their practice. Constructivism is a theory of learning rather than a theory of teaching, meaning that there is as yet no definitive check list of constructivist teaching strategies. They explore continually new instructional methods to see their usefulness and relevance

within the philosophical framework. Within their philosophy, they believe that teachers are important as facilitators of learning. Teacher enthusiasm and sensitivity to student learning patterns are vital characteristics that allow the teacher to respond to student needs and inspire devotion to learning. Turning to students, their foundational belief is that all students can learn if provided with the appropriate form of instruction. Their challenge as teachers is to find these appropriate instructional methods. Within math, they see that learning is enhanced when they focus on real world applications of problems and connecting new knowledge with past knowledge. They see the goal of education as promoting deep understanding of new concepts. This can be achieved when students have the chance to think independently and when they develop metacognition, or an awareness of their own thinking and an ability to direct their thinking processes. Because of the importance given to philosophy, they find it challenging to relate to teachers who have divergent philosophies. The difference in perspectives makes finding common ground for communication or collaboration difficult. However, when certain beliefs such as an emphasis on positivity and respect for students are present, some form of collaboration is possible.

Direct instruction is an approach to education that they generally criticize as ineffective for developing understanding in their students. They see it as emphasizing rote learning and nothing more. Direct instruction encompasses skills-based instruction and teacher modeling. However, they have not reached agreement on whether teacher modeling also might fall under constructivism as an effective practice. Their experiences in the classroom have led them to extensive individual debate over whether direct instruction is the best method to use with their struggling students. While they feel it

bypasses the essential component of understanding, at times it seems to be necessary to give students an initial base of ideas and knowledge for effective performance. Direct instruction has the advantage of providing accelerated coverage of some topics. Standardized tests are another feature of direct instruction. The teachers note a number of disadvantages of the tests, including the pressure to move through material quickly, and an emphasis on rote performance rather than understanding or transfer. In preparation for standardized tests they sometimes use more direct instruction teaching approaches, although they frequently tweak these to promote deeper student engagement and learning. The tests have proven useful in providing some assessment data to the teachers, and also in encouraging class bonding and collaboration as they work together to help all students achieve on the tests.

Constructivism, the philosophy they are most comfortable with, covers a wide spectrum of approaches. Their own version is broad but centers around the idea of constructing new knowledge together through a variety of methods. Being an effective constructivist teacher requires hard work as they predict student misconceptions, and design activities and questioning strategies to help students correct these misconceptions. It also requires spontaneity as they respond to student learning on a minute by minute basis. Close teacher involvement is key to the process, emphasizing the social nature of learning. Teacher guidance through questioning is central to helping students learn. Constructivism appeals to them not only because it resonates with their closely held beliefs about how people learn, but also because of the challenge it poses for them to become effective teachers.

They have particular attitudes towards special education as an approach in education. They feel that all students are capable of learning but face unique challenges. Special education students simply fit in with the continuum of abilities within a classroom, calling on the teacher to make adjustments for them as she would for any student. As a result, they embrace inclusion as the norm while recognizing certain challenges, namely, identifying the unique instructional interventions needed for these students. Many of them require one on one attention, and providing such support in a busy classroom can be difficult. The main exceptions to inclusion that they note are cases of severe emotional disturbance where a student's behavior might create an unsafe learning environment. Looking at inclusion from the other side, they also identify some negative aspects of separating special education students in separate classes. The students lose learning opportunities in a more rigid classroom environment, and miss learning time as they move between classes; the classroom loses by having less diversity in student ability, thus reducing overall learning. The administration plays a role in making inclusion the norm for special education in the school. Teachers are expected to adjust for diverse student needs regardless of the level of additional administrative support, and allow for all students to learn.

Construct 4 centers around their beliefs about students. They pay attention to how their students think and value their thought processes. Excitement over their creativity and insight are reciprocated as students respond to the enthusiasm the teachers show for their thinking. The teachers are motivated in this regard by their view that student learning is maximized when students' minds are activated. Student independent thought is seen as the starting point of learning. As a result, in addition to promoting thinking, the

teachers work to develop cognitive and metacognitive strategies in their students. They also work to address student misconceptions in thinking. This is particularly important in working with their struggling core of low performing students. To meet the goal of helping all students to learn, they address their instructional strategies to meet student thinking processes. These approaches differ from those of other teachers, who emphasize telling students what thinking processes and problem solving methods to use rather than eliciting their own ideas.

The teachers believe strongly that all their students are capable of learning. It is the responsibility of the teacher to find ways to meet their unique learning needs so they can fulfill their potential. This is particularly challenging when working with their struggling students as it is difficult to find the keys to help them with their learning. They use a variety of techniques, including math talk, skills-based instruction, visuals and manipulatives to promote learning. Regardless of the challenges they face, the teachers emphasize the strengths of their students and what they can do. They respect the diversity of their thought and the multiple ways they are able to solve problems.

Creating a supportive, encouraging classroom environment is a major priority. They work with their students to do this, asking them for ideas to promote ownership of the classroom. In doing so they work to strike a balance between teacher direction, an important component, and student leadership, vital to identifying and meeting student needs. Open sharing of student thinking is encouraged, and the atmosphere of mutual learning is such that students rarely feel afraid to share their responses, even if they think they might be wrong. This emerges from a supportive emotional environment where the students are encouraged to talk about their feelings, to build friendships with other

students, to learn how to collaborate effectively, and to participate in a joyful and humorous environment. Teachers emphasize group interactions, focusing on aspects of mutual encouragement and emotional support. A climate of mutual respect permeates the classes, as the teachers are willing to learn from the students and admit when they make mistakes. Bonds among students and teachers therefore are strong, and become stronger when they work together to accomplish goals such as succeeding on high stakes tests. Creating such an environment is an active goal of the teachers who use modeling to encourage internalization of self-control by the students.

Construct 5 focuses on the actualization of these beliefs and attitudes in the context of classroom practice. First, they interact with their students so as to elicit their ideas rather than impose teacher concepts on the students. They use extensive questioning to help students externalize their thinking and explain it to others. Prompting, an aspect of questioning, connects students with the cognitive strategies that promote effective thinking. Their questions both are devised in advance as instructional aids to help students address misconceptions, and developed and applied spontaneously to meet immediate student learning needs. Wait time is used with questions to allow all students the opportunity to reflect and respond. Repetition and rephrasing of teacher questions and student comments again allow time for all students to think and participate in class dialogue. As well, rephrasing of student comments assists students to clarify their own thinking, and draws attention of their peers to the comments made. They also make time for repetition of thinking processes and cognitive strategies, while preferring more interactive methods to promote retention of facts. Think-alouds, a form of teacher modeling, are a preferred method for teaching cognitive strategies, providing a non-

prescriptive model of effective thinking patterns. These are particularly useful for students with lower metacognitive abilities. Individualized instruction also is used, providing the one on one time needed for many students to process their own thinking. While hard to schedule in a busy classroom, it has shown its results in enhanced student performance. Finally, formative assessment is an ongoing strategy allowing the teachers to keep their finger on the pulse of student learning and use this knowledge to direct their instruction.

Cognitive strategies are at the core of these teachers' approach. They have been working for over a year on the progressive refinement of a systematic presentation and implementation of the strategies in all the grade levels. The strategies include "know, need, how," an initial orientation strategy by which students link the problem with their previous knowledge and identify what the problem is asking; rereading, which allows them to pull the essential details out of the problem; goal setting, which turns each problem into a directed activity and a conscious building block of cognitive growth; imagining, which allows students to integrate problem details into a mental picture; and planning, through which they apply what they know and organize a solution method for themselves. These strategies are taught directly to the students, as well as modeled and elicited through questioning. Over the year students have begun to internalize the processes, apply them individually, and finally modify and transfer them to other subjects.

The teachers emphasize group processes as an important element of learning. Math talk, their primary method of math instruction, is built around group dialogue about individual solution methods. Flexible grouping has been used by the teachers to allow

more individual participation in group processes with a greater chance of successful participation. Although there are difficulties with scheduling and monitoring, this has proven successful in promoting more rapid student learning. In these processes as well as peer tutoring, students have acted as facilitators and teachers to great effect. Finally, instructional aids and technology have been implemented across the curriculum to provide the prompts and encouragement that facilitate learning.

Overall Findings

In this study, a number of overall themes emerge that run across the five constructs. One theme underlying the actions of all three teachers is that of respect for every individual. They respect themselves, believing that they have the capacity to be effective teachers and to create change in the lives of their students. They respect their colleagues, believing they can learn from them, and that their peers are capable of growth and change. And above all, they respect their students as unique individuals, full of capacity, and with perspectives that are valuable and deserve to be shared. This underlying respect allows them to interact with others in ways that elicit their knowledge and perspectives rather than expecting them to conform to a particular way of viewing the world. They know each child, how she thinks, and how to reach her. They respect the thinking processes of each child even if they do not make sense at first glance. This respect springs from their basic philosophy.

A second theme, connected with the concept of respect for others, relates to a dichotomy in their approach to collaboration. The teachers use collaboration with their peers and with their students to ensure that all students, of whatever abilities and

disabilities, from poor urban families and minority backgrounds, are able to learn. Learn not simply well enough to be passed to the next grade, but learn well enough to be able to explain their ideas to others, to transfer their learning to new situations, and to be genuinely excited, self-motivated learners. Collaboration with colleagues is a cornerstone of their professional functioning, vital to meeting this goal. They value their collegial interactions above all else in their growth as teachers. Nonetheless, one major dilemma relates to this sphere of collaboration: their collaboration has been limited to those teachers whose philosophy and approaches are similar to their own.

The teachers describe some legitimate reasons for preferring to collaborate only with the small core of likeminded individuals at the school: lack of respect for the methods they use, no response or dialogue from teachers of other philosophies, and the difficulty of trusting others who tend to be negative or critical. They have tried to work with others of different philosophy in the past, but this has not been successful. They also continue to encourage other teachers to participate in the research projects ongoing at the school. At the same time, possibly as a result of past negative experiences, their current attitude goes slightly beyond lack of interest in collaboration with different thinkers to a feeling of negativity about working with them. While this is understandable, it is insufficient in the face of their desire for widespread social change and their emphasis on respect for all. Collaboration with those of different perspectives is a crucial component of widespread change. While the teachers have grown personally through collaboration, their broader impact is limited if their progress does not spread to other teachers. If they are to spread their innovative methods further, there needs to be a way to break through this dichotomy. Establishing wider circles of collaboration is essential

to wider scale educational transformation, and with their ideas, enthusiasm, ability and vision, these teachers are in a key position to do that.

As well as limiting potential social change, an unwillingness to collaborate with others of different philosophy can create disunity in an institution which will retard any progress. If someone is not willing to collaborate, it may not be possible to work with that person. However, when such a dichotomy begins to emerge, a climate of divisiveness can emerge in a school. Collaborators versus noncollaborators, innovators versus those who are stuck in the mud, weird thinking versus useless thinking. These teachers are not to blame for the fact that some of their attempts at collaboration have not been successful; this is an inevitability. However, it is the view of this researcher that an even greater step towards radical educational change could be made by them if they could find ways to see all teachers as their collaborators, regardless of their approach, and regardless of those individuals' responses to their innovative methods. If the same tolerance they show for their students could be extended to their colleagues, at least the walls between the different teachers need not be built higher than they are, if they cannot be abolished entirely. As inspiring educational leaders, these teachers are in a position to build those bridges and institute a truly radical educational innovation: school-wide inclusive teacher collaboration. The fact that they are willing to collaborate, that they have actively pursued collaboration with other teachers, and that they still continue to make some overtures to teachers who have rebuffed their efforts in the past, is laudable. This is a strong foundation for making the next step beyond traditional parochial boundaries and the in-group mentality that are common in schools towards establishing an inclusive collaborative practice. Whatever the response of the other teachers, an

attitude of openness and inclusiveness would keep the possibilities for dialogue and collaboration open. The researcher is confident that these teachers have the moral courage and personal maturity to continue to reach out to others even in the face of rejection and criticism. This is something they have shown already in their practice, and the extension of this behavior will translate their effectiveness onto a broader scale.

The high level of sensitivity of each of these teachers, and the value they place on being sensitive and responsive, is another overall theme with extended implications. The teachers are extremely sensitive individuals in multiple ways: their rapid ability to perceive multiple signals from the environment; their awareness of the implications of all their actions on their students; and their sensitivity to criticism and negativity. This sensitivity seems key to their effectiveness as teachers. It allows them to perceive the implications of their instructional practices, and provides them with insight into ways to modify practice. Sensitivity also inspires their sense of responsibility, as they are aware of the significance of their every action and strive to make their practice more effective. Attention to sensitivity, thus, may be an important component to emphasize in teacher training programs as an attitude to be cultivated in future teachers. Attention also will need to be paid to developing sensitivity without leaving teachers open to extreme feelings of guilt, another side effect of sensitivity. Finally, their extreme personal sensitivity undoubtedly plays a role in their current attitude towards collaboration. They seek to form alliances and collaborate with others in situations that will be supportive. The repeated negative responses they have had from some other teachers as they attempt to collaborate have affected them strongly because of their sensitivity. This has played a role in their current aversion to collaboration with others of different beliefs.

Another overall finding relates to the learning process of the teachers. Rather than being finite learners, and seeing their professional expertise as reaching a plateau, they are engaged in multiple cycles of action and reflection. They are in a continual process of evaluating their current professional functioning, experimenting with new methods, and revising their approaches with the goal of continual professional improvement and enhancement of student learning. This continual learning process adds excitement to their professional work, encourages collaboration, and stimulates their students to grow and learn continually. This approach explains their high valuation of questioning as a means for people to develop their thoughts actively and use them as a basis for action. Continual reflection and questioning are important because they provide the fodder for change in practice.

Supplementing their continual learning process, many of the methods emphasized by the teachers are nested on multiple levels within the school. Taking the example of cognitive strategies, we can see that the teachers are striving to develop their own use of the strategies in addition to encouraging their students to adopt these practices. As they apply them in their own personal development and for their students, they simultaneously work to create an environment within the school that will use these as a basis for collaboration. Nested levels of action are reinforced by the action-reflection cycles that serve to enhance the functioning of activity by all participants and on all levels. Practice by teachers of strategies improves their understanding of how the strategies function, enhancing their ability to teach them to the students. Students, in turn, are able to observe their teachers using the strategies. This authentic teacher modeling demonstrates for the students the relevance of such behavior, and provides them with real world

models of application of cognitive strategies. Finally, reinforcement of practice on multiple levels lends authenticity to the entire experience of the school. The teachers and administration are practicing what they preach. Students see this, feel this, and learn from their saturated, reinforcing academic environment. Their effectiveness grows as they live out the practices they use in their classroom in multiple dimensions, reinforcing their vitality and giving them authenticity.

The continuity between the methods they use with their students, and how they apply those in their own lives and in collaboration with colleagues, is discussed by the teachers. One example is their use of questioning. This is a major strategy used in the classroom with their students, but it is also a teacher development strategy:

Sydney: I'd write notes on everything I see, and mostly just questions. What about this, what's happening with that child, did you know it or not? Yeah. We did that too, right. ... One other thing I was going to say that's only somewhat related to this, is that another thing I'd say I learned through working with practicum students and student teachers, about how to help other people reflect on their own practice, and I found that I try not to really give my personal opinion about what they're doing but to ask questions, like how have you done this, or how might you push this forward, [Eisah: To do collaboration?] Yeah, those sort of things. So I found that very useful, working through that process with them.

Trying to figure out how to help someone reflect. (Focus Group June 11, 2003)

The methods they use in the classroom – questioning in this case, but also reflection, positive encouragement, use of cognitive strategies – also are used in their interactions

with colleagues, in promoting a school wide culture of learning, and in their personal lives.

The teachers' deep belief that all their students are capable of learning is another significant finding of this study. In their view, all students are capable of learning if taught appropriately. The responsibility thus falls on the teacher to identify student learning needs and match these with appropriate instructional methods. The depth of faith they have in their students is notable, even if their students have come from a deprived upbringing, or start the grade with significantly delayed academic functioning. They feel that all their students can be saved through being taught universally valuable ways to think. They as the teachers are the ones responsible for facilitating acknowledgement and assimilation of the thinking strategies in their students. Once these strategies are learned, as well as associated attitudes such as love of learning and desire to help others learn, a student's academic future is secured. The metaphor is religious: teachers as religious functionaries, ensuring the redemption of all students who become saved when they accept the new knowledge. The depth of commitment, faith, and devotion expressed by the teachers warrants the metaphor.

Related to their belief that all students can learn is the depth of their anguish as they struggle to identify appropriate instructional methods to allow this learning to occur. They work to make their philosophy a reality, and feel badly about themselves when they do not live up to it in practice. They feel personally responsible for their students' performance, and thus take their students' success and failure as personal achievements. They spend a great deal of time reflecting on how their students think and learn in an effort to identify new ways of teaching them that will enhance their learning. This

struggle is particularly evident in their dilemma over using direct instruction versus constructivist methods with their struggling students. However, there also seems to be overlap between what they attribute to direct instruction or constructivism. Some practices that they describe as direct instruction, such as careful scaffolding, could fit into a broader description of constructivism, particularly a definition focused on constructivism as students constructing knowledge themselves and building connections with previous knowledge (as per. Mayer, 2004). Perhaps breaking away from the dichotomy of the two philosophical approaches and recognizing more fully that constructivism is a theory of learning rather than teaching could help alleviate some of the stress they feel and allow them to experiment with a wider variety of methods, thus enhancing their learning about best practices. This is not to deny the value of using philosophy as a guide, but simply to allow them more latitude to develop this still emergent philosophy.

In spite of the dilemma over constructivism versus direct instruction, another overall finding is the nature of their definition of constructivism. Their definition involves a commitment to active teaching rather than open discovery learning, in contrast with public perception that conflates constructivism with undirected classrooms. They believe that learning is an interactive process that requires guiding and facilitation by teachers. As a result, in their view, teachers have a clear role in guiding instruction. They differ from direct instruction teachers, however, in terms of the goal of learning and the methods of guidance. Since their goal is for the students to develop a deep, transferable, and lasting understanding of the topic, as well as to become autonomous thinkers, they use guidance methods that encourage independent student thought,

generation of cognitive relationships, and connection of new learning with past knowledge and the real world. The struggle comes in as they attempt to identify methods of intervention that fit with their constructivist ideals, allowing them to guide without constraining independent thought.

A related finding concerns the nature of constructivist teaching. While the teachers talk about the diversity of approaches in constructivism, their approach reflects a pragmatic, implementable and results-oriented approach that might well be adopted by others. Their approach combines cognitive construction of knowledge by the students, social learning through extensive dialogue, and active teacher involvement in scaffolding learning and promoting the use of cognitive thinking strategies. The holistic nature of this model is one of the keys to its success: students are empowered by a nurturing environment where their feelings and opinions matter, and provided opportunities, individually and within groups, to develop their skills. A variety of research-proven instructional methods guide learning, while experimentation and modification of these and new methods ensure an evolving and dynamic instructional environment. Collaboration with other teachers contributes to the learning culture, making constructivist learning an activity for teachers as well as students. As found by Langer (2001), all these factors need to be integrated into the instructional fabric of the school in order for academic improvement to occur; piecemeal changes in practice will not have a significant impact on student achievement or school performance.

Turning again to the teachers, another point of interest is the high level of awareness, collaboration, and proficiency they achieved after working together for such a limited time. At the start of the research project, the teachers had been teaching for only

one year, and collaborating together for slightly less than that year. Traditional wisdom has it that the first few years of teaching are largely an uphill battle for teachers as they strive to keep order in their classrooms. This is not a period of time in which teachers are expected to shine. In spite of this conventional wisdom, however, these three individuals have used the brief window of time with confidence and vision. They applied, systematically, the best practices they learned in school and the beliefs that were central to their identity to create warm, cohesive classrooms in which students learned well. They established a strong, systematic network of collaboration with a number of other teachers that has become central to their professional development. They also have engaged in ongoing research with a variety of partners – other teachers, the administration, university researchers – covering a number of topics and involving experimentation and reflection in their classrooms. They have shown themselves to be proficient collaborators with the ability to engage in research, discuss it intelligently, and bring unique insights as well as theoretical perspectives to bear on the problems being investigated. The question is: How did they do this within one year? How did they overcome any potential sense of self-deprecation and fear of criticism to apply innovative instructional practices systematically in their classrooms rather than reverting to traditional classroom practices?

A number of factors undoubtedly is at play in generating such strong teaching and collaboration by new teachers. They were fortunate to have academic leaders in the principal and assistant principal who emphasized using such methods. An additional support was the cadre of exceptional teachers at the school who use these approaches well, and were available for material and emotional support. While the fact that they

collaborated is one of the exceptional things about their functioning, this collaboration itself served as a major support enhancing their teaching. Working with like-minded fellow teachers helped them follow through on implementing the strategies to which they had committed. Thus, the environment was conducive to their actions rather than putting roadblocks in their path.

As well, the three came to their first teaching job completely absorbed in and committed to a certain model of instruction. This was not simply something they were mildly interested in; their sense of identity was bound up with being effective constructivist teachers. As a result, they entered the job without any wavering as to what they needed to do. Their depth of commitment generated a certain confidence as well in their abilities to teach this way, and in the students to learn best through such methods, which helped them sustain their teaching approach even when it was challenging. It also may be something intrinsic to their characters. They are individuals who focus on the positive, and who build on what is there rather than lament what is absent. As a result, they have a perspective that conduces to involvement, engagement, and innovation. Undoubtedly, all of these factors have played a role in their rapid growth as teachers, and allowed them to bypass a waiting period as an unknowledgeable beginning teacher.

Their ability to step into the role of a competent teacher with confidence reflects another interesting finding: that they teach not as they were taught, but as they choose to teach. The teachers, while taught using direct instruction methods, have embraced a learner-centered instructional environment. They avoid treating their students as passive recipients of knowledge, and instead construct complex learning environments in which students use a variety of sources and processes to create their own knowledge. This

change is something the teachers are aware of, and have actively chosen as their desired instructional approach. Nonetheless, it is significant for its rarity. Changing one's practice is difficult even if the will is there. Particularly in the stress of the first year in the classroom, where so much is new and the responsibilities are so great, it is easy to fall back on programmed responses that have been learned through years of instruction. These teachers, however, were conscious of what they did in the classroom, and have been able to modify their interactions with their students consciously to teach in a different way from what they experienced as students. Their deep commitment to constructivist ideals undoubtedly has played a role in this, giving them a reason to follow a different path. This would be insufficient, however, without a relatively deep knowledge of what constructivist practices look like in a classroom setting. The depth and effectiveness of their university training, thus, has also played an important role in providing them with sufficient exposure to constructivist methods to enable them to have something solid to fall back on within the classroom. Effective mentoring and student teaching experiences also have been supportive, primarily for Sasha but also for Sydney and Eisah. As well, their individual sensitivity, discussed earlier, comes into play here as well. They are intensely aware of all their actions and the impact of these actions on their students. As a result, they are aware when their questioning methods serve to stifle thought rather than elicit new connections; they notice when they are telling students answers rather than allowing them to process things for themselves. Their sensitivity allows them to implement the practices they know well and believe to be effective within the stress of a classroom.

Finally, the three teachers are intuitive and spontaneous practitioners. While they are well trained and highly conscious of modifying their practice, this supplements rather than replaces a natural ability to connect with students. They have an intuitive grasp of student learning needs and spontaneously apply questioning methods and appropriate instructional interventions. They see their students as real people, and are willing to learn from them. They also see themselves in their students, such as Sasha's identification with her challenged math students. Such a deeper connection and identification of themselves in their students fosters respect for them, which then allows the teachers to understand their students more deeply and perceive their needs. Thus, they are able to form reciprocal relationships with them, and respond more readily to their needs.

While the teachers are very similar in their commitment, ideology and approaches, there are some differences that came through in the interviews. These may not represent actual differences in their functioning, but simply are what the researcher has observed from transcripts of observations and interviews. As well, they are differences of degree rather than a question of presence or absence, since all of them manifest all of these qualities. Eisah is the most enthusiastic, continually full of praise and encouragement for her colleagues and students. Sydney is highly introspective and responsible, and focuses on creating a nurturing, communication-filled environment. Sasha is highly focused on activating their cognitive processes and her students show high levels of autonomy in intellectual functioning.

Relationship Between Research Findings and the Literature

Many of the findings from this case study relate directly to ideas found in the literature. Beginning with Construct 1, the effectiveness of the school wide philosophy of constructivism emphasizes Hickey et al.'s (2001) finding that school wide implementation of constructivism led to enhanced student ability in mathematics. Langer also emphasized the need to look at entire environment, not just selected elements from it (Langer, 2001), lending impetus to this model of teacher practice that examines multiple levels of influence. Burbank and Kauchak (2003) found significant benefits from collaborative research in their study, including increasing communication and a desire to move one's professional development further. Wenglinsky (2001) also found that schools with a critical mass of teachers emphasizing higher order thinking skills had higher levels of student performance. These results are mirrored in the work at Newsome Park, where the teachers experiment with similar practices in their classrooms and share their learning experiences to move their collective practice forward. The teachers' engagement in school wide research projects creates a learning community in which they encourage each other to continue their learning and teaching. Such a dynamic also helps mitigate against teacher burnout as their work environment is stimulating, encouraging, collaborative and change oriented.

High levels of teacher involvement in research were found by Parsad, Lewis, and Farris (2001), similar to this study, but the levels of collaboration at this school are higher than the 50% that they cite. The research indicates that engagement in long term, systemic professional development that is focused on teaching methods has positive results on teacher and student performance (D'Ambrosio, 1998; Franke et al., 2001;

Garet et al., 2001; Pierce & Hunsaker, 1996). Collaboration has been found to improve teaching, as noted by Burbank and Kauchak (2003). Similarly, these teachers emphasize that their collaboration, an aspect of their long term professional development, has played a key role in enhancing their practice with concomitant improvements in student performance. They also feel the constraints cited by Inger (1993) of working with non-collaborative colleagues. However, they did not experience the difficulties that Sachs (1999) discussed where different research agendas between the university and the teachers created conflicts. This may be because the theoretical and research focus of the teachers coincided with the focus on the university researchers.

Requirements of collaboration noted by the teachers are mirrored in the literature. While Ruiz and Pares (1997) quote Wasser and Bresler (1996), who identify the importance of heterogeneity among the beliefs of a group of collaborators as important to gaining a broader perspective on the problem under investigation, my teachers struggled to work with teachers whose personal beliefs differed significantly from their own. That is not to say that there were not differences of perspective among the teachers – they often disagreed vociferously – but they shared enough basic beliefs in common to respect the perspectives of the other. Ruiz and Pares also identify that small group size is more likely to encourage cooperation; the existence of short term objectives as well as long term goals, is more likely to promote commitment; and open communication and genuine friendship or familiarity among members encourages cooperation. With my teachers, these principles have been shown to be true. Their findings also help to clarify that some of the teachers' perceived obstacles to collaboration on a wider scale are legitimate constraints. However, similar immovables have been overcome in the past.

Findings from Construct 2, Personal Agency, also accorded with findings in the literature. As Wenglinsky (2001) found, these teachers believe that teachers are the crucial centerpiece of student learning, bearing a high level of responsibility for student performance. They feel they can make a significant difference in how students perform. The high value the teachers place on reflectivity accords with the National Association for the Education of Young Children and the National Council for Teachers of Mathematics (2002) emphasis on the importance of developing understanding in order to promote effective learning.

Construct 3, Teacher Philosophy, builds directly on the literature on philosophy, and the teachers adopt many of the views of key theorists. The teachers believe in the learning process of accommodation and assimilation outlined by Piaget and emphasize the social construction of knowledge as discussed by Vygotsky as a source of learning. The teachers' practice of constructivism, thus, combines the social constructivism of Vygotsky with the cognitive constructivism of Piaget. As described by Dewey, the teachers place importance on reflective thought, on the use of questions to enhance student thinking, and on understanding as the goal of education. They also believe, as did Dewey, that guided learning activities lead to greater learning than open discovery processes. They place a major emphasis on the importance of a collective learning environment, of exchange of ideas to promote learning, and on the social creation of knowledge. At the same time, they focus on the cognitive development of their students through disequilibrium, experiential learning, exploration of thought processes, and other activities. Their practice reflects best practices from brain research and other literature as reviewed in Bransford et al. (1999). They apply many of the approaches highlighted in

this book, such as providing a context for learning, focusing on students becoming “masters,” the importance of metacognition in promoting learning, the value of repetition in learning, and others. Finally, as with key constructivist theorists (DeVries, 2002; Mayer, 2004) they recognize that constructivism is a theory of learning and not teaching, and thus, work to construct its implications for teaching approaches.

Concerning their dilemma over direct instruction, research shows that instruction in metacognitive strategies helped the poor students at least as much as it assisted the advanced students (Ip, 2001; Mevarech, 1999). The literature on metacognitive strategies may indicate that such students can benefit more from learning those strategies than from direct instruction on the actual content. However, this still leaves open the question of whether they should learn metacognitive strategies through direct instruction. Mayer (2004) emphasizes the pitfalls of discovery learning as a form of constructivist teaching, and this group of teachers would agree. Sasha says, “You’re not doing your job as a teacher if you’re just waiting for a kid to get it ... [You need to keep] asking questions that would challenge their conception” (Sasha Phone Call May 16, 2003). And Eisah says,

People have a view of constructivism that they’re giving kids and letting them explore it and develop learning completely on their own. And we know that’s not how you do it. You pull learning from lots of different resources, we wouldn’t evolve anywhere if you totally relied on yourself. (Focus Group May 14, 2003)

Providing guidance to learners through modeling as a form of constructivism rather than direct instruction also accords with Mayer’s (2004) views of the importance of guided instruction in constructivist classrooms. As well, real world problem solving as

emphasized by the teachers is supported by the literature which shows that contextual learning enhances retention.

Like Wenglinsky (2001), these teachers recognize the value of standardized tests in presenting an alternate form of student evaluation that can be useful. Ewey (1996) also found, as these teachers did, that her students bonded together when faced with the pressures of external standardized tests to form a collective learning community and succeed on the tests.

Construct 4 focuses on their beliefs about students. In Sasha's class, her students spontaneously developed mental models of their thinking processes. Such models were used by Sheppard and Kanevsky (1999) in their work with gifted students and metacognition, but were something that was actively derived from the students. The fact that Sasha's students voluntarily developed and shared such models illustrates the high levels of metacognition they are developing. As well, Sasha explored these concepts further with her students, helping them make explicit their analogies and use these to help store and process information. Such an approach accords with their findings that such models enhance metacognitive levels in the students. The teachers also believe that metacognition leads to enhanced academic performance, and identify a deficit in metacognition as the cause of the lower performance of their struggling students. This mirrors the correlation found by Desoete et al. (2001).

Construct 5 focuses on their instructional practices, for which there is much support in the literature. Langer (2001) found that overt teaching of thinking strategies and use of questioning serve to make the learning process visible to students, supporting these teachers' extensive use of questioning. In her study, classrooms with the goal of

developing deep understanding, shared cognition, and an holistic, integrated environment resulted in effective student learning. As she says,

... in the most successful schools, there was always a belief in the students' abilities to be able and enthusiastic learners; they believed all students can learn and that they, as teachers, could make a difference. They therefore took on the hard job of providing rich and challenging instructional contexts.... (p. 876)

Schifter (1996) similarly emphasized the importance of questioning to help students externalize their thinking. Wenglinsky (2001) learned that focusing on higher order thinking skills in a classroom has a statistically significant effect on student performance. He also identified the need for external tests as well as authentic assessment for complete evaluation of student learning. Both of these points were supported by this study.

Their choice of a version of constructivism is particularly noteworthy. Mayer (2004) critiques discovery learning as an appropriate model for constructivism based on evidence from multiple studies showing that guided learning is more effective in promoting student development. The teachers in this study have grappled with this dilemma. Sasha talks about her use of guided instruction in one email:

I find myself helping them make faster connections. ... Same thing with my advanced group. Did a math talk on remainders. When Daniel said right away but 8 doesn't go into 83 evenly there's gotta be a remainder, I said – exactly and that's what I'm teaching you today-remainders... I've never been so explicit. I've never been so quick. I actually had the goal in mind to walk them through and scaffold through the whole problem with them knowing it was new and then hoping that they would transfer to the extra challenge and do it independently.

They did and they did it well. Is this constructive? Did they figure out how to be successful on this skill completely by exploration and student dialogue? No – but they were making connections. I was thinking aloud and probing for answers through questions that lead them to discover the relation between multiplication and division and also (for others) remainders... I don't know. (Sasha Reflections February 18, 2003)

In general, they recognize the importance of providing sufficient guidance to their students. Through careful questioning they work to provide students with the scaffolding necessary to make meaning of their experiential activities. They also focus actively on developing cognitive processes and use group discussions and the math talk worksheets to link past knowledge with new knowledge. In this way, they are avoiding many of the pitfalls described by Mayer. Relatedly, the teachers emphasize the teaching and modeling of thinking strategies as essential for student learning. This mirrors Langer's (2001) finding that the best teachers taught strategies to their students. Similar results were found by Ip (2001), Maqsd (1998), Mayer and Wittrock (1996), Wolf and Brush (2000) and Zan (2000). The teachers also found that student collaboration enhanced learning, as also found by Manion and Alexander (1997), Mevarech (1999) and Sheppard and Kanevsky (1999). Finally, classroom discourse also was found to enhance learning and understanding, as found by Roth (1993) and Sheppard and Kanevsky (1999).

Reflections on the Collaborative Research Process

In addition to practical skills related to teaching thinking strategies, flexible grouping, and feedback, the assessment project has enhanced their theoretical knowledge

of teaching and increased their desire to participate in research and learning. As Eisah says,

I can tell you that if I hadn't done this project and I was pursuing a master's degree or a doctorate, and I saw the cognitive studies program there's no way I would have been, I would have looked into it and been interested in it, but not have been nearly as enthusiastic as I am now. I really just learned so much this year about the importance of it and really just what it is was. (Focus Group June 11, 2003)

The benefits of participation in a research project are significant.

This research project was intended to be a fully collaborative endeavor between the teachers and the university researcher. The teachers were highly active in research during the year and generated more than enough activities and experiences for the researcher to study. The researcher similarly worked hard to reflect actively with the teacher and provide them with insights, reflections, and feedback on what was happening in their classrooms as input for their learning process. However, in practice, the project never became a fully collaborative inquiry. The researcher was always the outsider. This did not seem to reflect unwillingness on anyone's part; rather, it may have been a function of personalities, different roles, or time.

Interpersonal issues – simply trying to establish rapport was sometimes a challenge, although other times a very comfortable relationship existed. The researcher, aware of the high demands on the teachers, may have diminished her own importance and not imposed enough on their time and schedule. This may have generated

uncomfortable feelings for the teachers, as they may not have been sure how much importance to place on their collaboration if the university collaborator was self-effacing.

As well, because of a similarity in ages and outlook, and because the beginnings of the project were based on interest and a desire to work together, an aura of friendship lingered over the relationships. However, this friendship was not given many opportunities to develop outside of the school environment, thus making it difficult to sustain the “friend” aspect of the relationship. As well, this was a friendship with heavy obligations: hosting a regular observer, scheduling interviews and observations, documenting one’s classroom practice, and emailing regular reflections to the new “friend.” There were, therefore, ample opportunities for guilt or frustration to emerge, without sufficient grounding points to alleviate these feelings that could have been created by a closer friendship.

The different roles of the participants – university graduate student and respected school teachers – also served to dichotomize the collaboration. The teachers were respectful and appreciative of the role of the university researcher in raising issues, asking questions, and documenting practice. However, their lives were about much more than just this project. They were called on to participate in multiple professional development activities over the year which consumed large amounts of time as they also enhanced their expertise. They also were more fully immersed in the details of their classroom than the researcher, for whom it was impossible to be an expert in three classrooms while also maintaining a broader perspective on the entire project. As well, each participant had other issues in her personal life to consider during the year. As a result, the researcher was never involved enough in the multiple aspects of their lives to

be fully a part of their experience. Related to this, time was also an issue. The researcher spent as much time as possible at the school, sufficient time to gather the reported data. However, had she been there more, possibly she could have become more fully immersed in the lives of the teachers, and she could have moved closer to the participant end of the participant observation continuum.

These reflections on the nature of the collaboration raise some issues for the quality of data collected. Because of the openness of communication, the diversity of collection points, and commonality in perspective over multiple teachers and time, the researcher is confident of the trustworthiness of the data. However, the uneven, back and forth nature of this interaction, while not tarnishing the data collected, may have diminished the collaborative nature of the data. Had there been a more clearly defined relationship between the researcher and the teachers, possibly more focused data could have been collected. However, had the relationship been more legalistic, it is unlikely that some of the depths of personal feelings about collaboration and their deeply held philosophies of education would have emerged. In spite of the constraints described above, a level of trust was generated between the researcher and the teachers that allowed a certain level of openness not always created in relationships governed by data collection treaties. At the same time, had a closer relationship of true friendship been established, a greater depth of data possibly could have been generated. This would have allowed deeper exploration of the issues surrounding collaboration and teacher growth.

In spite of this researcher's reservations about the levels of collaboration reached, the teachers express strong appreciation of the project. They feel that their involvement

in a formal research project has enhanced their ability to teach. The structured reflections with the researcher were cited specifically as of benefit to them in promoting ongoing learning. Eisah describes the benefits of the project in one interview:

Yeah. I know that I've gained a whole bunch, I think. Because it's like, I can reflect a lot on my own and I can reflect with Sasha on the phone, but it's not this type of organized reflection and this organized reflection has really helped me, I think. Because your questions were ... I think that Sasha and I know each other so well we know almost what kind of questions we'll end up coming up with, but your questions I wasn't ready for, so they helped me grow a lot too. So I really liked the organized reflections. Things that could have made it better. I should never have promised to do reflections over email because they just didn't happen.

(Focus Group June 10, 2003)

Eisah specifically notes the benefits of working with an external observer, emphasizing the benefits of collaboration with those who might not be insiders. However, she also hints at some of the pressure and guilt associated with the project, notably with the initial plan for regular email reflections.

Implications for Future Research

Further research in this area is implicated by the findings. The descriptions generated from this study may provide insights to people working in other educational situations. As a qualitative case study, these results are not statistically generalizable, but they may be transferable to other situations as deemed relevant by readers of the study, as well as provide specific insights to teachers and administrators in elementary school

settings. Findings about the characteristics of effective teachers, their philosophical orientation, and the importance placed on collaboration, can provide ideas for teacher recruitment and training programs as to the type of candidates they can focus on recruiting, and the types of training that are likely to prove beneficial. School administrators can draw insights from the findings about the importance of a collaborative environment, the support needed from administration to generate collaboration, and the types of encouragement that foster research across classrooms.

As a small scale qualitative study, repetition with other groups of teachers will help show the transferability of the findings both to similar and to divergent situations. From the findings of this study, a set of more focused research questions could be investigated with a stratified sample of teachers to see if these principles apply to a broader group of teachers. For example, attitudes towards and practice of collaboration with those of similar and different philosophical orientations could be examined with focus groups of teachers who espouse different philosophical approaches. This could be contrasted through another in-depth case study with a group of teachers of direct instruction orientation. Pulling this data together, the researcher could develop indicators of teacher characteristics from this model, and test it on a broader scale. With teachers of different characteristics, the levels of influence on their decision making may be entirely different: the findings may lean towards an emphasis on personal choice, a focus on the role of collaboration, or possibly the influence of outside parameters on teacher autonomy. With an ability to identify defining characteristics of teachers, insights for recruitment, preservice training, and professional development could be generated that could enhance teacher effectiveness and the profession at large.

Another issue that arises from this research is the relative influence of nurture and nature on creating excited, effective teachers. Further examination of the relative influence of personal history, education, and character, and personality on teacher characteristics could provide insights applicable to teacher recruitment and training programs. Initial studies could investigate in more detail the personal history, education, character, and personality of teachers identified as exemplary, average, and below average in ability. Such in-depth qualitative work could provide a series of explanatory stories, highlighting how innate attributes of potential teachers were either enhanced or modified by their subsequent experiences. The findings from each major group, if they prove to cohere, could facilitate recruitment. If exemplary teachers are found to have innate differences in personality from those less exemplary, this could suggest a greater focus on recruiting individuals with particular personality or experience profiles. As well, unlikely candidates who possess particular attitudes and approaches that have been found to be important might be accorded more leeway in entering the program. Nonetheless, it is unlikely and undesirable that such work would prescribe a definitive statement of who can teach, since teaching requires a broad spectrum of personalities and approaches to reach the diverse group that is today's students. On the other hand, if training of a particular type, or certain life experiences, are found to be significant in shaping teaching approach, these could be built into training programs, thus enhancing the quality of all future teachers. Such an approach seems to hold more promise than an exclusionary screening approach to teacher recruitment.

The findings also warrant longer term follow up with these particular teachers to see how their philosophy and practice change over time. As well, examination of their

levels of guilt and responsibility as these relate to disillusionment and burn out would be useful to study. This could provide insights into work on teacher retention and resiliency, particularly among idealistic teachers or those for whom teaching is a calling rather than simply a job. Another researcher also may want to conduct a historical study of the school and the context in which this particular educational environment has developed. Such work would provide an appropriate complement to this study of individual teachers in the school, each piece serving to illuminate the other.

One major area warranting future research is the implications of their beliefs about philosophy for collaboration in schools. Does collaboration only happen among people who already get along? Are there some people who can collaborate with widely different individuals? What are the key beliefs and principles that allow teachers to collaborate? How can we facilitate collaboration with people who have widely different beliefs? All of these questions could be investigated further, providing ideas for promoting teacher collaboration and possibly generating a model of the personal, interpersonal and administrative factors that conduce to collaboration.

The relationship between standardized testing and the use of constructivist teaching methods warrants further investigation as these two methods still imply different approaches to instruction. This research has illustrated that you can, in fact, apply best practices and produce significant student learning on multiple measures: standardized tests as well as understanding, confidence, and long term knowledge retention. However, the level of integration reached by these teachers is not common, and still contains contradictory elements worth studying. Administrative practices that encourage teachers to use effective teaching practices rather than responding to the pressure of tests could be

discovered. As well, particular approaches to teaching that facilitate both understanding and test performance could be highlighted as best practices. On the other hand, it is possible that a multiplicity of factors are required to create this “best” environment in which the two can go hand in hand; further study might identify the multiple facets of such an educational environment.

The role of the administration in creating a climate for collaboration warrants further investigation to see which elements can be transferred to other school settings. Particular practices such as setting aside time for research meetings, including teacher collaboration as one element of teaching evaluations, and providing financial and other incentives may prove to be important. As well, certain attitudes may prove crucial in facilitating collaboration, such as a willingness to learn from mistakes, openness to multiple practices operating simultaneously, and willingness to dialogue with teachers as peers.

A more specific research question relates to the teachers’ emphasis on cognitive strategies in math. The strategies were one of the key elements of their math instruction, and, from the perspective of the teachers, one of the most significant elements promoting math learning. The range of strategies that can be used in teach math and their relevance for each grade level warrants further exploration. As well, teaching of cognitive strategies was shown to be effective both in this study and in the research literature. Further investigation of alternate ways to teach strategies would be worthwhile. Finally, the relationship between individual instruction and enhanced learning was emphasized by all three teachers. Finding ways in which the cognitive strategies can help students

individualize group instruction, and thus enhance their own learning, could yield promising results for exponential growth in learning and teaching effectiveness.

One final direction which could be explored is to develop recommendations for the use of integrated instructional strategies for elementary math based on the results of the study. The overall features of their math instruction form an environment which generates student interest, motivation, and learning of math. These could be systematized to form a framework describing the attributes of such an environment on a number of dimensions: teacher attitudes and philosophy; teacher verbalizations; student interactions; instructional strategies; and cognitive strategies, among others. While this would not function as a checklist of desirable features, it could illuminate for other teachers the multiple dimensions needed to create such a math environment. Coupled with narrative stories to paint a picture of what such an environment looks like, such a product could help other teachers who want to create such a learning environment but do not know what it might look like.

Dissemination of Results

The results of the work will be disseminated through a number of means. A copy of the dissertation will be given to the school and to each of the teachers. The researcher will write articles for publication in academic journals. The researcher, possibly in collaboration with the teachers, will try to arrange presentations at a number of conferences, focusing on the annual Association for Constructivist Teaching (ACT) conference and the American Educational Research Association (AERA) conference. A short report on the work and results will be prepared for teachers and administrators in

the school and the Human Subjects Committee of the Newport News School District. As the researcher has an interest in influencing policy in education, an attempt will be made to publish an article in Educational Evaluation and Policy Analysis or a similar policy-related journal. Finally, if possible, the results will be published in a book form so that the entire narrative of a year in the life of these three teachers can be read by others who are working towards implementing a similar philosophical approach to education in practice.

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Appendix A. Research Project Agreement: Participant Responsibilities

The ODU researcher will:

- Participate fully in the project beginning June 2002 through completion of the dissertation and at least one paper for publication
- Apply for Human Subjects approval both through Old Dominion University and Newport News Public Schools
- Participate in the development of instructional methods for the classrooms
- Participate in informal discussions with the teachers as needed
- Facilitate focus groups/ debriefing sessions with the other participants every 3-5 weeks
- Conduct individual formal interviews with the teachers approximately 2 -5 times during the study period
- Arrange for transcription of the interviews
- Collect math talk journal pages
- Maintain a secure database of the information collected: electronic journals by teachers, transcripts of interviews with teachers, transcripts of focus groups, field notes
- Conduct a thorough analysis of the data based on the proposed research questions
- Provide feedback to teachers at least once every 3 weeks based on analysis of the data concerning emerging themes, commonalities and differences among their classroom practices, and ideas from the literature
- Prepare a final report on the project results
- Work with the teachers to prepare paper(s) for presentation at selected conferences or for publication in journals
- Ensure the confidentiality of participants

The teachers will:

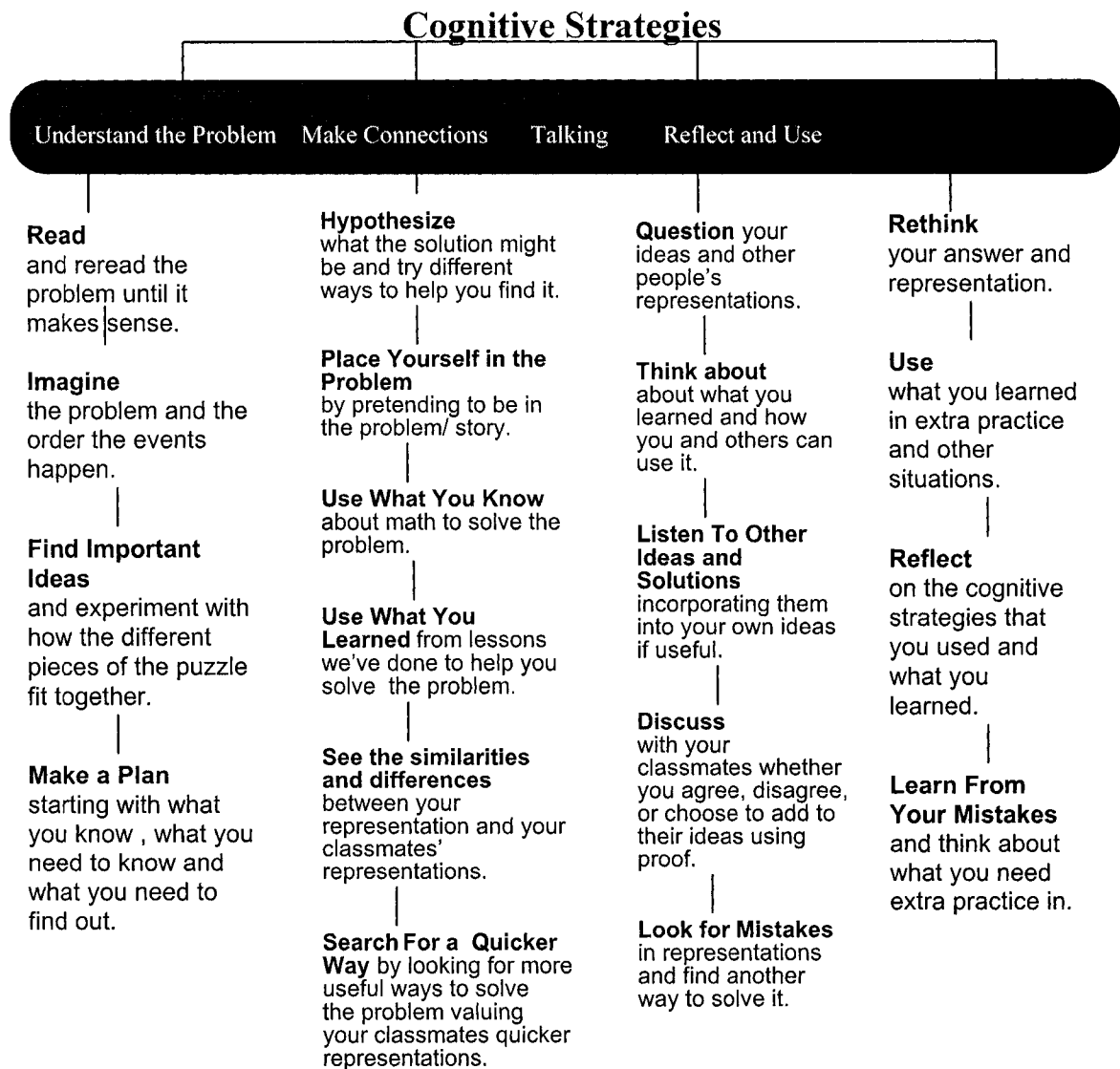
- Participate fully in the project beginning June 2002 through June 2003, and longer if interested
- Develop or adapt instructional methods for their classrooms designed to enhance metacognition in their students
- Implement instructional methods designed to enhance metacognition in their students
- Submit electronic journal entries with their classroom observations 3-5 times per week
- Participate in informal discussions with the researcher on an irregular basis
- Participate in focus groups/ debriefing sessions with the other participants every 3-5 weeks
- Participate in individual formal interviews with the researcher approximately 2 -5 times during the study period
- Clarify details in researcher reports and descriptions of classroom functioning
- Offer comments on the findings of the researcher and on the final report

- If interested, work with the other participants to prepare paper(s) for presentation at selected conferences or for publication in journals

Appendix B. Framework of Cognitive and Metacognitive Strategies

Created by Kate Chechak and Marie Ciafre

Metacognition is the executive or boss that has control over cognition, the worker, whose tools are strategies.
~Gaskins, I. & Elliot, T. (1991).



Appendix C. Sample of Math Talk Journal Page

Created by Marie Ciafre

Math Talk Problem Group 1/ Day 61**Thinking Tools: Understanding the Problem**

- ☐ **Hypothesize:** what the solution might be and try different ways to help you find it.
- ☐ **Place Yourself in the Problem** by pretending to be in the problem/ story.
- ☐ **Use What You Know** about math to solve the problem.
- ☐ **Use What You Learned** from lessons we've done to help you solve the problem.
- ☐ **See the similarities and differences** between your representation and your classmates representations.
- ☐ **Search for a Quicker Way** by looking for more useful ways to solve the problem valuing your classmates for quicker representations.

The goal I want to accomplish by the end of this math talk is...

At the end of the class celebration, we had some goodies left over. We had .367 of the pizza left. We had .362 cake left on the table. There was .36 left of juice left in the plastic container. Please put the items on the table in order from the most that was left over to the least that was left over.

Represent your thinking:

Extra Challenge: How much more pizza was left over than juice?

Extra Practice:

Put the following decimals in order from least to most.

.98 .981 1.981

Did I accomplish my goal? How?

Appendix E. Observation Protocol

What types of questions is the teacher using?

What kinds of responses do these questions get?

What strategies is the teacher using?

What instructional aids are used by the teacher?

How do the students respond to these?

What evidences of metacognition are the students displaying?

Which are spontaneous?

How do the students interact with each other?

Prompt each other?

Encourage or discourage each other?

What interactions are going on between the students?

When in the group is with the teacher?

When working in an unmonitored group?

When doing individual peer assistance?

Appendix F. Teacher Formal Interview Question Protocol

Introduction: Thank you for making the time to sit with me and talk specifically about what's going on with you and this project. In addition to discussing what you are doing in the classroom and how students are responding, I'm also curious to know how you're feeling about the whole evolution of the project. I have some broad discussion questions for you, but I encourage you to share all your insights on this process and what you're learning, even if it seems tangential to the issues. The interview will be audio-taped and transcribed later, and I will be analyzing it to learn about your views on these issues.

Tell me about the assessment project.

What is working? What isn't working?

If you could change one thing to make the project work better, what would it be?

How do you feel about your involvement with the project?

Benefits?

Challenges?

Frustrations?

How do you think your instruction affects the students? What difference does it make to them?

What do you believe is the most important in your teaching of math right now?

Has this belief changed?

What is your current philosophy of education with regard to math and your classroom?

If you were to change just 2 things to bring your classroom closer to your ideal math classroom, what would you change?

Why?

Appendix G. Teacher Electronic Journal Prompt Questions

What instructional strategies did I use today in math? What things influenced my choice of those particular ones?

What things do I want to keep the same in my instructional strategies? What do I want to change? What new things do I want to try?

How are the students responding to my strategies?

How is the research process working for me?

How is my interaction with Kamilla assisting me? Confusing me?

How is my interaction with other teachers assisting me in my work? Creating confusion or problems?

Appendix H. Focus Group Question Protocol

Introduction: Thank you everyone for being here and participating. This is an opportunity for us as a group to reflect on the process we're going through in developing and analyzing a method of instruction to assist your students in developing their metacognitive abilities. I have some broad discussion questions for you, but I encourage you to share all your insights on this process and what you're learning, even if it seems tangential to the issues. Hopefully some new insights will emerge from discussing these issues together. The interview will be audio-taped and transcribed later, and I will be analyzing it to learn about your views on these issues.

What trends have emerged in your classrooms over the past few weeks?

Instructional problems? New ideas?

Changes in student understanding,

Representation,

Performance?

How are these trends in other classrooms?

What new insights have you had about what you're doing in the classroom now with regards to math and student learning?

Where did the insights come from?

What ideas do you have for instruction?

to enhance metacognition, improve understanding, improve performance?

Where did you get the ideas?

Have you experimented with any new methods lately?

What were they?

How did they work?

What would you change the next time?

If not, have you been happy with what you've been doing?

Where do you want to go from here?

How have you collaborated with other teachers?

What ideas do you have about the process?

What's working?

What would you change? How?

What do you believe is most important in your math class environment?

What is math all about?

For you?

For the students?

(to be used later in the data collection period):

How did you come to metacognition as a central organizing idea for this project?

Retrospectively, do you still feel it is an appropriate concept to use? How might you frame things differently if you were starting this project now?

Appendix I. Coding Scheme: Constructs, Concepts and Themes

1. School Environment

- School Culture
 - Origins and Driving Spirit
 - Emphasis on Research and Collaboration
 - Differences in Perspective Within the School
 - Personal Stories of Connection to Newsome Park
- Collaboration & Colleagues
 - Value Placed on Collaboration
 - Forms of Collaboration: Dialogue and Reading
 - Observation as a Form of Collaboration
 - Prerequisites for Collaboration: Trust and Common Beliefs
 - Barriers to Collaboration: Lack of Trust, Positivity and Reflectivity
 - Sharing Expertise Beyond the School: Excitement and Responsibility
 - Importance of Collaboration and Ongoing Development
- Administration
 - Characteristics of the Administrators
 - Administrators as Visionaries and Setters of High Expectations
 - Administration's Focus on Collaboration and Experimentation
 - Administrators as Colleagues and Friends

- Pressures from Administration

2. Personal Agency

- Personal History
 - Early Educational Memories
 - Early Desire to Teach
 - Confronting Old Models of Education
 - Choice to Embrace a New Model of Education
 - Their Own Experience as a Source for New Model of Education
 - Mentors as Sources for a New Model of Education
 - Peers as Sources for a New Model of Education
- Personal Responsibility
 - Magnitude of their Sense of Responsibility
 - Teacher Responsibility for Student Performance
 - Responsibility that Students Carry
 - Limits to their Responsibility for Student Performance
 - Reflection over Instructional Methods
 - Guilt
 - Conscious Practitioners
 - Relating to Less Committed Teachers
- Cycle of Action and Reflection
 - Importance of Reflectivity
 - Possibility of Developing Reflectivity

- Necessity of Being a Reflective Teacher and Colleague
- Place for Reflection in the Classroom
- Value of Action
- Willingness to Change Practice
- Improvements from the Action-Reflection Cycle
- Spontaneous Practice and Cyclical Professional Improvement
- Excitement & Enthusiasm
 - Excitement about Students
 - Excitement about Learning, Teaching, and Their Colleagues
 - Impact of Teacher Excitement on Student Learning

3. Philosophy of Education

- Philosophy of Education
 - Relevance of Philosophy to Practice
 - Sources of their Philosophical Beliefs
 - Categorization of their Philosophy
 - Components of their Philosophy – Role and Characteristics of Teachers
 - Components of their Philosophy – Views on Students and How They Learn
 - Views on the Goal of Education: Understanding
 - Views on the Goal of Education: Metacognition

- Challenge of Relating to Other Teachers with Different Philosophies
- Direct Instruction
 - Views of Direct Instruction: Early Experiences and Basic Conceptions
 - Elements of Direct Instruction: Skills-based Instruction and Teacher Modeling
 - To Use or Not to Use: Direct Instruction with Struggling Students
 - Advantages of Direct Instruction
 - Disadvantages of Standardized Tests
 - Preparing for Standardized Tests
 - Value of Standardized Tests
- Constructivism
 - Attitudes Towards Constructivism
 - Components and Benefits of Constructivism
 - Challenge of Being a Constructivist Teacher: Hard Preparation and Spontaneity
 - Social Aspect of Learning and Teacher Involvement
 - The Challenging Appeal of Constructivism
- Special Education
 - Attitudes Towards Special Education Students
 - Inclusion as the Norm with Challenges
 - Exceptions to Inclusion

- How to Meet the Needs of Special Education Students in the Classroom
- Negative Aspects of Separate Special Education
- Administration's Role in Special Education

4. Beliefs About Students

- How Students Think
 - Attention to Student Thought
 - Value Placed on Student Thinking: Reciprocal Excitement
 - Activating Student Thinking as Key to Learning
 - Developing Cognitive and Metacognitive Strategies
 - Misconceptions in Thinking
 - Helping the Struggling Core to Think: Developing Cognition and Metacognition
 - Addressing Instruction to Student Thinking
 - Telling Strategies versus Eliciting
- All Students Can Learn
 - All Students are Capable of Learning
 - Teachers' Responsibility to Facilitate Learning
 - Working with Struggling Students
 - Teaching Techniques to Meet the Needs of All Students
 - Emphasize their Strengths, Respect their Diversity
- Class Environment

- Working With Students to Create a Supportive Environment
- Balancing Teacher Direction and Student Leadership
- Open Sharing of Thinking
- Supportive Emotional Environment: Feelings, Friendship, Cooperation, Humor
- Importance and Quality of Group Interactions in the Classroom
- Bonds Among Students and Teachers
- Climate of Mutual Respect
- High Stakes Testing Promotes Classroom Bonding
- Active Creation of Class Environment: Modeling, Internalizing, Encouraging

5. Instructional Approach & Strategies

- Interacting With Students
 - Questioning
 - Explain Their Thinking
 - Prompting
 - Premeditated versus Spontaneous Questioning
 - Wait Time
 - Repetition and Rephrasing
 - To Repeat or Not To Repeat: How to Cover Facts Effectively
 - Think-alouds and Teacher Modeling
 - Think-alouds for Struggling Students

- Rationale for Individualized Instruction
- Challenge and Benefits of Individualized Instruction
- Formative Assessment
- Cognitive Strategies
 - Thinking Strategies: Origin and Evolution
 - Details of the Thinking Strategies: Know, Need, How
 - Details of the Thinking Strategies: Rereading
 - Details of the Thinking Strategies: Goal Setting
 - Details of the Thinking Strategies: Imagining
 - Details of the Thinking Strategies: Planning
 - Teaching the Strategies
 - Student Modification and Transfer of Strategies
- Group Processes
 - Math Talk Definition and Value
 - Math Talk Process and Evolution
 - Flexible Grouping: Characteristics
 - Scheduling, Monitoring, and Facilitating Flexible Groups
 - Benefits of Flexible Grouping
 - Peer Tutors
- Instructional Aids & Technology

Appendix J. Data Files for Dissertation

Formal Interviews (17)		
File Name	Who is interviewed	Date
Eisah Phone Conversation December 6, 2002 (Notes)	Eisah	December 6, 2002
Sasha Talk in Coffee Shop January 11, 2003 (Notes)	Sasha	January 11, 2003
Eisah Interview April 2, 2003 (Transcript)	Eisah	April 2, 2003
Eisah Interview April 30, 2003 (Transcript)	Eisah	April 30, 2003
Sasha Interview April 30, 2003 (Transcript)	Sasha	April 30, 2003
Sydney Interview April 30, 2003 (Transcript)	Sydney	April 30, 2003
Sydney Interview May 7, 2003 (Transcript)	Sydney	May 7, 2003
Eisah Interview May 12, 2003 (Transcript)	Eisah	May 12, 2003
Sasha Interview May 12, 2003 (Transcript)	Sasha	May 12, 2003
Sydney Interview May 14, 2003 (Transcript)	Sydney	May 14, 2003
Sydney Interview May 15, 2003 (Transcript)	Sydney	May 15, 2003
Sasha Phone Call May 16, 2003 (Notes)	Sasha	May 16, 2003
Sydney Interview May 28, 2003 (Transcript)	Sydney	May 28, 2003
Eisah Interview May 28, 2003 (Transcript)	Eisah	May 28, 2003
Sasha Interview June 4, 2003 (Transcript)	Sasha	June 4, 2003
Eisah Interview June 5, 2003 (Transcript)	Eisah	June 5, 2003
Eisah Interview No Date (Transcript)	Eisah	No Date

Observations and Informal Interviews (27 files)

File Name	Who is interviewed	Date
Sasha Math Talk Observation September 19, 2002	Sasha	September 19, 2002
Sasha Math Talk September 23, 2002	Sasha	September 23, 2002
Sasha Math Talk September 30, 2002	Sasha	September 30, 2002
Eisah Math Talk September 30, 2002	Eisah	September 30, 2002
Sasha Math Talk Observation October 7, 2002	Sasha	October 7, 2002
Newsome Park Math Talk All February 10, 2003	Eisah, Sasha, Steven Johnston	February 10, 2003
Sasha Math Talk February 10, 2003	Sasha	February 10, 2003
Observation All March 7, 2003	Eisah, Sydney & Sasha	March 7, 2003
Eisah Math Talk Observation April 9, 2003	Eisah	April 9, 2003
Sydney Math Talk Observation April 10, 2003	Sydney	April 10, 2003
Observation All April 28, 2003	Eisah, Sydney & Sasha	April 28, 2003
Eisah Math Talk Observation April 30, 2003	Eisah	April 30, 2003
Eisah Observation May 7, 2003	Eisah	May 7, 2003
Sydney Observation May 7, 2003	Sydney	May 7, 2003
Sydney Observation May 7, 2003 #2	Sydney	May 7, 2003

Sasha Math Talk Observation May 12, 2003	Sasha	May 12, 2002
Sydney Observation May 15, 2003	Sydney	May 15, 2003
Eisah Observation May 15, 2003	Eisah	May 15, 2003
Sasha Observation May 15, 2003	Sasha	May 15, 2003
Eisah Observation May 19, 2003	Eisah	May 19, 2003
Eisah Observation June 5, 2003	Eisah	June 5, 2003
Sasha Observation June 5, 2003	Sasha	June 5, 2003
Sydney Observation June 5, 2003	Sydney	June 5, 2003
Eisah Observation June 9, 2003	Eisah	June 9, 2003
Sasha Observation June 9, 2003	Sasha	June 9, 2003
Sasha Observation June 10, 2003	Sasha	June 10, 2003
Sydney Math Talk Observation No Date	Sydney	No Date

Emails & Journal Entries (17)

File Name	Who is interviewed	Date
Email about NP Process Bridget November 14 2002	Bridget	November 14, 2002
Helene Reflections November 25, 2002	Helene	November 25, 2002
Sydney Email December 14, 2002	Sydney	December 14, 2002
Sasha Electronic Journal 1-22-03	Sasha	January 22, 2003
Sydney Electronic Journal 1-23-03	Sydney	January 23, 2003
Annette's Reflection to Sasha 02-10-03	Annette	February 10, 2003
Sasha Reflections for Kamilla 02-15-03	Sasha	February 15, 2003
Sasha Reflections 2-18-03	Sasha	February 18, 2003

Sasha Reflections first set 2-18-03	Sasha	February 18, 2003 (#2)
Sasha Electronic Journal 18 March 2003	Sasha	March 18, 2003
Sydney Electronic Journal 21 March 2003	Sydney	March 21, 2003
Eisah E-journal March 31, 2003	Eisah	March 31, 2003
Eisah Reflection 29 April 2003	Eisah	April 29, 2003
Sasha Email 29 April 2003	Sasha	April 29, 2003
Sydney Electronic Journal 3 May 2003	Sydney	May 3, 2003
Sydney Electronic Journal 8 May 2003	Sydney	May 8, 2003
Reflections from Helene 9 May 2003	Helene & Julie	May 9, 2003
Focus Groups (5)		
File Name	Who is interviewed	Date
Focus Group April 2, 2003 (Transcript)	Eisah & Sydney	April 2, 2003
Focus Group May 14, 2003 (Transcript)	Eisah & Sasha	May 14, 2003
Focus Group June 10, 2003 (Transcript)	Eisah & Sasha	June 10, 2003
Focus Group June 10, 2003 #2 (Transcript)	Eisah & Sasha	June 10, 2003 (#2)
Focus Group June 11, 2003 (Transcript)	Eisah, Sydney & Sasha	June 11, 2003
Field Notes (7)		
File Name	Who is interviewed	Date
Newsome Park Meeting September 18, 2002 (Notes)	Newsome Park	September 18, 2002
Newsome Park Field Notes September 30, 2002 (Notes)	Newsome Park	September 30, 2002

Newsome Park Meeting November 13, 2002 (Notes)	Newsome Park	November 13, 2002
Newsome Park Open House January 16, 2003 (Notes)	Newsome Park	January 16, 2003
Newsome Park Field Notes January 24, 2003 (Notes)	Newsome Park	January 24, 2003
Newsome Park Research Journal March 7, 2003 (Notes)	Newsome Park	March 7, 2003
Newsome Park Field Notes June 26, 2003 (Notes)	Newsome Park	June 26, 2003

Appendix K. Dialogue from Sasha's Second Classroom Dialogue about Mental Models of Storing Information.

Sasha: What did you just do with that word?

Melvin: Put it in the drawer.

Sasha: Which drawer?

Melvin: The big word drawer.

Sasha: I had something I wanted to ask you. Last time we talked Frank put something into a drawer. Does anyone have a similar story about how they store information?

Girl: I have little people in my head who type things in the keyboard

Sasha: Is there any organization to those people?

Girl: Yeah. Like ... I don't know.

Kristen: I have these cookies, and some of them have words in it, big words, and these little tiny people will eat up the words and put them on the computer, then the computer will pump them into the brain.

Sasha: This is like short term memory going into working memory going into long term memory.

Kristen nods head.

Sasha: Terry has a new story.

Terry: I have this box in my head that is so small, and all the big words that I hear from other people around me, I store it right inside the box, then the little people inside my head take it to the computer, open up the box wide like this, then they take it to the computer and store it into the computer, then store it into my brain.

Wilbur: I have certain lightbulbs, when Ms. Hawley says like math lightbulb, or history lightbulb.

Sasha: What happens when you turn them on?

Wilbur: The information that actually ... it's like, I don't actually, all the other lightbulbs are off.

Sasha: What else can you do besides turning them on?

Wilbur: Instead of using lightbulbs, I ... I can use pieces of information that I use for my brain, and it's like, when I think of the path, I can remember stuff we already did and I use it to ... I use it now.

Sasha: That is what I was hoping you would do with your story. It's like he's turning it on, so he's generating the remembering of things that he knows. He's remembering everything, then when he remembers a new pieces of information it flies back into the lightbulb and do you think it would be brighter?

Class: Yeah!

Telesia: Just from you saying that ... what were you saying ? ... uh ... I forgot.

Frank: I have a new story!

Sasha: Okay, go ahead, Frank.

Frank: Now it's so full, now they have to add 20,000 new rooms. Rooms with thousands and thousands of drawers. For the mind.

Jonathan: Hey, I've got a new one.

Sasha: Jonathan, why don't you tell us your story?

Jonathan: I have this friend in my head, his name is Jim Bob, and he says words and it pumps through my head, and the big ones, they pump through my blood cells, and they go to my mouth and I speak them.

Sasha: How does Jim Bob store new information?

[inaudible response]

Sasha: You know what I'm noticing? Stories have pattern. How they get new info, how it's stored, how they get it out. Jonathan, how does he store the information?

Jonathan: There's these little drawers, and there's these little packets.

Sasha: We're going to have to end this, so if you don't have a story, maybe you can make your own story.

Marty: My information is in my refrigerator. People in my fridge eat the food.

Telesia: They get the information and type it out, and science, they put it in the science drawer. (Sasha Math Talk Observation May 12, 2003)

VITA

Kamilla Bahbahani

Academic Experience

PhD	Old Dominion University	2004	Urban Services/ Education
	ECI Department, Rm. 145, Darden College of Education, Old Dominion University, Norfolk, VA, 23529		
MA	University of Guelph	1998	Geography
BA	University of British Columbia	1995	Geography

Professional Experience

2001 – 2004. Graduate Assistant. Old Dominion University. Norfolk, VA, USA
Research and grant writing for 6 proposals to address children's educational needs.

Spring 2003. Project Coordinator, Citizenship Education Program. Old Dominion University. Norfolk, VA, USA
Coordinated educational exchange for Kyrgyz educators for five weeks. Managed budget of \$27,000.

2001 – 2003. Co-Teacher. Old Dominion University. Norfolk, VA, USA
Co-designed and co-taught Master's level courses in education.

1999 – 2000. Fund Manager, Canada Fund for Local Initiatives and Election Fund.
Canadian International Development Agency. Moscow, Russia
Promoted the funds, evaluated over twenty project proposals per month.

Conference Presentations

Association for Baha'i Studies 27th Annual Conference. San Francisco, CA, USA
Sep. 2003. Topic: The Importance of Spirituality in Researcher Preparation.

Unravel the Mysteries Youth Forum. Toronto, ON, Canada
Apr. 2003. Topic: Models of Integrating Work, Family and Spirituality.

Association for Baha'i Studies 24th Annual Conference. Toronto, ON, Canada
Sep. 2000. Topic: Russian Election Systems in Transition.

Canadian Annual Geographer's Conference. Ottawa, ON, Canada
Jun. 1998. Topic: Environmental Worldview of the Buryats of Siberia.

Publications

Bahbahani, K. (2003, December 3). Kyrgyzstan today: A nation of change. *The Mace & Crown*, pp. 3, 5.

Bahbahani, K. (2002). Book review. B. Zhimbiev, *History of the Urbanisation of a Siberian City: Ulan-Ude* (2000). *GeoJournal* 57(4), pp. 344-345.