AN EXAMINATION OF THE EFFECTS OF A SYSTEMIC APPROACH TO

MATHEMATICS REFORM ON THE ATTITUDES AND PRACTICES

OF SPECIAL AND GENERAL EDUCATORS IN AN

INCLUSIVE SETTING

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AN EXAMINATION OF THE EFFECTS OF A SYSTEMIC APPROACH TO MATHEMATICS REFORM ON THE ATTITUDES AND PRACTICES OF SPECIAL AND GENERAL EDUCATORS IN AN INCLUSIVE SETTING

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DISSERTATION ABSTRACT

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This study examined the interfacing of reform-based teaching with inclusion. It utilized an ethnographic approach to examine what happen when the influences that drive reform-based teaching and those behind inclusion intersect. The research focused on how exposure to a reform-based approach to teaching mathematics affected two educators in an inclusive setting. It examined how their exposure to reformed-based teaching affected their attitudes and interactions with each other and students. It also focused on six students who were identified as special need in mathematics and the effect the reform-based approach had on them. The research enumerated some influences that are impinging upon the implementation of reform-based teaching in the inclusive setting and

some unique observations that were garnered about the interfacing of reform-based teaching and inclusion.

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I. INTRODUCTION

Students in the United States are not performing as well as students in many other countries (Woodward & Montague, 2002). The results of the Third International Mathematics and Science Study (TIMSS) confirmed the long-acknowledged need to question the quality of mathematics education and to take action to ameliorate the poor performance of students (Montague, Woodward & Pedrotty-Bryant, 2004). Nowhere is the lack of performance more obvious than in the area of mathematics achievement in special education (Bottge, 2001). The mathematical performance of 8- and 9-year old students who were identified as having a learning disability (LD) was at a first-grade level, and the performance of 16- and 17-year old students with LD was approximately at the fifth- grade level (Cawley & Miller, 1989). Fewer than 25% of students with learning disabilities have been able to automatize even the most basic skills that would allow them to concentrate on more conceptually difficult problems (Algozzine, O'Shea, Crews, & Stoddard, 1987). Many other studies support the claim that the mathematics performance of students identified for special education is significantly below that of students who are not identified for special education (Carnine, Jones, & Dixon, 1994; Cawley & Parmar, 1992; Parmar, Cawley, & Frazita, 1996; Parmar, Cawley, & Miller, 1994).

The low mathematics performance of students motivated organizations such as the National Council of Teachers of Mathematics (NCTM) to introduce a series of

visionary documents called the Standards (Mercer & Harris, 1993). The Standards are a critical part of the mathematics reform movement (Maccini & Gagnon, 2002). Mathematics teaching based upon reform tenets has focused on conceptual understanding rather than procedural knowledge or rule-driven computation (Maccini & Gagnon, 2002). The reform movement has placed an emphasis on problem solving and other higher order thinking skills. The heart of the reform movement lies in a paradigmatic shift from predominantly skilled based instruction to a constructivist epistemology that focuses on active student learning rooted in problem solving situations facilitated by teachers' guidance and questioning (Rivera, 1997). Mathematics reform has endeavored to change the traditional classroom which held a view of knowledge as disjoint, hierarchical and fixed, to one in which knowledge is regarded as a personal construction of the learner as she interacts with persons and things in the environment (Draper, 2002). Mathematics reform is a movement that emphasizes a process perspective (Skott, 2004).

The field of special education has held a worldview that has been dominated by foundational understanding that is rooted in the positivistic practice of the natural sciences (McPhail, 1995). This view has led to a field in which the predominance of its teaching has emphasized rote memorization and procedural skills (Cawley & Parmar, 1992). The students are continually exposed to repetitious practice in a hope that the desired response, correct answers, will be attained. This emphasizes the importance of the product over the process.

The implementation of the Education for All Handicapped Children Act (EAHCA) in 1975 demanded that children with disabilities have the right to an education in what is called the least restrictive environment (LRE; Villa & Thousands, 2003). The

idea of the least restrictive environment has gradually changed to include a greater number of students not previously identified by this legislation. This approach to education is now known as inclusion, the concept and practice of considering general education as the first choice of placement for all learners. Inclusion practices have increased dramatically the proportion of students with special needs included in general education (Villa & Thousand, 2003).

To compound the problem, the implementation of the No Child Left Behind Act (NCLB) has placed demands on schools that require students with special needs to meet the same standards as those not identified with special needs (Goertz, 2005). It requires all schools to test all students every year in grades 3 through 8 in reading and mathematics. Schools must demonstrate adequate yearly progress (AYP). In order for a school to demonstrate AYP, all racial groups, all major socioeconomic groups, English-language learners, and special education students must make AYP separately (Bracey, 2003).

NCLB, along with previously passed legislation have put pressure on schools to place students identified for special education into the general education setting with the same expectations as students not identified for special education, implying that schools must raise the achievement of students in special education (Thomas, 2005). This union has brought together two philosophically different paradigms. The quest in this research was to examine this union.

There exists a tension between the fields of special education and mathematics education. The special educators generally prefer a teaching approach that emphasizes basic skills as a part of a linear development of mathematics; while mathematics

educators, at least those guided by the contemporary reform principles, prefer a more conceptual approach to teaching in which the role of the teacher is more facilitative and the activities are student-centered (Cawley, 2002; Draper, 2002). This study examined the effects of a systemic approach to mathematics reform on the attitudes and practices of those involved in the teaching of students who have been identified as special need. The approach studied was systemic in that it sought to improve the mathematic performance of students by improving the mathematics curriculum, developing consistency in the ways that teachers teach, making professional development available to in-service teachers, and improving teacher preparation.

The research was an attempt to examine real-life issues impacting the implementation of mathematics reform in an inclusive setting. It utilized an ethnographic approach to examine what happened when the influences that drive reform-based teaching and those behind inclusion intersect. It also focused on how exposure to a reform-based approach to teaching mathematics affected two teachers in an inclusive setting. It looked at how both teachers' exposure to a reform-based teaching approach affected their attitudes and interactions in an inclusive setting. It also examined the interaction of both teachers with six students who were identified as special need. The study focused on the following questions:

1. How the implementation of a reform approach to mathematics teaching affected how a special needs educator and a general educator operated in an inclusive environment?

2. How reform mathematics impact students identified as special needs students in an inclusive class?

3. What are the factors that affect the implementation of reform in an inclusive mathematics setting?

II. REVIEW OF RELATED LITERATURE

The primary sections of the review of related literature will examine the history of special education, the history of reform in mathematics education, the philosophical and theoretical perspectives of special education and mathematics education reform, and current research in both arenas and some in the cognitive perspective.

The importance of the historical, theoretical, and philosophical perspectives of both special education and mathematics education reform are prevalent components of the review of related literature. The literature review will include an examination of current research relative to both perspectives. It will also document the dominance of positivist based research in special education, along with showing the lack of research pertaining to the main issues of the study. It will conclude with studies that investigated factors related to preparing teachers for reform-based mathematics teaching.

History of Special Education

In order to garner a better understanding of the complex issues in special education we must examine the history of special education. According to Winzer (1993), many of the contemporary issues in special education have their roots in the past. First, let us consider the treatment of those with disabilities before the appearance of special education as a discipline. The treatment of humans with disabilities has to be considered

before we can have a proper perspective on some of the discipline's perplexing issues. From man's earliest existence, individuals who were different have been destroyed, tormented, exorcised, sterilized, disregarded, oppressed, and even demonized (Hewett, 1975). According to Winzer (1993),

> No doubt throughout pre-modern history the disabled population formed a small though resilent minority — a minority always exposed to the prejudices of the majority, not only because they could not partake of normal life, but also because they represented evil or were seen as public threats. (p. 9)

The historically inadequate treatment of those who were different has certainly impacted the perceptions of many relative to those with disabilities and special education.

We will now examine the history of special education in the following section. It will begin with a definition of special education, followed by an excerpt on the treatment of those with disabilities prior to special education. It will be followed by an examination of some of the chief influences on the field of special education. The examination will include a look at the infancy of special education, the effect of compulsory education, the development of day schools, special classes, and public school involvement. The effect of the Civil Rights Movement and important federal legislation will also be included. The seminal article by Lloyd Dunn (1968) and its effect on special education will also be considered. Finally, the development of the learning disabilities issue and some of its implications will be considered.

Infancy of Special Education

"Special education is a term which has traditionally signified a need for alternative means/methods of educating students who are physically handicapped, have

sensory impairments, are nonconforming, or otherwise learning disabled" (Sigmon, 1987, p. 19). This definition gives us an idea that the development of special education involved the formation of institutions that are dedicated to the teaching and learning of those who are members of these populations. This is important, because special education has not always existed even in modernity. The infancy of special education was characterized solely by institutionalization (Sigmon, 1987). Winzer (1993) declared that "throughout most of the nineteenth century, institutionalization formed the mileau for disabled children" (p. 46). The first special education school in America was The American Aslyum for the Education and Instruction of the Deaf established in 1817 in Hartford, Connecticut (Sigmon, 1987). This began a period in which institutions for deaf, blind, mentally ill, mentally retarded, neglected, and delinquent children began to proliferate.

According to Sigmon (1987), "only when the attitude prevailed that all children should attend school did education for the impaired receive much attention" (p. 21). Rhode Island was the first state to pass a compulsory education law and by 1918 all states had them (Ysseldyke & Algozzine, 1984). As children with disabilities were moved from the institutions to public schools, permanent segregated classes were formed in public schools to meet their needs, resulting in a change from isolation to segregation (Winzer, 1993). However, children with disabilities were often excluded from public schools (Yell, Rogers, & Rodgers, 1998). Chaves (1977) stated that public educators unable to handle the record number of exceptional children and realizing that no special provisions were available for these youngsters began a movement for the establishment of special classes. Chaves noted that special classes came about not for humanitarian reasons, but because exceptional children were not wanted in the regular public school classroom. From 1915

to 1930, the number of special classes in public schools increased greatly, but from 1930 to 1940 this number suffered a decline due to the financial burdens of the Depression, dissatisfaction with the premature establishment of inadequately planned special classes with untrained teachers, and the misinterpretation of the assumptions of progressive education combined to dampen public enthusiasm for special education (Robinson & Robinson, 1965).

Civil Rights Legislation

In the 1950s and 1960s, the Civil Rights Movement, which sought changes in society that would allow minorities, particularly African Americans, equality of opportunity, led to litigation and changes in legislation. This legislation provided greater constitutional protection for minorities and eventually persons with disabilities. A landmark case, Brown v. Board of Education (1954) was a major victory for the Civil Rights Movement and has been the major underpinning for further civil rights action. The Brown decision not only had a tremendous impact on societal rights for minorities, but also affected many aspects of educational law and practice (Turnbull, 1993). Over a period of time, the precedents set forth in this decision resulted in sweeping changes in school policies and approaches to students with disabilities (Katsiyannis, Yell, & Bradley, 2001). Central to the Brown case was the constitutional guarantee of equal protection under the law found in the Fourteenth Amendment. This amendment stipulates that a state may not deny any person within its jurisdiction equal protection under the law. If a state has undertaken to provide an education to its citizenry, then it must do so for all its citizens.

The impact of Brown vs. Board of Education (1954) created an atmosphere that proved to be conducive for future litigation and legislation that would significantly affect special education. The initial litigation took place on the state level. According to Yell et al. (1998), in January 1971, the Pennsylvania Association for Retarded Children (PARC) brought a class action suit against the Commonwealth of Pennsylvania in Federal District Court (Pennsylvania Association for Retarded Citizens [PARC] v. Pennsylvania (1972). The plaintiffs' argument was that students with mental retardation were not receiving public school education because the state was delaying or ignoring its constitutional obligations to provide a public school education for these students, thus violating state laws and the students' rights under the Equal Protection of the Laws clause of the Fourteenth Amendment to the U.S. Constitution. PARC v. Pennsylvania (1972) was resolved by a consent agreement specifying that all children with mental retardation between the ages of 6 and 21 years must be provided a free public education and that it was most desirable to educate children with mental retardation in a program most like the programs provided for their non-disabled peers (Levine & Wexler, 1981). This ruling opened the door for continued developments regarding the educational rights of students with disabilities.

Yell et al. (1998) also stated that a federal class action suit was filed in the Federal District Court for the District of Columbia soon thereafter. This suit, Mills v. Board of Education (1972), was filed against the District of Columbia's board of education on behalf of all students with disabilities not attending school. The plaintiffs were the parents and guardians of seven children who represented a variety of disabilities including behavior problems, hyperactivity, epilepsy, mental retardation, and physical

impairments. These seven children represented a class action suit of over 18,000 students who had been denied or excluded from the educational system in Washington DC. The suit's claim, which was based on the Fourteenth Amendment, charged that the students were unlawfully excluded from school without due process of law (Zettel & Ballard, 1982). This ruling set the pace for more extensive legislation.

In 1973, Section 504 of the Rehabilitation Act of 1973, regarded as the civil rights declaration for individuals with disabilities, was passed. It was the first significant effort to protect persons with disabilities based on their disabilities. This law made it a necessity for schools to provide appropriate educational services to students with disabilities (Cross, 1999).

According to Yell et al. (1998), the primary purpose of Section 504 was to prohibit discrimination against an individual with a disability by any entity receiving federal funds. These entities include any agency that receives funds, personnel services, and interests in property, whether receiving these benefits directly or through another recipient. Section 504 requires agencies that are the recipients of federal financial assistance to provide proof of compliance, to take corrective steps when violations are found, and to make individualized accommodations to provide services that are comparable to those offered persons without disabilities.

In 1974, the Elementary and Secondary Education Act of 1965 (ESEA) was amended by the passing of The Education Amendments of 1974, P.L. 93-380 (Yell et al., 1998). The ESEA provided funding for various programs for children who were disadvantaged and for students with disabilities, and it required each state receiving

federal special education funding to establish a goal of providing full educational opportunities for all children with disabilities.

In 1975 the most significant piece of special education legislation was passed, the Education for All Handicapped Children Act (EAHCA) (PL 94-142) (Sigmon, 1987). This legislation made educational opportunity possible for all children with special needs (Cook, 2002). Educators had come to believe that all children, including those with disabilities, had the right to an appropriate education at public expense (Winzer, 1993). According to Schulte, Osborne, and Erchul (1998), this legislation mandated that schools provide:

1. free and appropriate public education to individuals with disabilities;
2. the least restrictive environment (LRE), and;
3. an individual education plan (IEP) for each student identified for special education.

This progressive legislation opened up the door for the "mainstreaming" of many special education students into the regular classroom.

Mainstreaming is the educational practice of placing students with disabilities in regular classrooms with their non-disabled peers (Turnbull & Shulz, 1979). According to Villa and Thousand (2003) schools usually interpreted mainstreaming to mean that they should place students with mild disabilities — for example, those with learning disabilities and those eligible for speech and language services — into regular classes where these students could keep up with other students with minimal support and few or no modifications to either curriculum or instruction. In the early 1980s, however, the interpretation of least restrictive environment evolved to include the concept of

integrating students with greater needs. By the late 1980s and early 1990s, the interpretation evolved into the approach now known as inclusion: the principle and practice of considering general education as the placement of first choice for all learners (Villa & Thousand, 2003). This led to the introduction of many necessary supports, aids, and services into the classroom instead of removing students from the classroom for those services. Inclusion of course has dramatically increased the number of students with disabilities in the regular classroom.

The 1990 amendments to the EAHCA renamed it the Individuals with Disabilities Education Act (IDEA) (Katsiyannis, Yell, & Bradley, 2001). According to Yell et al. (1998), major changes in this law included:

1. language change that emphasized the person first, the replacement of the terms handicapped student and handicapped to child/student/individual with a disability,
2. a separate and distinct class for students with autism and traumatic brain injury, and
3. a plan for transition from special education in every student's individual education plan (IEP) by age 16 years.

The Individuals with Disabilities Education Act of 1990 was revised in 1997. These revisions designated as IDEA 1997 brought about a shift in focus from guaranteeing that students with disabilities are receiving a free and appropriate education to ensuring that students are receiving required supports and services (Wolfe & Harriott, 1998). Wolfe and Harriott also affirmed that a significant emphasis of the IDEA 1997 concerns the development of individualized education programs (IEPs) and the discipline

of students with disabilities. The wording of these legislations reflects the prevalence of disabilities as a crucial issue in special education.

Impact of Dunn

Another significant impact on special education was Lloyd Dunn's (1968) seminal article "Special Education for the Mildly Mentally Retarded — Is Much of It Justifiable?" According to Cook (2002),

> It can be said without contradiction that Dunn's article, coupled with his commitment to provide access, expand opportunities, and improve educational outcomes, was in fact the prime mover for special education reform and contributed significantly to passage of Public Law 94-142, the Education for All Handicapped Children Act (EAHCA) of 1975. (p. 54)

Dunn argued for the elimination of universal placement of students with educable mental retardation into self-contained special classes, which at the time was the service delivery model of choice (MacMillian & Semmel, 1994). According to Patton, Polloway, and Epstein (1989), this article is among the most cited publications in the field of special education: "There is no denying the extent to which this publication is perceived to have influenced special education policy and practices" (p. 466). Hallahan and Kauffman (1994) stated "The moral imperative for change spelled out by Deno, and even more forcefully by Dunn, found a receptive audience in the special education professorate" (p. 496).

Dunn (1968) argued for a better education than special class placement for socio-culturally deprived children with mild learning problems who had been labeled educable mentally retarded. The article had a two-fold purpose, first to delineate reasons for the

claim that a large proportion of special education is inadequate and unjustifiable for these students, and second, to present a model for changing this significant portion of education for exceptional children in order to make it more acceptable (Dunn, 1968). These were truly shocking claims, coming from a special educator. His emphatic claim that these children have not made greater progress in special schools and classes, despite the good intentions of special and general educators was a stinging indictment of the entire special education process. He pointed to the results of the "'efficacy studies' — the substantial body of research focused on comparison of students with disabilities educated in regular versus special classes" (Hallahan & Kauffman, 1994, p. 499). These studies claimed that children with mental retardation make as much or more progress in the regular classes as they do in special education (Kirk, 1964).

Dunn (1968) also argued for the elimination of labeling as a practice in special education. His argument is as follows:

> Our past and present diagnostic procedures comprise another reason for change. These procedures probably have been doing more harm than good in that they have resulted in disability labels and in that they have grouped children homogeneously in schools on the basis of these labels. (p. 8)

According to Dunn (1968), these procedures were flawed because: 1) they too often occurred without the input of a multidisciplinary team, and 2) the assessment of educational potential was done in a short period of time in order to find out what was wrong with the child in order to label him for special education. Dunn also asserted that labeling had a negative effect on the attitudes of students. His suggestions included:

changes in school organization, curricular changes, changes in professional public school personnel, and hardware changes.

His suggestion that "we should try keeping slow learning children more in the mainstream of education, with special educators serving as diagnostic, clinical, remedial, resource room, itinerant and/ or team teachers, consultants, and developers of instructional materials and prescriptions for effective teaching," caught the ears of special educators (Dunn, 1968, p. 11). According to MacMillian and Semmel (1994), the adoption of special class placement has profoundly affected curriculum in special education. The impact of Dunn's article helped to create an environment that was conducive for the introduction of children with disabilities into the regular classroom setting. Dunn also helped focus the attention of those involved in the education of students with special needs on the topic of learning disabilities. In the following section, we will examine the impact of the presence of children with learning disabilities.

The Specific Learning Disability Issue

The previously mentioned factors created an atmosphere in which it was more acceptable for special education students to be placed in regular schools and classrooms. As they were placed in the regular schools and classrooms, another classification became a central focus of special education. "The large number of schoolchildren formally classified as having some form of a mild educationally handicapping condition is alarming, rapidly growing, and very well may be the most serious practical as well as ethical dilemma confronting American educators" (Sigmon, 1987, p. 5). Approximately 6% to 7% of the school-age population suffers from mathematics disabilities (Lerner,

2003). The question of what to do with students with specific learning disabilities seems to dominate the field of special education. A brief look at the evolution of learning disabilities follows.

According to Sigmon (1987), a learning disability refers to some significant deficit in essential learning processes requiring special education attention and that children with learning disability usually demonstrate some discrepancy between expected and actual achievement in one or more areas, such as speech, reading, writing, mathematics, and spatial orientations. However, this model of specific learning disability identification has been widely discredited by many research efforts (Warner, Dede, Garvan, & Conway, 2002). According to Kavale, Holdnack, and Mostert (2006) another approach to specific learning disability identification called responsiveness to intervention (RTI) is now being proposed as a model to determine the presence or absence of a specific learning disability. A discrepancy would no longer be the sole criterion for specific learning disability identification, but is replaced by a process that assesses the presence of a specific learning disability in a child based upon the child's response to research-based interventions (Kavale, Holdnack, & Mostert, 2006). Sigmon also declared that learning disabilities (LD) had its roots in the study of aphasia. There are many descriptions of aphasia, but perhaps the best definition of aphasia is "the loss of or impaired ability to speak, write, or to understand the meaning of words, due to brain damage" (Wolman, 1973). A comparison of this general definition of aphasia with earlier LD definitions suggested that the latter is merely a restatement of the former (Kirk, 1962; Kirk & Bateman, 1962).

An important idea in the evolution of learning disabilities can be attributed to Alfred Strauss. His studies concluded that mental deficiency could be attributed to exogenous factors, and this idea led to the establishment of two distinct categories of retardation: retardation as a result of brain damage and that with no apparent brain damage (Sigmon, 1987). In the 1950s as his works were disseminated among the public, some of the parents of children who recognized that Strauss' views accurately described their children organized parent groups for the purpose of convincing schools that these exceptional children were educable and that it was the responsibility of the schools to provide appropriate education (Lerner, 1981).

According to Sigmon (1987), the term 'specific learning disability (SLD)' as far as it is known was first used in print by Samuel Kirk in his book on exceptional children. Before the appearance of specific learning disabilities, the term "slow learner" was used to describe the students who needed help, but no special place was found in the regular classroom for them. One point of inquiry is how learning disabilities became so prevalent. According to Yell et al. (1998), an outcome of the Brown case was that when the equal protection doctrine was extended to a "class" of people, in this case racial minorities, advocates for students with disabilities, citing Brown, claimed that students with disabilities had the same rights as their peers without disabilities. They based their reasoning on two assumptions: first, that there was an untenable level of differential treatment within the class of children with disabilities, and secondly, that some students with disabilities were not furnished with an education, whereas those without disabilities were all provided an education. These important inconsistencies led to a series of court

cases in which individuals with disabilities both challenged and sought redress for similar inequities.

There was a dramatic increase in the number of students served as mentally retarded in public schools between 1948 and 1966 (Mackie, 1969). In the middle and late 1960s, the categories of mild handicaps and educable mental retardation were almost indistinguishable; there was no field of learning disabilities as we know it today (MacMillan & Semmel, 1994). In 1975 mild mental retardation made up the largest number of the exceptional children diagnosed (Reschly, 2002).

What to do with those students who were failing persistently, but were only eligible for special education as educable mentally retarded, was the question that needed to be answered. At the time, the definition of mental retardation used a dual criteria approach, which included low IQ and deficits in an invented construct termed ‘adaptive behavior’ (Greenspan, 1999). The use of these criteria by most states permitted identifying children as mentally retarded with IQs up to 85, including children who in the American Association on Mental Deficiency classification scheme were categorized as mildly mentally retarded (IQ 55 to 70) and borderline mentally retarded (IQ 70 to 85) (MacMillan & Semmel, 1994). MacMillan and Semmel also noted that educable mental retardation programs served a majority of children who would not qualify as mentally retarded today, and who also were, in many ways, much more capable students academically and socially, considering that approximately 3% of the general population scores IQ 70 or below, while 16% score IQ 85 or below. What to do with this marginal group of students (IQ 70 to 85) presented a great dilemma for special education.

Minority Overrepresentation

The definition of mental retardation and borderline mental retardation led to an overrepresentation of minorities, especially African Americans, in the mentally retarded population (Coutinho & Oswald, 2000), a fact that would lead to much litigation. According to Coutinho and Oswald, the overrepresentation of ethnic and linguistic minorities has produced several well known court cases, notably *Diana v. State Board of Education* (1970), *Guadalupe Organization v. Tempe Elementary School District* (1972), and *PASE v. Hannon* (1980). In 1973 a new definition of mental retardation, in response to the concerns related to the overrepresentation of minorities, was introduced that significantly reduced the number of students labeled as mentally retarded (MacMillan & Semmel, 1994). The placement of marginal students would become an issue. Warner, Dede, Garvan, and Conway (2002) suggested that overrepresentation was a result of bias in the referral process, the assessment process, or both. Some suggested that change in definition has simply allowed many minority students to be re-identified under a different category, namely those with learning disabilities (Coutinho & Oswald, 2000). The latter statement could be a possible conclusion. Consider the following example.

Coutinho and Oswald (2000) stated that between 1980 and 1994, in response to the Larry P. v. Riles (1972/1979/1984/1986) decision along with full implementation of IDEA, California virtually eliminated the overrepresentation of African Americans in mildly mentally retarded programs; however, there was an increase in the overrepresentation of African Americans students having learning disabilities. The issue of the overrepresentation of minorities in special education, especially specific learning disabilities, is a very pertinent issue that warrants much attention today.

Special education's evolution from infancy to its present state has indeed been an intriguing journey. Special education has come a long way from the institutionalization period, where confinement was perceived as beneficial, to the present, where legislation mandates that those with disabilities not only be educated, but be educated along side their non-disabled peers. However, there are important questions remaining about the attitude of society toward those who have been identified as members of this population. The factors that were examined in this brief history shed some light on how special education evolved. These factors have contributed and continue to contribute to the development of special education. We will now examine the history of reform in mathematics education.

History of Mathematics Education Reform

This section will examine the history of reform in mathematics education. It will include the early reform efforts influenced by Warren Colburn during the nineteenth century, followed by other influences in the twentieth century prior to the new math era. It will conclude with an examination of the new math era and the contemporary efforts of standards-based reform.

Mathematics Reform before New Math

A continuous debate in school mathematics is the one between teaching for understanding and teaching for skills development (Sztajn, 1995). Sztajn also noted that different instructional programs historically have promoted opposing ideas (teaching for understanding vs. teaching for skills development) about teaching mathematics and that during distinctive periods each viewpoint has been an emphasis in school mathematics.

Reform in mathematics education did not begin in the twentieth century. According to Michalowicz and Howard (2003), in the nineteenth century Warren Colburn introduced a method which stressed the importance of understanding as a means of learning arithmetic. Colburn defended understanding as the means to learning arithmetic and questioned the accepted practice of memorization. Colburn's book, *An Arithmetic on the Plan of Pestalozzi, with Some Improvements* blazed the trail of a complete reorientation of instruction in arithmetic (Cohen, 2003). His pedagogical belief system was greatly influenced by the philosophy of Pestalozzi, a learning theorist who emphasized the importance of children learning in a child-centered environment in which they were able to learn arithmetic in ways that had meaning to them (Michalowicz & Howard, 2003). Colburn's book had a significant effect on the mathematics curriculum in the nineteenth century.

Colburn's pedagogy was very different from the traditional approach. His pedagogical techniques were different in two respects: first, he wanted children to learn arithmetic as a mental process and second, he insisted that students discover fundamental rules for arithmetic for themselves through inductive reasoning (Cohen, 2003). These were hailed as revolutionary to arithmetic instruction. According to Michalowicz and Howard (2003), Colburn's new instructional method was appreciated because children did not have to rely on rote memory, and their minds were continually focused on the discovery of basic principles.

According to Stanic (1987), there were four perspectives that have battled for dominance in mathematics education during the twentieth century. These four perspectives are: the humanists, developmentalists, social efficiency educators, and the

social meliorists. The humanists emphasized mental discipline, the belief that learning mathematics would increase one's thinking capacity. The developmentalists desired to align the school curricula with the changing mental capacities of children. The social efficiency educators perceived school as a place that prepared students for their predetermined social roles. The social meliorists sought to make school a place where opportunities for equality should be emphasized.

Another aspect of this controversy is the dominant role that behaviorism held over the pedagogical techniques of teachers during most of the twentieth century. Behaviorism is a theoretical approach to learning espoused by such learning theorists as Edward Thorndike and B. F. Skinner (Woodward & Montague, 2002). The approach focused on teaching as an effort to produce the appropriate response based upon the application of the proper stimulus. The theories of Thorndike especially have influenced what goes on in the classrooms in this nation. Thorndike's Law of Effect implies that rewards for appropriate behavior always significantly strengthen associations, while punishment for unacceptable responses only slightly weakens the association between the stimulus and the incorrect response (Thorndike, 1913). Thorndike's Law of Effect still dominates practices in many mathematics classrooms today. Thorndike's Law manifests itself pedagogically in what is known as drill and practice. Drill and practice involves giving students pages of indistinguishable problems in a hope that by repeated practice the way of achieving the correct answer will be ingrained into the students. Many of Thorndike's ideas about teaching and learning such as after a student has mastered the process he may be permitted to disregard the reason for it were accepted in many instances without challenge (Thorndike, 1922).

Thorndike's emphasis on drill and practice was strongly opposed by William Brownwell with his emphasis on quantitative thinking (Arthurs, 1999). Brownell's claim that in order to think quantitatively one must have a fund of meaning instead of a plethora of automatic responses deemphasized the importance of responding with the correct answer (Arthurs, 1999). These two learning theorists represented two types of classrooms: one where drill and practice was the emphasis and the other where teaching with meaning ruled.

Also included in this controversy were the contributions of John Dewey to the theory and practice of mathematics. Dewey believed that the educational process should begin with the child's interests and that this process must produce opportunity for the intersection of thinking and doing in the child's classroom experience (Arthurs, 1999). Dewey focused on a commitment to democracy and community which was manifested through holistic instruction and curriculum and deemphasized individual assessment (Theobald & Mills, 1995). It can be seen that the viewpoints of Dewey and Brownell were similar and certainly opposed to those of Thorndike. Yet, what is so interesting is that the most frequently used strategy for teaching mathematics in America for most of the twentieth century was drill and practice (Arthurs, 1999).

Another force that has driven reform is this nation's perception of mathematics as the basis for its military and economic preeminence, and in periods of perceived national crisis, mathematics curricula have garnered special attention (Schoenfeld, 2004). Schoenfeld also reminded us that this perception has led to several attempts to change mathematics curricula before both World Wars, during the cold war and the crisis of the 1980s.

New Math Era

One of the most significant attempts to reform mathematics in the twentieth century was the so called "new math" movement of the 1950s and 1960s. New math represented an attempt at reform that was led by university mathematicians. It sought to introduce new topics into the teaching of mathematics such as: set theory, modular arithmetic, and symbolic logic (Schoenfeld, 2004). According to Herrera and Owens (2001), both educators and the public recognized the need to increase the amount of mathematical and technical skills being taught in our schools. The National Council of the Teachers of Mathematics (NCTM) formed the Commission on Postwar Plans to make suggestions about the mathematics curriculum. Herrera and Owens stated, "The goals were to establish the United States as a world leader and to continue the technological development that had begun during the crisis of the war" (p. 85). When *Sputnik* was launched in 1957, it created the perception that the United States had fallen behind in the technological race.

According to Garrett and Davis (2003), in 1952, prior to the launch of Sputnik, the University of Illinois Committee on School Mathematics (UICSM) launched an effort to improve school mathematics. This effort emphasized precision of language, mathematics structure, and understanding through discovery (Phillips & Kluttz, 1963). After a survey, it published a brochure, Mathematical Needs of Prospective Students in the College of Engineering of the University of Illinois (Osborne & Crosswhite, 1970). In 1955, the College Entrance Examination Board (CEEB) initiated a new approach by appointing a Commission on Mathematics to consider how assessment should reflect the changes in the field of mathematics that had taken place in the previous 50 years and the

commission's report called for a vastly different curriculum (Herrera & Owens, 2001). According to Cohen (2003), the commission's recommendations that most clearly captured the core idea of new math reform dealt with strategies for developing school curricula around concepts, structures, and reasoning processes. "Missing from the commission's specific recommendations, however, was any call to modernize teachers" (Miller, 1990, p. 80).

In 1963 a Cambridge Conference report, *Goals for School Mathematics*, proposed tentative views for a much more ambitious agenda for K-12 school mathematics (Cohen, 2003). Much of the foundation of this agenda had its support in the tenets of discovery learning that was being propounded by Jerome Bruner (Herrera & Owens, 2001). Using well-chosen problems, Bruner asserted that students can do investigations to "discover" concepts rather than being told relevant concepts and then expected to apply them (Herrera & Owens). Cohen declared the difficulty with discovery learning was that many mathematics educators found out that it was easier to recommend discovery teaching than it was to prepare teachers who could manage this style of teaching in everyday classrooms.

There were several attempts to prepare teachers for this new approach. According to Garrett and Davis (2003), the most prominent curriculum project of the era was the School Mathematics Study Group (SMSG). Hundreds of mathematics teachers and mathematicians were involved in summer writing sessions, classroom trials during the school year, rewriting, and publishing for national distribution, in an effort to properly use this curriculum (Herrera & Owens, 2001). However, these kinds of efforts were not

pervasive and arguments for more traditional direct teaching soon resurfaced in reaction to the discovery rhetoric of the new math period.

According to Miller (1990), the problem of new math might have been the country's penchant for the quick fix. Miller (1990) also concluded that had there been no Sputnik, University of Illinois Committee on School Mathematics (UICSM), SMSG, the Madison Project, and the other experimental programs might have developed slowly into a national curriculum; as it was, they were pushed to center stage, lavishly financed, and told to perform the miraculous (Miller, 1990). The conservative nature of schools led to a decrease in enthusiasm for change in the content and teaching of mathematics. Miller (1990) also noted that this skepticism had many sources, from teachers who had not been engaged in the conception of the new curriculum, to mathematicians who did not share the dominant abstract structural view of mathematics, and from a public which found familiar subjects rearranged until they were unfamiliar. The failure of new math swung the pendulum to the other extreme, “back to basics”. The new math movement followed a familiar pattern. First, there was a sense of national crisis, along with a concern about the lack of success of the traditional curriculum, followed by an enthusiastically superficial acceptance, criticism from a perception of its failure, and finally its abandonment.

Standards Based Reform

Mathematics education’s current reform effort has been labeled by some as standards-based reform. Thurlow (2000) indicated that standards identify what students should know and be able to do as a consequence of their schooling and other educational experiences, and also how well students must perform to exhibit adequate knowledge and skills. It is the object of much support as well as opposition. Like many other attempts at

reform in mathematics education, it has its staunch supporters and die heart opponents. According to McClure (2005) schools have had standards for practically everything except for what students should actually know and be able to do after a certain period of schooling. According to Goldsmith and Mark (1999) the standards movement represented a shift from rote learning and the application of procedures to an emphasis on conceptual understanding. This movement called for a systemic approach to mathematics reform which included "promoting the aligning of multiple components of the education system to elevate teaching and learning standards and enrich the instructional materials, content, and pedagogy offered to students" (Anderson, Brown, & Lopez-Ferrao, 2003, p. 619). Systemic reform is an approach to school change that acknowledges the complexity of the school system and its interconnecting parts (National Science Foundation [NSF], 1996). It encompasses some key ideas of setting high and explicit standards for student outcomes based on the negotiation among noted scholars from science, mathematics, business, and communities of teachers (Fuhrman, 1993; Kahle, 1998; O'Day & Smith, 1993). It should be noted that the approach to mathematics reform that was the object of this research was a systemic effort that was premised upon the aforementioned principles. We will now examine some of the catalysts of the reform effort along with some of the issues that have been the focus of attention since its inception.

According to McLeod (2003), the following are important events in the lineage of the current reform effort:

1. The report of the National Advisory Committee on Mathematics Education (NACOME) in 1975. This report examined the state of mathematics education in an effort to ascertain the strengths and

weaknesses of new math. It represented a shift in leadership from mathematicians to specialists in mathematics education and foreshadowed the broad view of educational change that would take place in the future.

2. The National Assessment of Educational Progress (NAEP) began gathering data on the performance of children in mathematics in 1973. The data gathered by NAEP produced evidence that students were prepared for only the simplest mathematical tasks. The NAEP data helped to produce a research base in mathematics education.
3. *An Agenda for Action* (NCTM 1980), a set of recommendations for school mathematics in the 1980s was published by NCTM. The Agenda recommended that basic skills be more generally defined, and that problem solving be a focus of school mathematics.
4. The National Committee on Excellence in Education (NCEE) published *A Nation at Risk* (NCEE, 1983). A *Nation at Risk* received extensive coverage in the media, and is credited for helping to develop a climate that was conducive for change in education.

These factors and others finally created an environment that was conducive for the birth of a reform effort which culminated in the publication of the document *Curriculum and Evaluation Standards for School Mathematics* in 1989 by the National Council of the Teachers of Mathematics (NCTM). The publication of this document launched what has come to be known as standards-based reform.

The latest round of this continuing battle over the teaching and learning of mathematics pits those who favor a continuation of the traditional approach (drill and

practice) against those who favor the efforts of standards-based reform. This controversy has become so contentious that it has been labeled the “math wars.” Fueled by philosophical and theoretical differences, sparked by political intervention, and fanned by intense media attention, this controversy has spread through the general community as well as the mathematics education community (Viadero, 2000). The publication of the NCTM standards sparked a chain reaction of responses, both positive and negative, to its release. The reform effort sparked by its release and subsequent releases by NCTM and other organizations are merely a continuation of a century old battle between opposing viewpoints about mathematics education (Kilpatrick, 2001). The reform effort challenged traditional beliefs about: how mathematics should be taught, why it should be taught, and who should be taught.

NCTM Standards

We will now examine the NCTM standards documents, to get a view of what kind of impact the reform initiated by them had on mathematics teaching and learning. The initial document, *Curriculum and Evaluation Standards for School Mathematics* represented a vision of teaching and learning that was radically different from the traditional one (Herrera & Owens, 2001). This document, as the name implies, set standards for mathematics education in the areas of curriculum and evaluation. According to Rivera (1993) the document set forth recommendations for mathematics curriculum and instruction, kindergarten through high school; procedures for evaluation, including teacher preparation; and pre-service training practices. It also called for a curriculum that prepared students to become mathematically literate using interactive instructional

practices that stressed higher-order cognitive thinking, problem solving, and discovery learning.

The *Curriculum and Evaluation Standards* is a statement of what students should learn at each of three levels: kindergarten-grade 4, grades 5-8, and grades 9-12 (Hofmeister, 1993). Woodward and Montague (2002) declared that this document was the impetus for many pedagogical and curricular changes that have occurred since its publication.

Driven by the notion that curriculum and evaluation were not the only aspects of mathematics education that needed improvement, NCTM addressed the teaching component of mathematics education. In 1991, NCTM published *The Professional Standards for Teaching Mathematics*. This document was an attempt to establish a broad framework to guide reform in school mathematics. This document delineated what teachers need to know to teach toward new goals for mathematics education and how to evaluate that teaching for the purpose of improvement (NCTM, 1991). According to NCTM, *Professional Standards for Teaching Mathematics* consists of five components:

1. Standards for teaching mathematics. This section presented a view of what a teacher at any level of schooling must know and be able to do to teach mathematics
2. Standards for the evaluation of the teaching of mathematics. This section presented a vision for the evaluation of mathematics teaching.
3. Standards for the professional development of teachers of mathematics. This section expressed NCTM's vision for well-prepared teachers of mathematics from the time prospective teachers of mathematics take their

initial courses in collegiate mathematics throughout their career-long development.

4. Standards for the support and development of mathematics teachers and teaching. The standards in this section delineated the responsibilities of those who make decisions that affect teaching mathematics.
5. Next Steps. The final standard of this document discussed some of the issues and next steps that were needed to be taken to move toward the goal of mathematical power for all students.

This document helped to create a more definitive picture of NCTM's vision for reform.

Following the release of the teaching document, in 1995 NCTM released the document, *Assessment Standards for School Mathematics*. This publication focused on the issues of evaluation that would have to be dealt with in order to continue the progress that the original document had begun. NCTM asserted in the *Assessment Standards for School Mathematics* that we believe that new assessment strategies and practices need to be developed in order to enable teachers and others involved in the assessment process to assess students' performance in a manner that is reflective of NCTM's reform vision for school mathematics (NCTM, 1995).

According to NCTM (1995), *Assessment Standards for School Mathematics* focused on six standards for assessment. They are listed as follows:

1. Mathematics Assessment Standard — mathematics assessment should reflect what all students should know and be able to do mathematically. Assessments that correspond to the mathematics standard involve activities that are based on important and correct mathematics. It

emphasized the idea that skills, procedural knowledge, and factual knowledge are assessed as part of the doing of mathematics and not as an object of assessment. It also reflected a shift in the importance that the world outside the schools increasingly places on thinking and problem solving.

2. Learning Standard — mathematics learning should be enhanced by assessment. The learning standard shifts the emphasis of using assessment as a product, to the use of assessment as a component in the learning process. It also placed an emphasis on making assessment a perpetual part of instruction.
3. Equity Standard — assessment should promote equity. Assessment that is equitable, first of all sets high standards of performances for all students. It provides each student an opportunity to exhibit what she or he has learned without regard to her or his background.
4. Openness Standard — assessment should be an open process. An assessment process that is open informs those who are affected by the process. Open assessment seeks the input of teachers and other professionals, and is also open to scrutiny.
5. Inference Standard — assessment should promote valid inferences about mathematics. An inference about learning is a conclusion about a student's cognitive processes that is based on the student's performance. The inference standard placed a focus on making valid inferences about student learning based on a convergence of evidence from a variety of

sources. The primary source of this evidence is no longer the traditional instruments such as multiple-choice and short-answer tests, but include includes evidence from observations, interviews, open-ended tasks, extended problem situations, and portfolios.

6. Coherence Standard — assessment should be a coherent process. A coherent assessment process involves three kinds of agreement. First, the assessment process forms a coherent whole; the components fit together. Second, the assessment process corresponds to the purposes for which it is being done. Third, the assessment process is aligned with the curriculum and with instruction.

Finally, in 2000 NCTM published *Principles and Standards for School Mathematics* (PSSM). This document was the latest effort in the process of presenting a vision of what school mathematics should look like. It continued the clarion call for reform that had begun with the 1989 document. “It emphasis are six principles and ten standards, five content standards and five process standards that are grounded in the belief that all students should learn mathematics with understanding” (NCTM, 2000, p. ix). The six principles delineated in PSSM are: equity, curriculum, teaching, learning, assessment, and technology; the content standards are: number and operations, algebra, geometry, measurement, and data analysis and probability; and, the process standards are: problem solving, reasoning and proof, communication, connections, and representation.

Connection to Special Education

The picture that is painted by the vision of mathematics education set forth in these documents varies significantly from the traditional picture. The Standards focus on

conceptual understanding rather than procedural knowledge or rule-driven computation (Maccini & Gagnon, 2002). The tension placed on mathematics education by reform has produced a trickle-down effect on special education. This issue has caused great concern, especially among special educators. Hofmeister (1993) voiced the sentiment that the NCTM documents must be reviewed with concern relative to the integration of at-risk students. Rivera (1993) pronounced similar caution by declaring as good consumers of reform efforts, we must analyze the implementation of the standards, especially as they relate to students who have mathematics disabilities or who are at risk for failure.

The reform movement has placed an emphasis on problem solving and other higher order thinking skills. According to Skott (2004), reform is a movement towards

1. attempting to understand institutionalized mathematical learning, both individually and socially, while emphasizing a process perspective, and
2. developing the teacher-learner process in accordance to those understandings.

According to Montague (2003), this approach underscores the social-interactive nature of learning and views children as active and engaged learners who construct meaning by selecting, organizing, connecting, and understanding information, ideas, and concepts as a consequence of prior knowledge and experience. The reform effort, along with the forces that have placed students with disabilities and other deficiencies in the general education classroom, seems to be on an inevitable collision course with special education.

Philosophical and Theoretical Perspectives

A tension exists between the field of special education and the field of mathematics education. This tension is based upon the paradigmatic shift in mathematics education in theories of learning from predominantly reductionistic skilled-based teaching to a constructivist epistemology that emphasizes active student leaning, centered in problem solving situations facilitated by teachers' guidance and questioning (Rivera, 1997). The reformed mathematics educator wants students to discover how to find the answer while the special educator wants to tell the students directly how to attain the answer. This fundamental difference has been seen as the cause of great debate between those who favor the traditional methods of special education and those who favor the non-traditional methods of standard-based reform. A basic understanding of the underlying paradigms of each discipline will help shed some light on the reasons behind these fundamental differences.

A paradigm is a set of beliefs that govern action. It is described as the worldview of a particular discipline (Denzin & Lincoln, 2003). Each paradigm involves four concepts: ethics, epistemology, ontology, and methodology (Cresswell, 1998). Each has its own sense of inquiry. Ethics asks moral questions, epistemology makes inquiry about knowledge, ontology wants to know about the nature of reality, and methodology focuses on the best way to gain knowledge (Denzin & Lincoln, 2003). We will now examine how the most prevalent paradigm in special education plays itself out in these various concepts.

Special Education's Philosophical and Theoretical Perspectives

The field of special education has held a worldview that has been dominated by foundational knowledge that is rooted in the positivistic tradition of the natural sciences (McPhail, 1995). According to Rhodes (1995), special education rejected the constraints of a medical model, to accept the positivist philosophy of science. McPhail also noted that it is not a surprise that early special educators embraced this worldview, a worldview that seemed so promising for individuals with disabilities. Having grown out of psychology and medicine, special education researchers were concerned with the learning and behavioral characteristics of children and interventions to address their needs (Paul, French, & Cranston-Gingras, 2001). This emphasis in the early stages of special education was the cause that most people who worked with persons with disabilities received very little, if any, personnel preparation training focusing on teaching skills (Collins & Schuster, 2001).

The worldview inherent in positivism is that the discoverable, regular patterns of natural science can be explained in some logical/ mathematical manner (McPhail, 1995). This view created the prospect of establishing a world through scientific investigations that was not ruled by superstition, luck, and local knowledge, but by a general system of knowledge based upon rational thinking that produced an improved sense of prediction and control. Reid and Robinson (1995) declared that the dominant philosophy of special education is empiricism. To use a modern vernacular, what you see is what you get. When this way of seeing the world is extended to the study of human beings, the phenomena associated with being human, such as thinking and behaving are also assumed to function with regularities of natural phenomena (Polkinghorne, 1983). This

viewpoint necessarily regards internal experiences, such as sensation, perception, and emotions, along with external behavior of human beings as material things that could be measured and analyzed in order to unlock some predictable pattern. A chief goal of these human scientists is to formulate human behavior similar to developing an equation for some chemical reaction.

Most special education researchers have maintained a strong commitment to positivist epistemology (Kauffman, 1999). Special education researchers, guided by a well developed and robust philosophy of behavior, generated a substantial base of technologies for defining and engineering change in behavior (Paul, et al., 2001).

Positivist science is focused on the acquisition of knowledge. Polkinghorne (1983) described three basic canons of positivist science designed to meet the goal of episteme:

1. Knowledge is not opinion or doxa. Knowledge is represented in statements of direct observation, or is derived from statements that have been deductively linked to direct observation. Inductive statements are less valid than deductive ones because they only represent approximations of episteme.
2. Knowledge is achieved when statements can be deductively generated and linked from axiomatic statements, and empirically verified.
3. Statements of opinion are inadmissable in scientific research because they are not grounded in observation and an axiomatic system. (p. 63)

According to McPhail (1995), the application of this model to the study of human beings necessarily eliminates opinion from the analysis of any phenomenon and concludes that human beings must be studied in ways that are verified by observation. Conclusions

based upon mere opinion and other subjective verifications cannot be included as evidence that will stand up to logical analysis.

Kelley (1971) asserted, epistemologically speaking, the following basis assumptions are commonly proposed for special education:

1. That the basic purpose of special education is to provide therapeutic-instructional benefit for its subjects.
2. That the other functions of special education, such as administration, supervision, diagnosis, and research is contingent upon this purpose.
3. That any paradigm of special education will need to concern itself with the epistemological question "How do we know when we are benefiting our subjects? (p. 9)

If the basic purpose of special education is the benefit of the child, then the beneficial functions of instruction and therapy are synonymous expressions of a single purpose (Kelley, 1971). If instruction is seen as therapy, then there is a desire to produce some demonstration of benefit to the subject, if it is only through the performance of some rote skill. This may be the key to understanding the pedagogical practices in special education. The influence of behaviorism on the theoretical aspects of special education is not as prevalent as it once was; however, in practice its influence is still prevalent in the classroom today and especially in the special education classroom (Woodward & Montague, 2002). An observation of most mathematics special education classrooms will reveal an environment in which students will receive instruction that emphasizes rote memorization and procedural skills (Cawley & Parmer, 1992). The students are continually exposed to repetitious practice in a hope that the desired response, correct

answers, will be attained. This kind of mentality emphasizes the importance of the product over the process.

In summary, the positivistic tradition, proposes: ethically that propositional knowing about the world is an end in itself; ontologically, that there is a reality that can be grasped; epistemologically, that there is an objective truth, and; methodologically, that knowledge can be verified deductively (Denzin & Lincoln, 2003). These all play an important role in the theory and practice of special education.

Philosophical and Theoretical Perspectives of Reform in Mathematics Education

According to (Draper, 2002), there might be a valid argument that educational reform has been an ongoing process since formal education began, it is widely accepted that the latest round of reform had its genesis with the publication of *A Nation at Risk* and got underway with the publication of *Curriculum and Evaluation Standards*. The NCTM Standards have their roots in cognitive and constructivist approaches to learning, as indicated by their emphasis on the development of the learner's ability to think about mathematics (Woodward & Montague, 2002). According to Pugalee (2001), constructivist philosophy grounds the teaching and learning methods recommended by the NCTM. Also, Calhoun, Bohlin, Bohlin, and Tracz (1997) related that constructivism has become a popular theoretical premise for many educational decisions and has influenced the beliefs of many about the way classrooms should operate. Draper (2002) added that mathematics reform has endeavored to change the traditional classroom which held a view of knowledge as disjoint, hierarchical and fixed, to one in which knowledge is regarded as a personal construction of the learner as he interacts with persons and things in the environment. The center of the constructivist agenda is the belief that

learning is an active, social, and interactive process and that learners construct an understanding of subject matter rather than receiving it directly from the teacher (Woodward & Montague, 2002). Rivera (1997) added that the heart of the reform movement lies in a paradigmatic shift from predominantly skilled based instruction to a constructivist epistemology that focuses on active student learning rooted in problem solving situations facilitated by teachers' guidance and questioning. A further examination of this paradigm is warranted.

Popper (1974) indicated that while special education was maturing in the latter part of the twentieth century, radical changes took place in the social and physical sciences. He declared that as special educators and policy makers were increasing their knowledge bases, the philosophy was changing and creating a rather different conversation about knowledge. He also noted that the traditional positivism that had dominated many of the social sciences, and most assuredly had an influence on special education philosophy and research in the form of behaviorism, had severely been opposed. These thoughts will now carry us into a discussion of the philosophical and theoretical underpinnings of constructivism. We will identify its roots, examine the basic assumptions of constructivism, identify various forms of constructivism, and discuss their differences.

Discussion of Constructivism

The roots of constructivism are found in the works of Piaget and Vygotsky (Harris & Graham, 1994). "The term constructivism was introduced by Piaget," whose works are based on cognitive psychology (von Glasersfeld, 1996, p. 307). Woodward and Montague (2002) reminded us that behaviorism was the most prevalent theory of learning

and instruction in the late 1950s and 1960s and when cognitive psychology reappeared in the late 1960s and early 1970s, researchers in both general and special education began to consider cognitively explained notions of learning and began to incorporate these notions into their research activities. This new emphasis led to the departure from the strict orthodoxy of behaviorism according to Woodward and Montague (2002). Piaget's interpretation of constructivism differs from the interpretations of others known as constructivists, but his was a catalyst in the evolution of this paradigm.

Constructivism is the philosophy, or belief, that learners create their own knowledge as they interact with their environment (Draper, 2002). Constructivism emphasizes the active role played by the individual in the construction of knowledge, the predominance of individual and social experience in the course of learning and the awareness that the knowledge attained may differ in its accuracy as a representation of an objective reality (Cooner, 2005). Harris and Graham (1994) also communicated the idea that constructivists emphasize the seminal role of active construction of knowledge. These descriptions of constructivism all point to the central role of the idea of the active learner and the importance of discourse in any valid definition of this paradigm. There are various forms of constructivism, but this idea permeates them all.

Constructivism plays itself out very differently from the positivist world view held by special education in terms of ontology (questions about the nature of reality), epistemology (questions about how one knows the world), and methodology (questions about the best way to gain knowledge). According to Denzin and Lincoln (2003), constructivism adopts a relativist ontology. It views reality as a human construction. Its

epistemology is transactional and the methodology of constructivism is hermeneutical and dialectical (Lincoln & Guba, 2003).

Endogenous constructivism. There are different forms of constructivism, but the two major categories are endogenous and exogenous. These versions represent the two extremes of constructivism. Endogenous constructivism emphasizes the mind as the originating place of knowledge, while exogenous constructivism emphasizes that human mental functioning is innately situated in a social context (von Glasersfeld, 1997). Endogenous constructivism views knowledge as constructed not from external experiences, but from prior mental structures, learning is the restructuring and reconstruction of old knowledge structures in the view of new experiences (Dalgarno, 2001). In other words, what an individual sees is a function of what that person brings to the experience. Von Glasersfeld (1995) explains it in these words:

> Knowledge, no matter how it be defined, is in the heads of persons, and that the thinking subject has no alternative but to construct what he or she knows on the basis of his or her own experience. What we make of the world constitutes the only world we live in. It can be sorted into many kinds, such as things, self, others, and so on. But all kinds of experiences are essentially subjective, and though I may find reasons that my experience may not be unlike yours, I have no way of knowing that it is the same. (p.1)

An example of an endogenous theory of constructivism is radical constructivism. This theory is a key force driving the Standards movement today (Woodward & Montague, 2002). Radical constructivism originated with Piaget, but its modern form has

been most fully articulated in epistemological terms by von Glasersfeld and methodologically by Steffe (Ernest, 1996).

Radical constructivism, as explained by von Glasersfeld, is based upon two principles:

1. knowing is active; and,
2. the function of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality (Ernst, 1996).

Overall, radical constructivism makes no ontological claims, making no presupposition about the existence of the world behind the subjective realm of experience. Its epistemology does admit that it is fallibilist (capable of failing), skeptical, and subjectivist (depends on the individual). “The fact that there is no ultimate, true knowledge possible about the state of affairs in the world, or about such realms as mathematics, follows from the second principle, which is one of epistemological relativity” (Ernst, 1996, p. 341).

According to (Brooks and Brooks, 1993) radical constructivism pedagogical emphases include:

1. Encouraging and accepting student autonomy and initiative;
2. The use of cognitive terminology when considering tasks;
3. Allowing student responses to drive lessons, change strategies, and alter content;
4. Giving precedence to student understanding of concepts;
5. Encouraging dialogue among students;
6. Providing time for students to construct meaningful relationships; and

7. Nurturing students' natural curiosity.

Exogenous constructivism. An example of exogenous constructivism is social constructivism (Harris & Graham, 1994). Social constructivism regards the interactional nature of knowledge (Moshman, 1982). Ernst (1996) declared that there is little or no attention paid to the idea of the wholly isolated mind, but there is an emphasis on persons in conversation with each other. This viewpoint emphasizes the importance of the interaction of the individual with the environment. A model of the social constructivist's world is that of a socially constructed world that creates the shared experience of some physical reality. Ernst also declared that there is a constant modification of the humanly constructed reality to fit ontological reality, which can never produce a true picture of this reality. The underlying metaphor of social constructivism is persons in conversation, which places value on people and their language in the construction of knowledge.

In summary, Ernst (1996) concluded that the social constructivist paradigm adopts a relativist ontology that says that there is a real world out there, but we do not have certain knowledge of it. It is based upon a fallibilist epistemology that regards knowledge as that which is experienced and socially accepted. Its methodology is eclectic but admits that all knowing is problematic (Ernst, 1996). The implication of this theory of learning on pedagogy can be eclectic. It may lend itself to a classroom which is dominated by cooperative learning groups to one in which explicit instruction is the chief medium of delivery.

Dialectical constructivism. Another form of constructivism is dialectical constructivism. Dialectical constructivism, according to Moshman (1982), is the perspective that learning occurs through realistic experience, but that learners require

scaffolding provided by teachers or experts as well as collaboration and discourse with their peers. According Harris and Graham (1994), dialectical constructivism exists both independently from and within the tension between endogenous and exogenous constructivism. Moshman declared that much dialectical theorizing is quite clear in its desire to include both the endogenous and exogenous perspectives. Dialectical constructivists see neither exogenous learning nor endogenous development as predominant (Harris & Graham, 1994). The source of understanding is seen as lying in continuing exchanges between the child and environment; a complex and dynamic reciprocity between the developing individual and a simultaneously varying world is posited (Moshman, 1982). Examples of instruction consistent with dialectical constructivism include scaffolded instruction, teacher-guided or prompted discovery, or instruction arranged so that students' misconceptions or partially formed conceptions encounter actual principles or different perceptions (Harris & Pressley, 1991).

This examination of constructivism has produced evidence that it is not a simple paradigm. There are variations of constructivism, yet if their differences are not acknowledged a cloud of confusion and ambiguity is produced. This ambiguity about this paradigm has led to the some of the confusion about the implementation of systems of learning based upon it. One of the issues that this research will examine is the confusion about this paradigm in the field of special education. We will now set our study in the context of previous research by examining studies that involved traditional special education interventions, followed by studies done involving cognitive research, and finally research done in reform settings.

Research Tensions

Another factor that has contributed to the tension between mathematics reform and traditional special education is the fact that each has emphasized different approaches to research. According to Kroesbergen and Van Luit (2003), a survey of the literature will reveal that most of the research that has been done in special education relative to mathematics has been done in the domain of basic skills using positivist approaches. A positivist mode of inquiry seeks for empirical evidence as the proof of a claim; which would tend to emphasize the results over the process that led to the results. Positivist methods of inquiry are in opposition to many methods of inquiry that focus more on the process than the result of the process; thusly the majority of this research paradigm features quantitative experimental and quasi-experimental designed studies (Vulliamy & Webb, 1993). Research geared toward examining the process over the result emphasizes qualitative designs. Some in special education claim that methods of inquiry based on postmodern and cultural relativism are a retreat from inquiry and knowledge and that adoptions of these doctrines are dangerous to special needs students (Sasso, 2001). Note the commentary of Kauffman (1999), referring to postmodernism and radical deconstructivist philosophy:

> I am not able to identify any practical applications of these writers' work to special education or comprehend how applying their ideas might make a positive contribution to teaching students with disabilities or researching special education problems. (p. 248)

As can be seen, this tension has spilled over into the research paradigms of each camp. An important point about research is that it cannot ultimately prove what is best, because the issue of what is best is a function of what is valued (Hiebert, 2000). What has been researched is what has been valued. In the field of special education, the result has been valued, while the constructivist-based reform effort in mathematics education has placed more emphasis on the process that led to that result. As a result, each perspective can produce evidence that refutes the claims of the other.

These two perspectives differ in many ways. The quest of this research is to examine factors to consider in the attempt to find some common ground for these seemingly competing viewpoints to come together for the primary purpose of mathematic education, the learning of mathematics. We will now set our study in the context of previous research by examining studies that involved traditional special education interventions, followed by studies done involving cognitive research, and finally research done in reform settings.

Positivistic Studies

We will now examine some research studies relative to special education and mathematics beginning with studies that were done with positivistic goals in mind. The first study involved the concept of constant time delay as a method of intervention to enhance the basic skills of children with learning disabilities. Koscinski and Gast (1993) conducted a study that examined constant time delay for teaching basic multiplication facts to elementary students with learning disabilities. In this study, students were directed to answer a set of problems without guessing. If the student was not able to give the correct answer, the researcher supplied the answer after waiting four seconds. The

student then read the problem again in order to give the correct answer. Students who did not wait for the response were reminded to wait for the correct answer. This was repeated until students reached a mastery level of 100%. The students obtained mastery in less than one hour. This study was basically one that emphasized a method to aid in the memorization of multiplication facts.

In a similar study, Williams and Collins (1994) made a comparison of the effectiveness of student-selected material prompts to teacher-selected material prompts using a constant time-delay procedure. The study's participants were four boys with learning disabilities. The intervention consisted of sessions in which each student worked with ten multiplication facts with three trials per session. Using flashcards, the first two trials per fact were presented with no time delay, and subsequent trials were presented with a five second delay. The material prompt consisted of: 120 tri-colored poker chips, a computer-printed timeline numbered from 1 to 100, and students' fingers. When a student gave an incorrect answer, he was instructed to compute using one of the three material prompts. Teacher selection of prompts and student selection of prompts were balanced. The intervention resulted in all students learning the targeted multiplication facts and maintaining those skills after the prompts were faded. Student selection of prompts was more effective than teacher selection of prompts for all students. The results of this study distinguished between the two interventions effectively, but the focus is again on an isolated skill. These studies focused basically on achieving a particular response based upon some prescribed stimulus.

In another positivistic-based study, Morton and Flynt (1997) compared the efficacy of two prompting techniques. The techniques evaluated were constant time delay

and prompt fading in teaching multiplication facts to students with learning disabilities. The participants were three third-grade boys and one fourth-grade boy. Written on cards, mathematics facts without answers constituted the constant time delay procedure. Cards containing mathematics facts with answers of varying intensity were used as the prompt fading procedure. The constant time delay phase was a four second interval. The intensity of the answer decreased over time during the prompt fading procedure. The first trial had cards printed at 100% intensity, each trial decreasing by 25% thereafter. Neither method proved superior to the other, but both were effective for acquiring multiplication facts. Notice the emphasis is on achieving mastery of a skill that is thought to be a prerequisite before students can be successful in mathematics, which has been a focus of special education research.

The next three studies investigated the effect of a teaching strategy called the concrete-semi-concrete-abstract approach (CSA) in which instruction began with the use of concrete manipulatives, which are designed to facilitate understanding of a particular concept, and transitions to a semi-concrete (pictorial) stage and then to an abstract (symbolic) stage. In the first study, Peterson, Mercer, and O'Shea (1988) compared the efficacy of two teaching methods. This study compared a concrete-semi-concrete-abstract (CSA) approach and an abstract-only method of teaching place value to 24 elementary and middle-school students with learning disabilities. Students placed in the experimental group received three lessons using manipulative devices (popsicle sticks), three lessons using semi-concrete instruction (drawings), and three lessons at the abstract level (symbols only). The students in the control group received all of their lessons at the

abstract level. The experimental group scored significantly higher than the control group on the posttest, maintenance, and retention.

Miller and Mercer (1993) conducted a follow-up study that examined basic skills instruction to students with learning disabilities. This study examined the efficacy of the CSA procedure in teaching addition facts and coin sums. It also involved determining how many lessons were necessary at each level before the students were able to transfer skills to abstract problems. The baseline phase consisted of daily 1-minute probes with no teacher feedback. The treatment involved 20-minute scripted lessons including an advance organizer, demonstration and modeling, guided practice, and individual practice. All students reached the goal of 80% criterion on their first attempt. The results indicated that the CSA sequence worked for acquiring these skills after five 20-minute lessons at each stage. The researchers concluded that for some students, fewer lessons at the concrete stage are needed, whereas other students might need all five at each stage.

Harris, Miller, and Mercer (1995) also examined the teaching of basic math facts using this method. This study examined the teaching of multiplication facts to students with disabilities in general education settings. Twelve second-grade students with learning disabilities, 99 students without disabilities, and one student with an emotional disability, were involved in this study. Six general education teachers taught their intact classes multiplication using lessons that progressed through the CSA sequence, along with a mnemonic device that facilitated the transition from the second phase to the last phase. All students with learning disabilities showed signs of improvement.

Van Houten (1993) examined two methods of teaching subtraction facts to four elementary students with learning disabilities. In every problem, 7 or 9 was the minuend.

Each student was taught a set of subtraction facts by rote-learning and a set using a rule strategy. The rote method consisted of subtraction facts written on flashcards. First, the experimenter shuffled the cards and presented them one at a time stating the problem and asking for the answer. Students were asked to respond verbally to each item. After each of the cards had been presented once, the cards were again shuffled and the procedure repeated until each card had been presented 8 times. If a student responded incorrectly, the answer was supplied and the question repeated. The rule was introduced as an easy trick that the student could use when subtracting (seven/nine). The strategy involved adding (three/one to the number above the (seven/nine). In the alternate method, the procedure was the same except that the students were taught strategies for answering the problems. The performance of the students who were taught the strategy was greater than those who learned by rote.

Rivera and Smith (1988) conducted a study that used a demonstration-imitation-key words intervention to teach students with learning disabilities long division. This procedure involved the teacher demonstrating a problem while verbalizing keywords, followed by an imitation of the process by the students. Next, the students completed a worksheet that displayed the illustrated problem as a reference, while the teacher circulated among them reminding them of the keywords. All of the students with learning disabilities achieved criterion with and without remainders.

As can be seen, the research that has been done under the traditional special education paradigm has focused on quantitative designs that sought to compare two or more treatments using single subject and group designs. These studies basically sought to find out which treatment produced the largest effect size, and thusly prove which

treatment was more effective. A focus on the production of the largest effect size is an example of a concentration on the result instead of the process that led to the result. This type of exhibit is in line with the positivistic philosophical perspective and runs counter to the focus of reform-base research.

Cognitive Studies

The following are studies that were motivated by cognitive theories of learning. Most of cognitive theory is buffered between extreme behaviorism and constructivism. Some of the topics investigated in cognitive theory include: strategies instruction, information processing, and schema strategy training.

Tournaki (2003) conducted a study in which forty-two second-grade general education students and 42 students with learning disabilities (LD) were taught basic, one-digit addition facts. Students received instruction via a) a minimum addend strategy, and b) drill and practice, or control. The minimum addend strategy is a strategy in which the student determines which is the larger addend and counts on from that larger number the number of units specified by the smaller addend; for instance, in 2 + 5 = ?, the student starts from 5 and adds 2 more units. The effectiveness of the two methods was measured through students' accuracy and latency scores on a post-test and a transfer task. Students with LD improved significantly both in the strategy and the drill-and-practice conditions as compared to the control condition. Relative to the transfer task, students were significantly more accurate in the strategy condition.

Kelley, Gersten, and Carnine (1990) evaluated the relative effectiveness of a curriculum that incorporated three empirically derived principles of curriculum design with a basal approach in teaching fractions concepts to students with learning disabilities

and other low-performing students in high school remedial math classes. The components of effective mathematics instruction articulated by Good and Grouws (1979**)** were implemented in both conditions. Good and Grouws articulated the following variables as components of effective teaching: 1) daily review, 2) development of lesson, 3) seatwork, 4) homework assignment, and 5) special reviews. Thus, the curriculum design variables were isolated by keeping all other aspects of instruction constant. Results indicated that, although both programs were reasonably successful in teaching the material, the curriculum program utilizing sophisticated principles of curriculum designs (detailed step-by-step strategies for solving each problem type) was significantly more effective.

Montague and Van Garderen (2003) conducted a study that investigated students' estimation ability and use of estimation strategies along with mathematics achievement and academic self-perception. Students were asked to respond to questions that required them to generate answers based upon their estimation abilities. In this study, the performances of learning disabled, average-achieving, and intellectually gifted fourth, sixth, and eighth-graders were compared and the results revealed that the students with learning disabilities performed significantly lower than their peers on the mathematics achievement measure, but viewed themselves to be as competent academically as their average peers. Students with learning disabilities and average achievers scored significantly lower than gifted students on the estimation assessment. The results also showed that gifted students did not show obvious proof of a well-developed understanding of estimation along with their peers.

Jitendra, DiPipi, and Peron-Jones (2002) conducted a study that extended the research on schema-based instruction by investigating its effects on the mathematical problem solving of four middle school students with learning disabilities who were low-performing in mathematics. A schema-based strategy makes use of schemata diagrams to map important information related to a particular problem type and highlights semantic relations in a problem to assist problem translation and solution (Jitendra, Hoff, & Beck, 1999). The following problem is one that can be solved by using a schema-based strategy.

> Jerry had 37 marbles; he lost 15 marbles while playing. How many marbles does he now have? A schema-based strategy that could be used to solve this problem involves drawing a diagram that depicts the change in the larger number of marbles that Jerry had from 37 to the smaller number 22. It could be any representation that indicates the basic notion of a larger quantity being reduced by some known quantity to obtain some unknown quantity.

During treatment, students received schema strategy training in problem schemata (conceptual understanding) and problem solution (procedural understanding). Results indicated that the schema-based strategy was effective in substantially increasing the number of word problems correctly solved that involved multiplication and division for all four participants. Maintenance of strategy effects was evident for 10, 5½ and 2½ weeks following the termination of instruction for the students.

Although these studies considered students thinking about strategies to use, they did not occur in environments in which the students were allowed to develop their own strategies for learning. Also the basic notion of problem solving was limited to the notion

of solving word problems. The studies took place in settings in which the strategies were explicitly taught by the teacher. This is not the emphasis in a reform setting.

Research in Reform Settings

There is a dearth of research studies on students with learning disabilities and those at-risk for mathematics failure done in reform mathematics settings. Now, we will examine a few research studies that have taken place in an environment where reform is the norm. The following is a study that was done in a reform setting.

Woodward and Baxter (1997) conducted a study that examined the effects of an innovative approach to mathematics instruction on academic performance of students with learning disabilities and other students who had been labeled as at risk for special education. The participants were nine third-grade teachers and their students from two schools who were using the Everyday Mathematics (Bell, Bell, & Hartfield, 1993), a reform-based curriculum. This program deemphasizes computation and places significant emphasis on innovative forms of problem solving. Unlike the approach to word problems in traditional mathematics curricula that often lend themselves to a key word approach, the problems or "number stories" in Everyday Mathematics often emanates from the students' everyday world or from nature, geography, or other school subjects. Participants in the comparison school were five third-grade teachers and their students who used a traditional curriculum. The teachers in both settings were comparable in their beliefs as indicated by their scores on a mathematics beliefs scale. Both qualitative and quantitative data were collected. The mathematical subtests of the Iowa Test of Basic Skills (ITBS) were the quantitative instrument and the Informal Mathematics Assessment

(IMA), a problem solving evaluation was the qualitative instrument. The IMA is an individual interview that probes students' thinking as they investigate problems that can be approached in diverse ways (Woodward & Baxter, 1997). The results of this study indicated that the innovative curriculum benefited the majority of the students in the intervention schools. However, the data indicated only marginal improvement in learning for students with learning disabilities and their academically low-achieving peers. The students at the comparison school made greater gains on the ITBS than those at the intervention schools, while the intervention students outperformed the comparison students on the IMA. Post hoc interviews conducted by these researchers indicated that a teacher's ability to meet the needs of the lowest-achieving students was affected by many factors, only one component being the structure and content of the curriculum.

This study revealed the complicated issue of addressing the needs of students with disabilities and those at risk for special education. The fact that the data clearly suggested that the curriculum benefited the majority of the students is reason enough to make further investigation to determine how to include the targeted population in this success.

In a follow-up study, Baxter, Woodward, and Olsen (2001) conducted a qualitative study involving the effects of reform-based mathematics instruction on low-achieving third-grade students' participation in classroom discourse. The study examined the effects of the implementation of the Everyday Mathematics (Bell, Bell, & Hartfield, 1993) curriculum on students who had been identified as low achievers in mathematics. Most of the instruction involved whole-class discussion and pair work and student talk with little class time given to independent practice. Typically, the teachers allotted the majority of class time for group work and pair work, and the activities were designed to

be carried out in these contexts. The challenges that reform-based instruction presented to these students was a chief focus of this study. The researchers observed that class discussion and pair-work were an enormous challenge to the target students. Their participation in a chief component of a reform classroom, that is discourse, was minimal and the majority of that participation was only superficial. The study concluded that reform mathematics instruction presented tremendous challenges to these students as they attempted to become a functioning part of a community of learners. An interesting observation brought forth from this study was that most of the current mathematics reform is being implemented in traditionally configured schools and how that structure constrains teachers' ability to reach low achievers. The researchers concluded with the thought that reform-based mathematics should not be abandoned as a mean of teaching low achievers, but the study suggests that the students needed additional support.

An often neglected aspect of mathematics reform is assessment. The multiple choice examination, which primarily assesses basic facts, runs contrary to the basic tenets of reform. If students are taught in one fashion and assessed in another, a misalignment is created. Other forms of assessment, such as portfolios, performance tasks, observations, and interviews produce multiple sources of evidence for assessment decisions (Woodward, Monroe, & Baxter 2001). These reform-based assessment tools are invaluable in furnishing evidence of learning not captured by traditional formats (NCTM, 1995). The following study is evidence of how an alternate form of assessment can be used to enhance learning.

Woodward, Monroe, and Baxter (2001) conducted a study involving students with learning disabilities in reform mathematics classrooms at intermediate grade levels. The

study involved the use of class-wide performance assessment tasks and ad hoc tutoring as interventions to enhance students' deeper understanding of mathematics. Performance assessment tasks are tasks that require students to solve difficult problems and to communicate their solutions with justification (Woodward, Monroe, & Baxter, 2001). The following is an example of a performance assessment task.

> A player can only jump on one leg, and it is Mitch's turn. Mitch gets 8 points for each time he jumps in the cement square, and he loses 6 points every time he jumps on a crack between the squares. Mitch jumped on 9 squares and 5 cracks. How many points does Mitch receive?
>
> Explain your response using words, numbers, or pictures.

Of a total of 11 students with learning disabilities, 6 were part of the intervention classrooms and 5 were in the comparison classrooms. Data indicated that the students with learning disabilities in the intervention group achieved higher levels of growth than all other subgroups. The study produced evidence that students with learning disabilities can benefit from participating in tasks that require higher-ordered thinking.

In another study that occurred in a reform setting, Baxter, Woodward, Voorhies, and Wong (2002) examined the largely undocumented challenge for teachers of how to include all students in classroom discourse. The study was part of a larger case study which involved examining the effects of an intervention that included the use of class-wide performance assessment tasks and ad hoc tutoring as a means to help develop deeper understanding in mathematics (Woodward, Monroe, & Baxter, 2001). It examined a teacher's effort to move her class from the traditional Initiation-Response-Evaluation method of instruction to one that is student centered, where classroom discourse is the

chief focus. The teacher used the Everyday Mathematics program, a reform based curriculum aligned with NCTM Standards. The teacher also supplemented the Everyday Mathematics lessons with performance assessment activities. Three low-achieving students' participation was observed over a nine week period and the gathered data helped clarify the problems that can occur when there is a persistent effort to include all students in class discourse. The level of participation by targeted students in this study was far greater than an earlier study conducted by Baxter, Woodward, and Olsen (2001). Two questions emerged from the data, how to balance high level participation while maintaining mathematically in-depth discussion, and how to balance achieving common intellectual goals with individual differences. This study brings to the forefront the value question, what do we value more, cognitive outcomes or social-emotional outcomes?

Another Way

These studies point to the difficult challenge of implementing reform-based instruction with students who have special needs. Of course, the alternative is to continue to let them remain on the lowest achieving tracks that only emphasize basic skills. Our desire should be to continue to search for ways to help make these students an intricate part of the classroom. One of the ways to help enhance low achieving students chances of survival in reform settings is through collaboration between special educators and general educators. Hick (2004) suggested that by including both general and special education stakeholders in the planning process, and getting them to agree to a common goal, districts can institute whole-school reforms to benefit the entire student body, including children with disabilities. Hick also added that evidence suggests that comprehensive

school reform programs, if implemented appropriately, can give special needs students greater access to the general curriculum by increasing their participation in traditional classes.

These efforts can be enhanced through two means, teacher preparation and professional development. Duchardt, Marlow, Inman, Christensen, and Reeves (1999) conducted a study that involved the special education and general education faculty at Northwestern State University of Louisiana in a collaborative effort for co-planning and co-teaching. The goals of this study were for special education and general education faculty to a) work together and model co-planning and co-teaching for their students, b) improve the knowledge of undergraduate elementary education students about students with diverse needs, c) share these results with interested parties, and d) develop a model of co-planning and co-teaching to implement within the state. The special and elementary education faculty met once a week to discuss course content and service delivery in the undergraduate elementary education classes that were taught at the university. The special education faculty observed the methods classes in order to become more aware of the aims, objectives, and class requirements of each general education faculty member. Following those observations, the group met again to discuss grouping arrangements. Finally, individual team members met to collaboratively plan a lesson. The following model for co-planning and co-teaching plan was developed.

1. Choose a teacher you trust
2. Find pockets of time to plan
3. Brainstorm
4. Prepare the lesson

5. Co-teach the lesson
6. Support your partner
7. Evaluate the lesson

Duchardt et al. (1999) concluded that co-planning and co-teaching arrangements can result in nine positive outcomes:

1. collaborating and developing trust,
2. learning to be flexible and collegial,
3. finding pockets of time to co-plan,
4. learning through trial and error,
5. forming teaching and learning partnerships,
6. challenging oneself and developing professionally,
7. solving problems as a team,
8. meeting the needs of diverse learners, and
9. meeting the needs of teachers as problem solvers.

This effort concluded that all teachers can learn to develop a collaborative teaching environment that will be beneficial to themselves and their students.

Both general and special educators need to develop an attitude of collaboration as they interact in the inclusive setting. To accomplish the feat, teachers must recognize the need to change. According to Battista (1994), teachers are the key element to the success of the current reform movement and that many teachers have beliefs about mathematics that differ from those undergirding the reform effort. Brahier and Schaffner (2004) conducted a study in which forty-eight teachers participated in a study group to reform their teaching practices in mathematics. The study group met routinely for one year, with

follow-up activities thereafter. Evidence gathered from surveys, interviews and site visits indicated that teachers underwent significant change in their knowledge, beliefs and teaching practices. A major part of the effort to reform the attitudes and practices of teachers has been directed toward those in general education. This study will examine the effect of a systemic approach to mathematics reform on the attitudes and practices of special and general educators in an inclusive setting.

The review of the related literature has revealed two divergent viewpoints: special education and mathematics reform. The viewpoint of special education, being positivist-based, has placed emphasis in theory and practice on students receiving instruction that emphasizes rote memorization and procedural skills (Cawley & Miller, 1994); while the viewpoint of mathematics reform, being constructivist-based, has placed an emphasis on a classroom in which students construct an understanding of subject matter rather than receiving it directly from the teacher (Woodward & Montague, 2002). The intersection of these two perspectives has dramatically increased in recent years, due to interventions such as: mainstreaming, inclusion, federal legislation, and the desire to improve the mathematics performance of all students in mathematics. The existence of tension between these two paradigms is undeniable in theory, while the existence of this tension has not been fully examined in practice, that is, in the inclusive environment.

As the forces that spurred the growth of education for students with special needs have forced them into the regular classroom, and the forces that motivated the implementation of systemic mathematic reform have allowed teachers to equip themselves with the training and the attitude needed to implement reform in the classroom, the confluence of these forces has produced fertile grounds for research. The

information gained from this research will be an important contribution to the literature because the intersection of special education and mathematics reform needs to be examined in an effort to garner what is really happening as these divergent paradigms meet in the inclusive setting. The examination of the intersection of two theoretically opposing paradigms, special education with its emphasis on basic skills development and rote memory, and constructivist-based mathematics reform which heavily emphasizes conceptual understanding, was a chief component of this study. One of the goals of the research was to examine the possible existence of tension in the actual practice of educating students with special needs in an inclusive environment. How do these theoretically opposing viewpoints play themselves out in the actions and attitudes of two educators who are representatives of each paradigm, was a primary element of the research? This study also examined how a systemic approach to mathematics reform affected how two educators reconciled the different perspectives that they brought to the setting.

The following research questions were also a focus in this study. The first being, how did the implementation of a reform approach to mathematics teaching affect how a special needs educator and a general educator operated in an inclusive environment. In other words, were the teachers significantly affected in some way by their exposure to mathematics reform?

The second question was how does reform mathematics impact students identified as special needs students in an inclusive class? The first concern being did the implementation of systemic reform affect the target students in anyway, and the second concern being the identification of the extent of the effect.

The third question was what are the factors that affect the implementation of reform in an inclusive mathematics setting? This question dealt with the identification of factors or influences that played a significant part in either the successful or unsuccessful implementation of systemic mathematics reform in the inclusive setting.

III. RESEARCH DESIGN AND METHODOL OGY

An ethnographic design was utilized to answer the research questions. An ethnography is a description and interpretation of a cultural or social group or system (Cresswell, 1998). According to Schwandt (2001), ethnography is the process and product of describing and interpreting cultural activities. An ethnography concentrates on the descriptions that people give to routine activities in their daily lives, allowing for a variety of views to be examined at the same time (Maggs-Rapport, 2000).

An ethnography involves prolonged periods of observation in which the researcher is immersed in the everyday lives of those being observed (Cresswell, 1998). Culture is not always obvious; often it lies in the background and is overlooked because of the distraction of the spectacular or the dullness of the ordinary. Like multi-colored carpet fabric, culture has to be examined closely enough to determine the constituent patterns. The ethnographer tries to discern those patterns that are inherent in the lives of those being observed, but are not easily discerned without close examination.

To discern these patterns, the ethnographer engages in extensive fieldwork, gathering data through observations, interviews, and text helpful in developing a portrait and the cultural rules of the group being observed (Cresswell, 1998). In an ethnography, the researcher seeks to move from an outsider to an insider in order to gain a meaningful estimation of the cultural experience being observed. This approach allows the researcher

to examine a culture based upon everyday normal activities, instead of contrived artificially created events. The ethnography seeks to paint a portrait of a culture, but that portrait is not based upon a single snapshot, but on many snapshots over an extended period of time. The approach allows the thick description of a case study, but also allows the abstract enquiry of the phenomenology. This ethnographical study produced some interesting as well as insightful results.

In this ethnographic study, I did participant observation of an inclusive mathematics classroom in which a general and a special educator were paired, while a reformed-based approach to teaching mathematics was being implemented. I sought to gain insight into how the implementation of reformed-based teaching affected general and special educators' interactions with one another, and with their students.

Background for the Study

This study sought to examine the relationship between two teachers, a general educator and a special educator at Logan Middle School, a school where a systemic approach to teaching mathematics was being implemented. The general educator, Ms Olivia Leonard was an experienced teacher with over twenty-five years of teaching experience. She received professional training from MATH Plus, the reform approach being examined. The special educator, Mr. Ulysses Varner was also an experienced teacher with over twenty-five years of teaching experience, all of which occurred at Logan Middle School. He also received training from MATH Plus, but not to the extent of Ms. Leonard. One purpose of the study was to examine this relationship between two

teachers whose backgrounds represent divergent theoretical and philosophical perspectives.

The study also focused on six students who were identified as target students, based upon their identification as special need, or as, at risk for special need. In order to better examine the impact of mathematics reform on the inclusive setting, the research sought to examine its eventual effect on students who were identified as special need, or were being considered as special need students. Two of the target students received assistance because of special education identification, two were Title I students, and the other two were included through teacher recommendation. The observation of these six students was a very important aspect of the study.

The study also involved the examination of the effects of a systemic approach to the teaching of mathematics, called MATH Plus. MATH Plus was systemic in that it utilized a holistic approach to mathematics reform. It sought to change every component of mathematics education: instruction, curriculum, evaluation, teaching preparation, and professional development. It examined how the implementation of this reform effort impacted the way teachers operated in an inclusive mathematics classroom.

Consent of the subjects to participate in the study was obtained as a part of the school's participation in MATH Plus. Teachers completed a consent form, as did parents of the students in the class. In addition, the students were given an information letter outlining their participation in the data collection.

Data Collection

In qualitative inquiry, the data collection process involves more than just doing interviews and observations. Creswell (1998) described the process of data collection as a circle. Creswell's circle involves the following steps:

1) locating a site or individual
2) gaining access and making rapport
3) purposefully sampling
4) collecting data
5) recording information
6) resolving field issues, and
7) storing data. (p. 110)

Summation of Study's Data Collection Circle

The site selection was based upon the school's participation in MATH Plus. Also, the selection was based upon the desire to find a school where the implementation of MATH Plus was in the formative stage, that is, still taking root. The selection of the site was purposeful, but was also made convenient by the presence of several faculty and staff members with whom I was already acquainted. The role of several "gatekeepers" proved to be invaluable to gaining access and establishing rapport at the study site.

Data were collected from several sources. The ethnographical approach to the research allowed the researcher to stay in the field long enough to gather enough data to present what Cresswell (1998) referred to as a thick description. It also allowed the researcher, an outsider, the opportunity to gradually move from a distant stranger to an insider. Due to my role as a participant observer, I was seen as a person whose presence

was beneficial and eventually welcomed by those in the setting. The stance created possibilities for data collection that were not available initially.

Data were collected initially from two belief scales relative to teachers' belief about reform. The first scale was a revised form of a Mathematics Belief Instrument (MBI): Urban Alternative Preparation Program (Hart, 2002) (see Appendix B). The other scale was a belief scale prepared by MATH Plus (see Appendix A). These instruments were administered to obtain a measure of the teachers' belief in the tenets of reform mathematics, and to obtain a relative measure of each teacher's attitude toward reform mathematics. The second source of data was a teacher survey that was developed by the researcher (see Appendix C). The survey was given to both educators. Semi-structured interviews were conducted with the general educator, special educator, principal, assistant principal for the fifth and sixth grade building, and the county curriculum specialist. Observations of classes were also recorded and transcribed. The observations occurred three days each week over a period from August to December. Data were also collected when attending faculty meetings, a teacher pod meeting (a meeting designed to discuss school improvement), and a Parent Teacher Organization (PTO) meeting as well as from the researcher's field notes of daily events and reflective journal. Also some valuable data were collected during informal and impromptu conversations that occurred with both the special and general educators. These sources of data provided multiple opportunities to validate the interpretation of data. Using multiple sources and method to validate the interpretation of data is a qualitative method called triangulation (Schwandt, 2001).

Data were stored using several media. Field notes and reflective notes were hand written in a notebook, and later stored using a word processor. Recordings of classes, semi-structured interviews, meetings, and informal conversations were recorded on both analogue and digital recorders. The analogue recordings were stored in a case at home. The digital recordings were downloaded from the digital recorder to my personal computer. The digital recordings were of a much higher quality than the analogue recordings, but proved to be much more difficult to find someone to transcribe them. None of the persons contacted about transcribing the data had the technology needed to transcribe digital data. After several unsuccessful attempts at attaining a reliable transcriber, one was found who transcribed most of the class recordings. I must mention that most of the semi-structured interviews were done by hand, my hand. This proved to be a very time consuming effort, but it created an intimacy with the data that was not possible by simply reading the transcription by someone else. These transcriptions were stored as hard copies and as files on the word processor. The collection of data proved to a daunting, but very important aspect of this research.

Data Analysis

The data were analyzed qualitatively with the aid of Atlas.ti version 5.0 (Muhr & Friese, 2004). The software enables the analysis of large amounts of textual data because of its ability to group similar thoughts from different documents under themes called codes. Documents can be loaded into Atlas.ti as individual pieces or as one document. These documents are called primary documents in Atlas.ti. The software enables the researcher to search the documents by identifying certain quotations and marking them

for future reference. The identification of certain quotations allows the researcher to refer back to these quotations later, or to further identify the text by connecting it to a code name. The code can be linked to a memo about the text or the individual code can be commented. A memo is a comment about a primary document, quotation, or code that can be stored separately from it. Primary documents, codes, and memos can be combined to form primary document families, code families, memo families, respectively.

Development of Major Themes

The purpose of the section is to discuss the development of the major themes of the study through the procedures employed by the use of the computer software used to analyze the collected data. The analysis of the voluminous amount of data collected during this study was made immensely easier with the use of the qualitative software called Atlas.ti. Atlas.ti made it possible to take textual data and to classify or regroup them under similar themes and headings. The process can be done in a hierarchical manner as to develop themes according to order of importance. Major themes can be distinguished from minor themes and lesser themes can be developed under similar, but more important major themes.

There were seven data sources integrated into Atlas.ti: interviews, class transcriptions, conversations, surveys, notes from meetings, field notes, and reflective notes. There were five semi-structured interviews, seven informal conversations, fifteen class transcriptions, two teacher surveys, notes from three meetings, field notes and reflective notes gathered from observations that occurred three times a week for approximately four months. All of the interviews, class transcriptions, conversations, and surveys were entered into Atlas.ti as individual documents called primary documents.

The field notes and reflective journal were not entered as individual documents, but as primary documents by week. The purpose was to reduce the size of these documents, which in turn made it easier to locate information in each document. There were a total of sixty-five primary documents entered into Atlas.ti for analysis. Each primary document was put in a primary document family. A family is a collection of themes or ideas that possess common qualities. In Atlas.ti, families may consist of: primary documents, codes, memos, or super codes. Table 1 enumerates the primary document families along with the numbers of quotations occurring in each family.

Table1. Primary Documents Family by Quotations

Class Transcriptions	212
Conversations	73
Field Notes Entries	170
Interviews	200
Meetings	35
Reflective Journal	187
Surveys	19

For a more detailed listing of the primary documents, see Appendix D.

The identification of primary document families makes accessing the documents much easier. See Appendix E for a detailed list of primary documents families. Each document was then perused for important expressions that were recurring or stood out from the rest of the text. These sayings were recorded as specific quotations in Atlas.ti. There were a total of 896 quotations. Each quotation was identified with an existing code, given a unique code name, or referenced for future consideration. Once codes were identified, a second perusal usually identified more quotations that could be recorded under that code or theme. The latter method is a deductive approach, while the former is an inductive method. There were a total of 135 minor codes identified from the collected data sources. See Appendix F for the list of codes.

Once the codes were identified, they were grouped together to form code families. Each family consisted of codes that possessed a common trait or characteristic. The code families represented major themes that were developed during the analysis of the data. A code could belong to more than one code family. The code families are briefly identified in Table 2.

Table 2. Code Families

Code Families	Code Frequency	Quotation Frequency
Reform Mathematics Influences	27	167
Special Needs Influence	27	183
High Stake Testing Influence	9	130
Administrative Influence	16	122
Divergent Paths	9	138
Inside the Classroom	34	411
Target Students	6	75
Consequences	10	148

For a more detailed examination of the code families, see Appendix G.

In some instances code families have commonalities that enable them to be categorized together. When this occurs in Atlas.ti, the groupings are called super families. In this analysis, the code families labeled Reform Influence and Special Needs Influence were grouped together in the super code family, Expected Influences. The code families labeled High-Stakes Testing and Administrative Influence were grouped as Unexpected Influences. The code families labeled reform influence and special needs influence were grouped together in the super code family, Expected Influences; while the code families labeled high-stakes testing and administrative influence were classified as Unexpected Influences. See Table 3.

Table 3. Super Code Families

Super Families	Expected Influences	Unexpected Influences
Code Families	Reform Influences Special Needs Influence	High Stakes Testing Influence Administrative Influence
Frequency Results	350	252

IV. RESULTS AND ANALYSIS OF DATA

In this chapter we will present an analysis of what happened during the study. The analysis will consist of the following emphases. In the first section, I will set a context for the study. The second section will describe the main observations garnered from this research, and the final section will concentrate on the impact on the six students who were identified as having special needs.

Context for Study

The following section will describe the setting for the study. It provides a description of the school, elucidates my initial research plan, describes the teachers and the classroom setting, presents a brief portrait of the class that I observed, and briefly describes the students who were identified for special observation. It concludes with a description of the mathematics approach being investigated in this study.

School Context

In the study, the setting was an inclusive classroom in which a special educator and a general educator were paired together teaching fourth-grade mathematics at a middle school in the southeastern United States. Pseudonyms have replaced the names of the school, the district, and all participants in the study. The school, Logan Middle School belongs to the Dayton County school district, which is one of the fastest growing counties

in the state. The district consists of fifteen schools with a student population of over ten thousand students. The district is run by its board of education and the district administrative staff headed by the superintendent. The board of education and superintendent are elected officials; this is an important point which will later prove relevant to the study. There were four major communities located in the district, and the chosen school is located in its largest community. Logan Middle School was located in a city with a population of approximately ten thousand, of which approximately eighty percent were White and approximately seventeen percent were African American. The median household income in the city was approximately forty-four thousand dollars.

Logan Middle School was chosen because it is one of the schools involved in the formative stages of implementing a systemic approach to reform mathematics called Math Plus. The school had an enrollment of fifteen hundred students. Grades ranged from fourth grade to eighth grade. The administrative staff consisted of a principal and three assistant principals, who supervised their respective buildings. The teaching staff consisted of seventy-five individuals. Relative to special needs, there were five special education teachers, one special education aide, three Title I teachers, and two Title I aides. According to Fritzberg (2003), Title I of the Elementary and Secondary Education Act of 1965 was a federal legislation that provided funding to provide equality of opportunity to under-privileged children. Title I funding provides assistance to children who have been identified as special need by employing teachers distinct from their regular education teachers to provide assistance such as compensatory tutoring (Fritzberg, 2003).

There were other schools visited in the preliminary stages of the research, but this school was selected for several reasons. First and foremost was the intended general educator, a sixth grade mathematics teacher, who I observed during the previous spring. She met the expectations of a reformed-based teacher as depicted in the literature review. Her involvement in reformed-based teaching predated the implementation of the Math Plus approach to teaching mathematics and therefore convinced me that her involvement was genuine. In a conversation with her, she related the fact that her involvement in reformed-based teaching was in response to another educator's suggestion that she try the approach. She tried it and was so impressed that she sought additional opportunities for professional development. One of the general educators at the school referred to the fact that this teacher was teaching entirely from a reform-based curriculum called Investigations. This indicated that her commitment was not just theoretical, but also experiential.

Secondly, the school was in the early phases of implementing the MATH Plus approach. In a conversation with Ms. Leonard, the teacher with whom I eventually did my research, she indicated that "we had hoped that we would be able to apply for professional development institute this summer" referring to a stage in implementation of the approach that represented a higher level of commitment. The fact that the approach was in the process of being implemented presented a dynamic atmosphere where events could be observed as they happened. Seeing the process as it happened proved more valuable than a post hoc or a futuristic examination. Thirdly, I was more familiar with the school due to the fact that I was acquainted with several of the teachers and staff and felt it would make transition from outsider to insider easier because of those relationships.

Another reason that made the school attractive was the fact that it did not achieve Annual Yearly Progress (AYP) in special education. The final reason was that it was geographically desirable, being closer than all of the schools that I had visited in my initial observations.

The school setting. Logan Middle School was located in an isolated area off the main road that runs through town. The school serves grades four through eight, and is one of the largest middle schools in the state. The main building faces the east, and extends along the street with four wings connected at the rear of the building. The central office is located in the main building. The principal's office is not located in the central office, but in a room across from the central office. I mention this because in the place where I thought the principal's office should have been located, was the office of the administrator of the fifth and sixth grade building. This administrator's demeanor and actions led me to initially think that he was the person who was in charge. At the north end of the main building is a gym that is used by the lower grades, and at south end is located the lunchroom and another gym for the upper grades. The junior high building is also located at the south end of the main building, but in a separate building that is connected to the main building by a breezeway. At the north end of the main building, the first two wings housed the lower grade classes while the next two wings toward the south end housed the fifth and sixth grades. Each section had its own administrator. The seventh and eight graders were housed in their own separate building with its own office and administrator.

The classroom that I observed was located in what was called the fourth-grade building. This building consisted of two wings that were joined to the main building by

an open breezeway. The wing was approximately seventy-five to one hundred yards from the main entrance to the school. I mention this because it represented quite a walk from my car to the fourth grade building, especially when I was physically disabled. The building had its own administrator, whose office was in this building. The administrator, Ms. Ingram, a Black female, was serving in her first year as an administrator at this school. In a semi-structured interview with Ms. Ingram I learned that she worked at Logan Middle School prior to leaving to take a job at another school. She returned to Logan Middle School to take her present position. She seemed to have been well respected by the staff in her building and at the school. However, her recent return only added to the sense of administrative instability at Logan.

Intended research plan. I will begin by describing my intended research in order to shed some light on what I eventually ended up doing. The initial purpose of the study was to observe two educators, a general educator and a special educator, in an inclusive environment to examine how the implementation of this systemic approach to mathematics reform, affected their attitudes and practices toward special education students. As previously mentioned, I had a definite viewpoint about the general educator who I wanted to observe, but that did not materialize. I had anticipated that it would be a simple task to observe the teacher who I had observed previously in the spring, but what was anticipated as a simple task ended up being an experience that was indicative of the way things were done at Logan Middle School. The following narrative from my field notes will shed some insight on this issue.

> On the first day of class, I arrived at Logan Middle School with the intention of beginning the preliminary stages of data collection, such as finding out how many

inclusive classes the intended general educator was assigned, and who the special educator was, with whom she was working. Since Logan Middle School was only a year away from full-inclusion, it was my basic assumption that she would have inclusive classes since I had observed her inclusive class during the prior school year, and I was certain that there would be even a possibility of a larger number of inclusive classes this year. After checking in at the office I made inquiry about the location of the prospective teacher's room. On my way to Ms. Butler's classroom I met her, and she informed me that the likelihood of her having an inclusive class seemed lost. She then took me to the assistant principal, Mr. Lyle, to introduce me and to inform him of my itinerary. In our conversation, he informed me that if he had known that we had planned to do research, the desired setting could have been arranged. He then directed me to the guidance office to meet one of the counselors to see if it would be possible to arrange the desired setting. After apprising her of my plans, she informed me that it would be possible to arrange the desired setting, but probably not with the same general educator. She mentioned that it might be possible to arrange an inclusive setting with Mr. Varner, a special educator who was also working with MATH Plus.

From there I was directed to Ms. Brown, another teacher involved in MATH Plus. She was giving first day instructions, or as she put it "laying down the law." After exchanging pleasantries, she gave me a copy of her schedule and asked one of her students to direct me to Ms. Ingram, the assistant principal for the fourth grade building. After explaining to her my research plans, she agreed to assist me in my research. She supplied me with a schedule for the teachers in the

fourth, fifth, and sixth grades. Upon leaving her office, I passed by the room of Ms. Key, a special educator with whom I was familiar. Ms. Key proved to be very helpful and facilitative in my attempt to introduce myself to various individuals from whom I might have to request information.

She first took me to meet Mr. Varner, a special educator who was a possible choice as the inclusive special educator. He expressed a willingness to work with me on my research. He made some statements that led me to believe that his perspective was the typical special education perspective, statements such as “These students are behind, and they need a lot of drill and practice.” She then took me to meet Ms. Leonard, one of the MATH Plus teachers who taught fourth grade. Ms. Leonard was also going over first day instruction, and my escort took over her class in order that Ms. Leonard and I could talk. Ms. Leonard also indicated a willingness to work with me on my research.

From there Ms. Key took me to the Junior High building to meet one of the special education teachers, Ms. Ball. She also covered Ms. Ball’s class as she talked to me. Ms. Ball indicated that she was one of my former students who I taught as an undergraduate. She informed me that she was not involved in any inclusive settings, but was willing to participate in my research. From there we returned to the counselors’ office to make sure that a schedule would be arranged. The counselors assured me that it would be done. I was told to check back on the next day.

The next day, I arrived at Logan Middle School at approximately 9:55 and after signing in, I went to the guidance office and talked with the counselors, Ms.

Bowen and Ms. James, about the schedule and they apprised me that they were working on it. Ms. James proved to be quite helpful in gaining an understanding of how things worked at Logan Middle School. We also discussed the design of my study and how they could accommodate it. I then left the guidance office and visited Ms. Brown, one of the MATH Plus leaders and we conversed for some time. While Ms. Brown and I were talking, Ms. Key, my escort on the previous day one came by and we talked briefly about my plans. When I finished talking to Ms. Brown and Ms. Key, I went by the office and checked out at 11:00. Finally, after several days of anticipation, an inclusive setting that I could observe was arranged with Ms. Leonard, a fourth-grade general educator and Mr. Varner, a special educator.

The general educator. Ms. Olivia Leonard, the general educator with whom I eventually ended up working, was a White female with over twenty-five years of experience, the majority of which was spent at Logan Middle. She held a bachelors degree in Elementary Education. She had been exposed to training and professional development provided by MATH Plus. She had also received training from RMSTI (Regional Mathematics and Science Teaching Initiative), a state sponsored reform-based effort to improve mathematics and science. She taught mathematics and history. Ms Leonard exhibited a no nonsense demeanor with her students. Her approach to teaching mathematics was to make it fun for the students as well as academically beneficial. When she was present in the classroom, there was no doubt that she was the one in charge. Her actions were a balancing act between being a strict disciplinarian on one hand and allowing the students to interact in meaningful ways. She believed that all children could

learn mathematics and sought to make learning available to all of her students. She kept a constant vigil to make sure that the students stayed on task, or did not get too noisy while participating in group activities.

Ms. Leonard's approach to discipline was to use a system of rewards and punishments. Students were rewarded for behavior that was deemed acceptable and punished for unacceptable behavior. Ms. Leonard was adept at convincing the students that it was a privilege for them to become involved in tasks that were not part of their academic responsibilities. Each week different students were assigned responsibilities such as checking homework and cleaning up in the lunchroom. They also competed for the chance to become involved in certain activities. When the students misbehaved, they were threatened with the loss of opportunity to participate in these tasks. She also kept a public record of their misconduct which entered into the determination of their conduct grades. The record was kept on a wall in the room. The most extreme discipline that was observed was when a student was placed in an isolated desk for a period of time. No flagrant acts of misconduct were observed in the class, and there were some, but they occurred outside of Ms. Leonard's class. Overall, the students were well behaved in Ms. Leonard's room, and that could be primarily attributed to her.

The special educator. Mr. Ulysses Varner, a White male, was the special educator in the study. He was also an experienced teacher who had taught twenty-five years, all of which were at Logan Middle School. Mr. Varner's persona was casual. He never seemed to take anything too seriously. He dressed in a casual manner, was easy to get along with, and was soft spoken. His demeanor in Ms. Leonard's class was one that did not draw attention to himself. He seemed to have the attitude "whatever the role, I can play it."

This attitude was a mix of confidence and pragmatism. His confidence seemed to have been based on having been around long enough to have seen most issues come full circle. His pragmatism was based on the desire to reach the students in any way possible. His attitude seemed to be to take life as it comes. This attitude seemed to have permeated his approach to teaching students with special needs.

A visit to one of his non-inclusive classes in the resource room revealed that his teaching approach did not vary significantly from the traditional approach to teaching mathematics, although he would incorporate non-traditional methods in an effort to give the students a means of obtaining correct answers. He believed in using any method available to reach the students, so he was not averse to using reformed-based methods to teach mathematics as long as they worked. His basic problem with the implementation of these reformed-based teaching practices was the amount of time that it took to incorporate them. He was well adjusted to the role of the special educator acting as the teacher's helper in the inclusive setting.

Classroom setting. The setting was a fourth-grade inclusive mathematics class taught by Ms. Leonard with Mr. Varner, the special educator. The class period was divided into two parts, before lunch and after lunch, because they had their lunch period during class. The class began at 9:45, and they went to lunch at 10:08 and returned at approximately 10:33. The mathematics portion of the class ended at approximately 11:10. After the mathematics class was over, they went immediately into history, usually with these familiar words by the teacher, "Take out your history book." The mathematics period ended at various times, depending on what the students were doing. The period sometimes ran over into the history time, especially if they were taking a test.

Ms. Leonard's classroom was a fortress of materials, supplies, and instructional aids. The walls of the classroom were literally full of items such as maps, charts, and students' work. Upon entering Ms. Leonard's room, one would notice a tall cabinet to the right of the entrance. On the door of this cabinet hung a clipboard which contained a chart of the students' homework. The chart was taken down by the student of the week and used to check the homework. To the left of the door going along the wall was a projector screen and one of the two blackboards that Ms. Leonard used. Also going in a clockwise direction along this wall was the overhead projector, and to its left was a chair that Ms. Leonard used as a depository for homework and other finished works by the students. To the left of the chair was an open cabinet in which the students' workbooks were stored. These were distributed as needed. To the left of the workbook storage was her desk which faced the door entrance. She did not spend a significant amount of time sitting at her desk.

On the wall behind her desk, there was a traffic light on the wall that measured the noise level in the classroom. If the noise level was too loud, she reminded the class to take notice of the light being on yellow or red, indicating that they needed to lower their voices. On this same wall, Ms Leonard kept what she called a conduct chart next to the traffic light. The chart had pouches with each student's name above it, and the pouches contained conduct cards. When a student misbehaved, they were usually warned initially, but when that failed Ms. Leonard would say, "you have just lost a conduct card," and she would go over to the chart and take out a card. Sometimes she would request that a student do this. Also along this wall sat several desks which held a personal computer, a laptop, a printer, and a globe. I would usually sit at one of the desks along this wall. The

wall opposite the door contained windows that allowed a view of students who were playing on their breaks. Their playing was not usually a distraction because the students were not usually outside during instruction. Along the wall was a plethora of materials, and the area also served as a storage area for extra school supplies. In the right hand corner facing the door entrance was a partially walled in area where the air conditioner/heater was located. I mentioned this because it was certainly noisy and a distraction to learning.

The students in this class passed to Ms. Leonard's class from their homeroom, while Ms. Leonard's students passed to their homeroom teacher, Ms. Norton. Once the students were settled, Ms. Leonard began the class with a review of the homework from the previous day. She went over some problems, usually from the textbook, and she solicited student participation by asking them to read a problem and then give the correct answer. Sometimes she asked the students to do problems on the board and then to explain them. Usually, while she was going over the homework, Mr. Varner, the special educator would come in and go from student to student assisting them, usually beginning with the special education students. By the time the Ms. Leonard had gone over the homework and maybe introduced some other concept, it was time to go to lunch.

Mr. Varner returned to the resource room during the lunch period to have lunch or to do some work. It was during this period of time that we had some informal conversations that helped enlighten me about him and some of the issues relative to special education. Trying to become an insider motivated me to frequently go to lunch with the class, even though most of the time the food was not very appealing. After lunch

the class returned and either finished what they were doing prior to going to lunch or began something new.

Other classroom features. Ms. Leonard had set procedures. The students sat in groups of fours, they lined up for lunch by groups, they did presentations for class reports by groups, and they had a certain seating arrangement in the lunchroom. There was a definite way of doing things. Doing homework was a central aspect of everyday activities in the class. Ms. Leonard would usually begin the class with a review of homework. While she was going over problems on the board or overhead projector, students erased incorrect answers and wrote the correct answers as she gave them out. She went over enough problems for them to get a feel of whether or not they knew what they were doing. During this time, I noticed some of the students frantically erasing and rewriting the answers. The students who were absent on the previous day were responsible for the homework that was assigned when they were last present. After Ms. Leonard reviewed some problems, she called on students to read the problems and recite the answers or she would ask them to go to the board or overhead and present the problems, with or without explanation.

Class population. There were a total of twenty-seven students in Ms. Leonard's class. Fourteen were females, and thirteen were males. There were ten Blacks and seventeen Whites. The students were seated in groups of fours with two of the students in a group facing the other two. There were seven groups in the class. The six students who were selected as target students, based upon their identification as having special needs, were in groups two, four, five and six. There were two of the target students in groups two and four. The other groups contained only one of the target students in them.

There were two students who stood out above the rest of the class academically, Quincy and Charles, both White males. Quincy was the student upon whom Ms. Leonard consistently called to get things going, probably because he would have the correct response. Charles was Quincy's peer academically, but his behavior was a little lacking at times. Most of the other students, based upon observation, were average to above average academically.

Profiles of target students. There were six students who received special attention, and they were identified as target students. Two were identified for special education, one Black female named Sarah, and one White female named Amy. There were also two students who qualified for assistance under Title One, a White male named Isaac and a Black female named Janice. There were also two more Black females, who were identified later because of their low performance. Of the twenty-seven students in the class, I focused most of my attention on the six named students while a participant observer in the class. A brief description of each follows.

Sarah was a Black female special education student, who often could not keep pace with what was going on in the class because she could not remember basic facts. She had been identified as specific learning disabled (SLD) in mathematics. She had become comfortable with her special education label and expected the accommodations that came along with it.

Brenda was a Black female student who basically was hindered due to her pace of learning. It just took her longer to do things. She had not been identified as a student who needed to receive services through special education or a Title I designation. There was some indication that the reason behind her slowness was due to a lack of understanding.

She would get frustrated sometimes and just give up on what she was doing. She received some of the same allowances and accommodations as Sarah. She sat with Sarah, and in many ways was treated as if she was one of the students with special needs.

Isaac was a White male Title I student, whose primary issues were not academically-based, but behaviorally-based. Trying to interpret his performance proved most challenging.

Janice was a Black female Title One student who turned out to be the lowest performing student in the class. Her Title One designation placed her in the target student population, but her performance was below the other target students. Until Ms. Leonard brought it to my attention, I was unaware of her low performance, and assumed that she was at least performing at the level of the other target students. After closer observation, I realized that her basic problem was a lack of understanding. One of the reasons that her low performance had remained hidden from me was due to the fact that most of her interactions with Ms. Leonard were in response to low level inquiries.

Amy was a White female who was identified for special education. She too had problems remembering basic number facts. Despite her special education classification, she was able to perform up to grade level. Ms. Leonard had mentioned that she was doing so well that she would eventually be retested to determine if she could be taken out of special education.

Monica was a Black female student, who was not identified for special education or Title One. Her initial performance on the basic skills drills was quite impressive, but her overall performance was less than impressive. It is interesting to note that a significant amount of Monica's interactions with teachers were negative.

These six students were identified as target students. A significant portion of my time spent in Ms. Leonard's class was spent observing and interacting with these six students, as I sought to examine the effects of systemic mathematics reform in an inclusive setting. The students who were not labeled as special education or as Title I were ones that were recommended by the general educator. The recommendations were based on their performance after a few weeks of school. A point to note about the target student population is that it only had one male in it, and no Black males, this fact is important in view of the representation of males in the special needs population.

Description of MATH Plus

MATH Plus is a five year commitment to improve the mathematics performance of students. It is an effort to change the mindset of those involved in the mathematics education of students. It is systemic in that it seeks to involve all those involved in the mathematics education of the students in a southeastern state. It seeks to involve a range of stake holders, including: teachers, administrators, mathematics educators, mathematicians, and parents in the education process. The effort begins with the alignment of all aspects of the K-12 curriculum. It is also systemic in that it seeks to guarantee teaching consistency. This systemic thrust is to be further accomplished by providing rigorous professional development to in-service teachers and improve pre-service preparation. The effort to improve mathematics performance began with the effort to align the K-12 curriculum. The principal aim of MATH Plus is to empower all students to understand, realize, relate and appreciate mathematics as a tool in their effort to become life-long learners and productive citizens. The following excerpt was taken from

the website of MATH Plus (2006) and represents its approach to changing mathematics instruction:

> Students need to know more than mathematical facts and procedures; they need to be able to apply their knowledge to solve problems in mathematics and in real life. Students need to understand not just how to do mathematics, but why it works. To accomplish this goal, MATH Plus seeks to expand the teachers' mathematical knowledge, as well as their range of instructional tools, so that they can increase the learning of all students. Rather than relying on "show and tell", teachers will help students to become more autonomous learners of mathematics through the use of engaging problems and innovative instructional practices, including reading and writing in the mathematics classroom and working collaboratively.

This view of the study from the school perspective has shed some light on the circumstances surrounding the implementation of mathematics reform at Logan Middle School. The introduction of reform-based mathematics instruction into the inclusive setting brought together, not only different teachers, but different paradigms with different approaches and expectations. The review of related literature indicated that the two paradigms have different theoretical and philosophical perspectives. According to Rivera (1997), in a reformed based classroom one will find an environment that focuses on active student learning rooted in problem solving situations facilitated by teachers' guidance and questioning. The special education environment is, on the other hand, one in which students will typically receive instruction that emphasizes rote memorization and procedural skills (Cawley & Miller, 1989). Results related to this contrast were

expected, and are discussed in the following section. Two additional factors emerged from the analysis; these were unexpected factors, and will be discussed in a later section.

Expected Influences

We will first examine the impact of the two main influences that were regarded as Expected Influences. The two influences have been identified as the Reform Influence and the Special Needs Influence.

Reform Influence

One of the basic points of interest of the research was the desire to find out what would happen to students with special needs in a classroom where a reform-oriented teacher was paired with a special education teacher in an inclusive setting. Since these two persons were probably going to have significantly different backgrounds and orientations, there was a desire to find out how they would negotiate and reconcile these differences. Going into a classroom with a general educator who had been exposed to the basic tenets of reform mathematics, one would hope to find an environment where reform-oriented teaching would be dominant. Both educators had been exposed to the professional training provided by MATH Plus; however, Ms. Leonard's responses on the survey indicated that her orientation was more reformed-oriented than Mr. Varner. Ms. Leonard had described her teaching as both traditional and reform in an interview, but she was also knowledgeable of the basic theoretical notions of constructivism, while Mr. Varner indicated that he had no knowledge of the basic tenets of constructivism. Ms. Leonard's exposure to reform-based teaching was more extensive than Mr. Varner's because she had previously been exposed to another reformed-based program. The first

aspect of the influence that will be examined is the attitude of the teachers toward reformed-based mathematics.

Attitude toward reform mathematics. The relationship between teacher attitude and practice is well documented in research literature (Ernst, 1989; Guan, McBride, & Xiang, 2005). So going into the classroom, it was expected that the attitudes of the teachers would be a significant influence in determining how the reform approach to mathematics would interface with inclusion.

The teachers' attitudes toward reform mathematics were present in multiple data sources. Both teachers expressed a belief that reform mathematics had its benefits, but Ms. Leonard expressed an explicit faith in the tenets of reform mathematics as indicated here:

Interviewer: Do you think that this type of approach would be more beneficial to those students who, as you just mentioned, who have problems memorizing things one day and keeping up with it, you know, the next day? Do you think the principles that MATH Plus expounds would that be more beneficial to students that are lower achievers or special education students?

Ms. Leonard: I think it would be, because the inquiry methods, or using the investigative activities, are supposed to help the child figure out the answers on their own. And, I feel like when they truly do that, it clicks in their mind, and they do have a true understanding. They're not just copying steps or going through something they've memorized like you might do with the traditional math, like we've

been practicing on our long division. I think a lot of the kids are just memorizing the steps of what to do and don't necessarily have a complete understanding of what the division means. But, I feel like if the special education child or any child, can figure it out on their own, it clicks in their head. They will remember it more and they have really learned that information and that they're not just trying to copy or memorize, or that kind of thing. But, that they've really learned it.

She not only expressed a belief in reform mathematics, but also exemplified some knowledge of the theory behind it as recorded in a survey response:

Survey: Are you familiar with the basic tenets of constructivism? If so, give a brief description of constructivism.

Ms. Leonard: I think this means to build or construct onto what you already know. I think this is related to investigative learning in the sense that people learn and remember best through self discovery- figure out answers for yourself. It could also mean using different materials or methods to construct or figure answers using pencil and paper, calculators, acting out, manipulatives, or drawing a chart, table, or graph.

Mr. Varner also exhibited a positive attitude toward reform mathematics as in the following exchange:

Interviewer: Well, let me ask you this ... compare what has been traditionally done, where for instance, even in the inclusive setting reformed

curriculum ... something like investigations where what has been set, it has been set really by the general educator. How does or how would that differ? How would those two scenarios differ where you have more of a reformed environment versus quote traditional? Do you think that you would approach that differently?

Mr. Varner: Using the reform type of teaching would give more students the chance to do the investigations, to grasp ideas on their own. Not just allowing them to work together as groups . . . Investigation-type learning would be better suited, not only for the special education student.

The general attitude of the two teachers toward reform mathematics was positive. Ms. Leonard's attitude toward reform mathematics was more positive than Mr. Varner's and that could be attributed to her greater exposure to reform-based mathematics. Ms. Leonard had been exposed to training from Math Plus and training from the Regional Mathematics and Science Teaching Initiative (RMSTI), a state supported effort to improve mathematics and science that is also reform based; while the special educator had only been exposed to Math Plus training. Evidence of her attitude is presented in the following comments when asked to describe her participation in MATH Plus and how it has affected her teaching.

I think it's been very positive, and I really enjoy going to the professional development institute that I went to this summer ... but, I feel very positive about it. I think right now, one of the main things that I see is, I think it does motivate the children to enjoy math more and I think they do many times. And even last

year, when I had first started using some investigative activities, and I've done some more this year, but a lot of times when you asked kids what their favorite subject in school was, they might say something like science or P.E. But many of them were saying math is my very favorite subject, because they were enjoying and remembering the activities that they were doing more so.

Mr. Varner's attitude toward reform mathematics was tempered by a touch of reality as revealed in this exchange:

Interviewer: If there were no special needs students in a class, should your teaching approach differ?

Mr. Varner: Just like we just mentioned, even if you don't even consider special needs students, if you give a variety of approaches to reasoning, you're going to benefit the students and help them have more of an ability to reason out answers rather than just learning one method or type of answer. Do more of figuring it out.

Interviewer: How has your involvement in MATH Plus affected the way you approach teaching students with special needs in math?

Mr. Varner: It's given me some ideas as to different methods to approach different skills to each student. Some of the skills, a lot of the skills, are things I was already doing in the classroom. But, a lot of the methods in which they talk about using or the investigation type, I have not used much of that just because of the students I have. In the resource room, when I'm working with most of my math students, they're already two and three years behind their

> math peers already. If you allow them to just do investigations, if you have the time, that would be wonderful. But too, in the limited amount of time that we have to cover skills, I don't have the time to just do investigations where everybody's just figuring out on their own way. Generally, if they are already that far behind, they've already had a bunch of methods thrown at them, and they still haven't been able to grasp it.

Expectations for reform mathematics. The expectation level for reform mathematics was also an important aspect of this influence. The two teachers seemed to have different levels of expectation for reform mathematics. Ms. Leonard had positive expectations for reform mathematics globally, but her expectations for reform mathematics at her school were not as optimistic.

> But, I feel like the inquiry-based learning is the direction we're going in. I think that eventually when all school systems do adopt this method, that there will be a follow-through so that by the time the children get to fourth grade, they really are understanding math, not just memorizing steps. I feel like they'll have the experience of doing group work and how to work together to solve problems. I think that in the long run, it will work.

Mr. Varner's expectations were linked more to a pragmatic realism. Notice these comments from the semi-structured interview:

> MATH Plus is wanting us to do more of a self-exploration, I guess you might call it, where you let the children try things—hands-on activities. And in some situations, that is a good idea. In some situations, though, some of these students,

they've been through so many different things and still haven't grasped the concept yet. I don't look for them to grasp something just because they tried it one more way. We always want to try to give them as many chances to understand, but when you're (in the) sixth grade and you're working on the second-grade level, you're two or three, sometimes four years, behind. You don't really have the time to do the self-discovery types of activities.

Also in a conversation with Mr. Varner in the resource room, this exchange took place:

Interviewer: I guess the general premise of the process oriented-teaching is that you build a concept and the students develop their own understanding of it or conceptual base for it. And it means more to them when they create their own system of understanding. I guess on the surface that you would say that sounds.

Mr. Varner: Sounds good. But, the practicality of it, some situations are not the best way to go. If you have students that are identified as learning disabled and retarded, even the rote memorization is something they cannot handle. So, you're asking this child to just sort of explore this idea and come up with it. It's a little bit too much.

Ms. Leonard's expectation for reform mathematics was based upon the belief that it was going to outlive its expectations by those who say that it was just another passing fad, another "new math," as noted in the following:

And the comment was made that if we're not required to do MATH Plus that we may just wait until RMSTI comes to our area. Of course they know and I've told them that they know and RMSTI is not gonna go away. It will be here for a while.

The comment was made, but when that five years is up Math Plus is gonna go away. Well, I don't think it is.

According to Guan, McBride, and Xiang (2005), teacher attitude influences the view of education, instructional behavior, and student learning outcomes. Ernst (1989) also argued that teacher attitudes toward teaching of mathematics such as enthusiasm and confidence can be major contributors to the culture of the mathematics classroom. Therefore attitude toward and anticipation of reform mathematics were very important aspects of what I feel drove the reform influence in this classroom.

Reform-based emphases. The concept of a reform-based classroom was not obvious to this observer initially. I must admit that I had to remind myself that this was a fourth grade curriculum that was being presented and the content's simplicity was something that should not have been a shock to me. However, the constant barrage of lower level basic skill activities presented a fog that dimmed my view of the classroom as one that was dominated by reform-based pedagogy. In a reformed-based classroom, students are involved in a learning environment in which interactive instructional practices, higher-order cognitive thinking, problem solving, and discovery learning are stressed. The whole purpose of doing the research would be for naught, if there was no reform-based teaching taking place in the classroom.

We will now examine the extent to which reformed-based teaching was taking place. The idea of reformed-based teaching was couched under the theme, Conceptual Emphasis, but there were different aspects of the focus that were examined in order to evaluate the extent to which the classroom can be described as a reform environment. These included activities, events, questions, and even comments that required the

students do more than respond with a rote answer, but required some higher-ordered thinking. First we will examine the classroom from a curricular perspective to evaluate the extent to which it met the curricular requirements of a reform-based class.

The curriculum is described as what is taught by schools. So often the curriculum is the textbook. The choice of curriculum material drives what is taught in the classroom. However, in a reform-based class, this propensity is resisted when it leads down a road to mediocre teaching and learning. I bring this up because the textbook that was used for Ms. Leonard's class could best be described as a traditional textbook: even though some of it contents were written from a reform perspective. The reform-based teacher has to augment the approved curricular materials with one that allows for a more conceptual-based emphasis. Ms. Leonard augmented her curricular materials with a reform-based curriculum called *Investigations in Number, Data, and Space* (Russell & Rubin, 2004). The Investigations lessons were inserted into the regular activities of the class periodically to help the students to develop more of a conceptual base for their understanding of a skill. These activities were more student-centered, and they gave the students the opportunity for more hands-on experience with concrete materials. Note the introduction to an Investigations lesson by Ms. Leonard:

> Ms. Leonard: Today in math we are going to be doing activities that will help us use different strategies to add and subtract, and we are going to be playing a game. After we have corrected your total assignment I need your desk completely cleared off, nothing on top of our desk. Actually you will need a pencil ... these are instructions and as I pass these out you're going to be doing the game with a friend and

I'm going to hand you the instructions and the person you play the game with. Janice and Karen you will be sharing together. Okay first of all, I want to take a look at our calculator and in just a moment I'm going to show you two ways that you might want to use your calculator. We're going be playing a game that's called Closer To 100, and the object of the game is to try to see how many numbers you can add together to make it equal a number close to 100 as you can get. So I'm going to make up two numbers and put them on the board, and I want you to put these numbers in your calculator, let say maybe I draw a card and write down 42 and I write the number 39, I want you to put these two numbers in your calculator and add it together, first of all add and if you know how much it is raise your hand. What did you get?

Brett: 81

Ms. Leonard: Yes you are right 81, now I got to think to myself, how close to 100 is 81, there are two ways that I can get the answer, I can either count up or I can use subtraction, I don't mind you using either way. So if I got 81, I could say well 82, 83, 84, all the way to 100 and figure out the difference or put it in your calculator, I could put 100 take away 81 now subtract that and when you finish you can raise your hand, what did you get, 19. To begin with we are going to be using the calculator or if using the calculator is confusing to you, you may also write the problem down just like I did on the

board and put it on the back of your sheet and figure it out. Now everyone in the classroom is going to have your own score card and so you can understand what I'm talking about I'm going to go ahead and give you your score card and then we will read over our instructions together. You may go ahead and put your name on these score cards. I appreciate everyone being nice and tidy and reading the instruction and while I'm thinking about it. Obviously you are going to need to talk quietly with your friend while you are playing the game. If I say so immediately stop, so that we can make sure we are accomplishing what we are suppose to be doing. Okay look at your instructions. Your instructions are on the front, I will give you one set of numeral cards, ... We'll have a score sheet for each pair. My directions say deal off six numeral cards for each player, use four card to make up two numbers for example the 6 and the 5 can make either 56 or 65 depending on which numbers you need to try to get closer to 100, the wild card can be any numeral, so if you are lucky and you draw a wild card you can make it any number you want it to be. So when you are adding you are to get the number closer to 100, now you are going to run across some instances where you may have to add numbers up and it goes above 100, try not to go over 100, but if you do, if its impossible, and you have to go 100, then you want to make your number as small as you can, you want to stay as close to 100 as

you can, in other words if you go over 100 you don't want 193 for your answer for your answer that's way too big, you want to try to work it out where maybe you will have 106. You want to get as close to 100 as you can then we are going to write these numbers on your score sheet for example; I might put 42 + 56 equals 98. I'm going to let Allison and Larry help me, and we are just going to play one round, and I'll kind of give an idea of what it will look like. If you get stuck and forget what to do, read the instructions. Then if you still can't get the answer, raise your hand and Mr. Varner or Mr. McTier will come around. Your cards should already be shuffled up. Take care of my cards and don't bend them, my first directions says deal out six cards to those people, so if they were close together I would go 1,1,2,2,3,3,4,4,5,5,6,6, then this is my deck to choose from and I put it to the side. . . Now our directions tell us that we are not going to use all six, we are only going to use 4, but you don't look at your four cards, he wants to make two numbers that he can add together that will get him close to 100. So I want you to pick out two numbers and arrange your cards (in a way) that you think will get you close to 100 and try not to go over, you can always change it around, you may have to change it several different times. Okay he got 53 and 53, but I know that 50 + 50 is 100 and with two 3's that going to be 106, so you got a hundred and 106, I want you to shift them around and a

little bit and see if you can get closer to a hundred and not quite so many, okay you picked out two, that you can add together? Oh the extra cards that you are not going to use, you can just put those to the side. But you can move them around and make choices; you got to figure it out. If it will help you to put your numbers in your calculator and add them so you can see what you are coming up with, try it. Charles is going to try adding 64, which one are you choosing, it doesn't matter, you get to try a lots of ways, okay he's going to try 64 plus 43, now add that together and see what you come up with Charles, 107. Now think about your other numbers, how can you move them around and come as close to 100 as you can? Try that and see what you come up with, try 53 plus 43 and see what you get, 96, that's pretty close isn't it? So that looks like a pretty close number isn't it? He figured it out cause if he could add these up and it would equal 96 that this is going to be about as close as he can get. That's pretty close isn't it? Keith worked it out and he got 98 and that's even better. So that would be a good choice to write down okay. Now I'm going to take your cards up. You are going to on your score sheet write your two problems that you are adding, then you add them together and put your total amount here, don't worry about the score card, I'll teach you how to do the score when we are finished playing the game. Now it's time to go to lunch so we'll stop right now…

The insertion of these reformed-based activities, even though very teacher-directed, represented a significant part of Ms. Leonard's effort to satisfy the curricular demands of a reform-based classroom.

The Investigations lessons enabled the students to approach learning from a concrete level because they provided hands-on opportunities. The students used calculators, cards, blocks, counters, stickies, and other manipulatives to investigate a particular idea. Here is a reference to one of the hands-on activities:

> Each student went to the board and put a sticky pad on the row that represented their favorite subject. Later they were given a ruler and a sheet of graph paper and were asked to construct a bar or pictograph. They responded well to the activity.

During the activities the students exhibited a high level of interest and participation. However, Ms. Leonard indicated that the students did not have sufficient time to thoroughly carry out the activities as they were designed, because of the amount of time that was devoted to other curricular concerns.

According to *Principles and Standards for School Mathematics,* students need to recognize and connect mathematical ideas (NCTM, 2000). Also, according to NCTM (2000), when students are able to understand how mathematical ideas interconnect, they are able to develop an understanding of mathematics, not as a collection of disjointed subjects, but a unified related whole. The thought should run consistently through the teaching in a reform-oriented classroom. The idea of mathematical connections was a theme that was developed in the data collection in the classroom under the codes, Mathematical Connections and Multiple Ways To Teach and Learn. There was a definite

effort to relate one mathematical idea to other mathematical ideas, and to connect mathematical ideas to other subjects as in this example:

> Now turn over on the back, to check your paper, I was so excited when I saw this because it reminded me about what you're studying in science in Ms. Osborn's room. We're going to have to tell her what we learned today in math because it goes along with science doesn't it?

In another class period she related traditional multiplication to what she called 'breaking apart' in order to apply distribution in multiplying 2x73:

> Try to do it in you head. On this one I am breaking apart 73, so you will have 70+3, 2x3 is 6, 2x70 is 140 so 140+6 and that gives you your answer.

Another connection that is important for students to make is the connection between what they are doing in class with their real world experiences. According to *Principles and Standards* (NCTM, 2000), children connect new mathematical ideas with ideas that they are familiar by using concrete objects. Children need to be able to connect abstract mathematical ideas to things that they experience in their everyday lives. This emphasis should be an integral part of instruction in a reform-based classroom. The students in the class were exposed to some real world concrete activities that were intended to connect their mathematical experience with their everyday experiences. They were developed under the code, Real World. The following is an example of the code as evidenced in the class:

> Ms. Leonard: Math is all around you every day in shapes and things that you see, numbers are every where, right here in our classroom we have arrays all over the place. These are just two that I found this

morning when I got to school. I want you to look around our classroom right now and see if you can find something else in the room that looks like an array. The ceiling tiles, excellent, see how they are in a row. These are in rows that you see over here, three rows and there are 4 in each row so that's an array isn't it Janice? Suppose I take my Juicy Juice and I hold it this way, I don't have two rows anymore, and now how many rows do I have?

Students: 5 rows

Ms. Leonard: 1, 2, 3,4,5 Now I have 5 rows, so this time when I make my problem, I got 5 rows and how many are in each row?

Students: Answer; 2 in each row

Ms. Leonard: Two are in each row, so 5 times 2 equals how much?

Students: Answer: Five times two equals ten.

Ms. Leonard: So if I drew an array to show that amount I'm going to need to draw a long one aren't I? Because I have 5 rows going down so, I'm going to draw it something like this. I need 5 rows, 1, 2,3,4,5 then I need 2 in each row, so I'm going to do this. This represents this problem, now you can draw a line across your paper; you'll want to make underneath your array problems. This time the Juicy Juice is punch flavored so lets put JJ for Juicy Juice and we'll call this one Punch. Okay, I've got 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12. There are 12 in all. When I hold it like this how many rows do I have?

Students: 3

One of the most basic tenets of constructivism is the idea that learning is meaningful when the individual constructs his or her own meaning of knowledge. This process is expressed in different manners. Piaget expressed this process with the concept called disequilibrium (Prawat, 2000). Vygotsky (1978) described the idea as the zone of proximal development. The process or zone can be described as a mental wilderness that has to be negotiated for learning to take place. The negotiation according to the constructivist perspective is best achieved as the learner develops his or her own idea of the construct being examined. Depending on whether the constructivist perspective is exogenous or endogenous, the emphasis is placed on social or individual negotiation. This point was acknowledged by Ms. Leonard in these comments:

> The inquiry methods, or using the investigative activities, are supposed to help the child figure out the answers on his own. And, I feel like when they truly do that, it clicks in their mind, and they do have a true understanding. They're not just copying steps or going through something they've memorized like you might do with the traditional math, like we've been practicing on our long division. I think a lot of the kids are just memorizing the steps of what to do and don't necessarily have a complete understanding of what the division means. But, I feel like if the special education child or any child, can figure it out on their own, it clicks in their head. They will remember it more, and they have really learned that information and that they're not just trying to copy or memorize, or that kind of thing. But, that they've really learned it.

However, most of the instruction was teacher-centered, not student-centered. The students were not allowed to struggle with a particular construct long enough to develop a meaningful approximation of it. They were given opportunities to examine various ideas, but were not consistently allowed to ponder until "it clicks in their mind(s)." Most of the time, they were simply taught by telling.

Coming together. The expected reform-based influence was not obvious initially, but after several weeks in the class it began to become more apparent. The lack of recognition was due to the overwhelming attention given to learning basic number facts during the initial part of my time in the classroom. Also, I had expected the fourth grade curriculum to be more demanding. After the overwhelming preoccupation with some of the outside influences had begun to dissipate a thread of reform-based practice was recognizable. The revelation presented a different picture of Ms. Leonard and the classroom. The following comments taken from my reflective journal are evidence of that revelation:

> I went to the class today, they did an exercise using arrays and multiplying, and I see the thread coming through for some conceptual understanding.... It's bringing more conceptual understanding to multiplication rather than just a memorized algorithm for multiplying without basically any understanding. So I see that thread coming through with the mental math and estimation and what they call breaking it apart.

Another reference to this experience is recorded in my reflective journal:

> Today, I started to notice a strand that comes through this teacher's instruction. She emphasizes constantly that there is more than one path to an answer. The

> thought gets lost in the simplicity of the curriculum. This was made more apparent, when the students were asked to go to the board and do some multiplication problems that were part of the Spinner Game they were playing. One student performed the multiplication in the traditional manner, while another student used repeated addition, and another student was allowed to use the zeros product shortcut.

Still another verification of the point is given here:

> Today, I realized another common thread that seems to run through Ms. Leonard's teaching and that is her emphasis on procedures and activities that did more than developed a rote understanding of a skill. The skills are so basic that if you are not really looking for it you will not discern it. The multiplication problems similar to 35 x 2 done like 2 x 5 + 2 x 30 help develop the idea that this problem is more than 2 x 5 + 2 x 3, the notion that is developed from doing the problem without mentioning place values.

The theme was recorded under the code Coming Together, and it represented the point in the research at which a clearer picture of the classroom as a reform-based environment began to be realized. Even though the reform thread was revealed, there was a very important aspect of reform-based teaching that was neglected, and that was discovery learning. It seemed that the students were not allowed to really struggle and go through that period of disequilibrium where the light bulb lights up. This point might have been influenced by the desire to reach all of the students, the special needs students in particular. Of course this also could have been attributed to the lack of time.

Special Needs Influence

There were basically three categories of special needs students in the class: the first consisted of the students who had been identified for special education; the second group was those who qualified for assistance under Title I; and the third group was those who were identified as possible candidates as students with special needs. The observation of these students was a focus of this research. A crucial aspect of the research was that it examined the interfacing of the need to reach special needs students with the implementation of a systemic approach to mathematics reform. An examination of two forces interacting in a real classroom is going to be a very important contribution to the existing body of knowledge. How the classroom was affected by the forces that brought special needs students into the regular classroom was examined under the theme, Special Needs Influence. The Special Needs Influence was an expected influence and needed to be examined in order to get a better perspective of the classroom. The first aspect that will be examined will be the attitude of the educators relative to special need.

Special needs attitude. The first aspect of the Special Needs Attitude is delineated in the themes, Attitude and Expectations Toward Inclusion. The second component of the Special Need Attitude is expressed in the themes, Attitude and Expectations Toward Target Students. A brief explanation of each is given below.

There were five codes that were related to the theme, Special Needs Attitude: 1) Attitude Toward Inclusion, 2) Attitude Toward Target Students, 3) Expectations for Inclusion, 4) Expectations for Target Students, and 5) Expectations for Special Education Students. One of the most important aspects of the influence was determining how the educators felt about having the target students in the same classroom with the regular

students. The primary focus of the point was to determine how they felt about inclusion. Note some reflective comments relative to a conversation with Ms. Leonard on the topic of inclusion:

> Her persistent mentioning of the fact that she understood the need of these students to be with the regular students leads me to think that she does not think that the present state of inclusion is working. She gave me the impression that she thinks, in some instances, inclusion is doing more harm than good. She also mentioned that the desire to have all of the students in the same classroom was noble, but it also came with some logistical problems. For instance, if students are pulled out and have to take three or four subjects, they will have to keep up with more materials than they would have to if they were in a special education setting. She related that she knew that it would be hard for the students because it was hard for the regular students.

These statements seem to be indicative of her feelings towards the idea of an inclusive setting. Mr. Varner's attitude toward inclusion was expressed with a sense of practicality as indicated by the following exchange during the semi-structured interview:

> Interviewer: What is your basic feeling toward the inclusion movement, I may put it like that?
>
> Mr. Varner: There are some positives and negatives I feel in the inclusion setting.

During the interview he does admit to the positive social experience that inclusion presents: "It does give the children a chance to be with their peers. It also gives them a

chance to learn from their peers." However, he admits one of the negative aspects of inclusion in the following comments:

> But, in some situations, you have students that, because of their disabilities, they cannot learn in those situations. They have to have repeated tries or repeated repetition in their work, you know, in learning a skill, rather than the short skills or lessons that they normally have in the regular education classrooms. They may take two or three, sometimes four, times as long. And, in some cases, you have students with problems that may never master those skills.

But, to sum up his feelings relative to inclusion, he relates, "But, overall, in whole, inclusion is good for most students."

Ms. Leonard's expectations for inclusion, as it was taking place at Logan were not too optimistic. She indicated a basic dissatisfaction with someone arranging an inclusive class with twenty-eight students. The following comments came from a conversation on the topic of inclusion:

> She indicated that she thought that it was basically unfair that general educators are asked to deal with special needs students with twenty-eight students in a class. She did not seem to resent these students being in her class, but objected to the circumstance in which they have been placed. She clearly indicated that her situation was not the optimal one. She mentioned that she had seen an inclusive program about ten years ago, where the general educator had only fifteen students in a class and also had a full-time aide. The circumstances in which she was placed led to the expectation that she didn't think that inclusion was going to work as it is presently implemented. She mentioned the lack of funding and other

factors that are contributing to the failure of the inclusion effort. Her lack of confidence in the way that inclusion was playing out in her classroom, due to the unfavorable constraints in which she found herself undoubtedly had an impact on her attitude toward inclusion in general.

Mr. Varner's expectations for inclusion were mixed, some positive and some based upon his realistic expectations for some of his students. He confessed his belief that inclusion was not the optimal environment for all special needs students. He refers to this in the same interview:

> Interviewer: Next year is going to be full inclusion. What's your expectation?
>
> Mr. Varner: For a number of my students, I feel that will be good. It will have them in the regular classroom. They'll still be getting some modifications and some help in their areas, but I have some students that are severe enough that I know that they're not going to be able to benefit from being in the inclusion setting, and we'll end up having to do more providing parallel material, lower-level material for them than the children in the classroom.

Again, his expectations were not the same for all students, as mentioned in this statement, "But, overall, in whole, inclusion is good for most students."

The target students included the special education students, the Title I students, and any student that the teachers had identified as needing special help to keep up with the class. There were no students with physical disabilities in the class, so there was no barometer to measure how these types of special needs student would have been treated in the class, but both teachers were very accommodating to the target students in the

class. Ms. Leonard's attitude toward the target students was generally positive. It was seen primarily in the amount of accommodations and modifications that she was willing to include on a day-to-day basis. Ms. Leonard's basic belief about students was revealed on her survey when she responded, "I believe that all children are capable of learning." She indicated that students with special needs should receive instruction that varied to a certain extent from that received by regular students. She relayed that point during the semi-structured interview:

> Interviewer: Let me ask you this ... Should the approach to teaching students with special needs in math in any way be significantly different from the approach to teaching what I would call average achievers and above in an inclusive setting?
>
> Ms. Leonard: I would say yes. I definitely think that it should be because I find that a lot of special education kids that I have worked with in the past can learn, but they often need things to be repeated over and over. They need things to be practiced over and over.

She questioned the extent to which she had allowed the students with special needs to receive accommodations, suggesting that the ability to properly evaluate what the students had actually learned had been compromised as noted in an informal conversation:

> That's something about special education kids. We help them too much. When I give her a modified test on that, and she only has two choices. How do you know if she's really doing it or if it's just a good guess? So far as it concerns the answer.

Overall, her attitude toward the students with special needs was pretty positive.

The general attitude of Mr. Varner relative to the target students can be found in his basic teaching philosophy as related on his survey:

> All children can learn. But all children do not learn the same way. We must provide the various modes that will enable a child to be successful in learning.

His response on the interview revealed his approach to teaching students with special needs:

> Usually, in my classes in the resource room, I try to provide them with methods to get around or to help them reach those goals, whether it's using marks on the paper or using arrays, to working out the times tables, addition. I don't care how you get it, as long as you're able to get it because when it comes to the test, they cannot pull out a times table sheet and get the answers off of it. So, my thing is to teach them to cope with whatever problems they may have.

He regarded each student as an individual, and that meant that there was no one way to teach students, whether they were special need or not.

The level of expectation for the identified target students was another important aspect of this influence. Students will adjust to the expectation level of their environment (Rosenthal & Jacobson, 1968). According to Rosenthal and Jacobson, when teachers, either subconsciously or consciously, send different messages to students about what is expected of them, students catch on and will respond accordingly. These educators' expectation level for the targeted students was evident in their comments. The primary issue affecting the expectations of the students identified for special education was the Individual Education Program (IEP). Note this response in Ms. Leonard's interview:

> They're only in my classroom, and it is my job to follow their IEP and to try to modify their work and help them as much as possible individually so that they're able to pass with at least a C average. It's written in most of their IEPs. Sometimes that can be very difficult because many of these children are working on a lower level than the actual fourth-grade skills that we are working on.

Mr. Varner's feelings are revealed below during his interview:

> Interviewer: Let me ask ... talking hypothetically, what happens when the perceived roles of the special educator and the general educator conflict? How do you handle that?
>
> Mr. Varner: Well, first things first. You have to follow the IEP. You need to make sure that the IEP is being met.

During an informal conversation about special education, he related:

> You have to learn to flow. You have to learn to ... well you have to adjust for the kids that are the IEPs. You have to think about how to modify and how to keep them along with teaching the regular class and keeping them moving at the same time. In some situations you are able to do it by reducing the amount of work that special kids have to do. Sometimes that might be doing a parallel. They might be working on a skill up here, but this is another skill that's parallel to it down here. Such as, they're doing a high-level multiplication problem. They may be doing a low-level multiplication problem. Things like that.

Mr. Varner's expectations for his special education students were linked to what the students' IEPs had set for them. He seemed to have higher expectation for Amy, when he

suggested that she had developed coping skills that would aid her success. This exchange occurred during the same conversation:

Interviewer: Right. But if I had to kind of use my horse sense, she seems to be the one of all of the kids in there who needs the most help. Amy doesn't ...

Mr. Varner: I'll say looking now that Amy is one of them, and she seems to do pretty good. She doesn't know her facts, her multiplication table. She still has to count them up, but ...

Interviewer: She has a mechanism.

Mr. Varner: She's getting it done.

However, there was one student who was expected to fail, not because of academic inability, but because of behavioral problems. Ms. Leonard had mentioned that Isaac, a Title I student, was probably going to have to repeat the fourth-grade because he was absent so much. To be honest, she went out of her way to help him in her class, but he seemed to be in his own world most of the time. He participated when he wanted to. Isaac's behavior was a little baffling at times, and it seemed that no matter what she tried, she was not able to get through to him. She mentioned him here:

Interviewer: Isaac, behaviorally, behavior aside.

Ms. Leonard: Isaac is capable. It is just because of his situation, and he pretty much needs to be retained in the fourth grade, that's the best thing for him. Get his behavior straightened out, and he's back in fourth grade next year where he can get caught up on some of his skills, that would be the best for him. I mean he would really have to

have really A's or high B's to be able to bring his average up enough where he would be able to pass fourth grade.

Interviewer: You don't see that happening?

Ms. Leonard: No. See I haven't gotten any of his work from DCAP (Dayton County Alternative Program) and I'm sending these tests and everything like that to DCAP, where over there he'll get a whole lots more individual attention than they would here. But I haven't got anything back and when they do send it back if there's anything missing then I'll just have to put zeros.

The expectations varied from student to student among the teachers; however, there was some evidence that there were different levels of expectations for different students.

Special education dilemma. Although Ms. Leonard and Mr. Varner put their differences aside in the classroom, the question of what to do with special needs students surfaced in a faculty meeting where the topic of full inclusion and its implications were being discussed. It was very clear that the dilemma of what to do with student identified as special need was still a volatile subject. The primary topic of discussion was the recent implementation of full inclusion at the school after the school year had begun. The fact that both teachers and students had to readjust themselves to a different scenario after five weeks of school was a source of complaint for the faculty. During the discussion about the unfairness of the situation, one of the general educators made a comment which suggested that they (general educators) didn't want the special education students in their classes. To the statement, one of the special educators responded that that was their (special educators) sentiment also.

The issues relative to special education students and other special needs students, although dormant in the classroom, were lying beneath the surface waiting for the right situation to erupt. The exchange prompted the moderator of the meeting, a county special education representative, to mention the history of the debate and how it has contributed to the present situation. The history of special education was not seen as connected to the conflict by these educators, but obviously it was by the special education representative. However, the special educator and general educator in this classroom seemed to exist outside of this reality.

Mr. Varner's personality was also a contributing factor because he was an easy-going person. He seemed to have no problems with his role in the classroom. The possibly tensed situations in the classroom did not develop, in my opinion because of his personality, and his acceptance of the role of the special educator as an aide to the general educator.

Roles of the educators. The anticipated conflict in perspectives between special educators and general educators was not apparent in Ms. Leonard's classroom. This point can be attributed to the understood roles assumed by each teacher. Ms. Leonard's idea about the role of the special educator in an inclusive setting is given in these comments:

> In the inclusive class setting, I would say that the special education teacher ... their job is to try to help the child with whatever skill we're working on at that time in my classroom and to give them individual attention, such as repeating directions or helping them on a problem if they're having trouble doing it independently. In my class, when I do grade something, I usually allow the students an opportunity not to teach them the test, but I would expect that special

education teacher would tell them, “number five is wrong, could you correct that one,” or that kind of thing to give them that opportunity to just recheck their work and to try to do the best that they can.

Meanwhile Mr. Varner’s perception of his role is given as follows:

To provide support as the students are covering the regular ed(ucation) class load. Or, in some cases, depending on how severe a disabled child you have in the classroom, it may be to provide an alternative math lesson in that class setting.

He also related his understanding of his role in the inclusive setting with these words:

I’m going into her class understanding that I’m assisting her, helping her students.

Mr. Varner’s appraisal of Ms. Leonard’s role was expressed as follows:

The general education teacher should be as a whole preparing lessons to teach the whole class, but they need to modify some of the materials that they have and some activities they have to meet the needs of the special ed(ucation) students.

Now Ms. Leonard’s perception of her responsibility in the inclusive setting was stated as follows:

In the class that you’ve been observing, Mr. Varner comes in three days a week to help special education children with their work, but two days a week, he’s not in there.... So, when he’s not here, I feel that it’s my job to make sure that those children are on the right track or repeat directions if I need to or give them more individual help ... that kind of thing, if I need to do that.

However, let me add parenthetically that the absence of conflict between the two educators could be attributed to an effort to avoid conflict. There seemed to be an attitude of avoidance when it came to possible conflict between teachers in this class. There was

one incident that was recorded in my field notes that mentioned the day that Ms. Norton, the homeroom teacher for the inclusive class interrupted the class by asking the class, "Where is Monica?" As Monica acknowledged her presence, Ms. Norton questioned her, "Why did you leave your book bag in my room?" Monica replied, "I have my book bag." When some of the other students informed Ms. Norton whose bag it was, she left the room without apologizing to Monica or Ms. Leonard. The incident suggested that the possible reason for the absence of external conflict in the class might be due to the desire to avoid conflict at all cost. Of course the best way to avoid conflict is for one party to submit to the other party. Mr. Varner's self-assumed role of teacher's aide may not have been evidence of external conflict, but his compliance with the arrangement might be proof that he yielded to the idea, that in order to get along with the general educator, the special educator must occupy a lesser role.

Ms. Leonard's and Mr. Varner's perceptions of the roles of the special and general educators in an inclusive setting were very consistent. The similar perceptions helped prevent the kind of possible conflict that may have arisen in a classroom where the roles were less defined. The teachers' mutual understanding of their roles was facilitative to a smooth relationship between the educators, but the real question is, is this environment most beneficial for the students, especially those with special needs? While the understood roles prevented some of the possible conflicts between the two educators in the particular classroom, there was evidence that the conflict existed more globally at the school.

Accommodations. One of the most powerful results of the special need influence was the commitment that was made to accommodating the students, particularly during

tests. The students were allowed to have extra time to finish quizzes, daily grades, chapter tests, and monthly tests. They were given helpful cues when taking tests, if Ms. Leonard felt that they did not understand what they were supposed to do. On one occasion, one of the targeted students was allowed to finish his work after class with the aid of one of his classmates.

The influences that were designated as expected were discussed in this section. The next section will explicate the two influences that were designated as unexpected.

Unexpected Influences

The designation, unexpected, did not imply that these were influences that were not expected to exist in the setting, but that the extent to which they influenced what went on in the setting was not anticipated. The two unexpected influences were the High Stakes Testing Influence and the Administrative Influence. These influences will now be discussed beginning with the High Stakes Testing Influence. In addition to the expected influences related to reform and special education, two unexpected influences were noted. These are described in the next section.

High Stakes Testing Influence

One of the unexpected observations that occurred in this classroom was the inordinate amount of time and activities that were dedicated to preparation for high stakes tests. The upcoming testing in the spring was occupying every facet of the school. It was as if the entire school had gone into a mode that only allowed activities that were related to preparation for the tests. To quote Mr. Varner, “Testing is everything.” It was certainly revealing to see the impact of the High Stakes Influence on the everyday activities in the

classroom as well as the school as a whole. The focus was related to the fact that the school had missed meeting AYP in the area of special education. Although special education was the only area in which it did not meet AYP, the school had been placed in School Improvement Year 1 status by the state department of education. There were three aspects of the theme that were developed from the data collected in the study and recorded under the following sub themes: Test-Taking Skills, Stanford-10 Preparation, and SRMT Preparation.

Test taking skills. The preparation for the big tests in the spring had initiated a wave of activities in the classroom relative to teaching the students how to take the tests. The students were being instructed on how to bubble in answers on the Stanford Achievement Test Tenth Edition (SAT-10), how to fill in gridded responses on the SRMT, and how to respond to open-ended questions. Ms. Leonard dedicated a significant amount of time to teaching test-taking skills to the students. In an informal conversation with Ms. Leonard, she indicated that it was important to teach students test taking skills for the SAT-10 test. She related that in these comments:

> They have one of these, and they fill it out, and then they mark their answers on here. It's really good practice for SAT because the little circles you know of course are similar to the real SAT test, but if they make a mistake on it, it won't grade it. Like if they color it too lightly it'll mark it wrong, or if they accidentally put two answers by one problem, it marks it wrong. So it really holds them accountable for the way they're marking their answers. They have to be real careful, and I'm hopeful in a few minutes, if we have time I'm going to give them their cards and fill out their answers.

SAT-10 preparation. One of the state mandated tests that the school was required to assess students with was the SAT-10. The test is a standardized norm-referenced multiple-choice test. It is not completely aligned with the state Course of Study, but it was still fascinating to see how much time was spent preparing the students for it as recorded in these comments by Ms. Leonard to the class:

> Last night, your homework was the book chapter test. I wanted you to do it, as kind of a SAT Review and an opportunity to study for our chapter test that we will be taking today.

Preparation for the test was also an emphasis of Mr. Varner as indicated here:

> I want them to learn the facts first. And at the first part of it, sometimes I'll say just keep them put up. I want you to use your head. Count up 'cause when it comes to the SAT test, you can't pull out a times table sheet. Some of the things you can't use a calculator on.

State Reading and Mathematics Test (SRMT) preparation. Another aspect of the influence was the emphasis placed on the SRMT. This test is the other big test that the school was required to give students in the spring. The score from the SRMT is used as a measure of accountability under the No Child Left Behind Act. The SRMT is a criterion-referenced test that is made up of questions from the SAT-10, along with additional items. It is a combination of multiple choice items, short answer items, and grid response items (Mosely, 2005). The fact that the test consisted of varied components contributed to a different dynamic relative to reform mathematics. This point is a very crucial point in the analysis of the data. The test definitely was on Ms. Leonard's mind as well. Notice:

> Now later this year we will be practicing working some problems in grid boxes like these because you are going to be seeing these on your SRMT test in spring, and I am going to show you on the over head projector what the answer or a similar answer would look like, but I want you to write the number of pennies.

Mr. Varner also admitted, "Now they're doing more with the SRMT-type things." It was also on the mind of other teachers and administrators at the school and district levels as well.

SAT-10 preparation and basic skills emphasis. The influence that preparation for the SAT-10 Test had on the class was overwhelming initially. Everyday there was a constant emphasis on drills to reinforce what they should have learned in the initial grades. The re-emphasis on the learning of basic facts took a significant part of the class period prior to them being introduced to new materials and even after they had begun new material. Many days upon arrival, they began the class with emphasis on the drills, and they would end the class with the same. Initially, I wondered how Ms. Leonard was going to get the class directed in some kind of conceptual direction. The class would often begin with a basic skills drill and at different points during a class, they would be given drills. The intention was to prepare them for the Big Tests that were to be given in the spring, particularly the SAT-10.

The fact that the test is an objective test where the answers are provided in a multiple choice form suggested to both teachers and students that there was a definite connection between passing the test and choosing the correct answers. The implication is that getting the right answer matters above everything else, including understanding. The focus on getting the correct answer, along with the need to pass the test in order to satisfy

the requirements of NCLB, placed pressure on both teachers and students to basically figure out how to get the right answer first and to worry about how that answer was attained later. The amount of time spent teaching test-taking skills and the amount of time spent on basic skills instruction were proof of the point. The connection between the latter and the SAT-10 was well documented in the data collected during the research. The amount of time dedicated to the SAT-10 had a definite influence on the amount of time focused on basis skills emphasis.

Many of the items on the drills were simple problems that could be answered from memory. The focus on the drills was on getting as many correct answers in the allotted amount of time. Ms. Leonard indicated that because of the emphasis, “we have really gotten our curriculum down to bare bones.” The emphasis seemed to permeate every facet of the class period during the early part of the observation, especially that period immediately after the implementation of the New Curriculum Plan, which will be discussed in later section. The basic skills emphasis was definitely connected to the inordinate amount of time and energy spent on the preparation to take the SAT-10.

SRMT preparation and conceptual emphasis. Even though the class was dominated initially by an overwhelming basic skills emphasis, eventually a thread of conceptual focus was recognized as a result of the persistent efforts of Ms. Leonard. The conceptual focus has already been connected to the Reform Influence, which was classified as one of the Expected Influences found in the classroom. There was also a component of the focus that was connected to the effort and time spent in preparation for the SRMT. The SRMT is a test that contains items which require more than the correct response. Some of the items are short answer, while others require an explanation of how

the answer was achieved. The emphasis created a focus in the classroom on how students arrived at their answers. When teachers recognize the need for students to clarify the path to an answer, they begin to emphasize to students the importance of not just getting the right answers, but also the importance of understanding the path to right answers. The presence of SRMT preparation in the class has been mentioned, but its presence was also connected to the Conceptual Emphasis in the class. Consider this excerpt taken from a transcription of the class on October 5:

> When we take our SRMT test in the Spring I'm pretty sure there is going to be a problem similar to that on it, where you have to multiply, it's going to ask you to show how you got your answer two different ways, and one way to show how you got your answer is to draw an array. Draw a picture of it. Then you will have to write a sentence or paragraph to show how you got that answer. I wanted us to practice that.

These two factors definitely were part of the High-Stakes Testing Influence that was present in the classroom, but they produced quite different emphases.

Administrative Influence

The second major unexpected influence was the administrative influence. The effect of administrative decisions would normally be expected to be a factor in the classroom. However, it is often thought that teachers give lip service to administrators and once the door is shut, they go about their own agendas. However, in Ms. Leonard's classroom the effect of administrative decisions seemed to have a constant presence. The influence was so prevalent until the Ms. Leonard was driven to make the statement, "It's all because we get new people (administrators), and they want to do things their way."

The administrative influence stemmed from two basic sources, those at the school level and those at the district or county level. The administrative decisions made at both levels had an overwhelming effect on what went on in the classroom and at the school. Probably, the most significant cause of the influence was due to the persistent turnover in administrators at both the school and district levels. The effect is registered under the code Administrative Instability.

The basic administrative attitude toward MATH Plus seemed to be one of ambivalence and indifference. On the school level it was recorded under the codes: Missing Administrative Support, Ambivalent Administrative Support, Laissez Faire Attitude, Just Do What You Are Told, and I Do What I'm Told. On the district level this attitude is developed with the codes: I Just Do What I'm Told, Just Do What You Are Told, and Ambivalent Administrative Support. There are also references relative to some experiential events on a personal level that are relevant to understanding the influence. The aforementioned themes help paint a clearer picture of the interfacing of the reform effort with special needs issues in an inclusive setting.

There was also a very important product of the Administrative Influence that was so noteworthy that it deserved special attention; this impact was recorded under the theme, the New Curriculum Plan. The plan is related to the influence because it was developed at the district level. There was also a plan that was developed at the school level to help improve the school's performance in special education by the principal which was labeled the Principal's Plan.

School-level administrative influence. One of the most potent factors that could be connected to the effect that administrative influence had on what went on the classroom

was due to the instability of the administrators at the school level. The school had undergone numerous changes administratively, a significant amount recently. The school had five different principals in the last nine years. The current principal had been at the school for less than a year. The administrator for the building where Ms. Leonard's class was located was also new to the position. The following comments by Ms. Leonard substantiate the point:

> There's been a lot of change in administration in our area, getting a new principal with Dr. Aaron, Ms Ingram is new to our building, we've only had Ivey one year. We went for six months without a principal at all. Our other principal got a different job working for the state. Dr. Aaron came this year ... I felt okay until right now because Ivey Lyle who was the assistant principal in our building last year.... And Dr. Aaron being brand new to our school is not really familiar with what Math Plus is at all.... It's all because we get new people, and they want to do things their way. And we're not getting together on the same page.

The fact that there had been so much instability in the school's administration had a definite effect on the implementation of reform at the school, and thus, on its influence on the special needs students in the classroom.

The school's administrative support of MATH Plus was ambivalent, if not missing. There were indications that the administration felt that the basic tenets of reform mathematics were good for instruction as exhibited by comments made by Mr. Lyle, the assistant principal in the fourth and fifth grade building:

> Well, I think it's good. I think any time you can bring in manipulatives and require students to think about things in ways that require them to use those

> higher order thinking skills, that's what we need to be doing anyway. I mean I think MATH Plus allows them, teachers, the opportunity to have methodologies that are going to allow them to require their students to do that, to use the higher order thinking skills to meet the different learning styles that are out there. It gives them, teachers, different ways of looking at the material and teaching the material than they've had in the past. So, I think anytime you have that, it's good.

These words, however, did not materialize into actions and prior to obtaining this response from Mr. Lyle, Ms. Leonard apprised me that the school's administration had indicated an unwillingness to continue with MATH Plus. The reason for the stance had not been made explicitly clear to her, but the outcome was made explicitly clear to her as follows:

> If Dayton County wants us to do this and requires us to do it this year, then we will do it. If they don't we're not going to do it.

These kind of mixed messages were undoubtedly very disconcerting to Ms. Leonard and the other teachers who had already spent two prior summers in professional development with MATH Plus. The lack of administrative support undoubtedly will function as a great hindrance to the implementation of systemic mathematics reform at Logan.

The first aspect of the school's administrative attitude dealt with its lack of proactivity toward impending issues. The attitude was connected to the code, Laissez Faire Attitude. The attitude manifested itself in different ways relative to my research. First, it was a key reason for my inability to attain the class with the desired educator. The point has already been indicated in another section, but here is another result. While

visiting various classrooms prior to the selection of Ms. Leonard's class, I visited a class in the Junior High building in which the teacher's approach to teaching was more reform-oriented than the class chosen, but the class was not an option because it was not an inclusive class, even though it contained several special education students.

The school had delayed implementation of full inclusion until it was mandated by the district. The delay took place even though the system was supposed to implement full inclusion the following year. There seemed to be the attitude, unless we are made to do it, we will not do it. The negative impact of the attitude had been noticed by one of the district's special education representative when he mentioned that the late implementation of the full inclusion plan did not help and that it should have been implemented no later than the summer. There was a very interesting statement made by one of the substitutes, relative to the school's attitude about change and it was that "procrastination seems to be the motto of the school."

There also seemed to be the desire to be rescued by some higher power, an attitude connected to the code, Looking to the Hills. There were references made to the district and state level, as to suggest that if change occurs, it will come from above, instead of being initiated at the ground level. In a conversation with Mr. Lyle, he alluded to the idea several times when referring to what needed to be done to reconcile the need to satisfy the mandates of the new curriculum plan with the need of the teachers to have more time to adequately teach the reform-based ideas being introduced as a part of MATH Plus. He indicated that in the subsequent statements:

> Well, honestly, that is something that is going to have to come from the curriculum Level.... So, that's why I really feel that the people at the curriculum

> level are going to have to really step in and say MATH Plus or RMSTI is the way we want to go. We're allotting sixty minutes a day for math. That's not enough to implement the program correctly, especially to reach students with special needs. What we need to do is add more time. Now, then they're going to have to decide how they want to add that time. You know and come back and tell us "this is how we want you to do it."

Note the principal's response:

> There's going to have to be a compilation of educational leaders to come together preferably from the State Department, they're the ones who have to take the lead on this to bring RMSTI and the math project ... and the new curriculum plan together where they're all talking the same language. The kids are the ones who are going to fall through the cracks if they don't bring all this together. I think that in order to reconcile it, it first has to start with the leadership of the State Department of Education.

Finally, the last two aspects of the attitude had to do with compliance, the idea that if each person is required to obey a superior, their subordinates were also supposed to obey them. It is captured under the codes, I Do What I'm Told, and Just Do What You Are Told. The idea that I am supposed to comply with the mandates from those in control was prevalent at both faculty and administrative levels at the school. Teachers were expected to comply with the edicts that were handed down, even if they were impractical to manage, or contradicted what they believed was best for the students. The idea was made explicitly clear by Mr. Lyle when he stated:

> You know, even at my level when the new curriculum plan is implemented, what I'm told is, you ensure that your teachers are implementing the plan. So, when I'm told that, then that is what I have to do.... Because, right now, what I told them is when the people from the central office come down because we have this plan, that means that Mr. King (superintendent) has approved it, so when they come down, and they say they want us to do this, they're not asking us to do it if we think it's a good idea.

The principal reiterated the same sentiment in a faculty meeting in which he responded to the fact that he felt unfair mandates have been placed on them, and they have to do them. He ended the meeting with these words: "It's a raw deal, but there is nothing we can do about it."

The attitude, of course filtered down to the classroom level in comments by Ms. Leonard during a class:

> I'm required to give you a daily grade on addition, a daily grade on subtraction facts and you're suppose to get a test grade on your multiplication facts. So we're going to start to work on them next week too.

There is also a note of personal experience that is connected to the attitude that was fostered at the school, and it is related to an incident that I experienced after being at the school for almost two months. It was personal and I would not mention it, but for the fact that it is related to a very important issue in my research, and that is disability. A record of the events surrounding the event is recorded in my field notes and reflective journal. After injuring my hip, I was restricted to walking with a cane. Ironically, the injury aided my efforts to move from an outsider to an insider in my role as a participant

observer. I noticed an increased interest and cordiality from some of the previously distant faculty members. Being an outsider, I was waiting for something to happen to bridge this gap; I just didn't know that it was going to happen to me.

One day while observing the class, I received a call from the secretary to come to the office. When I entered the office, the secretary referred me to the police officer outside. When I met him he asked me was I Mr. McTier, and I answered yes. He then apprised me that all of the parking spaces in that lot are reserved and that the reason that he was bringing this up was because someone had blocked a car in. He stated that there was available parking along a fence approximately fifty yards away. I moved my car and when I returned to the building, one of the staff members informed me that the person to whom the spot belonged did not drive. As I returned to the classroom, another teacher also mentioned that the person to whom the place belonged did not drive. The incident brings up the point that there was a greater concern at Logan about addressing insignificant issues such as reserving a parking place for a driver than accommodating an obviously disabled person. What I am saying is that if the incident could happen to me, an adult, despite the fact that I was obviously a person who needed to be accommodated in some way, what does this suggest about the empathy children with invisible learning disabilities might receive.

When I made inquiry about whose parking space it was, to my surprise I found out that it was the secretary’s. If she was displeased with me parking in her spot, it seemed that she could have communicated that to me herself without seeking assistance from law enforcement. The issue did not end there, because what happened next brings up another issue that seemed to be prevalent; the school administrators seemed to make

their own rules. After receiving a handicap parking sticker, my attempt to park in the only available handicap space was hindered by the presence of a vendor's truck; the vendor had made it a habit of parking in the space to unload packages. The space also was occupied by other vehicles without a handicap sticker, and it was not until I mentioned the illegality of the practice that the space was made available to those with handicap stickers.

It would appear that, if there was an effort to secure reserve parking for a person who did not need it, there should certainly have been an effort to make sure that parking be made available for those whose access was mandated by the law. The incident and the related circumstances and others not mentioned led me to develop the following codes related to the attitude of the administration at Logan: Intimidation and Make Your Own Rules.

District administrative influence. The district administrative influence could be felt all the way down to the classroom. The impact of decisions made at the district level had a profound effect on the classroom and certainly on the implementation of reform mathematics in the classroom. The impact was connected to the following codes: Administrative Instability, Coercion, I Do What I'm Told, Just Do What You Are Told, Laissez Faire Attitude, Missing and Ambivalent Administrative Support, and New Curriculum Plan.

Not only was the administration frequently changing at the school level, it was also changing at the district level. Change is good when it yields improvement, but all change does not yield improvement. The fact that there had been so much change at both the school and district level eventually caught up with the system. The evidence

suggested that when a sense of familiarity with an administrator developed, then the relationships and trust that had been developed by that person would be interrupted by personnel changes. The fact was established in a conversation with Ms. Leonard:

Ms. Leonard: Ah, you know Anthony Garrison?

Interviewer: No.

Ms. Leonard: He used to handle the curriculum and everything…. And then after working and getting that right they came back in and said no, redo it, we want the new curriculum plan. It's all because we get new people, and they want to do things their way.

The fact that there had been changes in both the superintendent and curriculum specialist positions points this out. The fact that the office of superintendent in the county is an elected position adds to the instability, and has produced a trickle-down effect on some of the subordinate positions. According to the new curriculum specialist, "I came in and I started this job in July." Her admission simply means that when the school year started in August, she had not had sufficient time to get settled into this position. And to add fuel to the fire, she was charged with implementing a plan that would affect the daily activities of the fourth through eight grade classrooms under her purview. She mentioned that in the following:

> And the people that interviewed me were excited about developing a new curriculum plan. So that was my first big project when I came to Dayton County, to develop that plan.

These changes in personnel at the district level may not have been as pervasive as those at the school level, but they bring home the point that administrative instability at the district level had a definite effect on what went on in the class and at the school.

The data gathered relative to the district level support for MATH Plus was from a semi-structured interview with one of the curriculum leaders in the district. She expressed the point that she was not against MATH Plus, but that she was trying to satisfy the requirements of the state when she mentioned:

> I am not against MATH Plus. I just want them to work with us, the state rules. You know the state is king and the state tells us to teach the Course of Study Standards and by law, that is what we're held to teach.

There seemed to be a bone of contention between satisfying the demands of the plan that she had developed to teach the state standards in seven months and the fact that the MATH Plus strategies would take longer than seven months to teach. She refers to that with the following comments:

> If there was some controversy, I don't know what words to use here, but when MATH Plus teachers stood up and said that this was not designed to be taught in seven months, that is not supporting our system, and we need the support there.

The dissonance seemed to be dominating the relationship between MATH Plus and the district administrator, and unless it is resolved, the successful implementation of reform will be hindered. In this atmosphere there was very little evidence of administrative support at the district level. The curriculum plan being new did not help the situation either. The dissonance seemed to have been playing itself out in a power struggle between the new curriculum plan and MATH Plus.

The general attitude at the district level was similar to that at the school level, one of compliance. The things that were required at the district level were simply passed down to the school level with the anticipation of full compliance. Statements made by the district curriculum specialist were proof of the point. There was also evidence that the administration at the district level was not as proactive as necessary in initiating progressive change. The very fact that there was no definitive plan developed for inclusion at Logan until a mandate came down from a higher source proved this point.

The new curriculum plan. There was also a very important product of the Administrative that was so influential, that it deserved special attention; this impact was recorded under the theme, The New Curriculum Plan. This plan was related to the High-Stakes Testing Influence because it was a response to the need to prepare the students to take the big tests in the spring. It was also a response to the Administrative Influence because it was developed by one of the administrators at the district level. A closer examination of this plan will now follow.

The first recollection of this phenomenon was the complaints registered by Ms. Leonard that the amount of time available to do MATH Plus-related activities had been reduced because the course contents must be taught in seven months instead of the previous allotment of time. Here is one account:

> Interviewer: What is in your opinion ... the greatest inhibitor? The greatest thing or things that are hindering the implementation of, for instance, more inquiry learning, more investigation ... in your opinion?
>
> Ms. Leonard: In my opinion, probably the main thing is time. In Dayton County, we have gotten a new curriculum where we are required to teach

> our SAT skills in seven months to try to cover all of the skills before the SAT test is taken. In doing that, it makes it very difficult to do a lot of the investigative activities because they just require more time, especially when you do the follow-through of letting the children present what they've come up with.

At the time, it was not apparent to me the impact that the implementation of the plan would have on the classroom and the educators in it. The plan, developed by one of the curriculum specialist at the district level, mandated essentially that the teachers do in seven months what they had been doing in nine months. In an interview with that administrator, she indicated that she had been recently hired in the position and that at her previous job she had developed a plan for a school that had not made AYP, and as a result of its implementation the school had improved its status. The plan, developed to teach the state standards had evolved into a preparation for the two big tests in the spring, the SRMT and SAT-10. The emphasis that the plan placed on covering the same amount of content in a smaller amount of time meant that anything deemed not directly related to the curriculum, and thusly what was being tested, became superfluous.

The plan also had an effect at the school level where both teachers and administrators had voiced their concerns about its implementation. Note some commentary from Mr. Lyle:

> So, I know exactly what you're saying and honestly this is a new dynamic in the school this year. I am in the fourth grade building this year. This was not something that was an issue this much last year, because the new curriculum plan is new this year. Last year, they did have a pacing scale, but I think her pacing

> charts, but I think the teachers ... well, I know the teachers were much more at liberty to decide how those skills were taught, when they were taught and how they were tested. This year, they are being told that they must teach them in a shorter time frame, and that testing information must be turned in by the end of the month. So, it's much the dynamic you're seeing this year, is much different from last year. This is new. And so that's kind of where we stand.

The New Curriculum Plan, according to the curriculum specialist, was implemented with the input of the teachers, but their responses to it signaled that there were unexpected consequences that had not been addressed. She stated in an interview about the implementation of the plan:

> Now when I say I've developed a plan, I did not do it by myself, okay? (In) each community ... we have four communities in Dayton County ... each school community sent one teacher.

Some concerns articulated by both teachers and administrators at the school revealed that the New Curriculum Plan had issues that needed to be addressed. Ms. Leonard voiced her concern with these comments:

> And see the other question they want me to ask is, how is this supposed to work with our new curriculum plan, because it's very difficult to have the time for these inquiry-based activities when you're trying to teach all of the skills in seven month. See we're kind of lost right now.

Mr. Lyle reiterated the same concern in these words:

> I've had a couple different meetings with teachers talking to me about the problems they're having covering these skills at the rate that we have been asked

to cover them, even with regular education students, much less students with special needs... But I do know any time there's this much uproar about something, you know there is cause for concern. It does need to be revisited and looked at.

There was some evidence that the plan had been reluctantly accepted. Listen to this comment by Ms. Leonard:

She's the one I'm talking about that's not going to be at the meeting today. And she's the one who did the new curriculum plan and really wanted us to go with it.

The new curriculum plan played itself out as another example of a mandate issued from the Powers That Be and reluctantly accepted at the school-level, with the problems and confusion that accompanied it. Now we will examine the observed responses to the intersection of these influences on classroom practices in Ms. Leonard's class.

Consequences

There were some consequences produced as a result of the interfacing of the four major influences in this study. Each helped to further explain the impact of the intersection of mathematics reform and inclusion. These results were described as follows: lack of time, mixed messages, and back and forth transition.

Lack of time. All of these influences have contributed to a constant search, to not only find the time to implement the kinds of activities that are connected with reform-based teaching, but also to do traditional teaching. In Ms. Leonard's classroom, the amount of time required to finish the planned activities was perpetually inadequate, especially those related to developing a conceptual understanding. There were several factors attributable to this lack of time issue. The first, being the educators' penchant to focus on basic number facts. Both educators had indicated that the acquisition of basic

number facts was an important part of learning mathematics. Ms. Leonard expressed that with the following words:

> I do believe having basic facts memorized makes more complicated math procedures easier, usually students who don't know the facts struggle.

Mr. Varner indicated similar feelings:

> But I also stress that they have to learn the multiplication facts or learn how to reproduce them on their own for whenever they may need them.

Secondly, both teachers had indicated that it took longer to reach students with special needs than it did to reach their peers without special needs. Ms. Leonard referred to that with these comments:

> I definitely think that it should be because I find that a lot of special ed(ucation) kids that I have worked with in the past can learn, but they often need things to be repeated over and over.

Mr. Varner's response was similar:

> They have to have repeated tries or repeated repetition in their work, you know, in learning a skill, ...

Another factor to consider, and probably the most dominant, was the mandated emphasis on basic skills development due to the implementation of the new curriculum plan and the inherent focus on basic skills. The emphasis had reduced a significant amount of instruction to basic number fact drills. Also, reducing the amount of time available for conceptually-based instruction was the time spent preparing students for the spring tests. There was an incident recorded in the researcher's reflective notes that demonstrated this point as follows below:

> The students had to stop doing this activity to review the November Test taken on last week. The continued emphasis on test preparation has once again conflicted with attainment of real understanding. The review of the items on the November Test took longer than the actual time spent on the clock activity.

The preparation for these monthly tests often meant that the teacher had to relinquish time needed for instruction to spend time on test preparation and review for retests. It seemed that mastering the skills related to passing these tests was driving what was going on in the classroom. The basic skills emphasis took precedence over what was going on in the class regardless of whether the students had gained an adequate understanding of what they were doing or the level of student interest at that time.

Another factor that contributed to the lack of time was that teaching conceptually-based skills took longer. The fact was revealed by both teachers and administrators. Ms. Leonard frequently expressed her desire to have more time to adequately carry out the investigative activities in her class. She voiced her lack of contentment in the following comments:

> And, as you know in observing my classroom, that often I feel like we run out of time when it comes to doing the investigative activities because often I'll do the introduction of the activity or will use the manipulatives, but I don't always follow through on the activities as well as I should, like allowing the children to document what they've done on the poster and then presenting it to the class and explaining exactly what they did and how they came up with their answers.

Here, she indicated her desire to have more time to allow the students to follow up with reinforcement activities designed to allow the students to express their understanding of a concept. The point was not lost to Mr. Varner either as indicated here:

> If you allow them to just do investigations, if you have the time that would be wonderful. But too, in the limited amount of time that we have to cover skills, I don't have the time to just do investigations where everybody just figuring out on their own way.

Administrators at both the school and district levels admitted the same. A comment made by Mr. Lyle revealed this:

> Because now the way we're doing this, say for example math ... now the way we're doing the math, it takes longer.

The district curriculum specialist's response was similar:

> Like you mentioned, we have discovered that MATH Plus, as you said, takes a little bit longer.

An interesting point to consider is that despite the fact that both teachers and administrators were cognizant that teaching conceptually took longer, a curriculum decision was made that decreased the amount of instruction time significantly. The inference is clear that there was little consideration about the impact of the decision on the implementation of reform.

A final factor that contributed to the lack of time was that much of the hands-on activities was new to many of the students because the feeder school that supplied most of the students had not implemented any kind of conceptually-based emphasis for its teachers; therefore many of the students simply were not familiar with using

manipulatives as learning tools. They wasted time playing with the manipulatives until the teacher reminded them that they were not toys. The perpetual lack of time produced consistent transitioning from a basic skills emphasis to a conceptual emphasis and vice versa. This constant back and forth had to be confusing and confounding for both students and teachers.

Mixed messages. The lack of time placed the educators in a quandary of mixed messages. The fact that the reform-based effort was allowed in the school system and particularly in this school gave the educators the impression that the powers that be wanted it implemented, but on the other hand with the implementation of a new curriculum plan, another message was sent that it was more important to prepare for the spring tests with the inherent emphasis on basic skills. There was a constant struggle to satisfy these diverse demands. The two teachers seemed to be caught in the middle, trying to satisfy the demands of two diverse efforts.

Initially, it appeared to me that this was not an environment that was being impacted by reformed-based teaching because of the overwhelming amount of time that was dedicated to basis skill development, particularly the memory of number facts. How much of this emphasis was due to the teachers' belief that students should acquire basic number facts first and how much was due to the demands emanating from the aforementioned influences is indistinguishable. Once the thread of conceptual-based teaching became apparent, the constant quandary was observed. Ms. Leonard often mentioned the difficulty involved in trying to satisfy these demands. Notice these comments:

> And see the other question they want me to ask is, how is this supposed to work with our new curriculum plan, because it's very difficult to have the time to do these inquiry-based activities when you're trying to teach all of the skills in seven months. See we're kind of lost right now. It's like we're doing a little bit of this and a little bit of that, we're not really choosing something.

In another conversation she stated:

> At this time, it's difficult because I see myself trying to pull out isolated investigation activities to try to go along with whatever I'm teaching at that time.

Mr. Varner felt the same way:

> The county has said that they wanted us to do MATH Plus, but then they turn around and push you up in such a schedule that you really don't have time to spend on any extra activities.

Mr. Lyle admitted the same:

> It's been really difficult to determine what's more important than something else. Is this more important than that?

Mr. Lyle seemed to have been caught in this quandary also, when referring to his response to the teachers' inquiry about how to solve this dilemma. Notice his response:

> What they've asked me is, "What do you want me to do? Do you want us to hit the skill one time and go over it one time and test it. No matter what they score on it, move on every time." I've told our curriculum people this. Every time that question is asked me, my answer is, no. If you're going to take the time to teach a skill, teach it properly. Test it. If the students don't have it, reteach it. Test it

> again. And you teach it and you test it again until they have it. If you don't do that, you've wasted your time.

He also mentioned:

> You know I would rather get to April, testing time, and the students have a thorough good understanding of seventy-five percent of the standards than a hurried and rushed kind of average, understanding one hundred percent of the standards. I feel, and my philosophy is, that we're going to score much better if our students have a thorough understanding of the skills that we covered, and we need to take the time that is necessary to cover those skills.

But, in the same conversation, he mentioned the fact that the teachers must adhere to the demands as mandated to them by the administration because he has to also. Notice:

> You know, even at my level when the new curriculum plan is implemented, what I'm told is you ensure that your teachers are implementing the new curriculum plan. So, when I'm told that, then that is what I have to do. So, really at my level is not where you can get into the argument of is the new curriculum plan successful? Does it allow us to use MATH Plus and RMSTI strategies? Does it allow us the time that we need?

The evidence in the data has shown the existence of a state of quandary among both teachers and administrators. The factors that led to this dilemma among teachers and administrators undoubtedly had an effect on the students in the classroom.

Back and forth transition. The primary manifestation of the quandary was the divergent paths this classroom took as the teacher tried to satisfy the various influences that were prevalent. The opposing emphases were recorded under the themes, Conceptual

Emphasis and Basic Skills Emphasis. The primary component of the Basic Skill Emphasis was the concentration on basic number fact drills, which were given quite frequently. The most prominent aspect of the Conceptual Emphasis was the investigative activities. There was a constant transition from isolated basic skill drills to activities that stressed conceptual understanding, and then a transition back to basic skills emphasis. The fact that a basic skills emphasis occurred so often, after a conceptual approach had been explored, in my opinion negated the effect of the conceptual emphasis. The focus on isolated basic number fact drills often seemed disconnected from what was going on in the classroom at that time. The slower students could be taking a drill on addition facts, while the class was studying division of a three-digit number by a single-digit number, which was being demonstrated in an investigative activity. This constant transition had to be a little disconcerting to both teachers and students. One moment they were involved in an activity of higher order thinking, and the next moment they were doing first-grade arithmetic. This constant back and forth transition leads one to ask the question, Which one is more important, getting the answer, or how to get the answer?

There were instances in which a transition from a traditional approach to a conceptual-based approach was used rather effectively to bring a point home to the students regarding a topic. Here is an example where a traditional approach to teaching division by using fact families is being used, and then a conceptual approach is used to teach the same idea. It represents a transition from a basic skills approach to a conceptual approach. Notice this exchange:

Ms. Leonard: Good. Remember when we were doing addition and subtraction and we made facts families with two addition and two subtraction

problems. Well, you can do the same thing with multiplication and division. I can make a fact family. For example, if I have 42 ... Larry, Allison, this is exactly why people are coming to the board and not knowing what to do ... 42 divided by 6. So, I'm going to write down 42 divided by 6 equals 7. Now, can someone tell me another division problem that would go with this that would have a 7, a 6, and a 42 in it? Ada?

Ada: 42 divided by 7 equals 6.

Ms. Leonard: Good. Now who can tell me a multiplication problem using those three members of my facts family? Allison?

Allison: 7 times 6 equals 42.

Ms. Leonard: Thank you. And then one more multiplication, Aaron.

Aaron: 6 times 7 equals 42.

Ms. Leonard: So we can also make facts families using multiplication and division. Now, there's one more thing that I want to show you and then we're going to work on an activity when we get back from lunch. I'll just take this problem as an example. (On the board, she counted out 18 stickies.) This means that I have 18 things in all. So, I'm going to count out 18 things. I've got one, two, three, four, ... eighteen. I have 18 things in all. Now, I'm supposed to divide those 18 things into three groups. So I'm going to start making three groups. Here's one of my groups, here's one, and here's one. And I'm just gonna go around, put one of these little ocean

characters in each group until I run out. Cause I'm taking all 18 things and dividing them into three groups. I do know that my groups need to be equal. So, right now I've got three in each group, and I'm gonna keep going until I've used them all up. Okay, there's another one. Got four in each group now. I want my groups to be equal and be the same. Five in each group. There's six in each group. So, 18 divided in three groups. There's one, two, three groups and how many are in each group?

Class: Six.

Ms. Leonard: So, this shows that 18 divided by 3 equals 6. When we get back from lunch, we're going to use our counting tubes and we're going to practice some problems using those. I want you to keep that same sheet of notebook paper on your desk and when we do our group activity, write your answers on that same sheet of paper. So just keep it out on top of your desk.

This kind of transition helped make connection between division as an abstract procedure to one rooted in real world experience, but the connection between this process and taking an addition fact drill is speculative at best.

Impact on Target Students

The fundamental issue of the research was to examine the impact of a systemic approach to mathematics reform on the attitudes and practices of two educators in an inclusive setting. The classroom evolved from one in which the implementation of

systemic reform had little, if any effect, to one in which a thread of conceptual emphasis was discerned. The thread became more apparent with time, even though it never developed into a rope that was strong and long enough to pull the teachers from the lower levels of basic skills emphasis to the higher level of conceptual emphasis. This transformation was inhibited by two factors and they were:

1. the impact of the aforementioned influences in this classroom; and
2. the educators' propensity to rely on basic skill attainment as the indicator for success in mathematics.

The two educators seemed to have been affected by their exposure to the reform mathematics approach in different manners. Ms. Leonard's response to her exposure was one of quandary. She often found herself trying to satisfy the mandates handed down from an administration that was ambivalent at best about its support for systemic mathematics reform, while at the same time trying to implement the kind of practices that she knew were components of mathematics reform. Mr. Varner's response was one of practicality, in which he utilized reform-based ideas in a product-oriented fashion to aid students' efforts to attain correct answers. Neither educator had come to the point of selling out to reform.

The essential question is, what was the trickle-down effect of systemic mathematics reform on the inclusive setting as evidenced by its impact on the students who create the inclusive environment, those labeled special need. Even though the environment contained powerful influences that affected the implementation of mathematics reform and ultimately affected its impact on the inclusive setting, there was some trickle-down effect on the students as indicated below.

The students who were identified as low achievers were classified into two categories. The first group consisted of those who did not know their basic number facts, but had developed, or were developing a mechanism for attaining them. This group included: Sarah, Isaac, Amy, and Monica. The second group consisted of those who were struggling with both, such as Janice and Brenda. The following are descriptions of the trickle-down effect of the systemic approach to mathematics on each of these students.

Sarah

Sarah was the student with whom I spent the largest amount of time interacting. She had been identified for special education, but was able to function in the class due to two factors, one being the amount of personal attention that she received from Ms. Leonard and Mr. Varner. The second factor was that she had developed a mentality in which she expected lots of assistance from the teachers, especially during testing, as indicated in this exchange with the general educator:

> Ms. Leonard: That's something about special education kids. We help them too much. When I give her a modified test on that, and she only has two choices, how do you know if she's really doing it or if it's just a good guess? So far as it concerns the answer.
>
> Interviewer: I think that she can get it.
>
> Ms. Leonard: They're use to getting a lot of help. They kind of expect it.

Evidence of this was also recorded in my reflective journal as follows:

> The students finished the chapter test that they had started on yesterday, while those who had finished were given a fun worksheet. While walking about in the classroom, I noticed that Janice, Sarah and Brenda were having difficulty working

the problems. Remember this was a test, they knew that they should be doing the work individually, but they continually sought help from Ms. Leonard and Mr. Varner, as well as myself. It appears to me that despite the emphasis on these basic skills in class, some of the most needful students have not come up to par. Also, she seemed to be the kind of student who favored a lot of attention.

Her basic problem was her inability to remember basic number facts. This was indicated in the initial observation of her performance. Notice these reflective comments dated September 19:

> Students were given drills on addition, subtraction, multiplication, and division. They have to get all of the answers correct before they can go on to the next drill. Some students were still doing addition including Sarah.

This conclusion was also garnered from observation; as noted in this field note entry on October 24:

> While they were doing these problems at the board, I helped Sarah with the problem,
>
> 49
> x 8
>
> Her basic problem was not learning the multiplication procedure, but remembering basic number facts. She was trying to find the product, 9 x 8; she could not remember what that particular fact was, but was trying to find it using one of the conceptually- based procedures that she had been taught. I helped her with her organization of the problem.

This is also seen in another field note entry recorded on October31:

After lunch, the students were given a worksheet covering multiplication of a four digit by a one digit number. Isaac did not finish, and Sarah also had some difficulties with the worksheet. Sarah knew what 7 x 5 was, but did not know the product of 7 x 4. She tried to determine the product by adding 4's. I told her to use 7's instead. I also showed her how to do 7 x 5 -7. I noticed that she found the difference, 35-7 by counting backward.

Her inability to remember basic number facts hindered her ability to produce correct answers immediately, but with the use of conceptually-based interventions, she could eventually produce the correct response. Judging her on her ability to produce the correct immediate response would be a judgment of her ability to remember basic number facts, not her understanding of the multiplication process. She obviously had garnered something from the conceptually-based ideas that enabled her make a connection between where she was and where she needed to be, relative to achieving the correct answer. This point was made in a conversation with the special educator.

Interviewer: Right. She has a mechanism for doing it, and I see a bunch of them using their fingers.

Mr. Varner: She's not the only one.

Interviewer: Right. And then I see some like Sarah. She doesn't keep up with her, but I saw her, as well as Isaac, using arrays to get her multiplication facts. When she writes the rows down, like doing 9 times something, she'll make rows of nines. Isaac was using it. So I guess they see something in that particular method that they can use to even obtain the multiplication fact.

Her use of these conceptually-based methods to attain basic number facts was evidence of the trickle-down effect of this systemic approach to mathematics teaching.

Isaac

Isaac was probably the most interesting of the students who were identified as target students. He was a White male, Title I student, whose problems were not academically based, but were rooted in his behavior. He was excessively absent from class due to his misbehavior, missed a lot of work, and was behind the rest of the class. In a conversation with Ms. Leonard, she indicated:

Ms. Leonard: Isaac is capable; he is just because of his situation, and he's pretty much needs to be retained in the fourth grade, that's the best thing for him. Get his behavior straightened out, and he's back in fourth grade next year where he can get caught up on some of his skills that would be the best for him. I mean he would really have to have really A's or high B's to be able to bring his average up enough where he would be able to pass fourth grade.

Interviewer: You don't see that happening?

Ms. Leonard: No. See I haven't gotten any of his work from the Alternative School, and I'm sending these tests and everything like that to the Alternative School, where over there he'll get a whole lot more individual attention than they would here. But I haven't got anything back and when they do send it back if there's anything missing then I'll just have to put zeros.

Isaac's behavior in Ms. Leonard's class was acceptable, and most of the disciplinary actions applied on him took place in other contexts. This could have been attributed to the amount of patience that Ms. Leonard exhibited toward him and the amount of student-centered activities occurring in the classroom. Notice the exchange recorded between Ms. Leonard and him in class.

Ms. Leonard: In the number 63, the 3 is in my one's place, so I'm going to put my 3 in my one's place where it goes. Then I'm going to carry the 6 tens and put it here in my tens place. Now I've got to go back and (working with Jamey) 5 times 9 is what?

Isaac: 44.

Ms. Leonard: One, two, three, four, five of them is 45. If I have six of them, what's 45 plus 9 more?

Isaac: 56.

Ms. Leonard: Not quite.

Isaac: 56.

Ms. Leonard: What's 9 plus 5?

Isaac: 54.

Ms. Leonard: Right. 6 nines would be 54. So what would 54 plus 9 be? 5 plus 9 is thirteen, so 9 times 7 is?

Isaac: 63.

Another incident of Ms. Leonard's patience with his unusual behavior at times is recorded in these reflective notes dated October 25.

> Isaac's behavior continues to be baffling. Today, he volunteered to do a problem on the board and when he went to the board, he started as if he was going to do the problem, after some hesitation he came back to his seat as if he was going to do the problem at his seat and then return to the board. After doing some scribbling on his paper, he just said that he was not going to do the problem. While we were waiting to see if he was going to get the problem done at his seat, Mrs. Leonard went to her desk to do something, I assume this was an attempt to make it look like she was not waiting on him. I think that he simply went into a shell when he could not do the problem ... She is still very patient with him.

He was also on some kind of medication that seemed to put him in an inattentive daze at times. Note this reflective journal entry on September 28.

> I noted him because he has problems with focusing because of what seems to be some type of hyperactivity. He takes medicine for it I learned. I cannot see him just sitting in his seat for 50 minutes and listening to the teacher even if he has taken his medicine, the medicine will cause his attention to drift from him.

He seemed to vacillate between this medicated state and an overactive state in which he was also very inattentive. The following reflective notes recorded on September 12 referenced this:

> Isaac was pretty inattentive and was talking to another student, who was warned by the teacher. When Mr. Varner came in and saw him not paying attention, he said something to him and it wasn't until Ms. Leonard went over to his desk and said something to him did he begin to pay attention. I wonder, what is his problem.

However, the student-centered activities seemed to have been a good remedy for this overactive state. Here are some more reflective comments recorded on September 28.

> I noticed that Brenda, Isaac, and Larry were having some difficulty identifying the numbers. I assisted them some before they went to lunch. The students were actively involved in the activity, marking the numbers on the card. The level of interest and participation during the student-centered Investigations activities are significantly greater than those that focus on the teacher.

These are now compared with some reflective commentary about him recorded on November 30, during the latter stages of observation.

> The low-performing students were well involved in the activity, and most of their graphs were correct. Jamey's graph was not correctly partitioned, but his graph was drawn correctly if you just looked at the numbers. It seems to me that this kid has good potential, but in an environment of rush-rush he is going to be left behind.

The positive effect of systemic mathematics reform on Isaac was also evidenced by the fact that he used conceptually-based interventions to help him remember basic number facts. He was observed using arrays to do multiplication problems.

Amy

Amy was a White female student who was identified for special education. She functioned quite well in this environment, despite the fact that she was absent quite frequently during the early part of the time that I observed the class. Her ability to function in the class limited my interaction with her. She had developed mechanisms for attaining basic number facts that seemed more mechanical than conceptually based. This

could be attributed to the pragmatic approach of Mr. Varner, whose emphasis was getting the answer by using any means possible. The following is an excerpt from a semi-structured interview with him.

Interviewer: So, the emphasis should not be on, if I may use the infamous term, one size does not fit all.

Mr. Varner: Right.

Interviewer: You have to teach, basically an individual approach.

Mr. Varner: It is and what one child is able to ... you can just teach one skill one way, and he may just get it like that, but you may have some other students with a little bit understanding, a bit better way of understanding what that concept is in order for him to understand that skill. And when you move to another skill, it could be completely reversed as to what you're working on. Depends on the child.

This was evidenced in a visit to his special education class. He taught his students various techniques for achieving answers, not necessarily the concepts behind them. Amy was often seen using her fingers to attain basic number facts. This was mentioned in an informal conversation with him regarding her. Notice:

Interviewer: ... But if I had to kind use my just horse sense, she seems to be the one of all of the kids in there who needs the most help. Amy doesn't ...

Mr. Varner: I'll say looking now that Amy is one of them and she seems to do pretty good. She is, she doesn't know her facts, her multiplication table. She still has to count them up, but ...

Interviewer: She has a mechanism.

Mr. Varner: She's getting it done.

Interviewer: Right. She has a mechanism for doing it, and I see a bunch of them using their fingers.

Mr. Varner: She's not the only one.

There were no observations of Amy drawing arrays to use as a means to attain basic number facts because she had developed other mechanisms.

Monica

Monica was a Black female student whose initial performance on the basic number facts drills exceeded the rest of the class. Her status as neither special education nor Title I, along with her performance on the initial drills, gave me reason to think that she had been misidentified as a target student. However, her performance on later evaluations contradicted this reasoning. The fact that she performed so well on the initial basic number fact drills is significant because what should have been an asset to her became a liability. Observations of her indicated that her problem was similar to that of the other target students, which was the inability to recall basic number facts. She not only had forgotten the basic number facts, but had reverted to some of the conceptually-based interventions that some of the other low achievers had begun to utilize. The following is a November 4 field note entry referencing this point:

> After lunch they were given this exercise on page 367, 6-17. I noticed that the target students Brenda, Sarah, and Monica were struggling with the exercise because they are not able to remember multiplication facts. Monica used the summation method to determine what was 8 x 8, while trying to divide 640 by 8.

The following is a sample of her work to show how she had begun to use a conceptually-based method to derive basic number facts. See Appendix H for an example of Monica's use of a conceptual method to find basic number fact.

It was interesting to observe that the students in the first category were the ones who produced evidence that the ability to master basic number facts was not necessarily a prerequisite for gaining higher order thinking skills. They were observed frequently using conceptually-based tactics to attain answers to more complicated procedures.

Brenda

Brenda was a Black female student, who, like Monica, was neither special education nor Title I. Her slow work pace was her chief identifying characteristic. It simply took her longer to do things. This inability to keep pace with the rest of the class led to her becoming frustrated and sometimes just giving up on class activities. A reflective note from August 29 illustrates:

> Brenda is real slow, slow to keep up, and she started crying because she couldn't finish the test. She gets behind and she gets frustrated. I encouraged her, but that didn't seemed to calm her down, so I stayed with her, and encouraged her enough to go on and eventually finish.

She showed very little indication of having garnered an understanding of many of the concepts demonstrated in class. She seemed to have reduced many of the concepts explored to a series of unrelated steps, as in this field note entry dated November 18:

> Brenda also needed some clarification on a division problem. It seemed that she had not garnered the understanding necessary to do division. Mr. Varner also assisted her after lunch. When I looked at the problem that I had given her some prompts on, she had not done it. From observation I realized that she and Janice had reduced division to a series of unrelated steps such as putting the number that is to be subtracted in the problem without an understanding that it was obtained by multiplication.

Her performance was due to a lack of understanding. She obviously was the kind of student who needed more time to grasp the meaning of concepts, but with the drive to prepare for the mandated tests, and the inherent emphasis on basic skills, it did not happen.

Janice

Janice was a Black female Title I student, who was identified as the poorest academically performing student in the class. Her Title I designation did not reveal the extent to which she needed help academically. She seemed to have been lost in the current of influences that had cascaded down on the classroom. Her performance was actually a shock because she did not attract a lot of attention from Ms. Leonard, Mr. Varner, or myself. There was a Title I Aid who came into the class to assist the two Title I students, but only spent a small amount of time with them because of a schedule conflict. Janice's lack of performance seemed to have sneaked up on everyone. In an

informal conversation with Ms. Leonard, she mentioned her concern with Janice's lack of performance:

Ms. Leonard: Yeah. That's what happens. They look at it can't do it, and they freeze. I think Sherita is doing okay with it. And may not realize it, but Janice the little girl right here is that one that I'm concerned about. She finished it (the test) and turned it in but I guarantee it's a F. At least Sarah and Brenda were putting the effort and trying to get it right. Janice is so lost. She's just writing answers.

Interviewer: Mr. Varner and I had a little conversation regarding her. Out of all of them, academically, she's probably the lowest on the pole.

Ms. Leonard: I've turned her name in to our BBSS (Building-Based Student Support) team. It's just a team that is suppose to watch the kids, and then if they don't you know progress. We're supposed to like observe them for a nine week period or something like that, then we can do the paperwork and fill out for special education, but I'm real concerned about her.

Interviewer: How did they miss her?

Ms. Leonard: I don't know I wonder about that a lot of times, cause you would think by the time they go to fifth grade, all of the special education students would have been identified.

Interviewer: By my observation the kind of attention she's getting through Title I, I don't know that much about it, when Ms. Young (the Title I

aide) comes in ten minutes whatever she spends truly it's nothing adequate compared to where she is. She's the lowest.

Ms. Leonard: Yeah.

Later in the same conversation, she concludes with these comments about Janice:

Interviewer: Janice is, she's the one.

Ms. Leonard: She's very low and I kind of hate it because I did give time to Sarah and Brenda helping them. I mean when they raised their hand I try to kind of get them going on whatever they're doing. But see Janice didn't even raised her hand she'd already turned it in as being finished. So I didn't want to give her the help that I would have had she kept her paper.

Interviewer: She's not putting anything together.

Ms. Leonard: She's just so lost to it that she just kind of

Interviewer: Yeah. She was trying first but then when she found out that the problem, you didn't have to show any work. That was a revelation to her.

Ms. Leonard: She just marked a, b, c, d

Interviewer: Right.

Both Brenda and Janice demonstrated a lack of conceptual understanding of the topics covered in Ms. Leonard's class. Their performance was indicative of the fact that they had not benefited from the traditional efforts. Also, due to the significant emphasis placed upon basic skills in the context of high stakes testing, it is difficult to ascertain if reform-based mathematics was given a legitimate opportunity to be of benefit to them. It

does point to the fact that if the two students had been allowed to spend more time developing a conceptual foundation for their learning, they certainly would have had more to work with than they did.

The fact that the systemic approach to mathematics reform had impacted at least some of the target students to some degree is significant in view of the presence of influences that could have easily nullified any effects at all. In spite of contravening factors, such as lack of time and a teacher quandary that put students on a perpetual seesaw, vacillating back and forth from a basic skills emphasis to a conceptual focus, it should be noted that a majority of the target students were able to gain valuable insights into important mathematics because of their exposure to this reform approach to teaching. It leaves one to wonder, what might have been the effect if the inhibiting factors had been minimized or eliminated. Another important point to note is the positive effect that being in the class had on the students' attitude toward mathematics. The point was reflected in the students' responses to an exercise done in class involving identifying their favorite subject. Many of them chose mathematics as their favorite subject.

V. SUMMARY AND RECOMMENDATIONS

The purpose of the study was to examine the impact of a systemic approach to mathematics teaching in an inclusive setting. This research was an attempt to determine real-life issues impacting the implementation of mathematics reform in a classroom setting involving a general and special educator.

The first area of concern in the study centered on how the implementation of a reform approach to mathematics teaching affected how a special needs educator and a general educator operated in an inclusive environment. In my opinion, the two educators were affected by their exposure to this approach in different manners. From an attitudinal point of view, both teachers indicated they felt the ideas advocated by MATH Plus were beneficial to students with and without special needs.

Ms. Leonard's response to her exposure to MATH Plus was evidenced in her continual efforts to integrate reform-based teaching materials, topics, and to drive home the idea that mathematics should be taught in such a way that students gain a conceptual basis for their knowledge. However, her delivery of instruction primarily through teaching by telling was indicative of traditional methods, which is paradoxical. It seems to me that if she was going to implement reformed-based teaching as promoted by MATH Plus, she would have at some point cast off the constraints of having to do teaching within a certain time frame at least for a brief period. The fact there was a

constant shortage of time did not mean that at least once she could not have let the students spend sufficient time on an activity to construct their own meaning of a concept. Again, her exposure to MATH Plus had produced some attitudinal and instructional changes, but not the kind of changes that were needed to throw off the negative influences that were so prevalent in her inclusive classroom.

Mr. Varner's response to MATH Plus was inscribed in his perception of the role of the special educator as an aide to the general educator. His exposure to MATH Plus had not affected his basic role in the inclusive setting. The main effect observed in him, as a result of exposure to MATH Plus, was the utilization of conceptual-based methods that were introduced to help students obtain basic number facts. These methods were introduced to the students without making conceptual connection.

The next focus was how does reform mathematics impact students identified as special needs students in an inclusive class? The students of interest in the study were students identified as students with special needs by the system, or as students of concern based upon my observation of their class performance. One powerful observation was that when the Investigations activities were going on in Ms. Leonard's classroom the participation and interest of all students were at their best. A primary problem with the manner the activities were done was that there was not enough time to allow the students, especially the target students who had special needs to make the activities mean something to them from a mathematical perspective. I think that the adage "scald the hog while the water is hot" is very applicable in this instance. It seems to me, once an atmosphere conducive for learning had been created, every effort should have been made to allow the students, especially the target students, to reach the educational goal of the

lesson. The lost opportunity can be attributed to the decrease in instructional time due to the invasion of external influences into the classroom.

Despite the prevalence of influences that clearly circumvented the proper implementation of MATH Plus as a viable learning system, there was a powerful observation made concerning the effect of the reform-based teaching methods on the target students. Most of these students with special needs were able to acquire and utilize reform-based methods to obtain basic number facts. They were observed using methods such as drawing arrays to find products, using repeated sums to find products, or using a grouping method to find a quotient in a division problem. The use of conceptually based methods to find basic computational facts indicated the students had garnered an understanding of the concepts behind the particular operation, despite their lack of basic fact knowledge. The point is a very powerful observation in view of all of the contravening factors that hindered the proper implementation of MATH Plus at Logan Middle School. The point being, if these students can acquire this kind of knowledge as the result of a constrained effect of reformed based teaching, what will happen when reform based teaching is allowed to be implemented without these constraints?

The final point centered on, what are the factors that affect the implementation of reform in an inclusive mathematics setting? There were four factors identified as influences that affected the implementation of the MATH Plus at Logan Middle School. Two were expected in the sense that these were automatically anticipated in an inclusive setting where reform based teaching is being employed. The other two influences were unexpected, not in the sense that they were totally unpredictable, but in the extent in which they affected not only what went on in Ms. Leonard's classroom, but the entire

school. The expected influences were identified as the reform and special needs influences. The unexpected influences were identified as the high stakes testing and administrative influences.

The reform influence was limited to the efforts of Ms. Leonard. Her efforts to implement reform based teaching in an inclusive environment were commendable, but without the kind of systemic support that is necessary to effectively create an environment conducive (both inside the classroom and outside the classroom) for the implantation and growth of new ideas, the effort was lessened. The impact of the influence was also reduced by the focus on students learning number facts outside of any meaningful real-world context. The impact of the special needs influences produced two primary results. First, the fact that both teachers exhibited positive attitudes and interactions with the target students was very much in line with the reform idea of making mathematics available to all students. However, there was indication that the expectations for the target students were not as high as the rest of the class.

The unexpected influences acted primarily as contravening factors to the successful implementation of MATH Plus at Logan Middle School. The focus on preparation for the mandated tests in the spring had an overwhelming effect on the teachers' perceptions of what should take place in the classroom. The fact that, in my opinion, an inordinate amount of time was spent preparing the class to learn the content and test taking skills thought necessary for passing the mandated tests, points out that passing these tests had become an end in and of itself. Instead of what students needed to learn and the best methods of learning becoming the focal point of the class, the skills needed to pass system mandated tests had become the focus. It appeared to me that

instead of curriculum, instruction, and assessment alignment being a focus, the tests were driving both instruction and curriculum.

The final influence was the factor that stands out as the most significant of the observed influences. Administrative decisions made at both the school and district levels, not only affected the implementation of MATH Plus in the inclusive setting, but also helped to create an environment that was inhibitive to reform in general. The data sources provided evidence there was verbal administrative support for the ideas advocated by MATH Plus, but in reality there was at best ambivalent support. There were administrative decisions made that inhibited, if not negated most of the reform efforts at Logan Middle School. The point was verified by the administrative attitude relative to the implementation of full inclusion. The administrative attitude combined with the compliant attitude of faculty and staff, produced an environment in which change was very difficult.

Major Observations

The first observation of note is the fact that the classroom was supposed to have been an inclusive setting in which a reformed-based approach to mathematics teaching was being implemented. The thought led to the anticipation of a significant amount of reform-based activities transpiring in the classroom. Even though the setting was not the intended one, there was anticipation that the kind of teaching going on in the classroom would stand out as reform-based because both teachers had received training in reform-based mathematics teaching. This was not the initial observation because my initial observations revealed a classroom in which reform-based materials were being used to

augment the traditional materials, but there was a constant occupation with basic number fact drills and preparation for the state-mandated tests. The occupation with these issues caused me to initially wonder if the setting could indeed be called a reform-based environment, even though there was a reform-based emphasis that included: the use of manipulatives, the connection of mathematics to other topics, and the use of reformed based materials. It was not until later in the observation that I noted a thread of conceptual emphasis coming through. The thread became more apparent to me with time. Ms. Leonard's use of the traditional method of teaching by telling, however, left out one of the most important aspects of constructivist-based teaching, which is allowing students the opportunity to create their own knowledge.

The intersection of reform and special education was a chief focus in the study. The desire to examine special education through the reform window was one of the motivations behind the research. To make the observation I had to examine, to what extent the presence of students with special needs affected what took place in the setting. It appeared the teachers' beliefs and attitudes about issues relative to students with special needs were positive, and reflected belief systems that favored their presence in the regular classroom in most cases. Both teachers, however, indicated that they had difficulties with the implementation of inclusion at Logan Middle School in light of the effects of factors such as NCLB and top-down administrative decisions.

Ms. Leonard and Mr. Varner exhibited a positive attitude toward reform-based mathematics as exhibited on the responses on the attitudinal scales and teacher surveys. Both teachers expressed the belief that reform-based mathematics teaching was the way to go, but expressed concerns with all of the other factors that were negating the effects

of its implementation. The best manifestation of this belief system was the willingness of both teachers to provide accommodations for the students with special needs, especially during tests. Another very important point brought forth was the effect that the assumed roles of the teachers had on the activities in the inclusive setting. The very fact that both teachers accepted the role of the special educator as one of subservience to the general educator was very significant and had a profound effect on the activities in the classroom, and of course the implementation of the systemic approach to mathematics reform.

A significant observation garnered from the research was the degree to which unexpected influences affected what took place in the setting. The fact that events outside of the classroom had such an effect on what went on inside the classroom was indeed an unexpected result of the research. The impact of mandated testing was a much unexpected classroom influence. The inordinate amount of time and energy dedicated to teaching students the test-taking skills needed for the two mandated spring tests, along with preparing them for the tests' content was overwhelming. A point of irony was detected, and that was the effect of one of the mandated spring tests. The SAT-10, the norm-referenced multiple choice test contributed greatly to what was identified as the basic skill emphasis, while the SRMT made significant contributions to the conceptual emphasis, a reform emphasis.

The impact of administrative decisions, both at the school and district levels, affected the implementation of the systemic approach to mathematics reform in a systematic way. The implementation of a curriculum plan at the district level that essentially reduced the amount of significant instruction time to seven months was the proverbial straw that broke the camel back when it came to the serious implementation of

MATH Plus at Logan Middle School. The curriculum plan not only reduced the amount of time for reform-based instruction, but for traditional instruction. Another very important observation made was the impact that administrative instability had on what went on at Logan Middle School and in Ms. Leonard's room. There had been very little stability in key administrative positions and that had helped to produce an environment in which it was more comfortable to go with the familiar.

The intersection of the aforementioned influences produced some consequences that were noteworthy. The most notable result was the consistent search for more time. Both teachers regularly mentioned that they did not have time to properly implement the reform-based demands of MATH Plus, as well as satisfy the constraints of the new curriculum plan. This desire for more time was a frequent theme in the data. The desire to satisfy the various edits and demands from the administration kept the teachers, particularly Ms. Leonard in quandary trying to satisfy the mixed messages that were being sent. The major quandary being, how can we satisfy the fact that we have been told to implement a reform-based teaching approach, while having constraints placed upon us that are in direct opposition.

Finally, the trickle-down effect of the implementation of the systemic approach to mathematics reform was examined by the impact that it had on the target students. The target student population, which consisted of two students identified for special education, two Title I students, and two students identified because of their low performance in class, was affected by the attempt to implement MATH Plus. It was observed that despite all of the contravening factors that hindered the implementation of MATH Plus, most of the target students made use of conceptually-based methods to

develop schemes and strategies to obtain basic number facts, the aim of many of the basic skill based activities done in the class.

Limitations

There is only one ultimate population sample and that is the population itself. Anything short of that population is only a sample and can only infer conclusions relative to the original population. In a qualitative research study, one is not interested in trying to replicate a desired setting, but in trying to examine the setting as it exists in real-life (Schwandt, 2001). Any inferences gathered from qualitative research are not indications of what will happen in other similar settings, but are statements that are applicable to that particular setting. These conclusions may or may not apply to a similar setting, but provide knowledge and insight into some aspect relative to that setting. So the conclusions of the study cannot be generalized to other inclusive settings, but may be transferred to them (Schwandt, 2001).

What we gain from qualitative studies, particularly ethnographic studies, is a magnified view of a particular environment, in this case an inclusive classroom. The view helps to classify the everyday experiences of a culture into a definitive structure. This is what was attempted in this study in order to gain a better understanding of the effects of systemic reform on an inclusive setting, particularly the participants: two educators and six students. With these thoughts in mind, several limitations are offered for consideration.

The first limitation is that the study only addressed one mathematics classroom and thusly, any conclusions cannot be generalized to other classrooms. There is no

suggestion that what has happened in this classroom is what is going to happen in other inclusive settings where mathematics reform is being implemented, but there is a possibility that the conclusions can be transferred to a similar setting (Schwandt, 2001).

The second limitation that must be considered is the fact that of the students identified as target students, there was only one male, who was White. The absence of any Black males in the designated population puts limitations on the transferability of the results to other inclusive settings, since Black male constitute a significant portion of the special needs population (Harry & Anderson, 1995).

The third and possibly the most significant limitation of the research is the subjectivity of the researcher. Every researcher brings his background into research, and what is seen is a product of prior experiences. The development of the study and the conclusions drawn has been affected either directly or indirectly by the researcher's prior experiences, as well as the experiences gained while a participant observer in the setting. This point does not suggest that it is impossible for the researcher to render impartial conclusions, only that the lens that one views things through does affect what is seen.

General Implications

One important issue brought forth in the research is that the context in which reform is implemented is a definite factor in its success or failure (Anderson, Brown, & Lopez-Ferrao, 2003). The context in which this inclusive setting existed had a definite effect on the implementation of systemic reform. The examination of internal and external influences which were significant factors in the implementation of the systemic approach to mathematics teaching, and its inherent effect on those involved in the

interface between reform and inclusion was an intricate part of the research. One of the most significant factors that affected the implementation of systemic mathematics reform in the study was administrative instability.

The constant administrative turnover, both at the district and school level, acted as a significant hindrance to change. The carousel of administrators seemed to have created an environment in which it was convenient to pass the buck. New administrators have enough concerns trying to adjust to new surroundings and personnel, and the thought of becoming involved in the implementation of something unfamiliar to both teachers and staff can be disconcerting. Each new administrator brings his or her own focus and thrust. The fact that there had been administrative changes in all but one administrative position at Logan Middle School had a definite effect on the outcome of the research. The administrative instability had a trickle down effect on those most vulnerable in the setting, the target students. The implementation of reform in an environment of administrative instability should therefore be considered with caution.

Another valuable lesson taken from the research is the problematic results of top-down mandates issued without substantive input from those who have to implement them (Tharinger et al., 1996). The implementation of the New Curriculum Plan, after the school year had begun, was an example. It was mentioned that the teachers had input into the implementation of the plan, but a consideration to offer is, how much input can occur when the decision to implement the plan had already been made? The teachers' participation in the process seemed to have been post hoc and perfunctory as indicated in the data. There was a tendency to put things into action without input from those most knowledgeable about the environment in which they would be implemented, the

classroom. This sort of top-down, “do as I say” mentality will get plans implemented, but will not guarantee success. The lack of input from teachers relative to the implementation of significant changes in the classroom is similar to generals developing a battle plan without input from the soldiers on the ground.

A very important point was brought forth in the study about the relationship that should exist between the general educator and the special educator in an inclusive setting. The review of related literature stressed the point that there needed to be collaboration between general and special educators (Duchardt, Marlow, Inman, Christensen, & Reeves, 1999). Duchardt et al. (1999) concluded that in the co-teaching environment, both special and general educators can learn to develop a collaborative teaching environment that will be beneficial to themselves and their students. The point was reinforced by my observation at another school in which a co-teaching model had been implemented. The teachers at that school faced some of the same issues that were prevalent at Logan Middle School, but were able to implement reform principles in an inclusive setting. It should be noted the school’s administration was a more positive influence.

A collaborative environment as described by Duchardt et al. (1999) did not exist in Ms. Leonard’s inclusive classroom. As previously mentioned, the roles of both teachers were well defined and accepted by both teachers, and these roles left very little space for collaboration and co-teaching. Another point to consider is that there was very little planning and preparation occurring between Ms. Leonard and Mr. Varner. This is in direct opposition to the conclusion derived by Duchardt et al. The fact that a significant feature needed to successfully implement reform in an inclusive setting was absent points

to the need to revise the thinking about the roles of the teachers in the inclusive setting. As long as the role of the special educator is presumed to be that of an aide to the general educator in the inclusive setting, the kind of collaboration and team work needed to facilitate effective reform based learning will be stymied.

Implications for Teachers

Teachers must understand that they must stick with reform materials, not just in a supplementary fashion, but must allow the materials to be used in a comprehensive way (Briars, 1999). The textbook Ms. Leonard used required the augmentation of reform-based materials. The approach prevents the consistent focus on reformed-based teaching. The fact that the main textbook was not adequate to implement the kinds of activities that MATH Plus stressed was no doubt an inconvenience to Ms. Leonard. An interesting though to consider is, the intended teacher was dedicated to the use of reform-based materials almost exclusively. Ms. Leonard did admit that her use of reform-based materials was rather novel.

Another very important conclusion drawn from the research is that the ability to master basic skills was not a definite prerequisite for higher order thinking (Zohar & Dori, 2003). This was evidenced by the use of conceptually-based mechanisms to attain basic number facts by most of the target students. The students had garnered something in the conceptually-based mechanisms that apparently meant more to them than isolated rote skills. They were able to reconnect to basic number facts much easier using the conceptually-based mechanisms than by memory. A simple, but powerful suggestion needs to be made at this time, and that is, it usually takes more time to do something over and over again than to do it right the first time. It would seem reasonable to suggest that

students are taught in a meaningful manner initially, rather than using a litany of unrelated drills.

Implications for the Role of Inclusive Teachers

Another very significant implication brought forth from this study is the need to change the perception of the relationship between the general and special educators in the inclusive classroom. As long as general educators perceive special educators as their aides in the inclusive classroom, the kind of collaboration that is required to reach all students, especially those with special needs, will not materialize. Special educators must also begin to see themselves as more than general educators' helpers, but peers involved in a collaborative effort to help all students to reach their greatest potential. This effort will require both attitudinal and practical changes in the way that both general and special educators think and act in the inclusive setting.

In order to create the kind of collaborative environment that is necessary to enhance the learning of all students, teachers, especially special educators must be empowered. This kind of empowerment comes from two sources, collaborative professional training and development, and the support of administrators. Administrators must understand the vital role that they can play in creating an inclusive environment in which both special and general educators are placed on equal footing as two well-prepared professionals. Administrators can encourage collaboration and planning among special and general educators and discourage the kind of relationships that advantage one professional over another.

Implications for Teacher Educators

Another important inference drawn from this research is the important role that teacher preparation can play in developing a truly inclusive classroom. As Duchardt, Marlow, Inman, Christensen, and Reeves (1999) found, teacher educators involved in the training of special and general educators can begin the effort by modeling collaboration and co-teaching among each other. This kind of modeling will indicate to pre-service teachers while they are in training that they can work together despite the divergent backgrounds of their chosen professions.

Implications for School Administrators

Administrators must understand the commitment level necessary for the proper implementation of reform-based teaching (Briars, 1999). They must understand that it is not only a commitment by teachers, but a commitment by administrators as well. According to Briars, school administrators must be willing to put some teeth in the commitment to mathematics reform by insisting that teachers be required to implement it when it has been adopted at the school level. Of course, school administrators, as well as teachers, will need to know reform-based mathematics in order to evaluate its implementation. So they will need professional development and training. It is very important that school administrators not only deliver lip service to the efforts to reform teaching, but become advocates of its implementation. The ultimatum must be “either we do it or we don’t.”

Implications for Policy Makers

Policy makers must realize the impact of policy decisions on the successful implementation of reform-based mathematics (Briars, 1999). The very fact that an

administrative decision was made at the district level that negatively impacted the implementation of reform-based efforts at Logan Middle School to the point that it was relegated to a secondary role in Ms. Leonard's class was evidence that there was a lack of thought about the impact of the decision. The implementation of another curriculum plan should have been given some serious thought, and not made without serious input from those who had to ultimately implement it, the teachers.

The point should certainly extend to inclusion as forces drive inclusion and reform into the same space, the inclusive classroom. Policy makers must begin to initiate policies that will positively affect the implementation of reform in inclusive settings. Policy decisions should enable teachers in inclusive settings to provide instruction that gives students the best opportunity to achieve high expectations. An inclusive setting suggests the inclusion of "all" students, but as long as policies are being implemented that reinforce the idea that "some students can and some students can't," it is proof that we have not captured the spirit of what inclusion means.

Conclusions

This research was an attempt to examine real-life issues impacting the implementation of mathematics reform in an inclusive setting. According to the review of related literature, it was posited that a major source of conflict could potentially lie in the interactions between a general educator with a reform-oriented background and a special educator with a positivist background. However, the findings of the research diverged from that possible conclusion. The influences delineated as factors that affected the inclusive environment were identified and discussed in detail, providing insight and

knowledge into the interfacing of two very important topics in education today, inclusion and reform.

One very important conclusion drawn from the research is that the ability to master basic skills was not a definite prerequisite for higher order thinking (Chancellor, 1991). It was evidenced by the use of conceptually-based mechanisms to attain basic number facts by most of the target students. The students had seen something in the conceptually-based mechanisms that apparently meant more to them than some isolated rote learned skills. They were able to reconnect to these much easier than those facts that were derived from the use of them. A simple, but powerful suggestion needs to made at this time, and that is, it usually takes more time to do something over than to do it right the first time. It would seem reasonable to suggest that students are taught in a meaningful manner initially, rather than using a litany of unrelated drills. In the long term, this way saves time if students do not have to be retaught the same skills year after year.

Final Thoughts

This investigation of the intersection between mathematics reform and inclusion has been exhausting experience, but also an informative one. The initial premise was to investigate the implementation of a reform-based approach to mathematics teaching in a school where it had not quite taken root. The conclusions gathered from this research were both unexpected and expected, but the real gist of the study points to the difficult task of trying to implement change in a setting and context where the parties have not sold out to “an attitude of change.” Change is both internal and external, but as long as

teachers, school administrators, and policy makers say one thing and do something else, they are as James Brown, the late king of soul put it, “talking loud and saying nothing.”

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APPENDICES

APPENDIX A

REVISED MATHEMATICS BELIEF INSTRUMENT

REVISED MATHEMATICS BELIEF INSTRUMENT

The following questions should are to be answered according to the degree to which you agree or disagree with each of the sentences.

Part A

1. Problem solving should be a SEPARATE, DISTINCT part of the mathematics curriculum.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

2. Students should share their problem-solving thinking and approaches WITH OTHER STUDENTS.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

3. Mathematics can be thought of as a language that most be MEANINGFUL if students are to communicate and apply mathematics productively.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

4. A major goal of mathematics instruction is to help children develop the belief that THEY HAVE THE POWER to control their own success in mathematics.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

5. Children should be encouraged to justify their solutions, thinking, and conjectures in a SINGLE way.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

6. The study of mathematics should include opportunities of using mathematics in OTHER CURRICULUM AREAS.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

7. The mathematics curriculum consists of several discrete strands such as computation, geometry, and measurement which can best be taught in ISOLATION.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

8. In K-5 mathematics, INCREASED emphasis should be given to reading and writing numbers SYMBOLICALLY.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

9. In K-5 mathematics, INCREASED emphasis should be given to use of CLUE WORDS (key words) to determine which operation to use in problem solving.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

10. In K-5 mathematics, skill in computation should PRECEDE word problems.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

11. Learning mathematics is a process in which students ABSORB INFORMATION, storing it in easily retrievable fragments as a result of repeated practice and reinforcement.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

12. Mathematics SHOULD be taught as a COLLECTION of concepts, skills and algorithms.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

13. A demonstration of good reasoning should be regarded EVEN MORE THAN students' ability to find correct answers.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

14. Appropriate calculators should be available to ALL STUDENTS at ALL TIMES.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

15. Learning mathematics must be an ACTIVE PROCESS.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

16. Children ENTER KINDERGARTEN with considerable mathematical experience, a partial understanding of many mathematical concepts, and some important mathematical skills.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

Part B

17. Some people are good at mathematics and some aren't.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

18. In mathematics something is either right or it is wrong.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

19. Good mathematics teachers show students lots of different ways to look at the same question.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

20. Good math teachers show you the exact way to answer the math question you will be tested on.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

21. Everything important about mathematics is already known by mathematicians.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

22. In mathematics you can be creative and discover things by yourself.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

23. Math problems can be done correctly in only one way.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

24. To solve most math problems you have to be taught the correct procedure.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

25. The best way to do well in math is to memorize all the formulas.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

26. Males are better at math than females.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

27. Some ethnic groups are better at math than others.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

28. To be good in math you must be able to solve problems quickly.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

Part C

29. I am very good at learning mathematics.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

30. I think I will be very good at teaching mathematics.

Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
○	○	○	○	○

APPENDIX B

MATH PLUS ATTITUDINAL SCALE

This page will be separated from your completed survey to make sure that your na linked directly to your responses. We will assign a code number so that your infor survey can be linked to other information from future surveys. All information wil confidential.

(Please print neatly)

Date _____ **School** _____

Name _____
Last Name First Name

Thank you for taking your time to complete this survey.

(Office use only below this line)

	System #	School #	Survey #	2005
	_____	_____	_____	
0	O O O	O O O	O O O O	O O
1	O O O	O O O	O O O O	O O
2	O O O	O O O	O O O O	O O
3	O O O	O O O	O O O O	O O
4	O O O	O O O	O O O O	O O
5	O O O	O O O	O O O O	O O
6	O O O	O O O	O O O O	O O
7	O O O	O O O	O O O O	O O
8	O O O	O O O	O O O O	O O
9	O O O	O O O	O O O O	O O

O O O

Please turn the page and begin.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
13. When planning a mathematics lesson, I know that I am able to provide mathematics activities that are relevant to my students' lives.	O	O	O	O	O
14. If a student is going to be a good problem solver, then it is important for that student to know how to follow directions.	O	O	O	O	O
15. Students should understand the meaning of a mathematical concept before they memorize the definitions and procedures associated with that concept.	O	O	O	O	O
16. Teachers should model and demonstrate mathematical procedures and then, ideally, time should be allowed for the students to have the opportunity to practice those procedures.	O	O	O	O	O
17. I don't feel that I need to recall all of the answers to all of the questions that my students may have about mathematics because I know that I will be able to figure out a solution as my students and I work on a question.	O	O	O	O	O
18. No matter whether I am teaching mathematics to the whole class or to one group at a time, I am most comfortable when I first model the activity, then provide some practice and immediate feedback, and, finally, clarify what the assignment is and how I expect it to be completed.	O	O	O	O	O
19. Students achieve mathematical understanding through the direct personal experience of figuring out their own solutions to problems and then verifying their thinking for themselves.	O	O	O	O	O
20. When students are grouped for instruction on the basis of their past mathematical performance, each student may then receive the level of mathematics instruction that is most appropriate for that student.	O	O	O	O	O
21. Rather than demonstrating how to solve a problem, a teacher should allow students to figure out their own ways of solving mathematics problems and to explain their own ways of solving mathematics problems, including word problems.	O	O	O	O	O
22. Students will not understand a mathematical concept until they have memorized the definitions and procedures associated with that concept.	O	O	O	O	O
23. When I work with a small group of students during a mathematics lesson, I know that I will be able to assess their understanding as I observe them working on mathematical problems and interacting with each other to complete a mathematics task.	O	O	O	O	O

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
24. I feel that most mathematics teachers in my grade level have a better understanding of mathematics than I have.	O	O	O	O	O
25. Teachers should incorporate students' diverse ideas and personal experiences into mathematics instruction that encourages greater student-student and student-teacher interaction.	O	O	O	O	O

SECTION B - Information About The Mathematics Classes You Teach

For this section of the survey, we would like you to report on a specific MATHEMATICS class that you teach. We will call this class your TARGET CLASS. To identify your TARGET CLASS, please read the following instructions carefully. If you teach more than one math class, your FIRST CLASS OF THE WEEK in which MATHEMATICS is taught is your TARGET CLASS (e.g., 1st period Monday, 3rd period Monday, etc.).

Class Information

1. How many different subject or course preparations are you responsible for?

1	2	3	4	5 or more
O	O	O	O	O

Please answer the following questions regarding your TARGET MATH CLASS.

2. What is the grade level(s) of the students in your TARGET MATH CLASS?

Pre-K	1	2	3	4	5	6	7	8	9	10	11	12	Non-graded
O	O	O	O	O	O	O	O	O	O	O	O	O	O

3. On a typical day, how long is your TARGET MATH CLASS?

< 40 minutes	41-50 minutes	51-60 minutes	61-70 minutes	71-80 minutes	81-90 minutes	Over 90 minutes

4. How many students are in your TARGET MATH CLASS?

For example, if you had 18 students:

1	8
0	0
●	1
2	2
3	3
4	4
	5
	6
	7
	●
	9

Number of students in your class:

0	0
1	1
2	2
3	3
4	4
	5
	6
	7
	8
	9

5. Please describe the range of student ability in your TARGET MATH CLASS. (mark only one)

- O Mostly below grade level
- O Mostly below or at grade level
- O A balance of students at, below, and above grade level
- O Mostly at or above grade level
- O Mostly above grade level

6. Approximately what proportion of students in this TARGET MATH CLASS are:

	None	1-25%	26-50%	51-75%	76-100%	Not sure
Title 1 Math	O	O	O	O	O	O
Students with disabilities	O	O	O	O	O	O
ESL students	O	O	O	O	O	O
Gifted and talented	O	O	O	O	O	O
African-Americans	O	O	O	O	O	O

7. Approximately what proportion of students in this TARGET MATH CLASS do you expect to:

	None	1-25%	26-50%	51-75%	76-100%
Graduate from high school	O	O	O	O	O
Attend a trade school or technical school	O	O	O	O	O
Attend a junior college	O	O	O	O	O
Attend a four-year college or university	O	O	O	O	O

Please indicate the extent to which you agree with each of the following regarding the influence you have on student learning in your class.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a. When a student does better than usual, many times it is because I exerted a little extra effort.	○	○	○	○	○
b. The hours in my class have little influence on students compared to the influence of the home environment.	○	○	○	○	○
c. The amount a student can learn is primarily related to family background.	○	○	○	○	○
d. If students aren't disciplined at home, they aren't likely to accept discipline at school.	○	○	○	○	○
e. When a student is having difficulty with an assignment, I am usually able to adjust it to his/her level.	○	○	○	○	○
f. When a student gets a better grade than he/she usually gets, it is because I found better ways of teaching.	○	○	○	○	○
g. When I really try, I can get through to most difficult students.	○	○	○	○	○
h. A teacher is very limited in what he/she can achieve because a student's home environment is a large influence on achievement.	○	○	○	○	○
i. When the grades of my students improve, it is usually because I found more effective teaching strategies.	○	○	○	○	○
j. If a student masters a new concept quickly, this might be because I knew the necessary steps in teaching that concept.	○	○	○	○	○
k. If parents would do more for their children, I could do more.	○	○	○	○	○
l. If a student did not remember information I gave in a previous lesson, I would know how to increase his/her retention in the next lesson.	○	○	○	○	○
m. If a student in my class becomes disruptive and noisy, I feel assured that I know some techniques to redirect him/her quickly.	○	○	○	○	○
n. The influence of a student's home experiences can be overcome by good teaching.	○	○	○	○	○
o. If one of my students couldn't do a class assignment, I would be able to accurately assess whether the assignment was at the correct level of difficulty.	○	○	○	○	○

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
p. Even a teacher with good teaching abilities may not reach many students.	○	○	○	○	○
q. When it comes right down to it, a teacher can't do much because most of a student's performance depends on his/her home environment.	○	○	○	○	○
r. If I really try, I can get through to even the most difficult or unmotivated students.	○	○	○	○	○

0. About how often do students in the TARGET CLASS take part in each of the following types of activities as part of their mathematics instruction?

Never
Rarely (a few times a year)
Sometimes (once or twice a month)
Often (once of twice a week)
All or almost all math lessons

	Never	Rarely	Some-times	Often	All or Almost All
a. Use a computer to practice their math	○	○	○	○	○
b. Use a calculator or computer to explore a concept or extend the understanding of a concept or skill	○	○	○	○	○
c. Promote student participation in small group discussions to help them make sense of mathematics	○	○	○	○	○
d. Listen to me lecture about math	○	○	○	○	○
e. Copy notes or problems off the board	○	○	○	○	○
f. Give a written explanation about how they solved a math problem	○	○	○	○	○
g. Present how they solved a problem to the class	○	○	○	○	○
h. Use wooden or plastic blocks, rods, shapes or other objects to solve a math problem	○	○	○	○	○
i. Work on one math problem or question for more than 10 minutes	○	○	○	○	○
j. Do 10 or more practice problems by themselves	○	○	○	○	○
k. Memorize formulas and rules for a test or quiz	○	○	○	○	○
l. Do math problems that require critical thinking	○	○	○	○	○
m. Think about why something in math class is true	○	○	○	○	○

	Never	Rarely	Some-times	Often	All or Almost All
n. Do math projects or investigations that take several days to complete	O	O	O	O	O
o. Apply math situations to life outside of school	O	O	O	O	O
p. Take tests where they have to explain their answers	O	O	O	O	O
q. Take multiple-choice tests	O	O	O	O	O
r. Complete many math problems quickly	O	O	O	O	O
s. Practice to take a standardized-test, like the SAT-10 or AHSGE	O	O	O	O	O

11. How much time do you spend preparing students in your TARGET MATH CLASS for standardized tests, such as the SAT-10 or AHSGE? (mark only one)

O 1 day or less
O 2 days
O 3 days
O 4 days
O 1 week
O 2-3 weeks
O 1 month or more

SECTION C - Background Information

1. How many years have you: (round up to the nearest year)

Example:

2	5
00	00
10	10
20	20
30	30
40	40
	50
	60
	70
	80
	90

Years taught at this school?

00	00
10	10
20	20
30	30
40	40
	50
	60
	70
	80
	90

Total years as a teacher?

00	00
10	10
20	20
30	30
40	40
	50
	60
	70
	80
	90

2. Have you ever taught outside this school system?

O Yes O No

3. Are you a graduate of this school system?

O Yes O No

4. What is the highest level of education you have completed?
   - O Bachelors degree
   - O Bachelors with additional graduate credits
   - O Masters degree
   - O Masters + 15 credits
   - O Masters + 30 credits
   - O Masters + 45 credits
   - O Specialist
   - O Doctorate

5. Please indicate whether your degree(s) were in Mathematics Education, Mathematics, or another discipline:

Bachelors:	O Elementary Ed	OMath Ed	OMath	O Other, please specify: _____
Masters:	O Elementary Ed	OMath Ed	OMath	O Other, please specify: _____
Specialist:	O Elementary Ed	OMath Ed	OMath	O Other, please specify: _____
Doctorate:	O Elementary Ed	OMath Ed	OMath	O Other, please specify: _____

6. Approximately how much time overall have you spent in professional development during the past year?

Less than 20 hours	20-40 hours	41-80 hours	81-120 hours	121-160 hours	Over 160 hours
O	O	O	O	O	O

7. Approximately how much time have you spent in professional development associated with TEAM-Math during the past year?

None	Less than 5 hours	6-10 hours	11-15 hours	16-20 hours	Over 20 hours
O	O	O	O	O	O

8. Approximately much time have you spent in mathematics-specific professional development (other than that offered by TEAM-Math) during the past year?

None	Less than 5 hours	6-10 hours	11-15 hours	16-20 hours	Over 20 hours
O	O	O	O	O	O

9. Are you:

O Female O Male

10. Are you:

- O African-American (Black)
- O Asian-American
- O Biracial/Multiethnic
- O Hispanic
- O Native American
- O White, Non-Hispanic
- O Other (please specify): _____

SECTION D - Involvement in MATH Plus

1. Please answer the following questions to the degree to which you agree or disagree with each of the sentences.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
a. Members of our school meet regularly to discuss the progress of our efforts.	O	O	O	O	O
b. I am more enthusiastic about our school now that I am involved in this project.	O	O	O	O	O
c. I personally support the MATH Plus mission and vision.	O	O	O	O	O
d. Our school has enough staff, time, and other resources to really make this project pay off for the school.	O	O	O	O	O
e. The assistance of the MATH Plus project team was valuable in preparing for this project.	O	O	O	O	O
f. The MATH Plus mission and vision are understood by members of our school.	O	O	O	O	O
g. I am satisfied with our relationship with members of the TEAM-Math project team.	O	O	O	O	O
h. I have found the MATH Plus Curriculum Guide useful.	O	O	O	O	O
i. I am trying to implement the MATH Plus curriculum in my classroom.	O	O	O	O	O

2. To what extent have you personally been involved in this project? (Mark all that apply.)

- O Not involved at all
- O Not directly involved, but I have heard about MATH Plus from colleagues who are involved
- O Involved in extensive discussions about MATH Plus with colleagues
- O Involved in implementing aspects of MATH Plus in my school
- O School Teacher Leader
- O District Teacher Leader
- O Other (please specify): _____

3. In what ways would you like to become further involved with the MATH Plus Project?

APPENDIX C

TEACHER SURVEY

Teacher Survey
Answer each question to the best of your knowledge.

1. In your own words state your teaching philosophy.

2. Would you describe your teaching as traditional or reform oriented? Explain.

3. In what ways is your teaching similar to the way that you were taught?

4. Are you familiar with the basic tenets of constructivism?
   If so, give a brief description of constructivism.

5. When a student derives a correct answer, what should happen if that student cannot explain his or her answer?

6. Should the teacher be more concerned about a student achieving the correct answer or how a student arrived at the correct answer? Explain.

7. How important is it for teachers to relate the teaching of mathematics to the real world? Explain.

8. In your opinion, how do children learn best?

APPENDIX D

PRIMARY DOCUMENTS TABLE

Primary Documents

Primary Document	Description
1	Conversation- General Educator's Views on Inclusion
2	Conversation- Ms. Leonard
3	Conversation-Ms. L-11-16
4	Semi-Structured Interview-Ms. L.-11-16-2005.
5	Semi-Structured Interview-Mr. Varner.-11-16-2005
6	Semi-Structured Interview- Assistant Principal-12-09-2005
7	Semi-Structured Interview-Principal -12-12-2005
8	Semi-Structured Interview-District Administrator - 1-20-2006
9	Faculty Meeting-9-6-2005
10	Faculty Meeting-October 3
11	Teacher Pods Meeting-10-24-2005
12	Tape Aug 17
13	Tape August 26
14	Tape Sep 9. Tapes of Ms. Leonard’s class
15	Tape Sept 28 Tapes of Ms. Leonard’s class
16	Tape October 5 Tapes of Ms. Leonard’s class
17	Tape - October 7 Tapes of Ms. L. class
18	Tape Oct 21 Tapes of Ms. L. class
19	Tape October 28 Ms. L Class
20	Tape Oct 31 Tapes of Ms. L. class
21	Tape-November 2 Ms. L. Class
22	Tape-11-02-2005-Mr. V.
23	Transcription-Ms L. Class-11-07-2005
24	Tape Nov 14 Tapes of Ms. L. class
25	Tape Nov 16 Tapes of Ms. L. class
26	Tape Dec 7 Tapes of Ms. L. class
27	Olivia Leonard's Teaching Survey
28	Ulysses Varner's Teaching Survey
29	Conversation-Mr. V.-11-07-2005
30	Tape Sept 19 Tapes of Ms. L. class
31	Tape Sept 7 Tapes of Ms. L. class
32	Tape Sept 3 Tapes of Ms. L. class
33	Tape Sept 30 Tapes of Ms. L. class
34	Aug. 8 Field Notes by Week
35	Aug. 15 Field Notes Week
36	Aug. 22 Field Notes by Week
37	Nov. 7 Field Notes by Week
38	Nov. 14 Field Notes by Week
39	Nov. 28 Field Notes by Week
40	Nov. 28 Field Notes by Week

Primary Document	Description
41	Oct. 3 Field Notes by Week
42	Oct. 17 Field Notes by Week
43	Oct. 24 Field Notes by Week
44	Oct. 31 Field Notes by Week
45	Sept. 5 Field Notes by Week
46	Sept. 12 Field Notes by Week
47	Sept. 19 Field Notes by Week
48	Sept. 26 Field Notes by Week
49	Aug. 8 Reflective Journal by Week
50	Aug. 15 Reflective Journal by Week
51	Aug. 22 Reflective Journal by Week
52	Sept. 12 Reflective Journal by Week
53	Sept. 19 Reflective Journal by Week
54	Sept. 26 Reflective Journal by Week
55	Oct. 3 Reflective Journal by Week
56	Oct. 17 Reflective Journal by Week
57	Oct. 24 Reflective Journal by Week
58	Oct. 31 Reflective Journal by Week
59	Nov. 7 Reflective Journal by Week
60	Nov. 14 Reflective Journal by Week
61	Nov. 21 Reflective Journal by Week
62	Nov. 28 Reflective Journal by Week
63	Conversation-Mr.V-11-02
64	Conversation with Special Educator September 3rd
65	Short Conversation with special educator September 7th

APPENDIX E

DETAILED PRIMARY DOCUMENTS FAMILIES TABLE

Detailed Primary Documents Families

Name	Comments	Primary Documents	Frequency
Class Transcriptions	This family consists of transcriptions of the general educator's class and the special educator's class. (There is only one transcription of the special educator's class.)	• Class Transcription Aug. 17 • Class Transcription Aug. 26 • Class Transcription Sept. 3 • Class Transcription Sept. 7 • Class Transcription Sept. 9 • Class Transcription Sept. 19 • Class Transcription Sept. 28 • Class Transcription Sept. 30 • Class Transcription Oct. 5 • Class Transcription Oct. 7 • Class Transcription Oct. 21 • Class Transcription Oct. 28 • Class Transcription Oct. 31 • Class Transcription Nov. 2 (Mr. Varner) • Class transcription Nov. 2 (Varner) • Class Transcription Nov. 7 • Nov. 14 Class Transcription • Nov. 16 Class Transcription • Dec. 7 Class Transcription	17 11 17 3 12 14 21 10 11 4 24 3 4 2 2 12 16 19 10
Conversations	This family consists of the informal conversations that I had with the two educators.	• Conversation — General Educator's Views on Inclusion-10-21 • Conversation- Ms. L.-11-18 • Conversation-Ms. L- 11-16 • Conversation-Mr.V.-11-07 • Conversation-Mr.V-11-02 • Conversation with Special Educator September 3rd • Short Conversation with special educator September 7	11 51 2 35 13 7 2

Field Notes Entries	Field Notes by Week Family consists of the field notes that the researcher gathered by the week	• Aug. 8 Field Notes • Aug. 15 Field Notes • Aug. 22 Field Notes • Aug. 29 Field Notes • Sept. 5 Field Notes • Sept. 12 Field Notes • Sept. 19 Field Notes • Sept. 26 Field Notes • Oct. 3 Field Notes • Oct. 17 Field Notes • Oct. 24 Field Notes • Oct. 31 Field Notes • Nov. 7 Field Notes • Nov. 14 Field Notes • Nov. 28 Field Notes	24 3 9 8 9 12 15 18 14 1 12 13 4 16 12
Interviews	This is the family of semi-structured interviews with teachers and administrators	• Semi-Structured Interview-Ms. L. • Semi-Structured Interview-Mr. V. • Semi-Structured Interview-Ivey Lyle-Assistant Principal • Semi-Structured Interview-Dr. Aaron-Principal • Semi-Structured Interview-Brenda Barnes	39 47 53 14 47
Reflective Journal	This family consists of the entries from the researcher's reflective journal as they were gathered by the week.	• Aug. 8 Reflective Journal • Aug. 15 Reflective Journal • Aug. 22 Reflective Journal • Sept. 12 Reflective Journal • Sept. 19 Reflective Journal • Sept. 26 Reflective Journal • Oct. 3 Reflective Journal • Oct. 17 Reflective Journal • Oct. 24 Reflective Journal • Oct. 31 Reflective Journal • Nov. 7 Reflective Journal • Nov. 14 Reflective Journal • Nov. 21 Reflective Journal • Nov. 28 Reflective Journal	5 2 10 9 10 13 15 14 11 11 7 18 3 12

Meetings	The Meetings Family consisted of the notes and references that the researcher gathered from faculty meetings and other meetings (PTO)	• Faculty Meeting–9-6-2005 • Faculty Meeting–October 3 • Teacher Pods Meeting–10-24	22 5 8
Surveys	This family contains the two surveys done by each educator	• Olivia Leonard's Teaching Survey • Ulysses Varner's Teaching Survey	13 6

APPENDIX F

CODES TABLE

Code	Description	Frequency
Low Achievers	These were quotations about or from the low achievers.	70
Basic Skills Emphasi	This code refers to the incidents and activities related to the overwhelming emphasis on basic skills.	46
Homework	The homework was an intricate part of the class' activities.	31
Outside Influences	The influences included: NCLB, seven month plan, principal's plan, adherence to requirements for gifted and special students, state department edits, pacing charts, and IDEA. These influences are cascading down on the school and ultimately on the teachers and students in the classroom to create a dynamic that places the reform teacher between a rock and a hard place.	30
Conceptual Emphasis	There was a significant amount of emphasis placed on the idea that the students were supposed to understand what they were doing, even though they would turn right around and drown that with emphasis on drill and rote memory.	29
New Curriculum Plan	This is the plan developed by the curriculum specialist, to help rectify the deficiencies at different schools in the county. This plan, according to the curriculum specialist, was developed with the input of the teachers, but their responses to it signaled that there were unexpected consequences that had not been addressed.	28
Lack of Time	There was a constant complaint from the general educator that with all of things that the teachers are asked to do within the constrained period of seven months, there was simply not enough time.	24
MATH Plus	This was the systemic approach to mathematics being examined in this study	23
Designated Responsibilities	Students were assigned certain tasks to do, both in the classroom and outside the classroom. This code references those statements.	23
Student Participation	This code contained instances where the students were actually doing something other than just listening to the teacher.	22
Principal's Plan	A plan developed by the principal for improvement in the special education performance at this school.	22
Reform Math	References connected to reformed-based mathematics.	21

Code	Description	Frequency
Isaac	This code is about Isaac, the Title One low achiever.	21
Brenda	Code with references to Brenda, one of the low achievers. She was the real slow one.	20
Preparation for Big Tests	Overwhelming is the word that describes the effect of the preparation for the SAT and ARMT that were scheduled in the spring.	20
Rewards	Code referring to the importance of rewards in this class.	19
Hands On Activities	This referred to the activities that involved manipulatives.	19
Sarah	Sarah is the black female special education student, who was identified as a low achiever.	17
Conflicting Interest	This code is about the constant back and forth between trying to satisfy the demands of the basic skills emphasis and the conceptual emphasis.	16
Multiple Ways to Teach and Learn	This code refers to the comments made about different approaches used to approach teaching and learning.	16
Attitude Toward Inclusion	This code refers to the general attitude at this school toward inclusion	15
SRMT	The preparation for the SRMT, though it consumed a fair amount of class time teaching the SRMT and the test-taking skills needed for it, it also lead to more teaching for understanding because it evaluates not only the correct answer, but the process that led to that answer.	14
Janice	The lowest performing low achiever.	14
NCLB Demands	The many implications of No Child Left Behind are mentioned here.	14
Crux of the Matter	This seems to get to the real issue of where the tire meets the road. These low achievers are capable of understanding the concepts that are behind these skills that are being taught, but so much time and effort is being spent on getting a number that they seem to not be able to follow through.	13
Smart Student	This student was frequently called upon, especially to get things started.	13
Testing	This refers to the teaching of test taking skills.	13
Training and Professional Development	The administrators recognized the value of training and professional development to the teachers.	11

Code	Description	Frequency
Accommodations	The low achievers received cues and advice while doing their tests.	10
I Do What I'm Told	This code reflected the attitude that teachers and staff were supposed to follow the edits and mandates handed down to them.	10
Lack of Resources	Refers to comments about the lack of resources as being a source of their problems.	10
Attitude Toward Reform	This code references the various comments made about reform mathematics and MATH Plus, in particular.	9
Collaboration	Collaboration between the individuals concerned with the education of students and especially special needs students is something that is needed and requested, but is not being realized.	9
Just Do What You Are Told	The attitude that permeated both school and district administrators that their subordinates should follow their instructions.	9
Full Inclusion	Comments made about the status of full inclusion at this school.	9
SAT	References to the Stanford Achievement Test (Version 10)	9
Contradiction	These statements seemed to contradict something that the person had already said.	8
Amy	Amy, a special ed student, identified as a low achiever.	8
Profile of Special Educator	Description of the special educator gathered from the survey.	8
Test Driven Objective	Doing well on the tests in the spring was not only the desired result of what the school was trying to accomplish, but this desire seemed to have the reason for having school.	8
No MATH Plus	The students were probably not familiar with the use of manipulatives due to the fact that the feeder school was not implementing MATH Plus.	8
Fixing Homework	The students were allowed to correct their homework	8
Administrative Instability	Refers to the many administrative changes.	8
Derailment of Initial Plan	I had intended to do observation of a teacher with whom I had already spent some time observing in the spring.	8
Transition	This code records instances of the transition from basic skills emphasis to conceptual skills emphasis.	8

Code	Description	Frequency
Lost Sheep	Referred to Janice, the low achiever.	8
Attitude Toward Disabled	This code refers to the general attitude toward those who needed assistance that the average person would not need.	8
Role of Special Educator	Described what the special educator actually did in the class.	8
Order and Protocol	This code referred to the fact that there was a definite way to do things, both in this class and at this school.	8
Monica	One of the low achievers, a black female who was neither special ed nor Title One.	7
Support for Research	This code is about positive responses to this research.	7
MATH Plus Administrative	This code refer to comments made by administrators about MATH Plus.	7
Looking to the Hills	Attitude that looked for solutions to come from the higher-ups.	7
Laissez Faire Attitude	The attitude that refused to anticipate and prepare for impending changes, such as full inclusion.	7
Unfairness	This code points out the unfairness to both teachers and students that this cascade of influences have made such an impression on what goes on in the classroom.	7
Profile of General Educator	Description of the general educator gathered from the survey.	7
Positive Results of Reform Math	These low achievers are gaining conceptual understanding relative to the skills, but there is so much emphasis on getting a right answer on a test, there seems to be little resources left to really reinforce that understanding.	6
RMSTI (Reform Mathematics and Science Teaching Initiative)	This code refers to another reform initiative that was state supported.	6
Faculty Stability	These two teachers had been working at this school for over twenty years and were very familiar with the school. The faculty in general was pretty stable, unlike the administration.	6
Board Work	This code references work done at the board in class.	6
Expectations	Statements relative to expectations about different aspects at this school.	6
Difficult Task	This code refers to issues that were described as difficult.	6

Code	Description	Frequency
Expectations for Special Ed Students	The possible conflict between following the IEP and the expectations for students in an inclusive environment in which a systemic approach to mathematics reform had been implemented was my intended point of interest.	6
NCTM Standards	Things referred to reform as suggested in the Standards.	6
Equilibrium Regained	This code describes the feeling of relief I experienced when the hopes of getting this study off the ground were beginning to appear	5
Expectations for Reform Math	This code references expression about the future of math reform.	5
Faith in Reform Math	Expressions made that expressed confidence in reform mathematics	5
Correct Emphasis	This code mentions the quotations that centered on the students being the important aspect of schooling.	5
Role of Special Educator by Special Educator	The special educator's view of what he should be doing in an inclusive class.	5
Attitude Toward Low Achievers	This code refers to references made about the low achieving students. These included: special ed, Title One, and others.	5
Real World	Refers to the connection between what students do in class and the real world.	5
After the New Curriculum Plan	What is going to happen in the class after the tests are given in the spring?	4
Doubts About What I'm Seeing	I had my doubts about the general educator's initial comments and when I started to observe her class, those doubts were multiplied.	4
Test Driven Curriculum	This code refers to the fact that much of what was done at this school was motivated by the need to pass the tests in the spring.	4
Intimidation	This refers to incidents that represent attempts to intimidate.	4
Positive Results of Inclusion	This was an expected result of inclusion, but there ought to be other positive results observed if one has a positive attitude toward inclusion in general.	4
Confusion	There was a cloud present about many issues at this school and this code refers to that cloud.	4
Special Education History	References about issues that are rooted in special education history.	4

Code	Description	Frequency
Special Education Dilemma	What to do with the special education student is still a dilemma that schools face today.	4
Familiar Faces	People who I knew already	3
Coercion	This code refers to the feeling of coercion that exuded from some of the interviewees, when they were questioned about some of the things that they had to do, even when they did not agree with them or wanted to do them.	3
Coming Together	This code is about the point in the study when I started to notice a reform strand coming through in this class.	3
We Get What We Get	The fact that there was little or no planning that existed between the two teachers and the fact that there seemed to be no plans for any would suggest that it was alright to get what you get in the classroom.	3
Alternative Setting	This code refers to activities that occurred in alternate settings, such as for those students who were placed in other teaching environments because of their behavior.	3
What Special Ed Students Need		3
Teaching Philosophy	The teaching philosophies of both educators are recorded under this code.	3
Ideal Environment	The ideal environment for the implementation of inclusion was one in which the two teachers were on equal standing. (Co-Teaching Setting)	3
Product Driven	Described the aim and thrust of the special educator.	3
Negative Results of Inclusion	Expresses concerns about downside of inclusion.	3
Important Statement	Statements that seemed to really express that person's feelings about a certain issue.	3
Make Your Own Rules	Expressed the idea that this school's administration made its own rules, especially when it came to the disabled.	3
Mathematical Connection	Statement that referred to the idea of making different topics relate to each in mathematics.	3
Reform Math Theory	Responses to questions about the knowledge of the theory behind reform-based mathematics.	3

Code	Description	Frequency
Logistics	Referred to comments about dealing with the problems of getting things or people in the right place at the right time.	3
Not Much Help	The quotations mentioned under this code referred to the ineffectiveness of the Title One resources as exhibited in this class.	3
Negative Response to MATH Plus	Expresses the idea that Math Plus had some shortfalls.	2
Competition Encouraged	This is about the competitive atmosphere in this class.	2
Teaching Style		2
Ambivalent Administrative Support	This code points to the wishy washy support of the school's administration of reform.	2
Administrative Support	The administrative support for MATH Plus was at best tenuous at this school. There seemed to be a wait and see attitude about MATH Plus, waiting to see if it would go away or waiting to see if the powers that be would demand that they had to do something else with it	2
Role of General Educator by General Educator	Her role as the teacher was more of the person in charge as displayed by her actions during the class. She was the person actually doing the teaching in the class. Her comment relative to "those children" in the interview would suggest that the special education students in her class were the special educator's responsibility while he was there, but hers if he was not there.	2
ARMT and Conceptual Emphasis	There was a definite connection between the ARMT and a conceptual emphasis in this class. This code refers to that connection.	2
Positive Reinforcement	The general educator often praised the students for positive behavior	2
Positive Results of Research	Some things revealed to administrators as a result of this research.	2
Role of Special Educator by General Educator	The general educator considered the role of the special educator to be that of an outsider or as an aide to the teacher. Her reference to the model seems to reflect this point of view	2
I Got It	This is the point when the light bulb comes on for the student, the point where the student really understands what he or she is doing.	2

Code	Description	Frequency
Wait It Out Attitude	There seemed to be the attitude that MATH Plus was going to just go away after the five years was up, similar to the way that other reform efforts had faded away.	2
Desperation	Statements about feelings of despair.	2
Intended Plan Of Study	Refers to what I had intended to do before with this research.	2
I'll See You Around	This code referred to the expected longevity of MATH Plus and reform math in general.	2
Intervention Tools	Tools used to save students from failing.	2
Expectations For Inclusion	This code is about the expected future of inclusion.	2
Going Through The Motions	Statements made about adjusting to the situation at hand.	2
Expectations For Low Achievers	This code is about comments made about low achievers.	2
Lack of Planning	There was very little planning between the two teachers in this classroom.	2
Reversed Tensions	What happened to this special educator was the opposite of what I thought was going to happen to the general educator in my desired environment.	1
Role of General Educator by Special Educator	The special educator's view of what the general educator should be doing in an inclusive class.	1
Ain't Going Nowhere	The general educator indicated that she didn't think that reform mathematics teaching was going anywhere, either MATH Plus or some similar approach would ultimately be adopted by the powers that be.	1
Anger	This code refers to the anger at the school about the way that things were going as a result of No Child Left Behind (NCLB).	1
Put it in the Teachers' Lap	The code that describes the fact that after all has been said and done, the responsibility is placed with the teacher.	1
Investigations	Investigation was reform-based curriculum materials.	1
My Opinion	The opinion of that person	1
Not Just Connected To Tests	Comments that emphasized that the tests were not the reason for school.	1

Code	Description	Frequency
Confronting Intimidation	Code about the result of confronting the intimidating environment at this school	1
My Role	Refers to a comment made to the researcher about what he was supposed to have been doing during a test.	1
Confession	A confession made by the general educator about reform math.	1
Optional Participation	This referred to the optional participation by teachers in MATH Plus.	1
Better Late Than Never	This code refers to the late implementation of full inclusion at this school.	1
Not On The Same Page	The relationship between those making decisions and those being affected by those decisions.	1

APPENDIX G

CODES FAMILIES DETAILED TABLE

Code Families Detailed

Name	Comments	Codes	Frequency
Administrative Influence	This code family represents those issues relative to the unexpected effect coming from the administration.	[Administrative Instability] [Ambivalent Administrative Support] [Coercion] [I Do What I'm Told] [Intervention Tools] [Intimidation] [Just Do What You Are Told] [Lack of Resources] [Laissez Faire Attitude] [Looking to the Hills] [Make Your Own Rules] [MATH Plus Administrative] [Missing Administrative Support] [New Curriculum Plan] [Principal's Plan] [Role of Special and General Educator by Principal] [Wait It Out Attitude]	122
Consequences	This is the code family that covers the results or consequences of the study.	[After the New Curriculum Plan] [Basic Skills Emphasis] [Conceptual Emphasis] [Mixed Messages] [Crux of the Matter] [Lack of Time] [Lost Sheep] [Positive Results of Research] [Reversed Tensions] [Support for Research]	148
Divergent Paths	This family of codes depicts the mixed messages being relayed during the implementation of MATH Plus at Logan Middle School	[Administrative Support] [Basic Skills Emphasis] [Conceptual Emphasis] [Math Plus] [Missing Administrative Support] [No MATH Plus] [SAT] [SRMT] [Transition]	138
High Stake Testing Influence	This family consisted of codes that were related to the unexpected high stakes testing influence.	[SRMT] [Basic Skills Emphasis] [Conceptual Emphasis] [Multiple Ways to Teach and Learn] [Preparation for Big Tests] [SAT] [Test Driven Curriculum] [Test Driven Objectives] [Testing]	130

Inside the Classroom	This code family is a way of expressing what I feel are the important issues relative to the environment of the classroom, whether they are incidents, students, teachers, structure, or any phenomenon involving the classroom	[Basic Skills Emphasis] [Behavior and Discipline] [Board Work] [Coming Together] [Conceptual Emphasis] [Confession] [Conflicting Interests] [Contradiction] [Crux of the Matter] [Designated Responsibilities] [Doubts About What I'm Seeing] [Fixing Homework] [Hands On Activities] [Homework] [I Do What I'm Told] [Investigation] [Lack of Planning] [Lack of Time] [Looking to the Hills] [Lost Sheep] [Low Achievers] [Mathematical Connections] [Multiple Ways to Teach and Learn] [Not Much Help] [Order and Protocol] [Ordering Whole Numbers] [Positive Results of Inclusion] [Positive Results of Research] [Preparation for Big Tests] [Real World] [Rewards] [SAT] [Student Participation] [Testing]	411
Reform Mathematics Influence	How reform issues affected what went on in the class is the essence of this code family.	[Ain't Going Nowhere] [AMSTI (Alabama Mathematics and Science Teaching Initiative)] [ARMT] [Attitude Toward Reform Math] [Collaboration] [Conceptual Emphasis] [Correct Emphasis] [Expectations for Reform Math] [Faith in Reform Math] [Hands On Activities] [I'll See You Around] [I Got It] [Investigations] [Math Plus] [MATH Plus Administrative] [Mathematical Connections] [Missing Administrative Support] [Multiple Ways to Teach and Learn] [Positive Results of Reform Math] [Positive Results of Reform Math] [Real World] [Reform	167

		Math] [Reform Math Theory] [Reversed Tensions] [RMSTI (Regional Mathematics and Science Teaching Initiative)] [SRMT] [Training and Professional Development]	
Special Needs Influences	The Special Needs Family has to do with how things like special education, Title One, and other issues affected the low achievers in the class.	[Accommodations] [Attitude Toward Disabled] [Attitude Toward Inclusion] [Attitude Toward Low Achievers] [Crux of the Matter] [Expectations for Special Ed Students] [Full Inclusion] [Lack of Planning] [Laissez Faire Attitude] [Logistics] [Lost Sheep] [Low Achievers] [NCLB Demands] [Negative Results of Inclusion] [Not Much Help] [Positive Results of Inclusion] [Reversed Tensions] [Role of Special Educator] [Role of Special Educator by	183
Target Students	This family included the six low achievers.	[Amy] [Brenda] [Isaac] [Janice] [Sarah] Monica	75

APPENDIX H

SAMPLE OF STUDENT'S WORK

Sample of student work that utilized one of the reform-based mechanisms to accomplish basic computation