DEVELOPING A PROFESSIONAL LEARNING COMMUNITY AMONG
MATHEMATICS TEACHERS ON TWO MONTANA INDIAN RESERVATIONS

by

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November 2006
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This study documents the development of a professional learning community [Math Inquiry Group] of mathematics teachers from schools on or near the Crow and Northern Cheyenne reservations in Southeast Montana (referred to in this study as the bounded system) using an approach referred to as ALRR (Ask, Listen, Respond and Reflect). It adds to the current body of literature identifying professional learning communities as a recommended method to improve classroom practice and close achievement gaps in mathematics. Although much has been written about professional learning communities within a given school or district, there is little advice for those wishing to develop a professional learning community across schools.

Teachers and administrators in the bounded system were committed to improving student learning in mathematics but struggled to do so within the context of high student mobility rates and a serious lack of consistent curricular material. The use of ALRR helped establish a spirit of trust among Math Inquiry Group [MIG] participants while responding to important contextual factors. The identified contextual factors were organized around three themes: organizational, family and community, and policy factors.

Twenty-three mathematics teachers from grades 5-12 were interviewed about their participation in the professional learning community known as MIG over a three-year period. The researcher’s analysis of the interview transcripts indicates teacher participation in MIG addressed their professional, intellectual, emotional, and personal needs. Teachers also identified an increase in personal content and pedagogical knowledge of mathematics and an increased self-confidence in their ability to teach the content. These in turn influenced their classroom practice. Through the process, teachers began to change their sense of professional identity.
CHAPTER 1

INTRODUCTION

The literature has fully documented the characteristics of professional development for teachers that results in increased student achievement. The one-shot workshops of the 1970’s that were designed to help teachers implement “teacher proof curricula” have been replaced with teacher-driven, classroom focused learning that is embedded in the teachers’ daily work (Katzenmeyer & Moller, 2001; Newmann & Wehlage, 1995; Kanold, 2002; Rosenholtz, 1989; Louis, Marks & Kruse, 1996). In the late 1990’s the idea of forming professional learning communities emerged as an avenue to build organic structures that could engage teachers in collaborative learning and help to improve student learning (Louis et al., 1996). The format of professional learning communities provides teachers opportunities to collaboratively establish shared values and goals which are focused on increased student achievement. These communities are seen as a promising area of inquiry concerning teacher learning and change in schools (Smylie & Hart, 1999).

This dissertation examines the process of establishing a professional learning community of mathematics teachers who teach in schools on or near two Indian reservations in Southeastern Montana. The study documents the contextual factors that limit or enhance the process of establishing such a professional learning community. The study also examines teachers’ perceptions of changes in their classroom practice and their
perspectives of responsibilities as professional educators that occurred as a result of participation in a professional learning community.

Setting

Geography

The Crow and Northern Cheyenne reservations are located in “big sky” country, 50 miles southeast of Billings, the largest city in the state of Montana. Driving onto the Crow reservation for the first time, one is struck with the beauty and breadth of the isolated landscape. The rolling hills, green in spring, golden in late summer and fall, stretch unbroken for hundreds of square miles. Scattered throughout this beautiful landscape are small towns consisting of trailers and government issue houses with an occasional tipi in the front yard. Horses languidly graze in the short sweet grass nearby.

Most of the residents who reside in small towns located on the Crow and Northern Cheyenne reservations are Native American. Larger towns located on the reservation borders have mixed populations and provide services and supplies to reservation communities.

The Crow reservation, established in 1851, is about the size of the state of Connecticut. Its smaller neighbor, the Northern Cheyenne reservation established in 1884, is about the size of Rhode Island (Figure 1). The land was assigned to the tribes by the federal government. Although the two reservations are adjacent to each other, the Crow and Northern Cheyenne are traditional enemies. Tribal or federal law governs all of the reservation land even though it is not all owned by Native Americans. Native
Americans feel a close connection to their land and guard their right to control what occurs on it.

Figure 1. Native American Reservations in Montana.

Driving south on I-90 from the northern boundary of the Crow reservation, white headstones on the hillside mark the places where Gen. George Custer’s men fell fighting Native Americans during the Battle of the Little Big Horn in 1876. This battle was fought over the use and ownership of the land that Native Americans had lived on for centuries. Today, a newly created monument, erected to commemorate the role the Native Americans played in this memorable event, shares the lonely hillside with memorials to the United States Cavalry. The monument honors members of many tribes who fought on both sides of the battle. Members of the Crow tribe served as scouts for
Gen. Custer while the Northern Cheyenne joined the Sioux and other tribes in their fight against Custer. These tribes were fighting to protect the only way of life they had ever known. Today, descendents of both tribes share classrooms scattered throughout the two reservations. Elders are quick however to remind visitors that even though they are all Native Americans, the tribes are very different. Members of both tribes retain strong links to their cultural roots and continue to use their native languages in daily life.

Demographics

The teachers who participated in this study teach in a variety of public, parochial or tribally controlled schools located on or near the Crow and Northern Cheyenne Indian reservations. There are five public K-12 districts, two public K-8 districts, one tribally run K-12 district, and one parochial K-12 district with a boarding school option and two feeder K-8 schools. The two largest K-12 public districts are located in towns just outside the borders of each reservation.

In this study, the combination of districts described above will be referred to as a “bounded system” (Figure 2). The districts are described as bounded because students frequently transfer between schools located on or near the reservations that form the “bounded system” but seldom move to schools outside of that system. Similarly, students seldom move into schools from outside the system.

Isolation

The school districts in this bounded system are located in ten towns that are separated from each other by up to sixty miles. The vast rolling land between towns
contains few man made structures. An occasional herd of cows spots the landscape, while majestic snow capped mountains can be seen in the distance. The feeling of isolation created by these vistas is amplified by the lack of access to communication deemed necessary by most Americans today. Cell phone and reliable Internet service becomes nonexistent a few miles into the reservations, and remains unavailable throughout the drive from one side of the reservations to the other. There is no bank on the Crow reservation and there is no gas station or grocery store in the town of Busby. These real and perceived distances make educational communication difficult for the teachers of students who frequently move between schools throughout the “bounded system” (Figure 2).

**Figure 2. Bounded System.**
Need for a Mathematics Professional Learning Community

The concept of a “professional learning community” grows out of the larger conceptual family of Wenger’s (1998) “communities of practice” (Halverson, 2003). According to Wenger’s theory of learning,

engagement in social practice is the fundamental process by which we learn and so become who we are. The primary unit is neither the individual nor social institution but rather the informal communities of practice that people form as they pursue shared enterprises over time (cover page).

The literature indicates participation in professional learning communities “promotes collective responsibility for student learning and norms of collegiality among teachers” that are associated with higher levels of student learning (Halvorsen, 2003, p. 3). When teachers have the opportunity to plan, teach, and reflect on their own and each other’s practice, they can address common problems of practice in a supportive environment (Darling-Hammond & McLaughlin, 1995) while at the same time increasing their own content and pedagogical knowledge. As stated by the National Commission on Teaching and America’s Future (2003), “Quality teaching requires strong professional learning communities. Collegial interchange, not isolation, must become the norm for teachers. Communities of learning can no longer be considered utopian; they must become the building blocks that establish a new foundation for America’s schools” (National Council of Supervisors of Mathematics [NCSM], 2003, p. 1).

Increased attention in the literature is being paid to the effects of teacher collaboration on teaching and learning and the social factors that nurture this collegiality.
In their longitudinal study of 400 Chicago elementary schools that successfully restructured schools, Bryk and Schneider (2003) state:

Good schools depend heavily on cooperative endeavors. Relational trust is the connective tissue that binds individuals together to advance the education and welfare of students. Improving schools requires us to think harder about how to best organize the work of adults and students so that this connective tissue remains healthy and strong (p. 44).

Establishing a professional learning community requires opportunities for individual teachers to listen to and interact with others. Participants observe the performances of each other and discuss successes and failures. Teachers are exposed to new information and get access to clear and meaningful feedback about individual and school performance (Smylie & Hart, 1999).

**Contextual Factors**

The establishment of a professional learning community always occurs within a specific context. Each context is unique and must be given careful consideration because each context is “complex, comprising many interconnected and dynamic influences” (Loucks-Horsley et al., 2003, p. 9). The literature has identified a number of contextual factors that must be taken into consideration such as: student mobility, poverty, isolated rural settings, state and federal policies, and standards and accountability. In addition to addressing these well-known contextual factors, the development of a professional learning community in this study must take into account the rich cultural history of each local community. In the context of this study, Native American history includes a unique
sense of place and relationship to the land and also includes a unique set of cultural ways of knowing and learning.

**Student Mobility**

During initial visits to schools on the reservation, teachers and administrators commented on the frequent movement of students between schools and the subsequent impact on the curricular consistency students receive. There are several factors that contribute to this movement. In Native American culture, “American Indian students see the family as an extension of themselves” (Pewewardy, 2002, p. 21). Aunts, uncles, grandparents and cousins all play important roles in raising the children. It is not unusual for children to live in a variety of different households, a structure that provides a sense of belonging and security (Pewewardy, 2002). The 2000 census showed 717 children on the Crow reservation lived in households with ‘other relatives’ (University of Montana, 2006, p. 17).

Research indicates that constant change in classroom membership impacts not only the students who are moving in and out, but also the students who remain in the classroom for the entire year. A basic principle of *Principles and Standards of School Mathematics* (National Council of Teachers of Mathematics [NCTM], 2002) is a charge to provide students with a “coherent curriculum, focused on important mathematics and well articulated across the grades” (p. 14). When new students move into the class, teachers do not know their background and spend a great deal of time reviewing concepts so the entire class can move forward. Thus, students who have maintained a consistent attendance are slowed down by this constant review. Teachers’ lack of knowledge of the
new students also minimizes the degree to which teachers can individualize instruction for them.

Poverty

Families on the reservations are some of the poorest in the nation. The literature indicates (Berliner, 2005; NCTM, 2005; Campbell & Silver, 1999) that families living in poverty move frequently due to changes or loss in employment, changes in the family structure and/or the ability to meet financial commitments. However, this movement within the extended view of family contributes to the challenges for teachers of providing a “well articulated, coherent mathematics curriculum” (NCTM, 2002) to students in the bounded system.

Isolation

Initial discussions with teachers and administrators regarding the establishment of a professional learning community in the bounded system revealed that past attempts to initiate a process of collaboration had met with little success. Not only are teachers isolated from one another geographically and electronically but they also belong to one of the most isolated professions. One of the most stable factors throughout the last century has been the relative isolation of teachers from each other throughout their workday and year (Garmston & Wellman, 2003).

Standards and Accountability

Current national and state standards outline the mathematics students should know and be able to do. These expectations present huge challenges for teachers in all schools,
large or small, urban or rural. According to figures released by the Montana Office of Public Instruction for the 2004-05 school year, only two elementary schools and no middle or high schools on the Crow and Northern Cheyenne reservations made “Adequate Yearly Progress” (AYP) as defined by the Montana State Board of Education and the federal No Child Left Behind Act of 2002. Many of these schools and/or districts have failed to make AYP for several years.

In an effort to set common expectations for students in mathematics, state and federal departments of education require districts to align their local curricula with state content standards. To meet these standards, the various school districts in the bounded system have adopted a variety of curricula. The smaller districts joined various curriculum consortia because they lacked the resources to do so on their own. The curricula of the three consortia and those independently adopted by the larger districts are distinctly different. As a result of the various curricula and materials used to implement them, students who transfer between schools experience little content articulation or coherency. School membership in various consortia results in different content emphasis in different districts and schools at various times of the school year. To further complicate matters, districts and even schools within a district use textbook materials with vastly different philosophies of teaching and learning mathematics to implement their curricula. There is no mechanism for teachers either within schools and districts or between districts to collaborate on building a shared vision for student proficiency.
Purpose

Previous research clearly suggests that teacher participation in professional learning communities can increase student achievement in mathematics (Newmann & Wehlage, 1995; Kanold, 2002; Rosenholtz, 1989; Louis, Marks & Kruse, 1996). The teachers who work in the bounded system on the Crow and Northern Cheyenne reservations face a unique situation. They share the same population of highly mobile students to implement local curricula and work with students who struggle to meet AYP. They have few opportunities to meet and collaborate with one another and next to no opportunities to form a professional learning community. Therefore, CLTW staff set out to establish a professional learning community of teachers who teach the same population of students yet work in geographic and culturally different schools and districts.

Previous studies have documented the development of professional learning communities within an individual school or between schools within a district. There has been very little research conducted on how this process can be effectively implemented in a unique, bounded system of schools such as those on or near the Crow and Northern Cheyenne reservations.

The ongoing supportive environment needed for building trust between teachers within the same school and/or district is challenging work. Establishing a professional learning community of teachers who serve the same population of students yet work in geographic and culturally different schools and districts may be even more challenging. The purpose of this study is to document a process of developing a professional learning community of mathematics teachers committed to improving student learning and
classroom practice. The participants work in various schools and districts on or near the Crow and Northern Cheyenne Indian reservations in rural Southeast Montana.

Questions

This study is guided by the following research questions:

1. What is a process for establishing a self-sustaining professional learning community of mathematics teachers who teach in small, rural, minority culture districts and who teach students from the same population?
2. What are the factors that enhance or limit collaboration between mathematics teachers in schools on or near the two reservations?
3. How do teachers perceive their classroom practice to have changed in light of participation in a professional learning community?
4. How has participation in a professional learning community changed teachers’ perspectives on their responsibilities as professional educators?
CHAPTER 2

REVIEW OF THE LITERATURE

This chapter describes the literature on K-12 professional development, communities of practice, and professional learning communities. It will also describe the contextual factors in which professional development is situated as identified in the literature and the specific contextual factors identified by the researcher that influence this study. The first section will review the literature on effective professional development. The second section reviews the contextual factors identified in the literature. The third and fourth sections will review the literature on “communities of practice” (Wenger, 1998) and “professional learning communities” (DuFour & Eakins, 1998), an adaptation by the educational community of communities of practice. The review of the professional development literature and the contexts in which it will occur in this study informed the researcher’s decision to foster a professional learning community of mathematics teachers on two Montana Indian reservations.

Professional Development

*Teachers cannot create and sustain the conditions for the productive development of children if those conditions do not exist for teachers (Sarason, 1990, p. xiv)*

A key focus of the United States’ efforts to improve K-12 education is to close the gap between teacher preparation and standards based reform through the implementation of effective professional development (Birman, Desimone, Porter &
Garet, 2000). The report “Before It’s Too Late” (Glenn, 2000), sponsored by the National Commission on Mathematics and Science Teaching in the 21st Century, defines professional development as “a planned, collaborative, educational process of continuous improvement for teachers” (p. 18).

Well implemented professional development helps teachers deepen their knowledge of the subjects they teach, sharpen their teaching skills in the classroom, keep up with developments in their fields and education in general, generate and contribute new knowledge to the profession and increase their ability to monitor student work so they can provide constructive feedback to students and appropriately redirect their own teaching (Glenn, 2000).

New curricula, state and federal policies, and organizational structures call for an expanded form of professional development to help teachers prepare for the range of knowledge students are expected to acquire and assimilate (Bobrowsky, Marx & Fishman, 2001). As a result, the form of professional development in the United States has changed significantly since the early 1970’s. This evolution, based on established standards for professional development (National Staff Development Council [NSDC], 2001), will be described in the next section.

Evolution of Professional Development

We have learned much about the effectiveness of various professional development efforts during the last 35 years. In the 1970’s teachers’ opportunities to learn often consisted of scattered, decontextualized workshops that occurred throughout the school year. Many times these were a hodge podge of knowledge about teaching and learning that did not lead to a coherent vision or knowledge base to guide practice (Katzenmeyer & Moller, 2001; Bobrowsky, 2001). Teachers were
expected to take their newfound knowledge and skill back to their classrooms for implementation. These workshops were presented by outside “experts”, many of whom had little experience in the classroom. Rarely was support or follow-up conversation provided for teachers upon their return to the classroom. Subsequent workshops were seldom linked to topics from a previous one. It is no wonder teachers felt demeaned by these efforts. This episodic and piecemeal nature of traditional professional development doomed any attempt to sustain a sense of intellectual community (Grossman, Wineburg & Woolworth, 2001).

In the 1980’s and early 1990’s, professional development moved through the “organizational development” stage, a bottom up design. Strategic planning is an example of this type of professional development. An outside facilitator was brought to the group to facilitate the development of a mission statement for the entire system. Action teams were formed to develop goals addressing the mission statement. The goals were based on the consensus of the group (Katzenmeyer & Moller, 2001). Although these attempts included teachers in the planning stages, the “big picture” goals were difficult for classroom teachers to implement in the individual classrooms (Schmoker, 2004).

The paradigm shift that occurred during the previous three decades has shifted the emphasis of professional development from the transmission of knowledge to experiential learning. Professional development therefore must present teachers with experiences that encourage them to examine their values and beliefs around teaching and learning (Robbins, 2005). Teacher learning “is driven by a well-defined image of
effective classroom teaching and learning” (Loucks-Horsley et al., 2003, p. 44) and thus effective professional development

- Provides opportunities for teachers to build their content and pedagogical content knowledge and examine their practice.
- Is research based and engages teachers as well as adult learners in the learning approaches they will use with their students.
- Provides opportunities for teachers to collaborate with their colleagues and other experts to improve their practice. [italics inserted by author]
- Supports teachers to serve in leadership roles.
- Links with other parts of the education system.
- Has a design based on student data and is continuously evaluated and improves. (Loucks-Horsley et al., 2003, p.44)

In general, the literature maintains that effective professional development must be connected to teachers’ daily work with students. It must be linked to subject matter and the concrete tasks of teaching. It must also be organized around problem solving and informed by research. Most importantly, it must be sustained over time by ongoing conversations and coaching (Darling-Hammond, 1998).

Figure 3 illustrates the evolution of teachers’ professional development as described in an interview with Michael Fullan (Sparks, 2003). The horizontal dimension contrasts teachers who are knowledge poor (uninformed) with those that are knowledge rich (informed). Knowledge refers to content and pedagogical knowledge. The vertical
dimension contrasts a prescriptive form of teaching with teaching based on teachers’ professional judgment.

![Diagram: Focus of Classroom Practice Based on Teachers’ Knowledge and Sources of Action]

Figure 3. Focus of Classroom Practice Based on Teachers’ Knowledge and Sources of Action.

In the 1970’s, teachers were expected to use their uninformed professional judgment to implement the knowledge and skills they learned at isolated workshops that “dealt with decontextualized information that did not resonate with teachers’ perceived needs” (Bransford et al., 2000, p 204). Professional development in the 1980’s focused on giving uninformed teachers a much prescribed method of teaching. In the 1990’s, professional development focused on teachers becoming more “content rich” but using
the prescriptive teaching methods of the 1980’s. In the 2000’s, effective professional development shifted to provide collaborative structures for teachers to improve their professional judgment in implementing content rich methods of teaching.

Research on Professional Development

Garet, Porter, Desimone, Birman & Yoon (2001) carried out the first large-scale study to determine the characteristics of effective professional development. The study was based on the responses of 1,027 math and science teachers who previously participated in the federal government’s Eisenhower Professional Development Program. These teachers reported characteristics of professional development they felt increased their knowledge and skills and resulted in a change in their classroom practice. Prior to this research, few studies had explicitly compared the efforts of different characteristics of professional development to determine which was more effective.

The study identified three core and three structural features that the respondents felt were essential for effective professional development. The structural features include the form of the activity, the duration of the activity and the make up of the participants. The form of the activity refers to the type of activity ranging from traditional to reform oriented. Traditional forms of professional development include one shot workshops or attending conferences. Reform oriented activities include mentoring, coaching, and participating in lesson study, inquiry groups, or professional learning communities. The duration of the professional development refers to the frequency and length of time the teachers participate in the activity in
terms of months and years. Lastly, the type of participants refers to the characteristics teachers engaging in the activity have in common such as teaching common content, common grade levels or are teaching in the same school.

Participants can also be classified as voluntary or non-voluntary based on their ability to choose to engage in the activity or are required to attend the activity. In their review of 35 articles referring to science professional development, Bobrowsky et al., (2001) found volunteers tend to be risk takers and are more motivated. Non-volunteers wait to be convinced about the worthiness of the activity. The analysis found non-volunteer teachers preferred one-time workshops while volunteers were more likely to be attracted to job embedded long-term professional development opportunities.

Three core features were also identified. These include the content focus of the activity, the degree of active learning and the coherency of the activity. The content includes the degree of emphasis on subject matter and content specific teaching methods, the specificity of changes in teaching practice encouraged, the collective emphasis for student learning and an emphasis on the way students learn. The degree of focus on content is the characteristic that moved professional development from the 1990’s model to the 2000’s model (Figure 3). It is a central dimension of high quality professional development. The degree of active learning engaged in by the participants includes an opportunity to engage in the activity as students, to observe or be observed, to review student work, and to present or lead an
activity. Lastly, the activities need to be coherent, consistent with teachers’ goals and aligned with state content and performance standards (Garet, 2001).

The American Institute for Research [AIR] (1999) examined the statistical strength of the relationships between the core and structural features of effective professional development. The study found the type of activity influenced its duration. Greater emphasis on content connected with other professional development experiences is more likely to produce enhanced knowledge and skills. Teachers who experience coherent professional development that is linked with other aspects of the system are more likely to change their practice (Garet et al., 2001). The structural characteristics of professional development activities affect the core features of the activities, which in turn influence changes in classroom practice (Birman et al., 2000).

These findings validate Loucks-Hosley and colleagues’ belief that, for science and mathematics professional development to be effective, experiences for teachers must occur over time, provide ample time for in-depth investigations and reflections, and incorporate opportunities for continuous learning (Loucks-Horsley et al., 2003).

In addition, the more successful programs encourage the development of teachers’ learning communities that allow for differing kinds of background training (Bransford et al., 2000).

Need for Further Professional Development Research

Studies are just beginning to emerge on the effects of various professional development strategies. Teacher learning is a relatively new topic of research (Bransford
et al., 2000) and much more extensive research is needed to guide policy and practice (Darling-Hammond, 1998). A comprehensive approach for this research should include at least three strategies; a growing knowledge of how students, how teachers learn and in-depth descriptions of how schools are reshaping teachers’ learning opportunities. The research should also recognize policy development and the value of the context in which the research is carried out. Research about successful professional development initiatives needs to be translated into policies that will penetrate widely and comprehensively. New forms of professional development should be collegial and focus on the work of students, the implementation of standards and providing a coherent curriculum within subject areas as well as on problems of practice. It must look at the kinds of teacher learning that result from professional development that features different characteristics in different contexts. Questions that need addressing include: What kinds of policies and organizational changes prove necessary to support these initiatives? Do the efforts make a difference for student learning? (Darling-Hammond, 1998).

Little research has been done on what effective professional development looks like in rural schools. Because of their size and geographic isolation, rural schools face challenges in developing effective professional development for the small groups of teachers they employ. Small student enrollments result in a lack of opportunity for teachers to work collaboratively with other teachers who teach the same subject or grade level. Schools also lack the financial resources to provide ongoing, high-quality professional development. Because of this, schools often need to work collectively with
outside organizations whose programs do not align with local rural school improvement goals (Arnold, 2002).

**Contextual Factors Identified in the Literature**

The Center for Learning and Teaching in the West [CLTW] (2000), is funded by a National Science Foundation grant and funds the project in this study. An overall goal of the CLTW proposal was to help the education community understand and enhance middle-level and high-school student learning and achievement in mathematics in high-need populations within urban and rural settings. High-needs populations, as viewed by CLTW, possess one or more of these characteristics: (a) high proportion of low-income families; (b) high proportion of minority students, including those with English as a second language; (c) low mean student test performance, or large performance variation, with low-income and minority students over represented at low performance levels; or (d) inadequate teacher access to professional development and educational resources due to location (CLTW Strategic Plan, 2003, p. 1).

There are many contexts in which professional development opportunities are situated (Loucks-Horsley et al., 2003). Every facet of teaching and learning is set within layers of contextual factors. Some of these factors are readily apparent for professional developers in a given situation while others require much more study and analysis. Contextual factors common to students and their teachers located in the communities in the bounded system include all four of the above characteristics for high need populations. Students reside in isolated rural settings beset with high levels of poverty,
are majority Native American living in homes where English is often the second spoken language, and whose teachers have little access to professional development. Other factors relevant to professional development commonly identified in the literature include high levels of student mobility, state and federal policies, local control, degree of administrative support, and the general culture of mathematics teachers. Unique factors specific to this study are the educational history of Native American students and the influence of Native American culture on ways of teaching and learning. These include family structure, language, and spirituality. A brief review of the literature on each of these contextual factors follows.

As professional developers plan opportunities for teachers they must have one foot planted in theory and the other foot planted in the reality of the of the community. The contexts in which professional development is situated is “complex, comprised of many interconnected and dynamic influences” (Loucks-Horsley et al., 2003, p. 7). Research offers several frameworks for looking at the contexts in which teaching and learning are embedded. This study is guided by the work of Arnold (2002) and Knapp, Copland, Ford & Markholt (2003). Arnold (2002) provides a framework for “thinking about how rurality might affect mathematics teaching and learning” (p. 2)

The schools in this study are set in isolated, rural environments. Arnold (2002) sees the technical core of mathematics teaching and learning as set in an environment of several subsystems. Drawing on the work of organizational theorists Hoy and Miskel (2001), Arnold identifies these subsystems as structural (bureaucratic expectations), political (power relations), individual (cognition and motivation) and cultural (shared
orientations). Since parts of the system are interconnected, attention must be paid not only to the technical core [of teaching and learning], but also to the structural, political, individual and cultural subsystems that impact student learning. Arnold (2002) warns “failure to attend to these subsystems will have negative consequences” (p. 4).

The key ideas of the work of Knapp et al. (2003) and his colleagues at the University of Washington’s Center for the Study of Teaching and Policy are based on the beliefs that “what a student learns depends on what the teacher knows and believes and what school and district leaders know and believe about teachers’ and students’ learning” (p. 11). In Knapp’s framework leaders must engage in three learning agendas related to learning; student learning, professional learning and system learning. Each learning agenda acts as a context for other two. A student’s learning occurs within the context of the content, the teachers and his/her interaction with other learners. Professional learning includes the knowledge, skills, and perspectives teachers acquire while preparing for and renewing their practice. System learning is the degree to which the school or district in which the learning takes place develops and evaluates policy, programs and provides recommended structures for teacher collaboration.

All three learning agendas are influenced by a larger set of contexts embedded in one another. This larger set of contexts includes families and communities, organizational contexts and larger policy and professional environments (Knapp et al., 2003). All of these contexts “enable and constrain” the learning of everyone in the system. In her work concerning the role of communities of practice in teacher learning, Gallucci (2003) found that any community of teachers is embedded in similar contexts: a)
the context of the classroom teacher and the local community of teaching practice; b) the social and organizational features surrounding the work and c) the multiple levels of policy environment.

This study explores several relevant contextual factors including administration, school and system structures, and the culture of classroom teaching. The study also takes into account the family and community contextual factors present in Native American culture and the cultures of ruralness and poverty. Policy contexts include local control and politics, state and federal mandates and the effects of external environments. Additional factors influencing the development of professional learning communities in this study include the history of the reservations, the educational history of Native American students and the influence of Native American culture and language on ways of teaching and learning. The study also explores the precondition of building relational trust and combating the several forms of isolation (racial, professional, and geographic) that teachers in the bounded system encounter.

In order for the three types of learning (student, professional and system) to occur, Knapp and his colleagues maintain that effective leaders must pursue five areas of action. They must establish a focus on learning at all levels, engage external environments, create coherence of curriculum, instruction and assessment, share leadership and work to build professional learning communities. Knapp maintains these five areas of action must “mutually reinforce each other. Pursuing a few of those areas while ignoring others, may not achieve the learning results they seek” (p. 12). Figure 4 (Knapp et al., 2003, p. 13) shows the relationship of the three learning agendas to the contextual factors and the
five areas of action adapted by the author. The importance and relevance of building professional learning communities is evident in this figure.

Figure 4. Overview: Leading for Learning.

**Organizational Contexts**

**Administration**

A 1996 Council of Chief State School Officers [CCSSO] standard for school administrators follows:

A school administrator is an educational leader who promotes the success of all students by advocating, nurturing, and sustaining a school culture and instructional program conducive to student learning and staff professional growth (pp. 10-12).

School leadership and culture can make or break reform efforts (Saginor, 2005). An administrator can be a culture builder or a barrier (Barth, 2001). A study by Moller
(2000) suggests that the actions of principals to provide supportive conditions for teacher collaboration are a key factor in encouraging effective professional learning communities. In a meta-analysis of the role of leadership in schools, Miller (2003) found the actions of principals to provide supportive conditions for teachers is a key factor within professional learning communities. Administrators who support teacher leadership, relinquish control, build trust, empower others, share responsibility for failure and give credit for success influence the success of their schools (Barth, 2001). This type of support is “vital to successful team work” (Morris, Chrispeels & Burke, 2003, p. 765). In its absence, “even comprehensive professional development can flounder and waste valuable resources” (Saginor, 2005, p. 12).

School Structure

Even thought teachers may work in the same building, they are remarkably alone in their efforts to educate students. Although grade level teachers may teach in rooms adjacent to one another, their schedules are rarely designed to give them time for productive collaboration. The culture of the teaching profession encourages teachers to work on their own. Assignment policies, graded school structures, and a host of other forces encourage isolation rather than collaborative engagement in common work (Knapp, 2002). The teachers in this study teach in school systems with this type of isolated design.
Teacher Isolation

Research on the impact of teacher isolation, dates back to the work of Lortie (1975). He maintained “professional privacy led to boredom and professional uncertainty, both of which hobbled any ethos of improvement – a sure recipe for apathy, frustration and professional stagnation” (found in Schmoker, 2005, p. 139). The isolation was so complete that teachers “quickly learned that they could teach whatever they liked, however they liked” (Schmoker, 2005, p.138). This belief has caused some researchers to assert that teacher isolation is one of the greatest factors hindering school reform (Garmston & Wellam, 2003). They believe it is one of the reasons students in the United States are not achieving at the level of other countries. For teachers, “the devastating implication of such privacy and isolation were seldom uttered, but were nonetheless clear: differences in teaching did not matter much; outcomes were irrelevant until recently” (Schmoker, 2005, p. 138).

Little (1990) characterizes the profession of teaching as “an assemblage of entrepreneurial individuals whose autonomy is grounded in norms of privacy and noninterference and is sustained by the very organization of teaching work” (p. 10). Teachers who work in isolation have little opportunity to form consensus for what they want their students to know and be able to do, but are now being pressed, invited and cajoled into ventures in collaboration. The organization of their daily work however gives them scant reasons or opportunities for doing so. Without some sort of structure that encourages professional collaboration, teachers are “as connected pedagogically as
commuters waiting briefly in a train station, each bound on a different route” (Rosenholtz, 1989, p.18).

Effective collaborative teams move teachers from isolation and are connected to substantive increases in student learning (Kanold, 2002). Without professional learning and support for meaningful collaboration, the few interactions in which teachers engage seldom reach beyond the collegial or social level (Grossman et al., 2001; McLaughlin & Talbert, 2001). Rosenholtz (1989) calls this form of communication “contrived collegiality.” “It’s not that teachers seldom talk, but rather that informal conversation rarely centers around a codified base of technical knowledge,” she continues (p. 18). It is this lack of technical knowledge or structure for collaboration that leads Grossman et al. (2001) to warn against labeling any type of interaction between teachers as a community. The interaction may in fact be a pseudo community rather than a professional learning community.

Family and Community Contexts

Culture

Rural. Rural schools are interdependent with the environment in which they function. Schools in rural settings are usually small and located in isolated communities. The size of the school usually precludes the types of classes available to students and knowledgeable support staff may be limited. Few districts in small rural areas have curriculum and assessment directors and thus, there is limited instructional leadership for
a focused, coherent mathematics curriculum. Often administrators act as teachers and have little background or time to function as instructional leaders.

The relative isolation of life on the reservations sets these schools in a unique rural situation. Geographic isolation is accentuated by the lack of reliable internet availability. The isolation is racial as well as geographic. Racial isolation is caused by a long history of misunderstandings and distrust between the majority culture and Native Americans and between the Crow and Northern Cheyenne tribes. Native Americans have a strong connection with the land and ties with the extended community. Their connection with the land and the community combined with the high degree of poverty make it difficult for students to leave the reservation and engage in experiences available to other students.

Poverty. There are both opportunities and challenges for students living in communities on or near Montana’s reservations. Most of the schools in the bounded system are located in predominately Native American rural communities beset with poverty. The unemployment rates are some of the highest in the nation. Over the years they ranged from 62% to 85% for residents on the Crow reservation and from 60% to 75% for those on the Northern Cheyenne reservation. Over 75% of on-reservation Crows live below the federally established poverty level (Montana Office of Public Instruction, 2004).

Poverty is the “single strongest and most persistent threat to high student achievement” (Rural Schools and Community Trust, 2005, p. 6). Even though studies (Lewis, 2001) indicate there is evidence that students in Montana who attend smaller
schools and districts outperform students attending larger schools even though they serve poorer communities, this does not appear to be the case for reservation schools in the bounded system. Challenges for students in poor, rural communities include the limited number of out-of-school experiences to which they have access. Berliner (2006) reports the traditional schools’ schedule of having two to three months school “vacation” poses further challenges for students living poverty. Whereas middle class families provide enrichment trips and camps throughout the summer for their children, poor families are not able to provide these opportunities. The study indicates that children of the poor consistently show greater learning losses over the summer than their middle class peers. This lack of supplemental academic and cultural activities limits building the amount and type of prior knowledge needed for building new knowledge. Parents often have limited educational experiences themselves and therefore, are distrustful of schools or of new educational methods used in the classroom. Administrators, anxious to meet the current accountability standards mandated by the NCLB law, often implement curriculum materials and instructional strategies shown to have positive effects on student achievement in larger communities. These efforts can be of concern for Native American children if members of the community are not given input into their implementation (Fox, 2001; Nelson, Simonsen & Swanson, 2002).

In her classic work on the relationship of students’ education to their parents’ socioeconomic status, Anyon (1980) argued that “public schools in complex industrial societies like our own make available different types of educational experience and curriculum knowledge to students of different social classes” (p. 1). She builds the case
that there is a “hidden curriculum” in schools that has profound implications for everyday activity in education. Mathematics for children of the working class involves step by procedures involving rote behavior and very little decision making. Mathematics work is often based on unexplained, fragmented procedures.

The mathematics achievement of students attending schools where poverty is prevalent is “shockingly low” (Berliner, 2005, p. 15). In NCTM’s monograph on the impact of poverty on the mathematics education of American students, the authors maintain that students in small, poor, rural communities must have the same access as those in more affluent communities, even though the delivery method may be different (Campbell & Silver, 2000). However, this may not be possible if other factors associated with poverty are not addressed. A Catsambis and Beveridge (2001) study on mathematics achievement using NELS88 data, as found in Berliner (2006), found that “the neighborhood had significant direct and indirect effects on achievement … tragically good parents frequently lose their children to the streets” (p. 22). In the same document, Rumberger (1987) concluded that “without strong positive peer influences, children attending high poverty schools are not likely to achieve well. Zip codes do matter. They determine who is around to exert an influence during a child’s formative years” (p. 22).

Berliner’s (2006) meta-analysis found numerous studies indicating that poverty is negatively related to school achievement. He concludes that improvement in the achievement of students from low-income families will need to include out-of-school living improvements as much as inside-of-school lives. At the same time we push for effective professional development, integration of technology and other school
improvements, we need to push for improvements in the daily lives of children living in poverty. Anyon (1997) concluded that “attempting to fix inner city schools without fixing the city in which they are embedded is like trying to clean the air on one side of a screen door” (p. 168).

Native American Culture. In the last quarter of the 19th century and the first quarter of the 20th century, land bases known as reservations were set aside for the tribes through treaties with the United States government in exchange for other lands (Montana Office of Public Instruction, 2001). In 2004, about 70% of enrolled Crow tribal members lived on the Crow reservation. Close to 60% of the Northern Cheyenne enrolled members live on the adjacent Northern Cheyenne reservation. In addition to the contextual factors that influence schools in general, schools in this study are situated in cultural contexts specific to their history, culture and location. Primary among these situational contexts is the Native American culture that is centuries old; cultural ways of knowing and assessing students, cultural “standards”, and cultural norms of family and behavioral expectations of children that are distinct from those of the dominant culture. The following sections will provide an overview of these historical and cultural influences.

Educational History of Native American Students. Education has long been seen as a priority by Native Americans. The Crow Chief Plenty Coups admonished the tribe members to remember, “education is your most powerful weapon. With education you
are the white man’s equal; without education you are his victim. Study, learn, help one another always” (Linderman, 2002, p. x).

Prior to restricting Native Americans to the reservations in the mid to late 1800’s, the tribal nations had very diverse educational systems. These systems were culturally responsive to the lifestyles and beliefs of the Native American students. The indigenous educational systems were designed to provide the skills necessary for students to function adequately within their nomadic environment. Traditional Indian education emphasized learning by application and imitation, not by memorization of basic information. It also emphasized learning by sharing and cooperation (Juneau, 2001). Children learned by observing their elders and listening to stories told by parents, elders and other social groups (Pewewardy, 2003).

Between 1879 and 1905, twenty-five nonreservation boarding schools were opened throughout the country. The boarding schools were located off the reservations in order to isolate Native American children from their families and language and customs of the tribes (Spring, 1997). It was thought this would hasten their assimilation into the dominant culture. In 1900 Montana began to create schools that would allow native American students to attend school closer to home (Juneau, 2001). In 1928 the Miriam Report began the process that would end the practice of boarding schools. Until that time, the majority of school age children were taken from their homes and families to attend boarding school.

One can assume that most of today’s Native American parents with school-aged children heard many stories of their grandparents’ experiences in boarding schools. Their
clothes were replaced by the white man’s fashion of the day. They were punished for speaking their native tongue and were expected to adopt (assimilate) the white man’s body language and behaviors. As a result, entire generations lost access to the traditional models of parenting, culture, language and values (Duran & Duran, 1995; Pewewardy, 2002).

Throughout the hundreds of treaties negotiated between various tribes and the United States government from the late 1700’s through 1871 (Juneau, 2001), Native Americans have theoretically had a voice in the education of their youth. For example, Article X, Section 1(2) of Montana’s State Constitution (1972) contains the following language: “The state recognizes the distinct and unique cultural heritage of Native Americans and is committed in its educational goals to the preservation of their cultural integrity.” However, it was not until the legislature passed the Indian Education for All Act (“House Bill No. 588”) in 1999 that recommendations were given to schools on how to enact the intent of the Constitution. As a result of a recent Montana Supreme Court decision (2004), school districts are required to provide opportunities for all Montana students to learn to respect and value the history and contributions of their Native American founders. The 2005 state legislature allocated several million dollars for the implementation of the Indian Education for All Act. While today only a little over 6% of Montana’s population is Native American, approximately 11% of Montana’s public school students are Native American and most of them live on one of Montana’s seven reservations (Montana Office of Public Instruction, 2004).
Influence of Native American Culture on Teaching and Learning. In successful research-based educational models for educating Native American students, local culture and community values are used as the basis for the curriculum, helping blur the line between the school and the community. The emphasis of learning experiences centers on students as the creators of knowledge rather than the consumers of knowledge created by others. Teachers serve as guides and facilitators of student learning, often serving as team members of a project. Student work is assessed on the basis of its usefulness to the community and sustainability rather on the basis of sorting and ranking schools and students (Smith, 2002). “While American culture encourages individual success,” (University of Montana, 2006, p. 5), the entire concept of ranking one student or school over another runs counter to Native American culture (Nelson et al., 2002). Much of this knowledge is lost as schools scramble to meet “adequate yearly progress”.

A Native Alaskan teacher comments that “In order to teach you, I must know you” (Delpit, 1995). Many Native American students have been raised in very rich cultures quite different from that of their teachers and administrators. Although some cultural values are common to members of the various Native American tribes – respect for the land, for example - each tribe has its own language, spiritual belief systems and traditions (Nelson et al., 2002). Studies have shown that Native American have “distinct cultural values, such as conformity to authority and respect for elders, strong social hierarchy, and an emphasis on learning, which are deeply rooted in the teaching of elders” (Pewewardy, 2002, p. 2). In general, Native American culture is holistic, integrating the community, the individual, the environment and spirituality. In traditional
Native American communities, the individual is inextricably linked to the good of the entire community. Although there is a differentiated role for each individual that abides by the social order, drawing attention to oneself creates ill will within the Native American community (Northwest Regional Laboratory [NWREL], 2002).

The relationship between parents and children is more egalitarian in many Native American communities than is found in middle class families in the Unites States (Nelson et al., 2002). In the Crow clan system, discipline belongs to the father’s clan, uncles “tease” children to keep them in line. The mother’s clan is meant to build self-esteem with praise and affirmation (University of Montana, 2006). Native American adults respect children as independent-thinking beings at a very early age. Children are encouraged to be quietly independent and self-assured, often taking care of themselves at a very young age. Thus, Native American parents are less likely to intrude or interfere with the decisions their children make. This comes in contrast to traditional American expectations where children are viewed as lacking the ability to take responsibility for themselves. Non-Indian teachers tend to view this as a lack of parental discipline and support (Deyhle & Swisher, 1997). The expectations children experience at home can be at odds with school experiences. This influences non-Indian teachers’ perceptions of students’ willingness to learn (Nelson et al., 2002).

Lone Wolf, a Blackfoot Indian remarked, “That among his people, children were never punished by striking them. That was no way to teach children; kind words and good examples were much better” (Nelson et al., 2002, p. 10). These differences in cultural and family expectations of Native American homes have the potential for
impacting the teaching-learning process in public school systems dominated by white middle-class values (Montana Office of Public Instruction, 2004). Thus it is critical to situate education, including mathematics, within the context of the local culture in which it is being taught if Native American student learning is to be improved (Davison, 2002).

A first step in addressing the needs of Montana’s Native American students is to establish an environment that conveys respect for the value and strength of their cultural differences (Deyhle & Swisher, 1997). Cultural differences surface in the areas of parental expectations, linguistics, assessment, and the value placed on certain aspects of learning and student behavior. For example, in Native American cultures, students are encouraged to learn by observing the adults in their lives and wait to try out a new skill until they are fairly certain they know how to do it. Confusion can occur when a teacher urges students to “guess and check” or “try” a method of solving a problem before the students feel confident enough to try (Pewewardy, 2002). Furthermore, being asked to “explain your reasoning” for a math problem to your classmates can be seen as arrogant by the students’ peers.

Native Americans have an oral society in which learning was passed down by word of mouth. Child rearing was a communal responsibility. Young people learned what was necessary to survive by observing the actions of others. When they felt they were ready, young people would attempt to do what they had been learning. If they failed, they were not reprimanded but would continue to observe others and learn from their mistakes. The Native American society was a communal one in which the expectation for every member was to contribute to the survival of all. Being singled out
for a good deed was not an acceptable practice (Pewewardy, 2002; Deyle & Swisher, 1997).

Cleary and Peacock (1998) make the following compelling challenge for all teachers of Native American students.

The most important endeavor for teachers in Indian schools and in schools that serve Indian children is to see themselves as learners, learners who are open to understanding the reasons that children and communities are the way they are, learners who are willing to discover and consider the cultures of the school and the home of the child, and learners who are willing to change their ways of teaching so that children have a better chance in school and a better chance to have purpose and hope in their lives thereafter (p. 6).

**Policy Contexts**

**State and Federal Policies**

As previously indicated, the current era of math and science reform coupled with accountability mandates at the federal and state level enhance the opportunities for learning while simultaneously presenting challenges for Native American schools. The No Child Left Behind legislation [NCLB] (2002) has intensified the pressure for administrators, schools and districts to find ways to close the achievement gap and ensure that all students graduate from high school. The pressure to reach Adequate Yearly Progress (AYP) has resulted in teachers in high-poverty schools spending significantly more time on test preparation than teachers in low-poverty schools (Association of Supervision and Curriculum Development [ASCD], 2004). This emphasis limits the content and higher level thinking skills accessible to students. For a school to meet AYP, the schools’ students must perform at a proficient level on state mandated assessments.
It is generally agreed that there is a strong connection between the school and community (Theobald and Nachtigal, 1995). In the days of NCLB however, state standards and measures of accountability force rural schools to align their instructional program with state rather than local expectations (Arnold, 2002). Schools can look at this from a negative or a positive view. The negative viewpoint is that accountability presents problems that must be fixed or overcome. The positive view is to look at the necessity of aligning instructional programs as “creating an environment that is conducive to expanding the indigenous capacity to improve mathematics teaching and learning in rural schools” (Arnold, 2002, p. 5).

External Environments

External environments are the outside school contextual factors in which a professional community is embedded. McLaughlin & Talbert (1993) inform us that “teaching and learning happens in multiple contexts or environments, embedded in one another” (pp. 167-206). Engaging in these environments defines and creates opportunities for learning improvement (Knapp et al., 2003). Knapp refers to three types of external environments. These three types are 1) family and community, 2) professional environments that include universities, professional networks and labor organizations and 3) larger policy environments such as state policies and federal programs and policies. These external environments can operate as both constraints and resources to teacher and student learning (Knapp et al., p. 31). The state and federal “from above” policies discussed in the previous section can preoccupy educators’ attention in a detrimental way. In looking for a quick fix to meet accountability
standards, administrators and teachers frequently ignore the power of learning communities and structures for collaboration outlined in the literature. Other external environments offer intellectual, human, political and social or cultural resources that public schools can rely on to improve teacher content and pedagogical knowledge.

Morris et al. (2003) point to external teacher networks as one of two promising approaches that provide the transformative power to “alter professional development and teacher learning in profound and sustainable ways. These are 1) external teacher networks that predominantly focus on enhancing teachers’ pedagogical knowledge and collaborative and leadership skills in a content area and 2) internal school reform projects that focus on in-schools facilitated structures for change and forums for teacher dialogue. In external environments, “Teachers come together across schools and regions to participate in professional learning communities” (Morris et al., p. 764). These networks build strong professional communities. Important as these communities are they must address teaching and learning inside the school. In order for teachers to share the expertise they developed externally, internal school structures must provide opportunities for teacher collaboration (Morris et al., p. 765).

During their reform work with school districts, Morris et al. (2003) found “the impact of the internal networks on teacher and student learning increased substantially when teacher expertise gained through participation in external networks was brought to bear on meetings in the school” (p. 765). The challenge of external networks is to “keep the fires burning” when teachers return to their schools that are not structured to allow them to share what they have learned and begin to incorporate that learning into local
professional learning communities. “When schools support teacher’s professional growth in both external content-based networks and internal teams, professional development can truly transform teaching” (Morris et al., 2003, p. 767).

Summary

Closing the achievement gap between Native American and Caucasian students in mathematics presents particular challenges for teachers and students in Native American communities in the bounded system. Federal and state mandated assessments often require knowledge and experience inaccessible to students on the reservation. Issues of local control, Native language usage, high levels of poverty, as well as teacher and community beliefs of who can learn mathematics further compound the work.

Most accounts in recent professional development literature of how to successfully scale up school reform come down to directly or indirectly influencing teacher learning on the job through networking and teacher collaboration (Grossman et al., 2001; McDonald et al., 2003). Teacher participation in professional learning communities surfaces as a method that encourages this type of in-depth collaboration. Based on this research base, I began to explore the feasibility of facilitating a professional learning community of mathematics teachers across the two reservations. This decision led me to explore the research on professional learning communities and the “related but much larger” community of practice literature (Wenger, 1998) that follows in the next section. The contextual factors in which this study is embedded challenge its formation.
Professional Learning Communities and Communities of Practice

Need for Establishing a Professional Learning Community

The professional development designer’s challenge is to assemble a combination of learning activities that best meets the specific goals and context of the situation. One guide to selecting strategies is to recognize the primary purpose of the strategy and match it to the needs of participating teachers (Loucks-Horsley et al., 1998). The needs of teachers and schools in this study are to provide a consistent, coherent mathematics curriculum as students transfer between schools in the “bounded system”. Inherent in this focus is the need for teachers to understand the mathematics content students are expected to know and the knowledge of how to teach it.

In the last decade several national reports advocated for structures that encourage professional collaboration between teachers. In 1996, the Commission on Teaching and America’s Future recommended that schools be restructured to become genuine learning organizations for both students and teachers, organizations that respect learning, honor teaching and teach for understanding (Darling-Hammond, 1996). In 2000, the National Commission on the Mathematics and Science Teaching for the 21st Century’s report ‘Before It’s Too Late’ recognized the importance of selecting a strategy to address teacher needs. The report states the key to long-term improvement in teaching is to figure out how to generate, accumulate and share professional knowledge. The report continues:

However well they [teachers] may have been prepared to teach, and whatever knowledge they may have gained in summer institutes, all teachers need continuing, collegial contact, peer reinforcement and
input from experts to sharpen their skills and deepen their subject knowledge. Building and district level inquiry groups are envisioned as communities of learning (pp. 26-27).

Since these reports there has been a plethora of research that focuses on the potential of teacher collaboration to improve teaching and learning. (Grossman et al, 2001; McLaughlin & Talbert, 2001; Imants, 2003; Garmston & Wellman, 1999). Figure 5 illustrates the impact that intellectual, social and material resources of “professional community contribute to teacher development, the collective capacity of schools, and improvements in the practices of teaching and schooling” (Little, 2003, p. 913, Figure 5).

![Figure 5. The Optimistic Premise of Professional Community.](image)

As early as 1989, Rosenholtz recognized that “organized groups provide the social interaction that often deepens learning and the interpersonal support and synergy necessary for creatively solving the complex problems of teaching and learning” (p. 26). These groups have become known as professional learning communities. When schools attempt significant reform to boost student learning, efforts to form a professional community characterized by building shared purpose, collaborative activity, and taking
collective responsibility for student learning among staff are critical (Louis et al., 1996; Newman & Wehlage, 1995).

Definition of Professional Learning Community and Community of Practice

The terminology used in the literature for the concept of community can be confusing. The terms, “professional learning communities” and “communities of practice,” are frequently used, sometimes interchangeably, to give name and meaning to the importance of building community in various situations. The concept of building community in schools has a long history dating back to John Dewey (1916). Dewey believed a community was a group of people who lived, worked and learned together. In the process they asked questions, listened to each others’ viewpoints and imagined other possibilities and solutions. The following section will look at definitions, characteristics and results of “community” found in recent literature to provide a framework for a professional learning community in this study.

In his seminal book, The Courage to Teach, Palmer (1998) comments “If we want to grow in our practice, we have two primary places to go: to the inner ground from which good teaching comes and to the community of fellow teachers from whom we can learn more about ourselves and our craft” (p. 1). According to Bellah, Madsen, Sullivan, Swidler and Tipton (1985), a community is “a group of people who are socially independent, who participate together in discussion and decision making, and who share certain practices that both define the community and are nurtured by it” (Grossman et al., 2001, p. 333). Five common themes of community found in the literature (Westheimer,
1998) include interdependence, interaction or participation, shared interests, concern for individual and minority views, and meaningful relationships. Many of these characteristics are embedded in definitions of the most frequently cited research on professional learning communities.

Critical to a professional learning community is the ability of its members to collaborate—on both a large and a small scale. All of the previous definitions of community emphasize that collaboration is an essential element for any serious teacher learning. DuFour and Eakins (1998) believe that “without collaborative skills and relationships it is not possible to learn and to continue to learn as much as you need in order to be an agent for social improvement” (p.4). That collaboration must include substantive professional discourse, because “it is the chief vehicle for analysis, criticism, and communication of ideas, practices and values” (Ball & Cohen, 1999, p.13).

Organizational Improvement

Much of the research on learning communities is based on the work of organizational theorists such as Peter Senge, Stephen Covey, Michael Fullan, and Etienne Wenger who began to look seriously at the “best path for sustained organizational improvement” and restructuring in the early 1990’s (DuFour & Eakins, 1998, Ch. 2). These theorists came to a remarkably similar conclusion for sustaining organizational improvement; they recognized the need for growing organizations to function as learning organizations. If an organization does not have a passion for learning, it will not have an enduring influence maintains Covey (1996). Learning is a phenomenon that a) takes place in shifts or changes that individuals experience through participation in activity
settings, and b) is mediated by cultural tools such as language or artifacts (Lave & Wenger, 1991; Wenger, 1998 as found in Gallucci, 2002).

Research on adult learning and “organizational development” indicates the power of teacher collaboration. In the 1990’s, effective professional development models for teachers began to emphasize teacher collaboration through participation in professional learning communities. With a focus on the school system as a whole, teachers have the opportunity to reflect on their practice with their colleagues in an ongoing manner. This approach recognizes their expertise to solve problems themselves, not needing to rely on outside experts (Katzenmeyer & Moller, 2001). Professional learning communities provide teachers the structure to focus on job-embedded problems over time. During this process they develop the social trust necessary to openly reflect on their own and others’ practice.

**Professional Learning Communities**

Current literature on high achieving schools serving at risk students suggests that well-structured professional learning communities can help teachers raise the achievement of students in mathematics (Newmann & Wehlage, 1995; McLaughlin & Talbert, 1993; Louis et al., 1996; Knapp, Copland & Talbert, 2003; McDonald & Klein, 2003). The revised NSDC, 2001, Standards for Staff Development are grounded in research that documents the connection between effective professional development and student learning. In addition to individual professionalism, teachers’ collective work in groups plays a critical role in increasing their commitment to their craft in educational
conditions that are increasingly complex and demanding (Louis et al., 1996, p. 758).

Halverson (2003) argues that professional community is “generated by networks of trust and obligation developed among teachers and school leaders around shared instructional practices in schools” (p. 2).

Key characteristics in the literature associated with professional learning communities and teacher collaboration include the following: shared norms and values, a collective focus on student learning, reflective dialogue, deprivatized practice, supportive and shared leadership, mutual trust and respect, and continuous learning opportunities (Hord, 1997; Kruse, Louis & Bryk, 1995; Louis, 1996; Newmann & Wehlage, 1995). In their work with high school teachers, MacLaughlin & Talbert (2001) define teachers’ learning communities as joint efforts to generate new knowledge of practice and mutual support of each other’s professional growth (p. 75).

The educational focus on the positive results of teacher participation in structured communities to increase student achievement was sharpened by the work of Richard DuFour during his tenure as principal at Adlai Stevenson High School in Chicago, Ill. He uses the phrase “professional learning community” to emphasize the need to build learning relationships with shared ideas and culture when working with educational communities (DuFour & Eakins, 1998). Each word in the phrase has meaning. A professional is someone who has expertise in a specialized field, an individual who has not only pursued advanced training to enter the field, but who is expected to remain current in its evolving knowledge base. Learning suggests an educator with ongoing and perpetual curiosity with the intent of improving practice or student achievement. A
community is a group of people linked by common interests. In a professional learning community all three characteristics are in evidence.

Organizing teachers into learning communities “whose goals are aligned with the school and district” (NSDC, 2001, p. 5) is one of the context standards of the National Staff Development Council standards. Educators need to learn the knowledge and skills to participate effectively in professional learning communities. As commented on earlier, the context in which professional development occurs helps determine the strategies that will be used in the design. Teachers in professional learning communities take collective responsibility for the learning of all students represented by the team members (NSDC, 2001). The research on the contextual factors highlighted in the previous section informed the researcher’s decision to implement a professional learning community for the mathematics teachers on or near the Crow and Northern Cheyenne reservations.

Several structural conditions must be met in order for a professional learning community to develop and grow within a school organization. These conditions include a time to meet and talk, physical proximity, interdependent teaching roles, established communication structures, teacher empowerment and school autonomy. In addition to these structural conditions, social and human resources need to be in place. These resources include openness to improvement, established trust and respect between the participants, a cognitive skill base to build on, supportive leadership, and a mechanism for establishing a socialization process. Research suggests that human resources are more critical to the development of learning community than structural conditions. If a school lacks the social and human resources to make use of the structural conditions, it is
highly unlikely that a strong professional learning community can develop. The authors believe too much attention has been given to the structural elements while the social and human resources have received too little (Kruse et al., 1995, p. 2). The nature of the professional community in which teachers work appears to be most critical for shaping teaching and learning for both teachers and students (McLaughlin & Talbert, 1993).

The NSDC (2001) (Figure 6) professional development standards are divided into three categories; the context in which new learning will be implemented, the process of the professional development and the content of the experience. Participating in professional development that improves the learning of all students deepens educators’ content knowledge, provides them with research-based instructional strategies to assist students in meeting rigorous academic standards, and prepares them to use various types of classroom assessments appropriately. The “process” is embedded in the contextual factors and contains the content the teacher is expected to learn.

Figure 6. The Process and Content Standards are Embedded within the Context.
DuFour and Eakins (2001) characterize members of professional learning communities as working in **collaborative teams** to establish **shared mission, vision and values.** Hord (1997) reminds us that “sharing vision is not just agreeing with a good idea; it is a particular mental image of what is important to an individual and to an organization” (p. 19). Staff is encouraged to use that vision as a guidepost in making decisions about teaching and learning. Members of the community are relentless in challenging the status quo through **collective inquiry.** In their quest for **continuous improvement,** members are **action oriented,** constantly experimenting in developing and testing hypotheses (DuFour & Eakins, 1998).

**Trust**

Research reveals that teachers working together in professional learning communities have a positive effect on student achievement (Imants, 2003; Newmann & Wehlage, 1995; Grossman et al, 2001). Grossman maintains that

> Of all the habits of mind modeled in schools, the habit of working to understand others, of striving to make sense of differences, of extending to others the assumption of good faith, of working towards the understanding of the group – in short, the *pursuit of community* – may be the most important (p. 100).

Relationships are the heart of a professional learning community (Barth, 2006). Teacher learning requires emotional safety, caring and respect from those within the community (NWREL, 2000, p. 5). Providing an atmosphere where teachers feel free to express themselves, share their success and failures and ask for the opinions of others without risk of ridicule is a critical component of
establishing a professional learning community (Bryk & Schneider, 2003; Leiberman & Miller, 1999; Louis & Leithwood, 1998).

Increased attention is now being paid to how the social factors that nurture that community can be encouraged (Smylie & Hart, 1999). Examples of these factors are social trust, finding channels for new information, shared norms and expectations and agreed upon sanctions. Social context provides opportunities for individuals to listen to and interact with others, to observe performances, successes and failures of others, to be exposed to new information and to have access to clear and meaningful feedback about individual and school performance. Trust is viewed as a necessary precondition to building a community capable of engaging in this sort of negotiation. That trust must include the recognition that there will be differences of opinion and divergent ideas and that learning can result in these differences.

In their study of successful restructured schools among 400 Chicago elementary schools, Bryk & Schneider (2002) found “that schools with high degrees of relational trust are more likely to make the kind of changes that help raise student achievement” (p. 5). Even after controlling for high levels of poverty, racial isolation, and student mobility (all contextual factors of schools in the bounded system) a strong correlation exists between trust and student achievement. This correlation is so strong they found that “schools with chronically weak trust throughout the four year study had virtually no chance of improving in either reading or mathematics” (Bryk & Schneider, 2002, p. 41). They believe that relational trust is the “connective tissue” that binds individuals together
to advance the education and welfare of students. The researchers identified and assessed trust in schools using indicators such as respect, competence, personal regard and integrity. Their findings indicated that human resources such as openness to improvement, trust and respect, supportive leadership and socialization are more critical to the development of professional learning communities than structural conditions. They maintain that the need to improve the culture, climate, and interpersonal relationships in schools has received too little attention (Bryk & Schneider, 2003).

Improving schools requires us to think harder about how to best organize the work of adults and students so that this connective tissue remains healthy and strong.

Building trust, protecting ideas, and establishing new norms of caring and concern for one another as well as for students is the glue that holds a professional learning community together. However, establishing an atmosphere where these interactions can occur takes time and capacity (Lieberman & Miller, 1999) and is a challenge all professional development must constantly address. Failing to build trusting relationships in schools can result in teachers who believe that “even the small losses are not worth efforts to arrange their classrooms differently, or to change the status quo in the school, even if it is acknowledged that current practices are not effective” (Louis, & Leithwood, 1998, p. 282).

Need for Further Research of Professional Learning Communities

There are serious gaps in our understanding of the theories of long-term professional development because the work is commonly funded by short-term grants
that make long term follow up difficult. Much of the needed research relates to building relational trust and networking. Building trust is not a short term process so few researchers studying school reform have paid much attention to it (McDonald and Klein, 2003).

Imants (2003) points to “black spots” in our knowledge of teacher learning (p. 299). These ‘black spots’ include the process of teacher learning in teachers’ professional communities and the potential discrepancy between the actual and the preferred outcomes of learning in professional communities. He also believes ‘black spots’ occur with regard to the unit of analysis (schools or units), the character of community (formal or informal), the role of organizational borders in identifying community as well as the role of factions or communities within communities. All of these ‘black spots’ were encountered in the process of building a professional learning community in this study. Many of these ‘black spots’ were addressed by teacher interviews for this study.

Descriptive examples of how professional learning communities function and the contextual variables that influence their development is an immediate need (Hord, 1997). Although their value is widely recognized, knowledge about how individual leaders create and sustain professional communities is not widely understood (Halverson, 2003, p. 5). In addition, further research for the design of organizational structures that support professional learning communities is needed (Gallucci, 2003). Because of the relative newness of the movement, research on how professional learning communities are formed and how they function is “essentially in its infancy”
(Hord, 1997, p. 56). “There are few models and little clear information to guide the creation of professional learning communities,” she continued (Hord, 1997, p. 53).

**Communities of Practice**

The term, *communities of practice* was first used by the Xerox Corp. to describe a phenomenon uncovered inside the corporation in the late 1980’s and early 1990’s. The phenomenon is the work-focused but off-task conversations of people who work together and come to rely on each other to teach them things no one else can teach them about crucial aspects of their work (Wenger, 1998). This term has gained credibility in educational circles as research has uncovered a strong positive association between schools with communities of practice and that schools’ success in boosting student achievement (Bryk & Schneider, 2002; McLaughlin & Talbert, 2001; Newman & Wehlage, 1995; McDonald & Klein, 2003).

With its “orientation toward persons’ mutual engagement in practice, the centrality of participation and its resources, and the notion of trajectories of learning”, (Little, 2003, p. 916) the concept of community of practice (Wenger, 1998; Lave and Wenger, 1991) is especially useful when talking about education because it includes a particular focus on learning within organizational environments (Gallucci, 2002).

Wenger (1998) begins his thesis of learning with the assumption that “engagement in social practice is the fundamental process by which we learn and so become who we are. The primary unit of analysis is neither the individual nor social institutions but rather the
informal ‘communities of practice’ that people form as they pursue shared enterprises over time” (preface).

Communities of practice have three dimensions: *mutual engagement, joint enterprise and shared repertoires* (Wenger, 1998). Membership in a community of practice is a matter of *mutual engagement* because “people are engaged in actions whose meanings they negotiate with one another” (Wenger, 1998, p. 73). The community creates a response among participants to their situation. This response creates a mutual accountability that becomes an integral part of the practice known as *joint enterprise* (Wenger, 1998). Joint enterprises are not static but change over time through group negotiation. In the course of its existence, a community of practice adapts or collects routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions or concepts. This collection of is known as the *shared repertoire* of the community of practice (Wenger, 1998). Little, 2003 “cannot emphasize enough these interrelationships [of mutual engagement, joint enterprise, and shared repertoire] arise out of engagement in practice and not out of an idealized view of what community should be like” (p. 916)

Communities of practice should not be confused with formal teams or units in the school. Teams or units are formally designed entities, while communities of practice are “informal, floating and emergent” (Imants, 2003, p. 300). Communities of practice are not self-contained entities but “develop in larger contexts – historical, social, cultural, and institutional – with specific resources and constraints” (Wenger, 1998, p. 79). The composition of these communities of practice is constantly changing with people from inside and outside the school who are participating in the activities of the community.
Communities are limited in size and scope and are marked by boundaries of participation available to individuals (Van Zoest & Bohl, 2003).

Members of a community of practice interact on two levels – through the participation of its members and by the reification (products) produced by the community. Participation is determined by the roles teachers play within the community. Some play a central role in determining and carrying out the goals of the community while others play peripheral roles to those goals. The reifications or products produced by the community can range from tests and artifacts for learning to curriculum design.

Most individuals are members of more than one community of practice at any given point in time. The membership of several communities can overlap or be embedded within each other allowing a participant in two or more communities to be a “broker” who is responsible for providing communication between communities through boundary crossing.

**Constellations**

Wenger (1998) refers to communities of practice related by membership or purpose as constellations. “A constellation is a particular way of seeing communities as related, and depends on the perspective one adopts” (p. 127). Some of the ways in which two or more communities relate and could therefore be called a constellation include communities that share historical roots, have related enterprise, serve a cause or belong to an institution [tribe], face similar conditions [rural, poverty, connection to the land], have members in common, share artifacts, have geographical relations of proximity or interaction, have overlapping styles or discourses and compete for the same resources.
(Wenger, 1998). Different community participants may have a different way or reason for defining a constellation. In this study, a constellation might include communities of math teachers from a given school or at a given grade level, the entire school community itself, the tribe and/or the community.

**Boundary Encounters, Brokers and Boundary Objects**

Wenger (1998) analyzes communities that form a constellation in three ways; boundary encounters, brokers and boundary objects. Boundary encounters occur when members of one community interact with members of another community while working on a mutual task. The participants can be central or peripheral members to either community. Brokers are participants who belong to two or more communities. They transfer information and knowledge from one community to the other. Boundary objects are the reifications or products that come out of the interactions of the community or the constellation (Cobb, McClain, Lamberg & Dean, 2003). In the case of the bounded system, the boundary objects may be performance assessments for each grade level agreed to by communities that are members of the constellation. Designing these assessments becomes the joint enterprise in which participants of the communities of practice are mutually engaged. The reifications or results of a successful professional learning community are the vision and goals of mutual engagement.

The construction of community requires ongoing social negotiation including the regulation of social interactions and group norms. For a community to be sustained, members must believe in their right to express themselves honestly without fear of
censure or ridicule. Membership comes tied to responsibilities of which the learning of other teachers is core (Grossman et al., 2001).

Summary

The review of the literature on professional development, professional learning communities, and communities of practice informed my decision to document a process of building a professional learning community set in the contextual factors identified in this chapter. Given that “education has been unable to forge a shared language of norms and values, teachers vary in their understanding of the goals of teaching, the purposes of education, the structure of the curriculum, the role of testing, and just about anything that has to do with teaching” (Grossman et al., 2001, p. 947). This study will add to the literature base by documenting the process of building a professional learning community of teachers who attempt to address these issues in a rural setting with a high needs minority population of students.

Research indicates that teacher participation in professional learning communities is one of the most effective forms of professional development that results in increased student achievement. The circumstances in which teachers on the Crow and Northern Cheyenne reservations teach clearly show a need for a structure for collaboration. The contextual factors, both general and specific to the schools in the bounded system, challenge the formation of such communities. Structures for ongoing community with the previously described characteristics do not exist in most American schools (Grossman et al., 2001, p. 947). In Halvorson, 2003, Grossman continues:
we have little sense of how teachers forge the bonds of community, struggle to maintain them, work through the inevitable conflicts of social relationships and form the structures needed to sustain relationships over time. Without such understanding, we have little to guide us as we create community” (p. 6).

Specifying the nature and significance of the multiple concepts of collegiality necessary for meaningful collaboration within the communities will require research designs and measurement adequate to reveal the situated meaning or value teachers attach to various types of interactions. The research also needs to reveal what those interactions require of teachers (Little, 1990, p. 11). McDonald & Klein (2003) ask “why, after so much teacher advocacy and practice of teacher knowing over the last decade or more there are such lingering theoretical gaps” (p. 1619). With the notable exceptions of the studies cited in their article, few researchers have paid much attention to teacher networking – an important component of successful school reform.

Much of the research that does exist on the impact of structured professional communities on teacher change looks at learning communities within individual schools and districts. The purpose of this study is to document the process of establishing a professional learning community made up of teachers from several small schools across reservations that are geographically distant from each other but who teach the same population of students. Although teachers in this study work in rural schools on or near two of Montana’s Indian reservations their situation is not unique. Teachers in rural schools throughout the country are confronted with the same need to collaborate and share their practice. In this study teachers share the same population of students who
move frequently between schools making a shared mission, vision and values critical for
students to succeed in mathematics.

It is the intent of this study to document a process of building a professional
learning community of mathematics for instructors who teach in rural schools on two
Indian reservations. The study reports on the factors that teachers report enhance or
limit their collaboration. Of interest will be whether or not these teachers perceive
their classroom practice and responsibilities as professional educators to have
changed as a result of their participation in a professional learning community.
CHAPTER 3

METHODS AND PROCEDURES

This study delineates the process of building a professional learning community of mathematics teachers who teach in small, rural, isolated, culturally diverse schools but share the same population of students. It examines the factors that enhance or limit teacher participation in the learning community. Finally, it seeks to describe teachers’ perceptions of the effect of their participation in the professional learning community on their classroom practice and professional role as an educator.

The literature is quite clear that all professional development occurs within and is influenced by the contextual factors in which it is embedded (Knapp et al., 2002; Loucks- Horsley et al., 2002). Efforts will “have little impact on practice unless professional developers learn to attend to the particularities of the local culture in which the teachers work” (Stein, Smith & Silver, 1999, p. 266). All strategies need to be matched to the group’s goals and to the context. In describing the “process” of building a professional learning community we must understand the context in which that process is set. Once the contextual factors are identified, the procedures can be identified that move the process along. Thus, the process a professional learning community requires consideration of a combination of procedures located within a set of contextual factors.

Throughout my work with teachers on the same two reservations in this study, I tried to remain aware of the advice given by Christopherson (2005):

As we seek our own understanding of tribal research and scholarship, we must remember the people of the community are the source of our
profound understanding of tribal life, values and rituals. We must hear their voices and participate in their stories and ritual in order to attain the wisdom we seek. As we explore the world of scholarship, the everyday people and everyday rituals must form the foundation of the lodges we build (p. 50).

This chapter describes the context, methods, procedures and data analysis used in this qualitative study. Patton maintains that “qualitative methods can be particularly appropriate for evaluation where program processes, impacts or both are largely unspecified or difficult to measure” (Patton, 2002, p. 471). Such is the case in this study. The uniqueness of teachers in these isolated settings, teaching the same population of students but having nothing in common with which to offer a coherent curriculum, and having no opportunity to collaborate, make the project challenging and the documentation of it even more so.

The first section outlines the context of the research and provides information about the location of the study and the funding source. The second section describes the teachers who were interviewed and the manner in which they were invited to participate. The third section identifies the instruments and procedures for data collection. The fourth section describes how the data was prepared for analysis and how the codes were determined. As pointed out in the literature, a professional learning community is shaped and influenced by the contextual factors in which it is embedded. These factors, as identified from the researcher’s field notes, will be described in the final section.
The Research Context

The Location

The participants in this study teach in schools located on or near the Crow and Northern Cheyenne Indian reservations in Southeast Montana. The two reservations were established in the mid 1800’s. They are large in geographic area but small in population. The Crow reservation is 4,989 square miles while the Northern Cheyenne reservation is 585 square miles, about the combined size of Connecticut and Rhode Island (Montana Office of Public Instruction, 2004). The history and culture of the people and region is rich and varied. Although the reservations are adjacent to each other, historically the two tribes were enemies (Figure 7).

Figure 7. Crow and Northern Cheyenne Indian Reservations.

In early reservation era, an “agency town”, located on each reservation, served as the seat of the reservation tribal government. It also served as a central point for agents
of the United States government. Crow Agency is the agency town on the Crow reservation; Lame Deer is the agency town on the Northern Cheyenne reservation. As more small towns sprung up on the reservations, the need for services and supplies grew. Entrepreneurs moved to the fast growing town of Hardin just outside the northern edge of the Crow reservation. In the mid-late 1900’s, the need for coal encouraged the population of the northern edge of the Northern Cheyenne reservation where the town of Colstrip was established just outside that reservation. Both Hardin and Colstrip were originally populated by white people but over time have become the home of many Native American families. Ashland is the third town that borders but is not on the reservations and is located on the eastern edge of the Northern Cheyenne reservation. In this study the phrase, “on or near the reservation”, refers to the Native American towns on the two reservations as well as the bordering towns of Colstrip, Hardin and Ashland (Figure 7).

Approximately 95% of the students who attend “on reservation” schools are Native American. The student body in “off reservation” schools has a greater percentage of white students than on reservations schools. Approximately 65% of students in the Hardin School District are Native American. Traditionally, the bordering “off reservation” districts have felt they offered superior educational opportunities to the “on reservation” schools.

Although most of the school districts on or near the reservation are public school districts, there is a strong presence of private parochial schools and one tribal school district. The public school districts on or near the Crow reservation are Hardin, Lodge
Grass, Wyola and Pryor. The Hardin District includes three K-5 schools. Hardin Primary and Hardin Intermediate schools are located in the town of Hardin itself, Crow Agency Elementary is located in the town of Crow Agency twelve miles from Hardin and Ft. Smith Elementary is a small schools located 45 miles from Hardin. Wyola is a small independent K-6 school whose students attend Lodge Grass or Hardin for middle and high school. Pretty Eagle School, located in St. Xavier, and St. Charles School, located in Pryor, are both K-8 schools located on the Crow reservation and are part of the St. Labre complex of parochial schools in Ashland on the border of the Northern Cheyenne reservation. St. Labre was established as a Catholic boarding school for students from both reservations. Pretty Eagle and St. Charles are not bordering schools but prepare younger students for attendance at St. Labre.

The Northern Cheyenne Tribal School located in Busby is the only tribally controlled school district on either reservation. Tribal schools are funded by the United States Government but are controlled by the tribal council. Lame Deer, the only other town on the Northern Cheyenne reservation has a public K-12 system. This mix of public, tribal and parochial schools makes teachers’ needed collaboration difficult for schools that serve the same population of students. The inconsistencies of funding sources and educational philosophies of the schools and districts on or near the two reservations make it difficult for teachers to provide a consistent, coherent mathematics curriculum for the students who frequently transfer between the schools. At times a student will transfer to Billings, thirty five miles north of Hardin, but other than these students transferring back to reservation schools, few new students move into the schools.
Because students frequently move between these schools but seldom move further, I refer to these schools as a “bounded system” (Figure 2).

The Sponsoring Organization

The professional development opportunities in this study are supported by the Center for Learning and Teaching in the West (CLTW), a National Science Foundation (NSF) five-year multi state initiative. A major goal for CLTW’s professional development staff is to help teachers “increase underrepresented students’ mathematics performance and participation” through the implementation of inquiry groups (CLTW proposal, 2000). In Montana, CLTW support for addressing these goals is partially addressed through encouraging teacher participation in on-site professional learning communities. The areas of focus for the communities are: 1) disciplinary content; 2) research based instructional strategies; 3) assessment strategies and 4) use of information technologies.

This study focuses on professional development with mathematics teachers who participate in the Math Inquiry Group (MIG) on the Crow and Northern Cheyenne reservations. The preliminary work for this study began in the fall of 2001 and is funded through September 2006. This study documents the process of building a professional learning community that occurred from June 2002 through June 2005.

The philosophy of the CLTW professional development staff grows out of research indicating the importance of teachers’ participation in professional learning communities to improve student achievement. Shared goals, vision and challenges for teachers in the schools were initially identified at an Open Forum for Math and Science
teachers held in Hardin in June 2002. The findings from this forum will be discussed in more detail in Chapter 4. The purpose of the Math Inquiry Group was to explore content, pedagogy, curriculum and assessment issues based on research and set in the context of current accountability standards. The goal was to address the teachers’ greatest challenge of providing a consistent, coherent mathematics curriculum for students who frequently transferred between schools in the bounded system.

Initially, teachers earned a stipend based on the number of meetings attended each semester. For the first two years, teachers who attended three of four Math Inquiry Group meetings a semester received a $200 stipend. If they did not meet this requirement they did not receive a stipend. The rationale for requiring attendance at 75% of the meetings each semester was to encourage commitment to a consistent agenda that would hopefully result in a change of classroom practice.

After the second year, we realized that winter travel was problematic. We were actually encouraging teachers to take risks driving many miles in bad weather in order to qualify for the stipend. In addition, the family obligations that take precedence in Native American families were unavoidable. We realized that many teachers were not attending any meetings because they knew ahead of time that they would not be able to attend the required number of meetings. Thus, in the third year we adjusted the policy so that teachers receive a $50 stipend per meeting. We realized it was more important for the development of a professional learning community for teachers to attend when they were able. The overall impact of that decision on building a professional learning community is still unknown. Instead of making the MIG stronger, it may have diluted the experience
by constantly bringing in new teachers who had not had the opportunity to develop the trust emphasized in the research as a precondition to professional learning communities. However, all teachers including special education teachers responsible for helping students learn mathematics and preservice teachers were encouraged to attend. The literature indicates the importance of encouraging relational trust between all members of the school community who work with the students in mathematics. The average group attendance was between 15 and 20 and included both Native American and white teachers.

The contextual factors that influenced this project include many of those identified in the literature but also others identified through analysis of the researcher’s field notes, minutes, and teachers’ evaluations. These will be presented in the last section of this chapter. I begin by describing the participants who attended the Math Inquiry Group at some point during the three years of the project.

**Procedures for Data Collection**

**Participation**

**Rationale for Sample Selection.** When the project first began there were 17 high school teachers (grades 9-12), 20 middle school teachers (grades 6-8) and 20 fifth grade teachers who teach in schools on or near the two reservations that were invited to attend Math Inquiry Group meetings. As individual teachers changed during the period of the study due to attrition, grade changes, etc., I made every effort to ensure mathematics teachers in the bounded system felt welcome to any and all learning opportunities. Forty-
eight different teachers attended one or more Math Inquiry group meetings during the three years of this project between September 2002 and June 2005.

**Invitation of the Interviewees.** The following procedure was used to invite teachers to take part in the interviews. After this study was reviewed and approved by Montana State University’s Internal review Board, I announced to the group of teachers present at the March 2005 MIG meeting that I was writing a story of our journey together in forming a professional learning community. Much research on Native Americans is done from a deficit model explaining something that has been done “to” them. I felt it was important that the voices of the teachers as well as my own were heard in the story. I approached teachers who had attended several meetings, either in a compressed period of time such as a semester or over several semesters or in some cases for the length of the project.

I asked 24 teachers to participate in interviews based on their attendance, either sporadically or intensely for a period of time, and demonstrated interest. All 24 agreed to participate in the study. A couple of the teachers never attended enough meetings to earn a stipend but were active in other CLTW activities such as the Math/Science Advisory Group and were recognized as leaders in the mathematics community. These teachers were seen as “legitimate peripheral” (Wenger, 1998) teachers. Wenger reminds us that these peripheral attendees may not be as passive as they seem. They put their insights to good use in conversing with other participants in other communities (Lave & Wenger, 1998). As stated in Chapter 2, the majority of studies regarding professional learning communities relate to teachers and staff within a specific distinct school or district. The
teachers in this study are unique because most of them did not know each other previous to the project but shared teaching a common population of students.

**Researcher’s Position Relative to the Participants.** I am a retired middle and high school math teacher from Alaska. Over a period of thirty years in addition to teaching mathematics at the middle and high school levels, I was also a high school and central office administrator, counselor and coordinator of a state higher education Eisenhower Grant. This combined experience of work in public school systems proved to be an invaluable asset in this study. The knowledge of the workings of a public school system at all levels helped me encourage the necessary communication between members of the various school communities. The combination of experience and doctoral course work has given me an extensive working knowledge of the standards and accountability movement as well as experience in organizing and facilitating professional development opportunities for teachers.

Probably the most important aspect of thirty years of living and teaching in Southeast Alaska in terms of this study is the knowledge I bring from interacting with the Alaska Native community on a regular basis. This history provided a background and comfort level for my work with teachers in the bounded system. It also helped me gain the trust of the participants.

I was initially introduced to administrators and teacher participants in the bounded system by the CLTW Montana professional development coordinator. Jackie, the coordinator, is a Montana born Native American of the Assiniboine and Gros Ventre tribes with extended family on the Northern Cheyenne reservation. Her knowledge of the
culture, history and people of these reservations was invaluable for me. All decisions related to the Math Inquiry Group and other CLTW professional development opportunities carried out in the bounded system were made jointly by myself and the Native American professional development coordinator.

The literature is clear on the importance of trust between members of a professional learning community that is attempting to increase student achievement. The teachers in this study were never viewed as simply objects of study for us. We had great respect for the teaching profession and recognized the challenges these teachers faced. Early in our work together, I realized that I wanted to document our time together in some format. I soon began to formulate the thought that we should tell our story together.

Although it is possible my familiarity with the participants influenced my interpretation of some of the teacher comments or behaviors, I felt the trust that was built between us encouraged more honest interview responses. The teachers in this study knew me and were comfortable with me. During the three years of the study we learned together and enjoyed one another. The trusting relationship between myself and the professional development coordinator and our common goals for the teachers was key to our work with participants in this study. Many studies have been carried out in these reservations, and most have centered around the deficit model. Neither Jackie nor I saw our work with the teachers in anything but a positive manner.
Description of the Participants. The 24 teachers interviewed for the project formed a cross section of teachers in the schools previously described. Descriptions of the teachers are found in Table 1 below.

Table 1. Description of Participants.

<table>
<thead>
<tr>
<th>Gender</th>
<th>21 Female</th>
<th>3 male</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td>15 White</td>
<td>9 Native American</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 Crow/4 Northern Cheyenne</td>
</tr>
<tr>
<td>Location of schools</td>
<td>6 Border schools</td>
<td>18 On reservation</td>
</tr>
<tr>
<td>Grade level</td>
<td>6 high schools</td>
<td>11 elementary grade 3-6</td>
</tr>
<tr>
<td></td>
<td>6 middle schools</td>
<td>1 para professional</td>
</tr>
<tr>
<td>Teaching certification</td>
<td>6 Secondary</td>
<td>17 K-8 certification</td>
</tr>
<tr>
<td></td>
<td>Mathematics</td>
<td>Special Ed etc.</td>
</tr>
</tbody>
</table>

Grades 3-12 were all represented. Six teachers taught high school and have secondary degrees in mathematics. Six taught in middle school, 11 taught in the upper elementary grades 3-6. At the time of this study, only one of the 6th grade teachers taught in a middle school. The 6th grade remained in the elementary school for the remaining 6th grade teachers. One para professional participated in the study.

Sources of Data Collection

As stated in the introduction to this chapter, the process of building a professional learning community includes procedures, decisions and turning points set in the context in which they occur. These are documented in my extensive field notes. Canales (CLTW Summer Institute, August 2005) refers to this as an “emic” (Mestizo) vs “etic” (European) approach to research. Emic research occurs in a natural setting. In this approach, the researcher observes people within their culture and is more of a
collaborator with them than a researcher “of” them. The researcher shares writings with participants who have options to make changes - leaving them feeling empowered with respect to the process.

Using this approach, there were two primary sources of data collection for this study. One source is the extensive field notes, minutes, agendas and observations of the researcher throughout the three years of the study. The other is the face-to-face interviews with teacher participants in the study. Teachers filled out formative evaluations after some of the Math Inquiry Meetings that were also used. Many of the individual teacher evaluations were designed to gather feedback on the activities and style of meetings that were the most helpful to teachers. Agendas of all meetings have been kept as well as minutes of the meetings. All of the above forms of data (field notes, evaluations, agendas and minutes of the meetings) were used to provide background information for the study and to help identify relevant patterns within the data.

Field Notes. I kept extensive field notes during my initial and subsequent visits with teachers and administrators. These notes included observations, comments from teachers, administrators and occasionally community members. After each trip I typed up these notes, adding my overall observations. Prior to each MIG meeting, I emailed and in some cases traditionally mailed agendas of the upcoming meetings. At the end of most semesters I would ask teachers to fill out a short evaluation form I designed or do a quick write on a prompt I gave them. These were all sources of my reflections on building a professional learning community with these teachers.
The Interview. Teacher interviews and questionnaires are the two principle methods used to obtain the descriptions and interpretations of others. The interview is the main road to describing these multiple realities (Stake, 1995). Based on the literature regarding the importance of relational trust (Bryk & Schneider, 2003) in affecting change in student achievement, I chose to conduct face-to-face interviews over written questionnaires and/or having others, i.e. graduate students, perform the interviews. Not only did the participants have prior knowledge and interaction with me resulting in a high level of relational trust but personally interviewing the teachers gave me the latitude to change the sequencing of the questions or in some cases the wording of the questions to increase clarity for the individual teacher. For this population of teachers, especially the Native American teachers, written evaluations have yielded minimal responses. Native Americans embrace the oral history tradition, often telling a story instead of directly answering a question. Attention to the culture and place of the people we are interviewing is fragile and must be respected (Patton, 2002). A face-to-face interview had the potential for allowing teachers to use the communication style they were comfortable with and to take their time.

We interview to “find out what is in and on someone else’s mind, to gather their stories” (Patton, 2002, p. 341). For most studies, especially case studies, gaining access to the population and building a rapport with them is critical (Creswell, 1998) to achieving this goal. Patton (2002) refers to three basic types of interviews: the informal conversational interview, the general interview guide approach and the standardized open-ended interview. I chose a general interview guide approach because this allowed
me to retain the option of probing participants' response based on my knowledge of the individual and the situation.

The interview questions (Appendix B) were piloted with the Professional Development coordinator prior to actually interviewing teachers to determine a reasonable time frame. It appeared the interview could be carried out in approximately 45 minutes, the length of a teacher’s prep period. I introduced the study to the teachers in attendance at the Math Inquiry Group meeting in Lodge Grass on March 17, 2005. I emphasized that I wanted the study be a joint effort to document the combined journey of the teachers and myself. I gave a copy of the consent form (Appendix A) to each participant present and explained that they would be asked to sign it before the interview. This eliminated the necessity of taking time for this purpose before the interview. I also explained the interview process.

The literature informs us that it is quite common for Native American people, students and adults alike, to refrain from speaking until they have listened to all aspects of a situation, observed others’ reactions and thought through their response (Pewewardy, 2002; Dehyle & Swisher, 1997). Thus, all teachers were given written copies of the interview questions before their scheduled interview. Although they were given the choice of responding in written form, they all chose a verbal interview. Some appreciated time to compose their responses before the interview. I informed the participants that if at any time they were uncomfortable, he/she could ask me to turn off the recorder and I would immediately do that. None did so.
I personally conducted all the interviews. The interviews were audio taped and given confidential identifiers. I felt it was important to listen to the participant’s stories and that it might be interpreted as impolite if I took notes during the interview so I relied on the interview tape. As soon as possible after the interview, I wrote down notes of everything that seemed relevant to the situation that would not have been on the tape. This included the room where the interview took place, the time, interruptions during the interview, and other thoughts I had about the teacher’s confidence, hesitancy, etc. In the case of one teacher, the microphone was not plugged in and the interview was not recorded. I realized this within an hour of the interview and immediately wrote down the results of the questions from memory.

In order to increase my understanding of the teachers’ responses, and because the meaning of the participant’s words is more important than the exact words (Stake, 1995) I asked Jackie, the Montana Professional Development Coordinator to listen to a random sample of the Native American teachers. I felt it was better to listen and ask for clarification of a response when needed than to take copious notes. Participants were given the option of viewing the entire transcription of their interview but Stake (1995) reminds us that interviewees might be disappointed that the transcript does not reflect what they meant to say. Since it was my intent to accurately represent what the participants feel about the process, they were given the opportunity to add to or change their responses. One teacher took advantage of this offer.
Preparing the Data for Analysis

Field Notes, Agendas and Minutes. Field notes (fn.) taken during the three years of this project were printed, labeled and placed in a notebook according to date. These field notes included teacher comments, thoughts I had while visiting administrators and other teachers, and the general atmosphere of the schools and the meetings. They helped me understand the data and set in context from my perspective what the teachers referred to. The field notes include those taken from meetings of other CLTW learning communities in which some of the Math Inquiry participants were present such as Hewlett Packard workshops or Advisory Group meetings. Agendas, minutes and formative evaluations of the meetings were labeled and organized from the beginning of the project. While reading through this material I looked for decision points and themes or categories that emerged. These notes were used to describe the researcher’s version of the process of building a professional learning community found in Chapter 4.

Coding the Interviews. A CLTW administrative assistant and work-study student transcribed tapes of the interviews verbatim. Both were familiar with the Native American dialect. The interview questions were designed to address specific research questions; participant responses were grouped accordingly.

I conducted multiple readings of the transcriptions to develop an accurate conception of each participant’s response. During the first reading I made notes about emerging themes or how the responses might connect with other research questions (Patton, 2002; Creswell, 1998). After a first reading I created a preliminary coding scheme and then reread the interviews to begin to assign formal codes. On subsequent
readings I looked for instances that fit the coding scheme as well as responses that did not fit the established codes.

I used the software package, Hyper Research, to track the responses to the interview questions for each teacher. The software allowed each transcript to appear on the screen beside a list of identified codes or questions and the description of each. As a segment of the interview was identified for a given code, it was highlighted on the screen. The software kept a running track of the code number and inclusive characters in the interview. This allowed me to view all responses to a given code or to combinations of codes using a Boolean method. It also allowed me to see the code in the overall context of the response.

As I identified the teachers’ responses to each interview question, I found that many teachers made reference to a previous question while answering a later one. In other words, in answering an interview question for the fourth research question, a teacher might provide more information to an interview question asked earlier in the interview. The software allowed me to double code these responses. I also began to notice comments regarding topics addressed in the literature or identified as contextual factors. I created additional codes realizing these topics might be important in my analysis. Examples of the added codes include reflective practice, administrators, trust, and isolation. As I added new codes, I returned to the previously read transcripts to pick up the new codes I might have missed. When I finished reading and rereading the transcripts, I had codes for each interview question and codes of overarching themes
addressed in the literature. The software package allowed me to print reports of teachers’ responses to single code or a combination of codes.

I initially made an outline of the interview questions (Appendix B) that addressed the process of establishing a professional learning community - research question one. First, I wanted to establish a baseline of the opportunities for students and teachers to engage in meaningful mathematics in the bounded system that existed prior to our first meetings and what motivated them to attend their first meeting. Second, I wanted to know why they continued to participate. Third, I felt it was important to know what made it difficult for them to attend. Fourth, I wanted to know why those who stopped for a period of time or permanently did so. Finally, I wanted to know if the teachers felt they belonged to a professional learning community and how they felt it could be sustained after the funding for the project stopped.

In determining the conditions for teacher collaboration that existed in the bounded system before we began our work, I examined teachers’ responses to the following questions:

• Before participating in CLTW activities, describe the types of discussions you had on the topics of teaching, learning and assessment with other math teachers

  1. In your building?
  2. In your district?
  3. In other districts?

• What motivated you to attend your first Math Inquiry Meeting?
I coded each transcript according to the codes for these questions and was able to print a report of all teacher responses to these questions using HyperResearch. Using the computer generated report, I searched for themes that answered these questions, underlining comments and coding them by hand as I went. As I grouped the comments, themes emerged. I then defined each theme and rechecked the transcripts to make sure they all fit into one of the themes. This method was used for analyzing the teacher transcripts according to the previous questions.

Verification of the Addressed Teacher Needs and Classroom Practice Codes

In order to support the validity of the codes created to represent teacher needs and changes in classroom practice codes, a verification process was necessary (Constas, 1992). In the present study, the technical method was employed to verify the coding. A colleague familiar with the study was given an orientation to the construct under investigation, an overview of the study’s design, and a random sample of the data from the teacher addressed needs and the changes in classroom practice codes. She coded the selected portion of the data using the teacher needs and changes in classroom practice definitions. Agreements and disagreements were recorded and counted for both teacher needs codes and changes in classroom practice codes. The raw rate of agreement was 88% for teachers addressed needs and 93% for changes in classroom practice. In order to correct for chance, inter-rater agreement was calculated using Cohen’s (1960) Kappa. The inter-rater agreement for the addressed teacher needs was $k = .867$. The inter-rater agreement for the changes in classroom practice was $k = .918$. These results can be
interpreted as representing a strong level of overall agreement. Descriptions of the type of response coded for each teacher addressed need can be found in Appendix C. Descriptions of the changes in classroom practice can be found in Appendix D.

**Researcher Identified Contextual Factors**

Professional developers perform their work in multiple contexts that are shaped by the values and established procedures of the schools, districts and communities in which they are located. As the literature reminds us, “professional developers must carefully analyze the constraints and alternatives offered by each of the various contexts” (Stein et al., 1999, p. 241). Just as professional developers must identify the contextual factors in which their work occurs, the qualitative researcher must describe the ‘context’ in which a particular event takes place (Rudestam & Newton, 2001).

The process of building a professional learning community described in this study is constrained in several contexts. These contexts had to be identified before deciding on the procedures for establishing a professional learning community and thus became an integral part of the process. To begin the process without an understanding of the contexts in which it is embedded would result in almost certain failure. In this section, I will describe the contextual factors I identified from close analysis of extensive field notes, minutes and observations from the three years of this study. These factors influenced the decisions made regarding the procedures that together with the context guided the process of establishing a learning community.
Initial Visits and Thoughts

I was introduced to the vast, isolated beauty of the Crow and Northern Cheyenne reservations in Southeast Montana during winter and spring of 2001-02. Jackie, the CLTW Montana Professional Development coordinator was my hostess and guide. Our agenda included meeting and visiting with school district superintendents, principals and tribal college math and science faculty as well as teachers when they were available. The purpose of our trips was to clarify CLTW goals with administrators and faculty and listen to their suggestions and concerns regarding math and science education in their schools and districts. The information I learned about the people and their cultures during these visits was far more important to implementing the goals of the grant than anything I had ever imagined.

Jackie is Gros Ventre/Assiniboine and grew up on the Ft. Belknap Reservation in Northern Montana. At the time of our visits, she was married to a Northern Cheyenne from the Lame Deer area. While living in Lame Deer, she taught mathematics and science at the local tribal college and facilitated professional development with some of the K-12 district teachers. As we visited schools, administrators, and teachers it was obvious that she had a deep understanding of the local culture and was well respected by those who knew her. Her initial introductions as well as the extensive knowledge of the area and culture she shared with me during our long hours of driving were invaluable to our work together and my commitment to the project. My initial understandings of the challenges inherent in the project we were embarking upon grew out of my first hand experience of the distances and isolation of the schools in the bounded system, teacher
and administrator reported high level of student mobility and the lack of consistency in mathematics materials and curricula used throughout the “system”.

**Contextual Factor Framework**

Knapp’s et al. (2003) framework helped me organize the information I encountered during my initial visits and conversations with administrators and teachers in the bounded system (Figure 4). The framework identifies learning needed on three levels necessary to improve student achievement. These levels include student learning, professional learning and system learning. All learning occurs within three groups of contextual factors identified as organizational, family and community, and larger policy and professional. Levels of learning in turn are influenced by five areas of action: building a professional learning, establishing a focus on learning, creating coherence, acting strategically and sharing leadership and engaging external environments. Other researchers (DuFour & Eakins, 1998; DuFour, 2004; Eaker, DuFour & DuFour, 2002; Hord, 1997; Halverson, 2003) include the last four areas as necessary components of building professional learning communities.

My early visits with Jackie and subsequent visits and interactions with teachers and administrators on the reservations provided a great deal of insight into the contextual factors that influence the mathematics education of students in the bounded system described. In this study, I used Knapp’s et al. (2003) three larger sets of contexts; organizational, family and community, and policy to organize the contextual factors I identified as specific to this study (Figure 8).
Figure 8. Contextual Factors Influencing the Math Inquiry Group.
Within each of the three broad contextual categories, I identified sub categories as shown.  Administration, the school and system structures, and the culture of classroom teaching are considered organizational contexts. Together, these contexts influence the degree of consistency of a coherent mathematics education available to all students. The broad category of family and community contextual factors includes culture viewed from three perspectives: Native American, rural and socioeconomic. For this study, the Native American culture includes the history of the people and schools on these two reservations, their language and the family. Each of these factors individually impacts the rate of student mobility and attendance which was identified by teachers and administrators alike as effecting the mathematics achievement of students. Together, they exert an enormous influence on teachers’ practice. Policy, the third category, includes the commonly accepted practice of local control and politics, state and federal mandates and the effects of external entities. The external entities in this study include CLTW, Montana Office of Public Instruction, the reservation tribal colleges (Chief Dull Knife Tribal College [Northern Cheyenne] and Little Big Horn College Tribal College [Crow]), and other grants administered by the tribes, universities and the Montana Council of Teachers of Mathematics [MCTM]. These factors are set within the overarching contexts of isolation exacerbated by the lack of access to or comfort with communication technology and the need for relational trust that exists between and among various school staff and me (Figure 8).

In the following sections, I will describe the events and conversations that helped me identify the specific contextual factors relative to building a professional learning
community of math teachers across schools in the bounded system as well as their impact on the process of establishing the Math Inquiry Group.

**Overarching Contexts**

**Isolation.** Many miles separate the schools and districts in the bounded system. This presented significant obstacles to our efforts to form a professional learning community of math teachers in the bounded system. The distance between my home and those schools compounded our efforts. This obstacle cannot be minimized. The roads were snowy and icy during the harsh, dark Montana winters causing dangerous driving conditions. I drove a minimum of 200 miles one way to reach the town closest to Montana State University. Teachers had to drive up to 70 miles one way to attend Math Inquiry Group meetings in the same conditions. For teachers, the meetings and drives came after a long day of teaching. Several teachers lived in Billings, which required an extra 35-60 mile drive after the meeting ended at 7:30 PM. The lack of cell phone service throughout much of the reservations can make the long drives even more hazardous.

The importance for teachers of meeting face-to-face with colleagues was brought to light during a discussion regarding the use of videoconferencing for some of our meetings. In an effort to help mitigate the long drives for everyone, we introduced the idea of employing email and videoconferencing to disburse information and hold meetings. As we discussed this option at a MIG meeting, several of the teachers replied they would drive 50 miles for a meeting but would probably not walk down the hall for a
video-conference. One teacher commented that she needed to be able to “touch” the other teachers.

**Trust.** The existence of trust or the lack of it between all stakeholders of the educational community is another overarching contextual factor challenging attempts to build a professional learning community of teachers from these two reservations. Previous research indicates a high degree of relational trust among all participants in a professional learning community is imperative for collaboration to occur (Bryk & Schneider, 2002; Imants, 2003). The history of interactions between the dominant culture and Native Americans and between the Crow and Northern Cheyenne tribes had not instilled a feeling of trust.

During our early visits it appeared to me that trust between teachers, administrators and the community was also strained at times – both within and between schools in the bounded system. Trust had been eroded between districts in the bounded system in recent years due to cultural misunderstandings and financial problems. In an effort to increase their operating budgets through increased student enrollment, districts in the system had to compete for the same students who frequently transferred between districts. Administrators found it difficult to collaborate in instructional ways that would benefit student learning after they had been involved in lawsuits against each other over students crossing enrollment boundaries. These practices set up competing rather than collaborative cultures between administrators that did not benefit the consistent academic offerings students had available to them.
Trust between administrators and local school boards appeared to be strained. Scarce jobs are fiercely protected within a culture of poverty. School boards often do not back administrators in firing or transferring incompetent teachers because eliminating a teacher’s job is not only taking away his or her livelihood but also the financial support of the extended family. This practice of seeming protection of incompetence has undermined the trust between administrators and some faculty members.

The lack of trust and resulting communication between administrators restricts opportunities for collaboration between teachers. Without communication regarding curricula and materials used, the possibility for students to receive a consistent, coherent curriculum based on a common vision for all students is remote. The teachers in the Math Inquiry Group confirm this problem and have engaged in many discussions about the various teaching materials and texts used at various grade levels in different schools.

Organizational Contextual Factors

The first broad category of contextual factors that influences learning has been named “organizational factors”. It includes aspects of a) administration, b) school and system structures, and c) classroom teaching.

Administration

The literature on effective school reform emphasizes the support of the administrator as one of the preconditions for establishing a successful professional learning community (Katzenmeyer & Moller, 2001; Miller, 2003; Moller et al., 2000, Morris et al., 2003; Saginor, 2005). As a result, it is traditional for grant proposals to
include evidence of administrative support for the project. The initial CLTW proposal to NSF included a letter of support from administrators for their teachers’ participation in CLTW activities. During our initial visits, the administrators welcomed us and spoke frankly about their concerns. These concerns centered on meeting NCLB requirements, the high level of student transfers, high rates of student absences and financial solvency. Initially, the curriculum directors from the two large off reservation schools took an interest in the Math Inquiry Group and came to occasional meetings. For the most part, the other administrators supported our efforts by releasing teachers to attend MIG meetings but did not attend meetings or indicate an interest by engaging participants in conversations regarding the goals of the group.

In small, rural schools administrators are required to wear many hats, which limits the time they have available for participating in professional learning communities. They often serve as CEO, CFO, personal relations officer, curriculum director, assessment and professional development coordinators and hopefully as instructional leaders across grades K-8 or in some cases K-12. Only the two larger towns at the edge of each reservation have curriculum directors. In one district the high school principal is a basketball coach and does a fairly good job at trying to get the kids to behave in the halls but it is not tied to any academic plan. Due to pressure from the community, there is a proposal on the table to decrease grade point eligibility for athletics – allowing more students to play (fn. Nov. 23, 2002). Instructional leadership often takes a back seat to these more pressing issues. Additionally, politics in small towns located on the reservations require a great deal of administrative energy and time. These varied
responsibilities can compromise building a trusting environment needed for supporting professional learning communities in their schools.

During the three years of the study and 18 months since, the administrative turnover varied across the bounded system. In one large border town there has been no turnover at any level. In the other border town district the turnover has all been in district. In the three larger on reservation K-12 the pattern varied as the table below indicates (Table 2).

<table>
<thead>
<tr>
<th>District</th>
<th>Superintendent</th>
<th>High School</th>
<th>Middle School</th>
<th>Elementary</th>
</tr>
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<tbody>
<tr>
<td>Off reservation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District A</td>
<td>No Change</td>
<td>No Change</td>
<td>No Change</td>
<td>No change</td>
</tr>
<tr>
<td>Off reservation</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>District B</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>On reservation</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District C</td>
<td>3</td>
<td>No Change</td>
<td>2 In house</td>
<td>No Change</td>
</tr>
<tr>
<td>On reservation</td>
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<td></td>
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<tr>
<td>District D</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>On reservation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District E</td>
<td>2</td>
<td>No Change</td>
<td>NA</td>
<td>2</td>
</tr>
<tr>
<td>On reservation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>District F</td>
<td>3</td>
<td>4</td>
<td>NA</td>
<td>4</td>
</tr>
</tbody>
</table>

New administrators experience a steep learning curve in understanding the history, culture, and politics of the reservation school and community. They often come to the position with ideas of their own that are not related to previous initiatives. Each Fall I had to establish a relationship with the new superintendents. The remaining administrators had to adapt to the vision and goals of the new superintendent and were
unclear of how our prior work with the districts would be continued. This further complicated my role with these administrators.

Many of the area administrators, both new and with many years of experience, appear to “lead” in a top down manner. Several seem to make decisions without consulting the teachers who become responsible for carrying out their decisions. Although top down administrative practices are not new to education, this type of administrative practice is not conducive to the collaborative environment necessary for building a professional learning community. Several examples of this type of leadership follow.

In one high school, aides appeared in every math classroom one day. The classroom teachers were not notified they would be getting aides and had no say in who was hired or why. Many of the aides had little knowledge of mathematics. In another district, an administrator attempted to override the curriculum suggestions of the math committee made up of teachers (fn. March 16, 2005). In another school an administrator decided to place all 9th graders in General Math because they were not ready for Algebra I. He did this without engaging middle and high school teachers in discussions regarding student expectations. In yet another district, teachers at a 100% Native American elementary school were told by the high school principal that 65% of their students would fail when they transferred to the district high school (fn. March 2002). These kinds of interactions made it difficult to build relational trust between teachers and administrators.

The history and resulting misunderstandings between Native Americans and the white administrators and teachers can also limit the degree to which relational trust can
be established. A Native American administrator of one reservation district recently informed a grant director offering support for his teachers that he felt strongly that all teachers in his district should be Native American. In his opening message to the staff his first year, the administrator shared his goal to have all native language teachers at the school. He wanted all students to build on their existing cultural knowledge to acquire new knowledge. This was a laudable goal with unintentional consequences. Many of the district’s math and science teachers were white and had lived and taught in the community for many years. They were devastated and felt their jobs were threatened. This type of situation can undermine the trust between teachers and also between teachers and the community at large.

On the other hand there are many administrators who encourage trust. For example, the principal of a 100% Native American elementary school was raised on a reservation. At least 50% of the teachers in that school are Native American. He encourages teachers to understand where the children come from and not to talk down to them. He reinforces that Native American children are smart, but “We just need to work with them and get them up to level through test-taking.” He takes an active part in the education of the children, listening to them read in the morning and greeting them as they come in the morning or leave in the afternoon. He is also extremely supportive of CLTW’s activities with his teachers and stays in contact with the teachers who participate in the Math Inquiry Group. The difference in these two administrative philosophies is evident in the feeling of trust their staffs exhibit.
Even though they have overwhelming responsibilities, many administrators do not take advantage of available help. One example involves the use of student data generated by state mandated tests. The Montana Department of Education made great efforts to build a database of disaggregated student scores for administrators and teachers to use in changing instructional practice and curricula. They also supply trainers for districts to use in training teachers free of charge. Most of the teachers in MIG work in districts that do not take advantage of these resources. Even though the data is available for teachers’ use, they are not given the training or the time to access this information and collaboratively decide how to use the information to change their instructional practice.

School and District Structure

The second aspect of organizational factors that influence the professional development of mathematics teachers is the structure of the schools and districts in the bounded system. “Norms of privacy, assignment policies, graded school structures, and a host of other forces encourage isolation rather than collaborative engagement in common work” (Knapp et al., 2003, p. 25) that is critical for teacher participation in professional learning communities. The same is true for teachers in schools in the bounded system.

Most of the elementary teachers who teach in schools in the bounded system have K-8 general teaching certificates. Lacking any special training in math content or pedagogy, they are assigned to teach various content strands at a particular grade level. There is no structure provided for teachers who teach the same grade level or who teach in adjacent grade levels to collaborate during the school day. This limits the opportunity
for teachers to work together to ensure students receive a consistent, coherent mathematics program either within a building or between buildings.

Even when a school has two math teachers who teach in adjacent rooms, there is seldom time provided for any substantive interaction. At one MIG meeting in which the discussion centered on sharing their practice, two high school teachers who had taught next to each other for years stated that before attending MIG meetings, they only saw each other briefly in the halls. Now they engage in in-depth discussions about teaching and learning in mathematics (fn. Dec. 2005).

In an attempt to provide a structure for academic consistency between schools, all Montana districts were required to align their local curricula with the state content standards. Due to a lack of resources, staff, money or time to satisfy this requirement, small schools and districts formed curriculum consortia in order to meet the state requirements. However, in the case of the bounded system, even though they share the same population of students, the on reservation districts belonged to two different curriculum consortia. In addition, the two large border districts developed local mathematics curricula.

This issue is further complicated by the fact that even though the consortia provided a common curricular base for member schools, there appears to be little consistency in a given consortium member’s implementation of the curriculum. Vastly different materials and texts are used between the member schools of a given consortium. As I visited schools and talked to teachers, I found that the materials used ranged from traditional texts such as Saxon Math (2002) to reform based materials such as Six through
Eight Mathematics (STEM) and the Connected Math Project (2004). The philosophy of the Saxon materials is very procedural and uses a spiral approach to learning mathematics. The Connected Math Project (CMP) on the other hand, is a series sponsored by the National Science Foundation. CMP is based on a constructivist philosophy – encouraging students to build a conceptual understanding of concepts before designing and using algorithms. Although it does spiral, the curriculum introduces and teaches each concept in depth.

The internal curricular inconsistency was very apparent in one district where the 5th grade teachers used Saxon curriculum materials (2002), one of the 6th grade teachers used CMP, and the other used Saxon. Students in the 7th grade had experienced a mix of these curricular experiences making it difficult for the 7th grade teacher to build on their prior understanding. The teachers had little opportunity to collaborate and discuss these inconsistencies until they began attending the Math Inquiry Group meetings.

Administrators are beginning to realize the impact of this curricular inconsistency on their students. Some began to suggest all schools in the bounded system use the same curriculum (March 22, 2002 notes). At the time of this writing, no effort had been made to follow through on this idea.

As we began our work in the bounded system in 2002-03, most districts had a mismatched set of K-12 materials that ranged from very traditional to reform based. If student mobility was the problem that everyone seemed to think it was, I quickly saw how impossible it would be for even the brightest student to be successful if he/she transferred between districts using such different materials. This curricular inconsistency
led one high school math teacher to make the following comment during our first conversation. “I don’t care what materials they use. I understand people have their personal favorites. If we could only agree to what we’re going to teach every year and what time of year we’re going to teach it – that would be great” (fn. March 2002). This awareness was instrumental in the decisions I made in the rationale for building a professional learning community of mathematics teachers.

In addition to the systems within local schools and districts that influence MIG, the three types of districts - public, parochial and Bureau of Indian Affairs [BIA] - each have their own governing system and instructional philosophy. Locally elected school boards in public districts make decisions that impact curricular decisions. The BIA funds their schools through the tribe. In the case of the tribal school on the Northern Cheyenne reservation, the tribe actually fired the locally elected school board and superintendent a couple of years ago.

**Culture of Classroom Teaching**

The third organizational factor influencing professional development is the culture of the teaching profession itself. It is a common occurrence at Math Inquiry Group meetings for teachers from various grade levels in the same school to engage in excited conversation about the math curriculum. They do not have this opportunity within the structures of their own schools and districts. This feeling of isolation was very apparent in the remarks teachers made in their interviews.

The following story illustrates the double impact that teacher isolation has on students who frequently transfer between schools. Two high school math teachers teach
in towns thirty-five miles apart. Their students often transfer between the two high schools. Even though each teacher had taught in their respective schools for over six years, they had never met each other until both attended a CLTW meeting. They immediately started talking about shared students, what books they were using, the curricula at both schools, etc. During this discussion the teachers realized that although they were using the same text to teach Algebra II, one high school covered the material in one year while the other covered it in two years naming the classes Algebra II and Algebra III. The impact on students transferring between the two schools and subsequently enrolling in the local tribal college was significant and confusing to students and instructors alike. This one on one connection would not have occurred via video conferencing. Because teachers live in such rural and isolated environments, the social aspects of the Math Inquiry groups were as important to them as the math related agenda items and contributed to building the relational trust that was necessary for in-depth collaboration.

Summary of Organizational Factors

During our initial visits and conversations, I realized that the organizational contextual factors influencing the professional development of teachers in the bounded system precluded any consistency of the mathematics curriculum for students as advocated by the NCTM Curriculum Principle (2002). The limited trust that existed between administrators and the isolation of teachers both within and between schools made collaboration between staff difficult.
Most administrators support the efforts of CLTW to work with math teachers but with few exceptions have little idea of the type of support teachers need to increase students’ mathematical understanding. Their understanding of mathematics may be limited to their own experience and the pre-standards era emphasis as a check list of skills. The importance of providing teachers a structure for collaboration that ensures students the opportunity for a coherent, consistent curricula across grade levels is not well understood.

This became even more important because of the high rate of student mobility between schools. As administrators asked for my advice during their mathematics textbook adoption cycles, it was clear they rarely checked with other bounded system schools regarding the mathematics materials used in neighboring districts. The literature informs us that it is not unusual for administrators to lack skills necessary to help teachers improve their mathematics classroom practice. The National Commission on Teaching and America’s Future (1996) concluded that “most schools and teachers cannot achieve the goals set forth in new educational standards, not because they are unwilling, but because they do not know how, and the systems they work in do not support them in doing so.”

The schools and districts in the bounded system appear to be no different. The schools in the bounded system are isolated geographically, professionally and culturally. Relational trust between faculty members and the community is weak or does not exist. Set in this environment, the organizational structure at all levels of the schools and districts, the overwhelming responsibilities of the administrators and the culture of
teaching limit the access to a consistent, coherent curriculum for students moving among schools. This was the initial context of the work to build a professional learning community of math teachers as we saw it.

Family and Community Contextual Factors

The second major category of contextual factors that influences learning is referred to as family and community. The three aspects of family and community addressed in this section include Native American culture, poverty and rural. Many definitions can be found for the term “culture” however most include the following terms: a shared, learned, symbolic system of values, beliefs and attitudes that shapes and influences perception and behavior. I will use this definition in describing the poverty and rural environment that influences the Native American culture of students attending schools in the bounded system. Based on my field notes, I will describe the impact of each on building a professional learning community of mathematics teachers. The literature on each of these facets of culture (poverty, rural and race) with respect to teaching and learning is found in Chapter 2.

Native American

Robbins (2005) provides a framework for understanding culture. According to this framework it is important to understand the values and beliefs of the culture based on the following attributes: traditions, definition of success, stories, expectations, physical environment, use of time, history, routines, cultural players, norms, rewards and celebrations and rituals. Following are observations of several of these attributes I found
during my visits to the schools and districts and conversations with teachers, administrators, and community members.

**History.** An examination of the Crow and Northern Cheyenne tribes reveals a longstanding pattern of cultural clashes, disputes and fights over territory (Juneau, 2001; Linderman, 2002; Deyle & Swisher, 1997). The two tribes, historically enemies, reside on adjacent reservations. As a result of the proximity of their reservations the tribes have intermingled however, their history, language and cultures are different. The following stories of MIG Native American teachers illustrate how this historical tribal animosity still impacts the school lives of their descendents.

- **Anita’s story:** One teacher came from a different tribe and reservation to teach on the Crow reservation. At the first Math Inquiry meeting she attended (Oct. 3, 2003) she joked about the irony of her teaching in a Crow school when their two tribes had been traditional enemies. At subsequent meetings I noticed that she frequently brought her middle school aged daughter with her. In the spring she quit attending meetings. I commented to one of her fellow teachers that I missed her and asked if everything was OK. That teacher replied that the family had left and moved back to the mother’s reservation because her daughter had been threatened at the school.

- **Eunice’s story:** Eunice is a Northern Cheyenne teacher who taught in a school on the Crow reservation for almost three years. She was very active in the Math Inquiry Group and participated fully. When she transferred from an elementary position to the middle school she inherited a standards based mathematics program. She was excited about the philosophy of the program and felt it would be helpful for her students.
Eunice shared that some of the students’ parents were initially unhappy with the program. They asked for their children to be transferred out of her class into special education classes. At the time she felt it was because the parents were unfamiliar with the philosophy of the curriculum. During her second year, a Native American who had held the position of elementary principal for several years, became the principal of the middle school. He and Eunice had many conversations over the math program that resulted in his asking her to use a more skill driven curriculum. Their interactions became quite confrontational. In the spring of her second year as the middle school math teacher, Eunice left the school and at this point is not teaching.

Another middle school teacher who had taught in the school for over 15 years and had participated in other CLTW activities, shared that he felt the problem between the principal, the parents and Eunice stemmed from the fact that the Crow community was not accepting of a Cheyenne teacher.

• Julia’s story: Julia was born and raised on the Crow reservation. She raised her family there and has taught for many years in reservation schools. She was afraid to attend our first meeting at a school on the Northern Cheyenne reservation because of the historical animosity between members of the two tribes. Other MIG teachers encouraged her to go with them, which she did. During her interview she shared many instances of feeling she was the victim of racism. In her interview with me she shared a deep-seated anxiety about the prejudice she felt from other teachers and administrators in her district as well as from members of the neighboring tribe. For many years she did not attend
professional development activities. With CLTW support she now feels confident to ask her principal’s permission to attend.

**Family.** Native American culture places a strong emphasis on the extended family. Child rearing is the responsibility of aunties, uncles, grandparents and other tribal members. In turn, the children are responsible for making sure their parents and grandparents are cared for as they age. This belief plays out in the decisions parents and teachers make about when or if students should be absent from school. Students frequently transfer from one school in the bounded system to another to take care of members of the older generation or just to spend time with family members. If an elder or family member is sick, keeping a student home to take care of younger siblings aids the sick and is a priority. Similarly, when there is a death on the reservation the services are often held at the school and attended by the entire community. This priority on family contributes to the high rate of student absenteeism frequently mentioned by teachers and administrators as the main reason students’ poor achievement in school.

**Parenting.** Native American parents often expect their children to become socially independent at an earlier age than the dominant culture (Ogbu, 1995). This attitude impacts the regularity with which students attend school. A Native American teacher stated she feels that even though children are academically low performers, they are socially mature. She encourages her 7th and 8th grade students in her classroom to start to take responsibility for their own learning (fn. Oct. 28, 2004).
During a MIG Math meeting (Jan 27, 2005), I made the statement that students’ limited math knowledge was a system problem, referring to districts within the bounded system. One of the teachers gave an eloquent talk about how girls, including herself, often became mothers at a very young age and grew up with their children. As in many cultures, Native American mothers are often the primary parent for young children. “Many fathers are out of the childrens’ lives until they reach middle or high school. Fathers become part of their lives when children begin to participate in sports” (Oct. 28, 2003). Young parents often do not know what to do or how to parent. This teacher went on to say that if you do not know the questions to ask or what to expect, you could not guide your children. She gave her own children independence when they were very young. As soon as they were able to drive they were allowed to make more decisions about how to live their lives. This independence carried over to taking responsibility for their own learning including telling the teacher what they were not able to learn (Ogbu, 1995).

Another Native American teacher gave a similar testimony. In her early forties, she is the mother of two primary aged children and two older daughters who have children of their own. She shares in the responsibility of raising her grandchildren. After the meeting she asked me if it was OK that she had shared her feelings about raising her children. To me, sharing their own feelings and experiences was illustrative of the trust teachers were beginning to feel with each other as well as myself. Even though Native American parents may have different priorities in terms of the time their children spend in the classroom, they indicate they want their children to learn.
Education. Education has always been a priority for Native Americans. Chief Plenty Coups, a famous Crow chief, gave the following advice to his followers. “Education is your most powerful weapon. With education you are the white man’s equal; without education you are his victim. Study, learn, help one another always” (University of Montana, 2006, p. 36).

The “boarding school effect” (fn. Nov. 23, 2002) described in Chapter 2 left its imprint on the elders of the current generations. Many grandparents of today’s students and their parents were taken from their families and forced to attend boarding schools in which they were not allowed to speak their own language, engage in their own traditions and spirituality or live with their families. After attending boarding schools or hearing stories about the experiences of close relatives that did, many parents of today’s students are not comfortable in traditional schools.

The limited education of some parents impacts the degree to which they can help their students academically. For parents who did not complete a high school education themselves, or who had negative school experiences, it is difficult and sometimes threatening to support the schools’ expectations for their children. According to two Native American teachers, over 50% of the parents of their students had not graduated from high school. However, many of these adults with limited public school education go on to become school board members who make decisions about current school policy (Oct. 28, 2003).

Chief Plenty Coup’s advice was brought to the forefront during a meeting at one of the local tribal colleges. A Native American math tutor at the college came into a MIG
meeting to ask why the tribal college students did not know math as well as he thought they should. He was quite concerned. A non-traditional aged student with him said he wanted more opportunities for students on the reservation than he had had. He felt parents needed to become involved in their children’s lives at a much earlier age and indicated he would be interested in helping get parents and teachers together to discuss these issues.

**Language.** While visiting schools on the Crow reservation, I noticed the Crow teachers frequently spoke to each other in their Native language. In conversations between Crow teachers and myself, it was not unusual for them to switch between Crow and English. In an effort to understand this dynamic, I asked Frankie, a middle aged experienced 6th grade Crow teacher, if it was difficult for her to switch between languages as she did. Her response indicated an implicit understanding of the purpose of my question. It would be rude for her to speak English to a Crow speaking person she replied.

Two years later as Jackie was introducing me to a group of teachers that included several Native Americans, she made the comment that she knew I would be able to work effectively with teachers on the reservations after introducing me to two Native American teachers at Crow Elementary School. She pointed out to me that after the introduction, the teachers acknowledged us and then continued to talk to each other in Crow. According to Jackie, the fact that teachers felt comfortable to continue to speak in their native language in front of me indicated they trusted me – a necessity for working with teachers. In retrospect I understood this as a compliment.
Adults value their native languages. At the Best of the Best Conference sponsored by the Crow Education Committee Nov. 2003 in Billings, discussions on the use of the Crow language were placed first on the agenda to honor the importance and need of bringing the Crow language into the children’s education. Native Americans feel the survival of their culture depends on the continued use of their native language by the younger generation. Although the reintroduction of the Crow and Northern Cheyenne languages into the curriculum is a priority of schools and communities, several teachers, both Native American and non Native American shared their beliefs that the continued use of Crow at home combined with English at school and in students’ daily lives, was a factor in students’ low reading achievement. The concern centered around the fact that the students were not fluent in either language.

Understanding the spoken and written language of the classroom is an integral part of mathematics proficiency. Students are frequently asked to explain their reasoning, keep math journals, and communicate their understanding of math to groups of students. The combined use of English and Crow in the classroom may influence students’ understanding of mathematics. There may not be Crow words for some mathematical concepts. Given that there was no written Crow or Northern Cheyenne language until the early 1970’s, it would be interesting to know how the math concepts evolved in these translations. This conflict of priorities, retaining and/or learning the traditional language while learning the new presents added challenges for student understanding.
Rural

Hardin, the town bordering the Crow reservation, is 35 miles from Billings. The view five miles outside of Billings looks out over thousands of acres of unbroken landscape. The mountains on the horizon are over 100 miles away. It feels like one is looking out over a vast, rolling sea of grassland. The drive from Hardin to Lodge Grass is another 35 miles. Five miles into the journey I lose cell phone service. From Hardin to Busby, home of the Northern Cheyenne Tribal School is another 35 miles – then 16 more miles to Lame Deer. There still is no cell phone service. The landscape is unbroken by any type of housing developments or farms seen in typical Midwestern states. Pryor is almost 100 miles from Lodge Grass across a similar landscape. There are no service stations on the way.

The isolation, long distances between schools and towns and the sparse population affect the cost of transportation and access to goods and services. It is difficult to recruit and retain quality teachers for these small schools (Why Rural Matters, 2005). Housing is at a premium. Several teachers live in Billings and drive the long distances to teach in Hardin, Pryor, Crow Agency and even Busby – an 80 mile one way trip.

It is difficult for small schools and districts to offer a selection of classes such as those found in many comprehensive schools. Recommendations to support the innovative use of technology to minimize the challenges associated with isolation are severely compromised by the lack of technological infrastructures. Even if technology was available, many homes on the reservations do not have access to telephone service
let alone high speed internet. Few have computers. The isolated environment and lack of technology infrastructure made communicating with MIG teachers a challenge we needed to constantly address.

Two-year tribal colleges are located on each reservation. These institutions provide an important way for reservation students to earn a two year degree without leaving the reservation. The faculty of these institutions support and encourage local students to gain skills necessary to help build infrastructure on the reservations or to transfer to a four-year university.

The report “Why Rural Matters” (2005) reminds us that “society’s obligation to educate is not dependent on demographic good fortune. A child’s right to an education should not be compromised by geography …. ‘no child left behind’ must also mean no place left behind” (p. 22).

Poverty

Big Horn County, the location of the Crow reservation, ranks as one of the poorest counties in the United States. In the recent Kids Count report (2006) by the Annie E. Casey Foundation, almost one-third (31%) of Native American children in Montana were living in poverty in 2003. Figures from the 2000 census indicate that Lodge Grass, the largest Native American town on the Crow reservation, had an unemployment rate of over 16%. Thirty-seven percent of children under 18 live in homes with incomes below the poverty level (www.fedstats.gov). Most families living on the reservations derive their income from employment with the BIA, Indian Health Service [HIS], tribal, federal, and state programs, local school systems, and/or public
assistance and welfare programs. A few residents work in the small number of local businesses. Many reservation area towns, including most on the Crow and Northern Cheyenne reservations do not have a library, bank, or community center for its youth.

Many residents on the reservation live on a cash only basis. Without a bank in their home community, operating without a savings account, credit card or checkbook is not uncommon. Without advanced mileage checks, many teachers are virtually unable to attend meetings and workshops across the state or in other distant locations because they cannot afford gas or do not own a vehicle. At the same time these are very proud people and many teachers refuse to acknowledge their financial situation by asking for a cash advance. During one of our Math Inquiry Group meetings (May 2004), a teacher remarked in frustration that “people are just surviving every day – just getting by. We need to pay parents to come to functions – especially if it involves driving to a different location. Parents can’t come any time due to jobs and other responsibilities.”

As discussed in Chapter 2, high degrees of poverty are often correlated with low student achievement (Campbell & Silver, 2000; Berliner, 2005). Student opportunities for learning provided through travel and reading material in the home are virtually non-existent. Based on their own academic experiences, many parents have low academic expectations for their children. According to the literature at large, students living in poverty often live in single parent homes. Even though families on the reservations often live in extreme poverty, children are cared for in the context of the extended family culture of Native Americans. Many family members often occupy one housing unit and share responsibilities for raising the children.
Living in poverty limits student access to healthcare that in turn limits the students’ opportunities for learning. In his study on the effects of poverty on student achievement, Berliner (2005) found that vision screening tests for the students in poor urban schools in Boston and New York found over 50% of the children had an easily correctible deficiency but rarely did anyone follow up on the diagnosis. This finding confirmed an observation I made as I was visiting a middle school classroom in Oct. 2003. During the class period, the teacher made frequent references to a poster on the wall reminding students of the relationship between number systems. I saw several students squinting at the poster. I realized that they probably had vision problems that prevented them from seeing the board. Without private insurance or ready cash, attending to non-life threatening health issues such as vision is a low priority for many families.

Personal income seems to parallel the financial strength of the schools on the reservations. Some districts appear to have larger amounts of money to spend on professional development opportunities for their teachers than others. Teachers from these larger districts, usually the districts located in border towns or off-reservation areas, have the opportunity to attend conferences in other states as well as participating in workshops brought to their district however, structures for sharing the knowledge with other teachers is not apparent. The teachers at reservation schools do not seem to have these professional development opportunities whether from lack of funds or information of available opportunities.
Student Mobility

Students on or near the reservations in Montana have traditionally moved freely among the local schools, sometimes as many as three or four times a year. As previously explained, the Native American culture revolves around the concept of extended families. The extended family includes aunties, cousins and close family friends. Students frequently move between these family households. In addition, the literature on the effects of poverty indicates that students living in poverty move at a much higher rate than their middle income peers (Berliner, 2005).

The frequent movement of students between schools as described by teachers and administrators made it difficult for teachers and districts to provide a coherent, consistent curriculum recommended by NCTM (2002). Forty-one percent of high school students were new to the school district at the beginning of the 2001-02 school year at the Northern Cheyenne Tribal School (NSTC), (fn. March 2002). During my interview with a reservation high school teacher, she mentioned that only one of the current ten students in the class I had just observed had been there in the fall. For schools in the bounded system, the possibility of students transferring increases as a result of the strength of the extended Native American family and the level of poverty in which most families on the reservation live.

The problem of student mobility is so great that in testifying before the Montana Advisory Committee to the U.S. Commission on Civil Rights, tribal education committee members found it was impossible to determine the dropout rate on Montana’s reservations because of the high mobility of students. Counselors do not have time to
track these students and there is no system in place to help them. One of the counselors remarked that “kids can move out and we can’t catch up with them. Many are lost through the cracks” (Nelson et al., 2002).

To address the impact of student transfers on academic achievement, one off-reservation administrator started the school year using state student assessment data to compare students who had attended his district throughout their school career with those who had transferred in at some point. He pointed out that a larger percentage of students who consistently attended schools in his district were proficient in mathematics than those who frequently transferred. The student population of the district was close to 70% Native American according to the Montana Office of Public Instruction (2005). Even though the administrator was trying to instill pride in the accomplishments of his district, many parents and community members interpreted his remarks as demeaning to the culture of the students who transferred. These types of comments continue to undermine the trust between all levels of the educational community. This illustrates the power of culture on the issue of high mobility rates among students and the lack of trust that exists within the community.

Summary of the Influence of Family and Community Contextual Factors

Taken individually, each of the contextual factors described in the previous sections influence the professional learning community known as MIG. It is tempting to look at the influence of each factor individually but taken together they present a unique framework in which MIG is situated. The families are not only poor, they are some of
the poorest in the United States. They are not only rural in terms of geographic isolation but are isolated in terms of inter and intra culture isolation and electronic communication. The cultures of the Crow and Northern Cheyenne tribes are unique in and of themselves and the interaction between them is complicated by the added dynamic of the history that exists between the two tribes. All of these factors combine to form a unique situation in which teachers teach mathematics to the students who reside in the bounded system.

The influence of poverty on Native American culture is illustrated in the following comments made by Jackie. Her comments illustrate the complexity of this dynamic in terms of this study.

“It’s hard to articulate how/where the fine line is between Native American culture and socioeconomic class. I think of the lifestyles of old Indians and how this lifestyle changed when they moved into housing communities or had to adopt the white ways of living. With this move, what is valued has been affected by poverty. It has only been about three generations ago that the Native American population began living in this sort of white community culture” (fn. January 2005).

She continued, “I assume [sometimes mistakenly] that some people don’t look at culture in a broad way – as being affected by lifestyle and poverty but only as racial.” Jackie’s reflection illustrates the economic impact of being forced into a way of life with little experience or knowledge of how to adapt to that lifestyle.

During our meetings, teachers and administrators frequently mentioned high rates of absenteeism as a main reason for students’ low academic achievement. There are many reasons why students miss school in Native American communities. Responsibilities for extended family members and attending cultural events such as powwows and athletic events that have high status in Native American communities
influence student’s attendance. One of my Native American colleagues made the remark that “when you live in poverty, your family is your wealth”. This belief plays out in the decisions parents and teachers make about when or if students should be absent from school. Similarly, when there is a death on the reservation the celebrations are often held at the school and attended by the entire community. This requires closing the school for a portion or all of the school day. Native American culture and history influenced by poverty combine to influence the behavior of Native Americans with respect to the priority they place on school attendance.

Anyon (1980) found that social class is a lived, developing process that influences the opportunities of educational experiences students have. Social class is also perceived as a complex of social relations that one develops as one grows up. The relationships Native Americans have developed in the preceding three generations have involved resistance to the white man’s ways. The result for many Native Americans has been a life of poverty lived on reservations. The mathematics education of students in schools on the reservation reflects this social reproduction.

**Policy**

The third broad category of contextual factors is policy. This category includes state, federal, and local policy and the influence of engaging external environments (Knapp et al., 2002).
State and Federal

During our early visits, administrators shared their uncertainty regarding the recently enacted “No Child Left Behind” (2002) federal law. The accountability demands set out for schools in this new law were daunting. Most schools in the bounded system have failed to make adequate yearly progress (AYP) as determined by the state. Several administrators indicated that a focus on reading would be their first priority in dealing with the requirements of the No Child Left Behind law. One high school principal actually told us he was thinking about discontinuing teaching all subjects except reading.

District administrators are grasping at straws to find quick fixes in their attempts to increase student achievement. These attempts include hiring outside consultants and implementing curricular strategies reported to raise student achievement. In most cases, the resulting collection of strategies is rarely aligned to provide a consistent mathematics experience for teachers or students.

In the spring of 2004, students in grades 4, 8, and 10 were required to take a criterion-referenced test aligned with the Montana Content standards for the first time. Adequate Yearly Progress (AYP) reports for spring 2005 indicated 93% of the schools and districts in Montana met AYP. The schools and districts in the remaining 7% were mostly on the seven Indian reservations. There were only two elementary schools in the “bounded system” that achieved AYP status.

A large number of items on the test were designed to measure more higher-level thinking skills than the previously mandated norm referenced tests. In addition to problem solving and reasoning, there was an emphasis on communication. For students
of limited English proficiency, these items caused more challenges. This assessment required teachers to use different types of pedagogy; they could no longer focus solely on procedural skills. Students in all grades 3-8 and 10 will be required to take the criterion reference test in the spring of 2006.

Local Control

In addition to preparing students for the state mandated tests, districts were confronted with declining enrollments and revenue. Since yearly state and federal funding was determined by current student count, maintaining enrollment numbers became a priority. The constant practice of students transferring between schools made it difficult to project the count and challenged the districts’ ability to build an adequate budget. During those early visits, we frequently heard stories of districts “closing their boundaries”. In general, if a district closed its boundaries, school busses from a neighboring district could not come into a district and bus students out to their school. This had been a previously accepted practice. Lawsuits were filed regarding this issue and the practice was disallowed. To circumvent the ruling, parents in some districts purchased a bus that picked up students and drove them to the district border where they transferred onto a neighboring district bus. Some districts even changed their schools’ class schedules such as going to a block schedule from a traditional schedule to discourage students from transferring out or into their districts.

These financial and often confrontational disputes led to distrust between system administrators. As recently as February 2004, a teacher remarked that even though students from a neighboring school often transferred into her classes and were at
completely different places in the curriculum, the principals did not support having the teachers meet together because they did not get along with each other. This distrust stemmed from differences over economic issues but transferred to impairing opportunities for student learning.

**External Environments**

The importance of collaborating with knowledgeable sources outside the teachers’ immediate circle is crucial (Stein et al., 1999). Establishing trusting relationships between practitioners and the outside experts who bring different kinds of expertise to the table is key to school improvement. My colleagues and I have worked diligently to establish and maintain the trust necessary to help bring that expertise to teachers in the bounded system.

Teaching and learning happens in multiple contexts or environments, embedded in one another (Knapp et al., 2003). External environments are the many networks and organizations that help provide professional development and support to schools and teachers. These external environments serve as a means of interacting with the local community in ways that create opportunities for improving learning. For schools and districts these external environments can include personnel from: the local tribal colleges located on each reservation, the universities, the Montana Department of Education, and various grants that come to the districts through universities, tribes and other organizations.

The schools and districts in the bounded system have had the opportunity to participate in many federal, state and local grants designed to raise student achievement
in high needs schools. Universities and other external entities are often in competition for grant money addressing the same population of schools. Unfortunately these grants are usually not “embedded in one another” and often serve at cross-purposes. Administrators looking for any helpful expertise commit their schools and districts to several grants without understanding how they fit together. Many times they do not involve the staff that will be the participants in the decision making process.

A recent example of this is the “Reading First” grant in which many of the schools in the bounded system participate. The grant requires 90 minutes a day devoted to reading as well as extensive summer training for teachers and administrators. The grant is producing positive results in some cases but leaves teachers frustrated in finding the time to teach other content – particularly mathematics.

Early in our work with teachers in the Northern Cheyenne schools, staff of the Rural Systemic Initiative encouraged local districts to adopt NSF sponsored standards based curricula. Rather than focusing professional development on the philosophies of the various curricula, districts just took advantage of the opportunity for support in buying curricular materials. The implementation failed because the curricular philosophy was not well understood by teachers and the community. A well-intentioned “external environment” failed because all parties concerned were not engaged in developing a shared vision. Another well-intentioned example occurred when the Montana Department of Education contracted with one of the regional Eisenhower Consortia to provide professional development to schools and districts with low student proficiency in mathematics. MIG teachers were required by their administrators to attend a meeting
with the consortia staff. After the first meeting they realized the intent of the MIG and the consortia were similar. They felt if the administration required them to go to the state sponsored meetings they would not have administrative support to continue with their participation in MIG. The state department had no idea we were duplicating efforts and were more than willing to support us working together with the consortia when we brought our efforts to their attention.

Summary of Policy Contextual Factors

Schools, districts, and teachers in the bounded system have many opportunities to participate in professional development or pilot curricular implementations. When universities and organizations come into the schools on the reservations offering financial opportunities for schools and teacher professional development without a cultural understanding of the communities, their efforts are often scattered and diluted. If the opportunities were “embedded” in each other and in the larger systems of learning, their impact would be more focused and have a great effect on student achievement.

Summary of Researcher Identified Contextual Factors

The literature is clear that “the first responsibility of leaders is to define and assess their current reality” (Depree, 1989). The reality of building a professional learning community of mathematics teachers in the bounded system was embedded in a multitude of contextual factors identified by the literature and myself. Isolation and the lack of relational trust were overarching factors that we initially identified and constantly worked to overcome. It was also extremely important to try to gain an understanding of the
beliefs and values of the teachers’ cultures. As we began to build trust with the teachers, they began to gently guide our understanding of their cultures. The history of the reservation system and the high rates of poverty and unemployment for the residents further influenced our efforts. To an outsider, the structure of the schools and districts may appear to be similar to traditional systems throughout the United States, but the effectiveness of these schools was compromised by the isolation and lack of trust needed to comply with current state and federal policies. These complex and intertwined contextual factors formed the background for MIG.
CHAPTER 4

ANALYSIS OF THE DATA

This chapter will document the journey of building a professional learning community of mathematics teachers from two rural reservations. The professional learning community is embedded in the contextual factors identified in the literature and the local factors identified from my initial visits. These factors were described in detail in Chapters 2 and 3. Part I of this chapter describes the process of establishing the professional learning community documented in my field notes, and agendas and minutes of the various meetings. In Part II, I will report the findings which grew out of the interviews with twenty four teachers.

Part I: The “Process” Through the Researcher’s Eyes

Philosophical Model: Ask, Listen, Respond and Reflect (ALRR)

Our work of establishing a professional learning community was guided by principles previously described in the research (Garet et al., 2001; Loucks-Horsley et al., 2003). Jackie, the Montana CLTW professional coordinator, and I agreed that our work with teachers would be grounded in the following philosophy: ask, listen, respond, and reflect (ALRR). We felt it was important to consistently ask teachers for their opinions of what students should know and be able to do, and for them to articulate their goals for students. We needed to listen and respond to teachers’ ideas and then reflect on the outcomes of those responses in order to begin the cycle again. To include others, we
attempted to establish a welcoming atmosphere for any teacher or aide who wanted to participate in Math Inquiry Group meetings. This included being flexible in the amount of effort and time we expected teachers to contribute to meeting the goals for the Math Inquiry Group. We tried to be respectful of the responsibilities teachers had to their families and communities and to take into account the many contextual factors described in the previous section. This philosophy took into account the characteristics necessary for building relational trust: respect, personal regard, integrity and role competence (Bryk & Schneider, 2002).

Many of our decisions were also based on Peter Senge’s (O’Neil, 1995) steps for building a community of learners. The process began by pulling interested, willing people together who had a real commitment and passion to do things differently. It continued by providing them the opportunity to talk to each other. According to Senge, in order to develop trust and encourage positive relationships between all members of the community, participation in the process needed to be flexible and open for all teachers to participate. The community environment nurtured a process of continuous learning for participants and students alike (Hord, 1997). It is important to have leaders at the center of the community AND persons providing leadership outside the school (Hord, 1997). It was critical to involve facilitators and advocates from external environments to work with local educators in their efforts to increase student mathematics achievement.

Early School Visits

During the winter and spring of 2002, Jackie and I visited with teachers and administrators in all of the schools in the bounded system. This was the initial “asking”
phase of our project. During this process, administrators and teachers identified common challenges of student mobility and lack of attendance, inconsistent curricula and materials, and the need to increase student achievement in mathematics.

During these visits, I noticed there appeared to be little collaboration between the districts even though the students transferred frequently between them. Several comments about “closing the borders” were made. This was a phrase I had not heard before. Although there is always competition between schools for the revenue generated by student attendance, for schools in this study, the competition was heightened by the complex relationships of schools and districts in the bounded system. Some district boundaries cross reservation lines allowing students from one reservation to attend schools on the other reservation. These circumstances created a lot of stress for district personnel.

A new high school was built in Lame Deer in the late 1990s. This was the first public high school located in Lame Deer. The high school then vied for the local population of students who previously attended either the Northern Cheyenne Tribal School or the Colstrip Public School system – a larger district on the border of the Northern Cheyenne reservation. At the same time, the coal industry – the primary source of income in Colstrip – was deregulated and the town began to lose its population base. Many parents who lived on the reservation who had attended school in Colstrip wanted their children to attend school there. To accommodate them, the Colstrip district sent a bus onto the reservation to pick up students who otherwise would have attended Lame Deer High School. This added to Colstrip’s student enrollment figures and decreased
Lame Deer’s. Lawsuits followed and the border between the two districts was “closed” to school busses coming onto the reservation. One teacher commented on the effect this action had on the trust between members of the districts saying, “The borders are closed so the kids don’t have a choice. Residents in Lame Deer wanted it closed so the kids now stay ‘down there’ [on the reservation]. I think there are still bitter feelings involved.”

The court order also impacted students wishing to attend St. Labre, a parochial school located in Ashland, a town on the border of the Northern Cheyenne reservations. As students began to shift between other districts, similar suits followed. Other borders that had previously been “open”, allowing students to transfer freely between schools, were closed. These actions impacted parent and student choice of the school they attended and the ease of transferring between schools. This competitive environment further eroded the trust between members of the communities already strained by cultural tensions. This was the environment of school communities in the bounded system as we began our work with the teachers.

Math/Science Open Forum

During our early visits, the Lodge Grass High School principal shared that the previous year his district had sponsored a successful paid, voluntary professional development opportunity the first week of June. He suggested that it might be a good idea for us to sponsor a system wide meeting for all math and science teachers providing them with the opportunity to discuss the challenges and opportunities for teaching math and science in the bounded system.
The conversations with teachers and administrators during our early visits and the contextual factors we previously identified included enough common issues that we began thinking about a format for getting the mathematics and science teachers together (fn. April 15, 2002). The common issues ranged from the variety of curriculum materials used, the frequent transferring of students, staff turnover and the impact of standardized tests. As we traveled between schools, we began to ask teachers if they would be interested in attending a forum to discuss common challenges for teaching math and science. Most teachers expressed interest, however, several shared that other people or groups had tried to get teachers together before but had not succeeded. In spite of these comments we felt there was enough interest in common issues to forge ahead. The CLTW professional development staff began to plan an open forum for all math and science teachers in the bounded system in June the week after school was over. We hoped that modeling our ALRR philosophy would begin to establish a sense of trust with the teachers on which to build our future work.

The Open Forum for math and science teachers from all of schools on or near the two reservations was scheduled for the first week of June 2002. All teachers and administrators were sent flyers and individual letters including a draft agenda inviting them to attend. A stipend, mileage, lunch and Continuing Education Units (CEU’s) were offered to encourage attendance. As we traveled between schools that spring, we continued to talk about the forum and encouraged teachers to attend. In a letter to principals whose schools were situated in the bounded system, we explained our rationale
for the forum and asked for their support. We were pleased that over 60 teachers attended the first open forum for math and science teachers on June 3, 2002.

Our goal for the forum was to let teachers know we valued them as professionals and to assure them an environment to safely share their goals for students learning and the challenges they encountered in helping students reach those goals. Donaldson (2001) reminds us “leaders show others by their example that they are learners” (p. 135). We did not want to impose our agenda but were interested to see if the goals and challenges we had identified during our initial visits and conversations were similar to those identified by the teachers. The format of the forum was designed to gather teacher input in a collective setting with a respectful, open environment.

We began the meeting by asking the teachers to meet in cross-school groups to discuss how their students were doing in math and science at that time. We wanted to know what teachers felt was working in their system and what they felt their students would need to know in the 21st century. Finally, we asked what changes they felt were needed in the current system to help students reach these goals. As the small groups reported out to the group as a whole many of the same issues surfaced that we observed during our earlier visits with administrators and teachers. Teacher identified areas of concern fell into the following four broad categories.

• The lack of consistent student attendance is exacerbated by frequent student transfers between schools and lack of parent commitment to student attendance.

• The implementation of the Montana content standards in mathematics is inconsistent across schools in the bounded system. Schools and districts lack
consistent curricula and textbooks that result in knowledge gaps for students who transfer between schools. Students’ reading abilities are very low. This makes learning in all content areas problematic.

- Students’ performance on state mandated standardized tests are very low.
- Student’s lack of self-confidence in their ability to do well in school. This lack of confidence influences students to drop out of school and/or to attend a postsecondary school.

These teacher identified needs were similar to those the administrators voiced during our initial conversations.

After we asked the teachers to identify their areas of concern, we asked them to recommend changes schools and districts could make that would help address these concerns. Working in small groups again they identified the following needed changes.

- Schools in the bounded system need consistency of curriculum, texts, attendance, and transfer policies. Dr. Fran Curcio, a member of CLTW’s National Advisory board made the following comment during a visit to the schools in June 2002. “Students who move from school to school ... pose a great challenge in a system where different materials and curricula are used for the same subjects and grade levels.” Teachers felt there was a need for a system to collect data across the schools relating to demographic information, attendance rates and policies. A system was needed to track students as they transfer between schools. This system should make specific reference to student achievement.
• Collaboration between teachers, administrators, parents and community members should be encouraged. The collaboration should focus on student expectations, school calendars, curriculum, texts, professional development, and the use of technology.

• Continued professional development and teacher education should be provided for all members of the educational staff.

• The school staff and community should set high standards for all students. School personnel need to address community issues of unemployment, “fear of leaving”, poverty etc.

• Schools and the community should encourage parents and students to be accountable for the student’s learning. The need for parental and community involvement and support for the education of their children should focus on identifying the community values schools can build on.

Many of the changes teachers felt were needed were beyond our power to address. These included finding ways to involve the community, establishing a system to track student attendance and other data, and providing high quality professional development for all teachers. In spite of our inability to address these needs, we felt giving teachers the opportunity to discuss topics that were salient to them was a pivotal step in establishing trust and adhering to our ‘ALRR’ philosophy. This gave us a sense of what the teachers felt was important – not just what we thought was important. In addition to the group reports, we sought additional information from individual teachers through an extensive questionnaire which they were asked to complete before leaving the meeting.
The questionnaire was designed to gather information about individual teacher knowledge of standards, content and pedagogical knowledge, use of assessment strategies and the use of technology. The CLTW professional development staff used the combined information from the group responses at the Open Forum and the individual questionnaire responses as a basis for developing the agendas for the professional learning community known as Math Inquiry Group (MIG).

I felt we had reached one of our goals for the meeting when a highly respected, experienced Native American teacher approached me and shook my hand at the end of the forum. She shared that she had attended many meetings like this before and had never felt comfortable. Today she felt comfortable. That teacher is now a member of the Science Inquiry Group and has continued to support CLTW in its other endeavors. Interactions like these indicated we were on the right track in establishing trust among the teachers by using our ALRR model.

Teacher Leadership Institute (September 2002)

One of the initial goals of CLTW was to develop a cohort of mathematics teacher leaders in districts identified by the five member universities. To address this goal and follow up on the suggestions made at the Open Forum in June, CLTW hosted a Teacher Leadership Institute in the fall of 2002. The institute was facilitated by Kathy Stiles, co-author of the nationally recognized book, *Designing Professional Development for Teachers of Science and Mathematics* (1998, 2003).

The CLTW professional development staff met with Kathy for two days prior to the leadership institute to share our goals and establish a vision for the institute. The
institute focused on the definition of leadership, how to engage teachers from local schools in teacher leadership activities and other skills relevant to teacher leaders. Since the institute was located in Montana, only Montana mathematics and science teachers in grades 6-12 were invited to participate. In an effort to encourage administrators to consider implementing distributive leadership, we asked administrators to identify teachers they viewed as mathematics/science instructional leaders or teachers and would like to mentor into leadership positions. Of the ten middle and high school math and science teachers who attended the leadership institute from schools on or near the Crow and Northern Cheyenne reservations, only four are still teaching in reservation schools. Of those, two sporadically participate in the Math or Science Inquiry Groups.

We learned several lessons from this experience. It was far too early for us to ask administrators to identify teachers as leaders or potential leaders in the bounded system. Although we had visited with each of the administrators and were encouraged by their verbal support and sign off on the grant proposal, we had not engaged them in discussions of their vision for the mathematics instruction of their students or their interest in utilizing teacher leaders in coaching or mentoring roles to help meet the goals. Second, there had not been time for us to establish a relationship with the teachers. Lastly, most of the teachers had never met each other prior to the institute. Holding the leadership institute before we had the opportunity to get to know each other and build a degree of trust illustrated the need for building a structure for those dynamics to occur. Although the effort was well intentioned, it was premature. The importance of timing and respecting the process taught us there are no short cuts.
Administrator’s Reception

Recognizing the need for supportive and knowledgeable administrators, we hosted an area-wide reception for administrators during their annual conference (Montana Conference of Educational Leaders, MCEL) in October 2002. This conference was held in a large town close to the reservations. The invitation and rationale for the meeting was delivered to all administrators by mail, email, telephone, FAX and face-to-face contacts. It was our intention to share the priorities and needed changes identified by teachers in the Open Forum and the Leadership Institute. Anticipating a good turn out, we hoped to open discussions on system changes teachers had suggested and involve administrators in continued dialogue on these issues.

In spite of our extensive efforts to invite all administrators, we were disappointed when only two came - one superintendent and one middle school principal. In another attempt to engage local administrators, I asked the then president of the School Administrators of Montana (SAM) if I could address the Crow/Northern Cheyenne administrators the next time they met to share the goals of the Math Inquiry Groups and receive feedback from them. He looked at me rather quizzically and replied, “They never meet.” To date we have met with limited success in our attempts to involve administrators in joint conversations regarding learning and teaching mathematics in schools and districts on or near the reservations. Possible reasons for their limited involvement include the following: administrators in small schools are required to assume many responsibilities and may not have the time or expertise to be an instructional leader in mathematics or attend additional meetings, legal proceedings
surrounding financial and policy situations eroded the trust between the school administrators or their prior experience with professional development was limited to a workshop format disconnected from the teachers’ work days.

Planning for Future Professional Development

Based on the information collected from our visits, the results of the open forum, and a review of the literature, we decided to provide a structure for continued collaboration among teachers in the bounded system in the form of a professional learning community. The positive effect of professional learning communities on student achievement is well documented in the literature (DuFour & Eaker, 1998; Gallucci, 2002; Gewertz, 2002; Hord, 1997; Kanold, 2002; Knapp et al., 2002; McLaughlin & Talbert, 2001). In most cases, studies on professional learning communities are based on communities of teachers from one school or district. Our work was unique because we proposed to form a professional learning community of K-12 teachers from different districts across two reservations and separated by many miles. We believed that documenting the process by which the professional learning community was formed would add valuable information to the literature base.

The literature identifies a high degree of relational trust as a precondition for building a learning community. Our initial goal for the learning community was to provide a non-threatening environment for teachers to discuss topics surrounding student learning in mathematics and to support them in changing their classroom practice while increasing their own content and pedagogical knowledge. Teachers needed to know they could openly talk about the academic challenges they faced in the classroom without
worrying that their comments might be misconstrued or miscommunicated. Even though the teachers often shared the same population of students, until the Open Forum, many of them had not previously met. These teachers came with different histories and experiences in teaching students in predominately Native American populations. Several of the teachers were Native American, born and raised on the reservations; some had grown up in other parts of Montana, and a few came from out of state. The historical interactions between the white and Native American population during the last century had not engendered an atmosphere of trust. The culture of teaching itself adds another dynamic of isolationism. Both of these conflicts are addressed in comments teachers made in their interviews.

In planning for our first year of work with teachers in the bounded system, we found ourselves asking questions that would eventually evolve into the research questions for this study.

• What is a procedure we could use to establish a learning community of mathematics teachers who teach in small, rural, minority culture districts and who teach the same population of students?

• What factors would enhance or limit collaboration between mathematics teachers?

• How would participation in a professional learning community affect teachers’ personal and professional practice?

I was aware that the process of establishing a professional learning community of teachers across the bounded system would differ from those described in the literature.
Based on the literature, we felt it was important for us to continue to model the open dialogue process (ALRR) used at the Open Forum. We also wanted to adhere to the teacher-identified characteristics for meaningful professional development found in Garet’s et al. (2001) study. Building trust between all members of the educational community and myself was critical for meaningful collaboration. As found in the literature (Bryk & Schneider, 2003; Imants, 2003; Donaldson, 2001), reform is virtually impossible without a strong degree of relational trust among school and district staff and between the districts and the communities in the bounded system. Eventually we hoped teachers would develop a shared vision of mathematics achievement for their students and feel safe to participate in individual and collective reflective dialogue through sharing their practice. To do this, we needed to build a high degree of relational trust between each other, between CLTW staff and the teachers and between the teachers, CLTW staff and the administrators.

Structural Decisions. The teachers in Garet et al.’s (2001) study identified three structural and three core components for effective professional development. The structural components include the form and duration of the professional development activity and the type of teacher participation. As we considered these components, we decided to hold MIG meetings three to four times a semester. This continued throughout the three years of the study. In general, we held one full day meeting a semester. The other three meetings were held from 4:00 p.m. – 7:30 p.m., eliminating the necessity for teachers to find and prepare for a substitute. Teacher participation was voluntary and included teachers from districts across the bounded system.
Communicating details of the meetings (date, time, place, and agenda) to teachers was one of our greatest challenges. As discussed in the previous section, we needed to take into account the contextual factors of geographic distance, poverty’s limiting effects on access to electronic communication and transportation, and unreliable Internet access. Furthermore, teachers had no previous structure for collaboration. In our constant efforts to be inclusive, all math teachers in grades 5-12 were notified of the meetings through traditional mail, email, FAX, telephone messages or a combination of the above of each meeting. By the end of the first year we knew that many teachers did not receive our email messages – either because they did not have access to reliable Internet provider service or because email was not part of their life. A few of the teachers did not even have a personal home phone.

The majority of teachers with whom we had communication difficulties were Native American teachers. These teachers worked in isolated reservation schools and either did not have access to email or seemed uncomfortable using it. Because we felt their participation in the Math Inquiry Group was critical, we made every effort to include them in the meetings using multiple forms of communication. We believed this effort would insure they felt welcome and very needed.

Teachers and administrators received a calendar and description of the meetings at the beginning of each semester by mail. We knew from previous experience that sending flyers announcing the MIG meeting agendas to the principals and/or superintendents and asking them to pass the information along to teachers did not work. The information seldom filtered down to the teachers. We kept the administrators
informed of our meetings and efforts by mail and email. In addition to email, mail and FAX notification, I made face-to-face contacts with the teachers whenever possible. If I drove to the reservations the day before a meeting, I would visit the schools and drop by each teacher’s classroom – just to say hello and to remind him/her of the meeting the next day. Many times this face-to-face communication resulted in the teacher attending the meeting.

Due to the remoteness of the schools we rotated our meetings between districts and reservations. This reduced the number of miles an individual teacher would have to drive over the course of the semester. It also gave teachers the opportunity to become familiar with the schools and towns in the bounded system. Although many teachers had taught in the bounded system for several years, most had never had the opportunity to visit schools in neighboring districts. By the beginning of the second year, teachers (fn. Aug. 2003) began to proudly offer their schools as a place to meet and gave us “mini” tours of their facilities. One teacher from a larger district (fn. 2003) shared that one of the things she liked best about the meetings was getting acquainted with the towns and schools on the reservations. Although teachers from schools in towns on the reservations often visited and/or lived in the border schools, the reverse was not true. Even though they only lived 30-50 miles from reservation towns, many teachers from the border towns never left the interstate to drive into those towns and certainly had had no reason to visit the schools.

Core Characteristics. In addition to the structural characteristics, teachers in the Garet (2001) study identified three core features of effective professional development:
the content focus of the activity, the degree of active learning of the participants, and the coherency of the activity. Initially we chose to focus our work on middle school mathematics. There were several reasons for this decision. First, a majority of students taking the state standardized tests in grades 4, 8, and 11, had scored below proficient on the state tests for many years. The content focus of the meetings was on the Montana Grade 8 Mathematics Content standards and benchmarks. We felt this would challenge teachers at both the middle and high school levels to clarify their expectations for what students at those grade levels should know and be able to do. We addressed active learning by modeling standards based instructional strategies during the meetings and asking the teachers to go through the activities as their students would. Many of the schools were using textbooks that focused on the procedural manipulation of numbers devoid of the necessity of engaging in higher-level thinking or the application of mathematics. Through a focus on middle school mathematics content, upper elementary teachers would be encouraged to expand their own mathematical content understanding. The lack of coherency within and between the schools’ mathematics curricula was identified at the Open Forum as a problem for students who constantly transferred between schools. We addressed the important of having a coherent curriculum at every meeting.

Secondly, a goal of the Chief Dull Knife Rural Systemic Initiative (RSI) was to encourage teachers and administrators in schools on the Northern Cheyenne reservation to implement standards based curricula. Chief Dull Knife is the Northern Cheyenne tribal college located on the reservation. We felt it was important to coordinate and
support other “external environments” that were also working with teachers and schools in the bounded system. This effort resulted in bringing together middle school administrators from three on reservation middle schools to discuss curriculum choices. It was one of the few times we were successful in bringing administrators from different districts together. As a result of the meeting, all three administrators decided to implement the Connected Math Project in their schools. The Chief Dull Knife RSI directors then contracted with a consultant from Black Hills State to facilitate CMP professional development with the teachers from the two Northern Cheyenne schools. One of the three schools involved was located on the Crow reservation and therefore was not served by the Northern Cheyenne RSI. In order to include teachers from the Crow school, we arranged for CLTW to host the meeting with the consultant. This was the initial activity that brought teachers together from both reservations.

A final reason for initially focusing on the middle school level was in response to the breakout sessions at the Open Forum. At that meeting each of the middle school math teachers discussed the texts they were currently using and realized they were very different in format as well as teaching philosophy. After the forum, several teachers expressed an interest in working together to develop some consistency of curriculum throughout the system. Those not implementing CMP were interested in learning more about the curriculum.

Developing Trust and Relationships. An initial and continuing focus of our work with teachers in the bounded system was to build a structure for collaboration that would result in building relational trust between the participants. The literature on the effect of
relational trust between teachers and between teachers and the professional development facilitator on successful school reform is strong (Bryk & Schneider, 2002). Building trust with teachers and administrators was especially challenging for me since I lived 200 miles from the closest school and only saw teachers once or twice during each month. This was compounded by the fact that face-to-face interaction was the only communication I was able to establish between many of the teachers. Recognizing this, I always made it a priority to go to the individual schools and visit the teachers in their classrooms. To make sure all teachers who participated in the Math Inquiry Groups knew I valued their participation, I was careful to maintain contact with all of the teachers. A focus on building relationships has remained a priority throughout my work with teachers. In addition to building my own relationships with teachers and administrators, a greater challenge has been to encourage trust between teachers within schools, between grade levels, between schools, and between cultures (white, Crow and Cheyenne).

The following example illustrates the importance of face-to-face interaction. During my initial visits with teachers one Native American high school teacher appeared to avoid my attempts to contact her. We would make an appointment to meet but when I arrived, her room would be locked and dark. Based on my previous experiences with Alaska Native teachers, I did not take her avoidance as an indication that she did not want me to contact her but that she was afraid I would in some way be there to judge her or her students. It was easier to say she would meet me and then not be available than to risk what might have been an unpleasant experience. This in fact turned out to be the case. A
core member of the Middle School Math Group had established a good relationship with the teacher and assured her that I was not there to judge her teaching or the scores of her students, but was there to help. When I later stopped by her room unannounced, she was tentatively welcoming. During my first conversations with her, I listened carefully to her responses to my inquiries about her classes, her family and her life in general. Since then she has been a regular MIG participant and is now a recognized teacher leader of mathematics in her district and reservation. Two years after our initial conversations, she gave a presentation of a culturally relevant math lesson she designed for her students at the annual state teacher’s conference. Watching her confidence grow through her participation in the Math Inquiry Group has been amazing. I often think about what would have happened if I had not pursued the effort to connect with her.

In a subsequent conversation a Northern Cheyenne teacher said her interactions with “white ladies” were rarely positive. Most conversations were with employees from Health and Social Services regarding custodial or truancy issues, probation violations, or other family problems. Other contacts had to do with financial problems. She said, “I’ve never seen you as white” in referring to my interactions with her.

In the introduction to this chapter, I spoke of the critical role of broker (Wenger, 1998) that Jackie, the Native American Montana coordinator for professional development, played in building trust between the teachers, the community and myself. Her introductions of me to the bounded system school personnel and Native American teachers proved to be indispensable. Another critical piece of building trust included my twenty plus years of experience as a public school high school math teacher and
administrator. This familiarity with the work and culture of teachers and the intricacies of school district systems was indispensable. Jackie’s expertise combined with my life and professional experiences proved to be a powerful combination in moving this work forward. The positive, respectful relationship the two of us formed enabled us to constantly learn from each other. We had a similar vision and goals for teachers and students in the bounded system. We, along with the graduate students working with us, were forming our own small professional learning community.

**MIG Content Focus**

During the three years of the study the content focus of MIG shifted. We initially focused on middle school math in response to teacher comments during the Open Forum. During these first months I continued to visit with other high school and middle school teachers throughout the region. I listened to their ideas, observed their classes, and shared topics that other math teachers were discussing. This was done in an effort to continually gather a broad spectrum of information and to provide a link between teachers. My hope was that it would help build relational trust between the teachers and myself and would encourage more teachers to attend future Math Inquiry group meetings.

**Backward Design**

During these visits, I realized that restricting our agendas to a focus on middle school mathematics topics and curricula was preventing other teachers from attending our meetings. Since my primary goal for MIG was to encourage collaboration between teachers across the system both by grade level and across grade levels 6-12 within and
across the system to address the mobile student population, it was important that all teachers felt included in our efforts.

To encourage more teachers to attend MIG, I needed a structure that would be meaningful to teachers at all grade levels. I chose McTighe and Wiggins’ (2002) “Understanding by Design” model as a structure for our meetings. I referred to this as the backward design model (Appendix E). The model encouraged teachers to first identify the standards they would be addressing in the lesson, then determine what students should know and be able to do to show proficiency with the standard prior to deciding on instructional strategies. This model is in contrast to the traditional mathematics instruction of designing the assessment at the end of a unit with little focus on the standards being targeted.

The model has served us well throughout the project. Teachers focused on defining common math expectations for students through the use of teacher designed performance assessments and rubrics during the spring semester of 2003. In fall (2003), we began the practice of focusing on specific content strands each semester (Figure 9). Initially I selected the content but as time went on, the teachers identified the content they felt they needed. Beginning in Spring 2003, the agenda for each MIG meeting followed the same format. We began each meeting by reviewing the backward design model and the Montana Content Standards and benchmarks for grades 4, 8, and 10 that would be the content focus of the meeting. After reviewing the appropriate standard, we examined released items from criterion reference tests developed by other states. Sample items for Montana’s first CRT were not available until the fall of 2003. We then engaged teachers
in activities based on current research of how students learn the content. We based our activities on research from nationally recognized sources such as *Adding It Up* (National Research Council, 2001). We used lessons from NSF standards based curriculum materials and other sources recommended by NCTM. This format focused on content and assessment aligned with the Montana standards and involved teachers in active learning (Figure 9).

The overall focus of MIG meetings was to support teachers in implementing the Montana Content Standards by engaging them in content lessons and modeling standards based instructional strategies. We emphasized the importance of establishing common expectations for what teachers wanted students to know and be able to do through the design of various formative assessments. Tables 3, 4, and 5 give general overviews of the three years of the project.
Figure 9. Evolution of the Math Inquiry Group.
### Table 3. MIG Meeting Agenda, Year 1.

<table>
<thead>
<tr>
<th>MTG</th>
<th>FOCUS</th>
<th>ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 02 #1</td>
<td>• Identify content big ideas by grade level (6-8) for students</td>
<td>• Share ideas for teaching big ideas in mathematics.</td>
</tr>
<tr>
<td></td>
<td>• Examine curriculum materials</td>
<td>• Examine curriculum materials in use.</td>
</tr>
<tr>
<td>Fall 02 #2</td>
<td>• Implementation of Connected Math Project (CMP) curriculum.</td>
<td>• Focus on launch, explore, summarize approach using activities from CMP Bits and Pieces I &amp; II units.</td>
</tr>
<tr>
<td></td>
<td>• Pedagogy: Launch, Explore, Summarize lesson approach strategy</td>
<td></td>
</tr>
<tr>
<td>Spring 03 #1</td>
<td>• Content: Probability &amp; Statistics</td>
<td>• Design Carnival Games</td>
</tr>
<tr>
<td></td>
<td>• Implementation of CMP</td>
<td>• Basketball Math Activity</td>
</tr>
<tr>
<td>Spring 03 #2</td>
<td>• Assessment: Coming to consensus on what all students will know and be able to do (6-8).</td>
<td>• Design a performance assessment by grade level</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Assessment: How will we know when they know it?</td>
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</tbody>
</table>

### Table 4. Math Inquiry Group Agenda, Year 2.

<table>
<thead>
<tr>
<th>MTG</th>
<th>FOCUS</th>
<th>ACTIVITIES</th>
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</thead>
<tbody>
<tr>
<td>Fall 03 #1</td>
<td>• Introduce “backward design” lesson model</td>
<td>• Connection to Montana Content and Performance Assessment</td>
</tr>
<tr>
<td></td>
<td>• Content: Number &amp; Operation</td>
<td>• Research on how students learn fractions</td>
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<td></td>
<td></td>
<td>• Activities using manipulatives for teaching concepts of fractions.</td>
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<tr>
<td>Fall 03 #2</td>
<td>• Assessment: Finalize grade level performance assessment.</td>
<td>• Use assessments from other sources to compare wording and form of rubrics.</td>
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<td></td>
<td>• Design task specific rubric</td>
<td>• Design rubric</td>
</tr>
<tr>
<td>Fall 03 #3</td>
<td>• Content: Proportional Reasoning</td>
<td>• Proportional reasoning student activities (i.e. use of multiplication tables for learning proportional reasoning)</td>
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<tr>
<td></td>
<td>• Assessment: Changing traditional problems to open ended problems.</td>
<td>• Changing traditional problems to open ended problems.</td>
</tr>
<tr>
<td>Fall 03 #4</td>
<td>• Assessment: Looking at student work</td>
<td>• Establish interrater reliability using rubric and samples of student work for.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Double score samples of student work using teacher designed rubric.</td>
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<tr>
<td>Spring 04 #1</td>
<td>• Content: Geometry</td>
<td>• Introduce Van Hiele model of geometric understanding.</td>
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<tr>
<td></td>
<td></td>
<td>• Use of manipulatives (ZOME tools) for teaching geometric concepts</td>
</tr>
<tr>
<td>Spring 04 #2</td>
<td>• Content: Geometry</td>
<td>• Continue discussion and application of Van Hiele model.</td>
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<tr>
<td></td>
<td></td>
<td>• Properties of and relationships between polygons.</td>
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<tr>
<td></td>
<td></td>
<td>• Applications of geometry in Native American culture (beadwork, quilts)</td>
</tr>
<tr>
<td>Spring 04 #3</td>
<td>• Pedagogy: Looking at classroom practice</td>
<td>• Why reflect on practice?</td>
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<tr>
<td></td>
<td></td>
<td>• What does research say? (TIMSS)</td>
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<td></td>
<td></td>
<td>• Methods to use in looking at classroom practice (coaching, mentoring)</td>
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</table>
Table 5. MIG Meeting Agenda, Year 3.

<table>
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<tr>
<th>MTG</th>
<th>FOCUS</th>
<th>ACTIVITIES</th>
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</thead>
<tbody>
<tr>
<td>Fall 04 #1</td>
<td>• Content: Measurement (Volume)</td>
<td>• Joint meeting with science teachers.</td>
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<tr>
<td></td>
<td></td>
<td>• Activities relating buoyancy and volume.</td>
</tr>
<tr>
<td>Fall 04 #2</td>
<td>• Content: Measurement (Volume)</td>
<td>• Build models with greatest volume.</td>
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<td></td>
<td></td>
<td>• Use origami to build three dimensional shapes</td>
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<tr>
<td></td>
<td>• Culturally Responsive Standards (Center for Research of Education</td>
<td>• Explore relationship between area and perimeter.</td>
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<td></td>
<td>Diversity &amp; Excellence [CREDE])</td>
<td>• Introduce CREDE standards for teaching Native American students.</td>
</tr>
<tr>
<td>Fall 04 #3</td>
<td>• Content: Measurement and pedagogy: Use of technology</td>
<td>• Joint meeting with science teachers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Introduce CBL probes to explore sound, temperature, light and motion.</td>
</tr>
<tr>
<td>Spring 05 #1</td>
<td>• Content: Proportional Reasoning</td>
<td>• Instructional activities from NCTM Proportional Reasoning Yearbook</td>
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<tr>
<td></td>
<td>• Reflective practice: Looking at Student Work (LASW)</td>
<td>and CMP Stretching and Shrinking.</td>
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<td></td>
<td></td>
<td>• Use Critical Friends Group protocol for LASW.</td>
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<tr>
<td>Spring 05 #2</td>
<td>• Content: Proportional Reasoning</td>
<td>• Proportional Reasoning Activities (NCTM Yearbook).</td>
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<td></td>
<td></td>
<td>• Teacher shared activities for teaching proportional reasoning.</td>
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<tr>
<td>Spring 05 #3</td>
<td>• Content: Algebraic Reasoning</td>
<td>• The pool problem</td>
</tr>
<tr>
<td></td>
<td>• Reflective practice: Curriculum maps</td>
<td>• Introduction of diary mapping to develop mathematics consistency across</td>
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<td>bounded system.</td>
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Participation

Many of the teachers in attendance during those early meetings remain core members of the Math Inquiry Group today and have been critical in helping us build community. As we expanded the scope of the Math Inquiry Group to focus on broader content and pedagogical knowledge and assessment, teachers encouraged other teachers in their respective buildings to attend the meetings and our core group grew. The support of other teachers within the buildings was critical for making sure the goals and vision of participants in the Math Inquiry Group were supported and valued at the classroom level (Hord, 1997).
Throughout the project we kept the administrators informed of our activities and invited them to participate. In August 2003, we sent a letter to all schools and district administrators explaining our rationale for establishing a professional learning community of mathematics teachers in the bounded system. In the letter we quoted Michael Fullan (NCSM, 2003) stating, “It has become increasingly clear from various sources that we need professional learning communities in which teachers and leaders work together and focus on student learning”. Fullan continued that teachers who produce high levels of learning for students “have to get outside their classrooms, both within their school and to link them to what’s going on in other schools – to learn from each other as well as contribute to them” (p. 55).

Teacher Sharing

As the semester progressed, we encouraged teachers to share activities related to the content strand they had found to be successful with their students. These opportunities were well received by the teachers. In an evaluation one teacher remarked that she was more likely to try an activity recommended by another teacher than one of the research-based activities. Throughout the meetings I modeled instructional strategies recommended by the Teaching Principle in NCTM (2002). I tried to model a safe environment for learning, demonstrating questioning techniques to encourage teachers to share their understanding. We discussed ideas of how the activities could be adapted for classroom use at various grade levels. During the four semesters from Fall 2003 through Fall 2005 we focused on the content strands of number sense, geometry, measurement and proportional reasoning. The format of the agendas kept the focus of the meetings on
the standards and gave teachers examples of assessments related to that content. As the teachers became better acquainted, their level of discourse became more truly collaborative.

**A Unique Professional Learning Community Emerges**

The characteristics of a professional learning community identified in the literature include establishing a shared vision and goals for students, accepting a collective responsibility for student learning, engaging in collaborative dialogue, reflecting on their classroom practice and deprivatizing their practice. The teachers who attended the Math Inquiry Group came from geographically distant and culturally diverse schools. Due to the contextual factors in which the community was situated, the participation of teachers was flexible or as Imants (2003) characterized membership in communities of practice - “fluent, floating and emergent” (p. 300). Building a safe environment for collaboration became all the more challenging within these contexts.

During conversations related to the semester’s content strand, teachers began to have substantive dialogue on what they thought students should know and be able to do at each grade level – to establish a shared vision and goals for their population of students. This dialogue evolved back to the inconsistency of curriculum materials and expectations of students who frequently transferred between schools. A classic example of the inconsistency of curriculum between districts occurred as two high school teachers from neighboring districts discussed the continuum of classes offered at their respective schools. Although they both used the same textbook for teaching Algebra II, the on reservation school spread the content over two years naming the classes Algebra II and
III whereas the school in the larger border district spent one year on selected topics called Algebra II. There was no Algebra III class in this school. A student in Algebra II in the on reservation school could be studying Chapter 5. When he/she transferred to the Algebra II class in the larger school, the new class might be studying Chapter 10. Students frequently transferred between the high schools but prior to their discussions in MIG, the teachers were not aware that the students were having extremely different learning expectations as they transferred between the two schools.

Through their interest in providing a consistent, coherent mathematics curriculum for their students, the teachers have accepted joint responsibility for the students’ learning. The teachers designed assessments and rubrics to assess student understanding of the content focus. They definitely reflected on their practice during the meetings – sharing activities that worked as well as those that did not. Teachers shared examples of student work but have not observed their colleagues teaching.

**Summary**

Our vision for the professional learning community MIG was to incorporate the structural and core aspects of meaningful professional development identified in the research. Throughout the process we were aware of the fragile existence of the relational trust we had worked to establish between all members of the schools and districts in the bounded system. Many hours were spent designing agendas, editing correspondence and strategizing the most appropriate ways of working with all members of the educational community. If the trust were unintentionally compromised, our work could not go
forward. We continued to support teachers in identifying a shared vision and goals for their students through collaboration and reflective dialogue. Communication continues to be one of our greatest challenges but as our group ‘flows and emerges’ a core group of teachers has surfaced who help us address the isolation teachers in the bounded system experience.

During the spring and fall of 2005, I interviewed 23 teachers and one paraprofessional for this study. Nine (37.5%) of the teachers are Native American. The teachers teach math in schools on or near the Crow and Northern Cheyenne reservations in Southeast Montana. The teachers are scattered between various buildings and grade levels in five districts (Colstrip, Lame Deer, NCTS, Lodge Grass, and Hardin). They have all participated in the Math Inquiry Group for a period of time ranging from one semester to three years. The analysis of these teachers’ perspectives on a process for establishing a professional learning community follows in Part II of this chapter.

Part II: Analysis of Teacher Interviews

Introduction

In the first section of this chapter, I documented the process of building a professional learning community from my observations, field notes and minutes of our meetings. I described the rationale for the decisions we made during the process and the results that occurred. I interviewed twenty-three teachers and one paraprofessional to understand their interpretations of that process. The interview questions can be found in Appendix B. This section of the chapter will first describe the teachers’ perceptions of
the conditions for collaboration that existed prior to MIG. I will then describe the teachers’ identified needs that motivated them to attend their initial MIG meeting and the needs teachers felt MIG addressed. The difficulties teachers encountered in participating in MIG meetings follow. Finally, I will describe why they feel they are members of a professional learning community and the conditions that need to be addressed for that community to continue.

The focus of this study was on building a community in a system where trust had been eroded between cultures, between various levels of the school communities and between the school and local communities. For these reasons, I chose not to differentiate between Native American and non Native American teachers. I felt it was important to show respect for both cultures and respond to their needs accordingly. I was concerned that differentiating would build walls instead of trust.

Conditions Prior to MIG

The process of building a professional learning community of mathematics teachers in the bounded system consisted of framing the study within the identified contextual factors and other baseline conditions identified by the teachers. These baseline conditions included teachers’ opportunities to engage in discussions of teaching and learning mathematics within their building, between buildings and between districts prior to participating in MIG. Existing issues of trust and feelings of isolation continued to surface throughout the interviews.
Broken Trust

The importance of trust in successful school reform has been identified as a precondition for teacher’s continued participation in MIG. In their hallmark study on the impact of trust on school reform, Bryk and Schneider (2002) define relational trust as the “deliberate action taken by any party to reduce the sense of vulnerability in others – to make them feel safe and secure – and help build trust across the community” (p. 41). When referring to relational trust, I will rely on this definition. Improving schools requires us to think harder about how to best organize the work of adults and students to improve the feeling of relational trust. The researchers remind us “relational trust is not something that can be achieved through some workshop, retreat or form of sensitivity training, although all of these can be useful. Rather, it is forged in daily social exchanges” (Bryk & Schneider, 2002, p. 136).

Armed with this definition and the overwhelming research, we knew we needed to build a professional learning community on a foundation of trust. Teachers’ responses highlighted the lack of trust that existed between and within faculty members of schools in the bounded system before their participation in MIG. The comments teachers made during the interviews indicate that MIG was establishing a safe environment for them at several levels.

Trust between residents of the bounded system had been eroding for generations. The literature documents the lack of trust between members of the two tribes residing on the adjacent reservations as well as between the white culture and the Native American culture. In the bounded system, trust between system administrators in different districts
has been compromised by the law suits and competition for students. There are also indications from my own observations and the comments of teachers that there is sometimes a lack of trust between administrators within a district and between administrators and staff.

Teachers made reference to this apparent lack of trust in their interviews.

“There’s a lot of politics,” said one teacher. “I think a lot of people want to collaborate and are willing to, but certain principals don’t like certain principals, or certain teachers don’t like certain teachers and talk bad about them. The people have bad feelings and want to stick to themselves. They’re not willing to open up. So that’s really hard.” This lack of trust between administrators and between some teachers limits collaboration.

“From my understanding,” commented another teacher from the same district, “some of the principals don’t get along.” A teacher from another district said, “I think there’s an administrative barrier between the high school and other schools [in our district]” that limits the opportunity teachers in that district have to collaborate. She also feels, “There’s some reluctance on the part of some of the elementary teachers to discuss their program with the high school.”

“The system is broken,” said one teacher. “I think we have to look at it as a K-12 challenge.” Instead of working together to improve the system, it is “almost a competition between teachers,” commented a teacher. “In some cases [I think] it’s [about] job security,” she continued. Teaching jobs are highly valued in the reservation schools. Occasionally, jobs are awarded to those who “need” the job or who are political appointees, not necessarily to those who are the most qualified. In another district, one
teacher felt, “They [teachers of the majority culture] feel they are better than the ones that are coming off the reservation.” This cultural mistrust between teachers is evident in one Native American teacher’s comment, “They look at me like ‘she is just Cheyenne. She can’t do anything’. I can say something but it doesn’t have any effect.”

Together, these factors created a feeling of distrust between teachers and the larger educational community. The demands of NCLB put further strain on these tenuous relationships. Because of the importance of the presence of trust in personal interactions, establishing trust among teachers participating in the Math Inquiry Group became a priority for our work to proceed.

Isolation (“You Fended for Yourself …”)

The sense of isolation teachers referred to went beyond the commonly accepted geographic definition of isolation. Several teachers referred to a sense of professional, intellectual, emotional and social isolation. Regardless of whether a teacher was early career or experienced, the feeling of isolation and often despair born out of isolation is evident throughout their responses. A typical remark illustrating this feeling of isolation was made by the teacher who felt, “before CLTW …you fended for yourself…you figured it out on your own.” Despair echoes in the voice of the teacher who commented, “Truthfully, everybody is - you know, sinking on their own.” The feeling of isolation and lack of support from colleagues and administrators is strongly evident among teachers across schools and districts and will be examined more closely in future sections.

Teachers’ comments indicated they had no experience with structures identified in the research that would help them provide a consistent, coherent math curriculum for
students within their districts. Indeed, it appeared they taught in extremely isolated communities of practice (Wenger, 1998). The lack of existing opportunities for teachers to communicate, much less collaborate prior to their involvement with CLTW posed huge challenges for building a professional learning community of math teachers across schools in the bounded system.

The following section describes the limited opportunities for collaboration teachers reported having prior to their participation in CLTW. This baseline context of collaboration provides a benchmark by which to examine the degree of professional growth and support teachers experienced during their participation in the Math Inquiry Group. Participants described the types of discussions they had on the topics of teaching, learning and assessment with other math teachers in their building, their district and in other districts prior to their participation in MIG.

In general, teacher responses indicated that discussions at all levels (building, district and inter district) were primarily informal, infrequent and not deeply focused on issues of teaching and learning. The discussions were in the form of conversations rather than collaboration. The conversations were collegial, similar to that described as “contrived conviviality” by Grossman’s (2001) seminal study on teacher collaboration, but lacked focus. An example of this type of informal conversation is characterized by the following teacher’s remark, “Informally yes… you don’t have time when you can actually get together and carry on a conversation.” Most conversations were “on the run.” Some teachers “didn’t remember discussing [math], …, we didn’t have any [discussions].”
This type of conversation is the opposite of the reflective and focused collaboration the professional learning community literature indicates is needed to increase student achievement in mathematics. Opportunities for this recommended in-depth collaboration were few and infrequent.

Collaboration: In the Building

In general, in-depth discussions of how to improve learning for students were extremely rare between teachers in the same building. Conversations that did occur were brief and superficial. Discussions focused instead on the correct class placement of students, the sequence of chapters in the text to be used or professional development on how to implement or pilot a new curriculum.

Participants described their limited informal conversations as brief interactions in the lunch room or “talking to the person next door” between classes. These conversations focused on whether “we’re at the same place at the right time” or to “talk about what we’re going to do and what chapters to teach” at the beginning of the school year. Teachers report they rarely revisit conversations they have with colleagues about low achieving students in terms of how to address the student’s needs.

A lack of focus on student learning in discussions is evident from the following teacher response, “I don’t remember ever having relevant conversations about how to improve instruction or student learning.” She continued that the teachers’ conversations “were mostly about – not even assessment but just if our kids were placed in the correct classes.” Another teacher who has worked with special needs students for many years commented that “most of the discussions were not a comprehensive picture of what a
student should know at a point and how to help them ...but more if they needed remedial work.” He went on to say, “Most discussions were not as much [on] curriculum or what should be taught, but more often who is to be served, and how did we select the students.”

An informal mentor was the main source of support and in-depth discussions for a few teachers, although these discussions appear to have focused more on classroom procedures rather than reflective collaboration. One teacher described her experience this way, “I had a self-selected mentor teacher down the hall and I talked to her on a daily or more basis. She told me what to do - how to do it or how she did it - step by step - she helped me. In my building there wasn't anybody else.” Another teacher asked a more experienced teacher who was considered the link between middle school and high school, “Is this the correct way to go about this, or what do you think about this?”

Two early career teachers participated in a formal mentoring grant that paired them with mentors outside the district. A few teachers received professional development to support them in piloting a National Science Foundation standards based curriculum their district agreed to in the late 90’s. Within that context one teacher remarked she “worked with two other teachers but set aside from that, nothing.”

Collaboration: In the District

When rare teacher discussions between buildings or grade levels within a district took place they were also informal and lacked a focus on student learning. Moreover, teachers’ comments revealed a strong sense of isolation and lack of connection between colleagues at various grade levels. One high school teacher stated, “The only teachers
that I was able to talk to came from the middle school so I don’t know. I never had contact with teachers from the other feeder schools [elementary]. I didn’t even know who to contact at that time.” Another teacher concurred that she “didn’t even know who these people were until CLTW…, it was like we never had any contact with each other, and they’re in our district. ….it’s really sad.” Even when grade level configurations, K-5, 6-8 and 9-12 are housed under the same roof, “sometimes we don’t even know the teachers in the high school. We don’t know their names unless we have meetings or something like that with them”, replied another teacher. In addition to the physical separation, teachers often experienced the cultural separation that added to the sense of isolation they felt when they did meet. “Crow teachers sit together, (another school) teachers sit together,” shared a teacher in describing district meetings. It is safe to generalize that from the teachers’ point of view, discussions concerning math and the teaching of mathematics ranged from minimal to non-existent between staff in buildings across the districts.

Collaboration: Across Districts

The types of conversations teachers had with their counterparts in other districts were similar to those in building and districts; they were informal, infrequent and lacked a focus on student learning. The exception was when teachers took university classes or participated in other grant opportunities. “When I take those classes [offered by a local university] that is normally the only time I get to talk to other teachers,” responded one teacher. A couple of teachers reported having more in-depth discussions with teachers around student learning through their participation in other grants. One teacher
commented that discussions with teachers in other districts did occur, “especially with the e-mentoring grant – that was huge.”

For those teachers who did not take classes, “the only connections [with] teachers in other districts would be those I made in either sporting events or outside the classroom.” There was no other indication from teacher comments that schools and districts administrators within the bounded system made an effort to provide opportunities for teacher collaboration between districts in the bounded system, even though both teachers and administrators constantly voiced concern about the large number of students who transfer between their schools.

Summary of Baseline Opportunities for Teacher Collaboration Prior to MIG

Prior to their involvement with CLTW projects, teachers in the bounded system had very few opportunities to communicate on the topics of teaching and learning mathematics at any level; building, district or between other districts. The interactions that did occur were most often informal, infrequent and fragmented. Teachers did not know the names of teachers in other schools in their own districts. They virtually had no connections with teachers outside of their own district. Feelings of isolation at many levels were threaded throughout their remarks. There was little relational trust on which to build a professional learning community. These conditions influenced teachers’ decision to attend their first MIG meeting.
Building a Professional Learning Community

Motivation: (“I Came to My First MIG Meeting because.”)

The MIG participants were asked to reflect on what initially motivated them to attend their first Math Inquiry Group meeting. Their responses ranged from stipends and credits to combating a profound sense of professional isolation.

Stipends, Credits and Curiosity. As previously described, teachers were offered stipends and continuing education credits for attending Math Inquiry Group meetings, however only two teachers gave these as reasons for attending during their interviews. Other teachers said the advertised focus of the initial meeting to provide an opportunity for collaboration and coming together to “talk about our common goals” intrigued her. She continued, “We all do have this transition problem [students transferring]…they will stay with grandma for awhile then they’ll leave and we’ll see them again.” “If something was going to be done to improve teaching math, I wanted to be involved with it,” shared a teacher who was raised on the reservation. A paraprofessional aide in a 5th grade class said she “wanted to find out what [her host teacher] was learning, so that’s why I went along with it.”

Administrative Suggestion and Word of Mouth. A few teachers were encouraged to attend by an administrator or colleague while others were motivated by the emails and flyers we circulated throughout the schools. For other teachers, the decision was made for them. One teacher “arrived at school that day and was told there was a sub in her classroom. She would be attending this meeting.” Many teachers found out about the
meetings through colleagues, administrators, CLTW mailings, and general word of mouth. “Word had gotten out that you guys were doing this,” summed up this word of mouth phenomena (LR).

**Combined Needs.** Other teachers’ responses indicated they were motivated to attend MIG meetings by a combination of professional, intellectual, emotional and personal needs. Their self-assessed limited understanding of mathematics and their subsequent insecurities in how to teach math were major reasons teachers gave as their motivation for attending their first meeting. These intellectual and emotional needs were shaped by their sense of isolation. Perhaps the most profound response for attending meetings came in the one word teacher response of “loneliness” followed after a long pause by the phrase, “and collaboration”.

I was surprised by the number of teachers who shared they lacked the confidence to teach mathematics. In the following powerful response a teacher shared her own insecurities and her desire not to transfer these feelings to her students as her reason for attending her first meeting.

I was intimidated by math, I was scared of math, I didn't do well in math, . . . and I wanted to, I wanted my students not to be afraid of math, I wanted them to get over that intimidation, I wanted them to know that math can be fun, it can be learned . . . and that's the reason I wanted to go to a math inquiry group, because I needed help, in order to teach them.

Some teachers were looking for new strategies to use in teaching math while others were interested in receiving feedback on their own practice. An early career teacher said she, “Very much craved interaction between peers for collaboration and to
get new ideas. I need to have feedback from a variety of areas and I didn't feel I was getting that from this building so I wanted to seek it out and figure out who can give me that. This group did.” The meetings provided a safe setting for teachers to collaborate with their colleagues.

Addressing Teacher Needs

Teachers continued to attend the MIG meetings because they felt safe and other needs in terms of their professional, intellectual, emotional and personal lives were met (Appendix C). We were ever mindful that our actions did not occur in a vacuum. We intentionally focused on providing a non-threatening environment in which teachers could share, collaborate and learn together. Establishing a sense of trust once again surfaced as a primary need for teachers.

Trust (“I Feel Safe”). A number of responses indicated teachers felt comfortable and safe at the MIG meetings. They felt shielded from the professional jealousies or turf protection that often occur between teachers in school settings. They did not feel threatened by the watchful eyes and ears of administrators who teachers feel may be evaluating or judging them. It is difficult for teachers to collaborate, share and risk in an emotionally unsafe environment.

Teachers used words such as “open”, “honest”, “positive”, “welcoming”, “encouraging”, “comfortable”, “friendly”, and “open to sharing”, in describing the atmosphere of MIG meetings, and these factors that encouraged them to continue their participation. A supportive environment is a safe environment where “people, … if they
feel like their opinions matter and you’re not going to go behind their backs and talk about them, … are really willing to open up” responded one teacher. “People feel comfortable… it’s not scary” another shared.

“The further we go, the more open we got with one another. We were willing to take that risk of sharing things that didn’t work. We didn’t have to feel like we were going to be criticized but [would be] critiqued,” said yet another. Other teachers concurred that “everybody is open and honest and it’s a comfortable safe environment.”

“You know everybody is there to support you,” a middle school teacher leader remarked. “The information you get from other teachers is so valuable … being able to collaborate is the biggest part about feeling you belong to a community.” added a high school teacher.

Leadership style is important in creating a positive atmosphere in the meetings. Positive facilitation is important to teachers and contributes to establishing the safe environment needed for collaboration. “I like it that everyone’s positive” is a statement embedded in many responses. As one teacher said, “You have a lot to do with it, as a group leader, I just enjoyed being there with everybody.” “I like the positive atmosphere your personality brings to the group…having an open mind that I don’t have to know algebra or physics” in order to be accepted said another. “I was thinking,” shared a third teacher, “Karma always makes sure that it’s [the meeting] positive and running smoothly...there’s always something positive. You always thank them for sharing.”

During the meetings, teachers also learned “little skills to use in working with adults” so conversations “don’t get sidetracked.”
These comments indicated to me that our initial goal of building an atmosphere of relational trust, a necessary ingredient for school reform to occur identified in the research (Bryk & Schneider, 2001) was happening both within and between members of the various communities of practice. One teacher’s comment that she felt “really safe there [in MIG meetings], safer than I do just meeting with math teachers only up at the school building” seemed an indication that a degree of relational trust was building.

Isolation (“You Figured it Out on Your Own”). As referenced earlier, teaching is, in and of itself, a lonely profession. In addition to the geographic isolation of the bounded system, teachers in the MIG experienced professional, intellectual, emotional and social isolation as well. Some of this feeling of isolation was due to the long distances teachers must drive in order to collaborate face to face with one another. Teachers are even more isolated by the lack of available access to electronic communication. Other feelings of isolation are due to misunderstandings between Indian and non-Indian cultures and the isolating culture of the teaching profession itself.

I recognized a profound feeling of isolation, and in some cases despair, evident in many teacher responses as they described the support they felt when attending the MIG. Attending the Math Inquiry Group meetings “makes you feel a support because you find you are not alone. Sometimes [I] think these problems are just my problems or my schools’ problems, but this gives [me] the opportunity to see, no it is wider than that,” said one teacher. It is nice “to know that there is this support system. When we’re sinking we know we’re not sinking alone,” remarked another teacher. “I feel I’m over here, I am by myself,” one teacher shared. “It's great to get to go talk to everybody, you
know, and see what they're doing and get ideas. You feel like you have another family out there, you know. Someone that you can talk to... It's kind of nice to have somebody to vent your problems to. And they can vent their problems.”

Lacking a structure for collaboration or discussion among colleagues at her own school caused one teacher to question her own efforts in teaching her Native American students. “Sometimes I feel like I’m kind of lost out here.” She then asks herself, “Am I doing the right thing? Am I doing enough for these Indian kids? It is kind of a hopeless feeling… But I think, this grant has really helped me focus as a teacher.” This teacher continued that going to the meetings “gives me the chance to talk to other teachers to see where they are. Because I don’t know, sometimes I kind of feel that [my school] is isolated and …it gives me a chance [to see] that the other teachers are struggling with the same things.”

**Emotional Needs (“What’s the Matter with Me?”).** I coded teacher statements that indicated they felt valued as professionals and supported by other teachers and professionals as “emotional” needs that were met by their continued participation in MIG. This theme also included comments on the atmosphere of the meetings and a means of combating a sense of isolation.

Because of their feelings of isolation, participation in MIG appeared to address teachers’ emotional needs by building their self confidence as professionals. Prior to her participation in MIG a teacher felt she “was the only person that had any students that didn’t seem up to snuff. What’s the matter with me?” she asked herself. “Am I doing a lousy job or what?” This teacher goes on to say, “I think I’m becoming a better teacher
than I probably would have been... just the fact that I feel better about myself.” In addition to realizing they struggled with similar challenges and were not alone, many of the teachers’ remarks indicated they felt valued as professionals during MIG meetings. “The place is set, the time is set, and you go there and you’re collaborating with these people,” remarked one teacher. Another teacher liked that the “time was made for you” to collaborate and learn with other teachers.

During one meeting a teacher said she “kind of woke up and said to herself ‘I’m not the only one that’s struggling with kids that are hopping from school to school and that miss a lot of school... That made me feel better.” Knowing they are not alone supports teachers and helps ease the sense of isolation enabling them to “go back [to their classrooms] and try harder, and try harder. Things don’t bother me quite as much for a few days you know, and so, I need it [a meeting] about every other day,” smiles an elementary teacher. Referring to the norms of privacy felt by many teachers, a new teacher shared she felt it would ease the sense of isolation if teachers got past the “I’m doing it better than you thing. There is kind of a little secrecy here.” She added, “It is job security too. You always have to worry about that.” The indication was that by helping a new teacher you might jeopardize your own position.

A strong sense of support among teachers in the Math Inquiry Group helps to combat the feeling of isolation and lack of professional validation. While at the meetings a teacher remarked that she was surprised “they [the other MIG teachers] would even listen to me...When I left [the meeting] I thought ‘I didn’t know I knew how to do that..... It takes another person or group to tell me that.” Summing up this feeling of
support, another teacher commented, “We’ve met together often enough that I guess I don’t feel any stress or constraints about expressing myself.”

**Professional Needs (“Validation is a Big Thing.”).** Professional needs included opportunities for collaboration, sharing and professional growth. Comments regarding students’ increased understanding and enthusiasm of mathematics as a result of teachers’ implementation of MIG ideas and activities in the classroom were included in this theme.

Other than student/parent feedback, teachers’ primary source of validation is based on yearly administrative observations. In these days of accountability and NCLB, their sense of worth as a teacher is often determined by their students’ test scores. Validation of their instructional decisions by their colleagues is rare and therefore very precious. Few adults or peers observe teachers “in action”. As one teacher stated, “I think validation from it [Math Inquiry Group], which I don’t feel like I always get. I think that’s a big thing. I think that might be a thing for a lot of people [in MIG]. Just that pat on the back which we all need.” The MIG “validates a lot of things I’ve felt in my heart and my brain,” shared another teacher.

Teachers learned to respect the efforts of their colleagues. This was reflected in the following remark, “She [another teacher] shares with us – she is a strong vibrant lovely leader that is excited about teaching.” “I am shy and introverted in so many ways and I feel comfortable [with her],” a teacher commented with respect to a fellow MIG participant.
Intellectual Needs ("I Always Learn Something."). The intellectual needs teachers felt were met by their participation in MIG included increased content and pedagogical knowledge. Included in this theme were comments on the importance of receiving up to date information on state and federal policy and research on teaching and learning mathematics.

A primary goal of the CLTW professional development grant is to provide teachers with research based teaching and assessment strategies that will help them address the mathematics learning needs of their students. The importance of building trust and addressing the professional and emotional needs of teachers documented in the previous sections encourages teachers to become more content knowledgeable and increases their self-confidence to try different instructional strategies. One teacher’s impassioned comment that “CLTW and these inquiry groups really helped me to focus on math educating, math, math education. I really mean that” illustrates the impact their participation in MIG has on teacher’s professional lives.

In addition to increasing their own mathematical content and pedagogical knowledge the MIG “makes me feel like I am doing what I’m supposed to do.” Other teachers stated they “always learned something” and “got new ideas . . . information on how to teach math.” Participation in MIG encouraged teachers to maintain high expectations for their students. One high school teacher said we “push so hard” in our efforts to increase teacher understanding of content and pedagogical knowledge. The strategies for teaching math we share with teachers seem “way out of the limits, way out of the box” to some teachers. And yet, one teacher responded, “[if] you say it can be
achieved I guess we can step a foot or two out there” to try it. They feel supported in taking risks.

Addressing her own limited understanding of geometry, an elementary teacher remarked that “Geometry was one of the greatest things you did – because it made me realize that [learning] geometry was so sequential [Van Hiele method]. It explained a lot about myself. I have a very poor geometry background.” Yet, another teacher who experienced failure in high school algebra said “I was always really afraid of math and yet you know, I feel more competent now.” An experienced math teacher shared that attending MIG meetings was a “chance to broaden your own knowledge,” while for another it “expanded my horizons.” “It keeps my mathematical mind going … I’m learning, continually learning,” concluded another teacher.

The MIG discussions “gave me confidence in the classroom. Students like to manipulate teachers … when you’ve been to a CLTW meeting you think yes everybody is doing this. I have a right to do it and I’m going to expect it,” shared an early career teacher. Experienced as well as early career teachers were also empowered to improve their own teaching practice. A twenty plus year veteran teacher thought attending MIG meetings “built her confidence up probably 100%. I feel that now when I start questioning I can say this is why I am doing this…I’m not afraid to try something different.”

MIG also focused on the content expected of students on the state mandated criterion reference test and multiple forms of assessment as well as the use of rubrics for scoring constructed response items. An experienced teacher said, “Being from an old
school I had never heard of a rubric until a couple of years ago - what does that mean - what is a rubric?” As a result of her participation another teacher said “My grading has changed. … I grade from a rubric now.”

Teachers often felt uninformed of the national and state accountability expectations for their students. “Talking about the different types of assessment and how NCLB is affecting things was a big eye opener” for one early career teacher. “We don't have time to...to do that here [in his school].” “I love the information that you give us that keeps us up to date… like testing. … Had you not talked about the MontCAS [the state CRT test] and the different response questions - nobody else talks about that. Every time that comes up in the [school] those of us who have been participating [in MIG] share with people” said another.

**Personal Needs (“I Enjoy It!”).** Personal needs were defined as the importance of socializing and making friends and/or receiving stipends or credit as reasons for attending MIG meetings. An often-overlooked incentive for teachers to commit time and energy to any “after school” activity is the promise of social interaction. One reason teachers drive 30-50 miles each way to attend a MIG meeting was the promise of “teachers coming together, meeting together, meeting new people.” The MIG meetings resulted in the formation of ongoing relationships. As one teacher explained, “A group of us I know are friends. People we would never have known.”

Living in such an isolated environment, every event has the potential for becoming a social event. Native Americans are known for their fun loving nature and the abundance of laughter in their conversations. The importance of humor can be seen in
any Native American event! “I enjoy it. It’s a lot of fun,” remarked one teacher who drives many miles for each meeting. After a long day of teaching and long drive, the importance of a tangible reward such as food cannot be overlooked. “If you know there is a muffin waiting at the end of an hour and half drive it motivates you to get there – you would not believe – the muffin calls your name and you drive,” laughed one teacher. This teacher did not drive over an hour because she was hungry for food. She was hungry for the opportunity for social interaction and professional growth she experienced at MIG.

**Overcoming Difficult Conditions to Attend MIG**

Attending the MIG meetings was not easy or without sacrifice. Distance, weather, finding competent substitute teachers, time, family commitments, health and coaching were all reasons teachers gave that made it difficult to attend after school meetings on the reservation.

**Weather and Distance.** Some of the schools on the Crow reservation are up to 50 miles apart on the I-90 corridor while Pryor and schools on the Northern Cheyenne are 60-90 miles from the Interstate. (Figure 7) Therefore, selecting a time and place that was fair in terms of the distance teachers had to travel presented a major challenge for us. We were committed to holding the meetings in various schools on the reservation. Previous to CLTW’s involvement, when combined meetings did occur, they were held in the larger border districts of Hardin and Colstrip. We felt it was important for the teachers in the reservation schools to be validated by sharing their schools. “Picking a time for
everybody to meet and get together is difficult – but that still happens within your own building,” said a teacher in one of the border towns. Attending meetings often involves the support of family members. An elementary teacher who lives 22 miles down a dirt road deep on the Crow reservation, relies on her husband for a ride to the meetings. If she stays after school for a meeting, he has to stay in town too.

Weather and distance were frequent reasons teachers gave that made it difficult for them to come to a meeting, especially for teachers on the Northern Cheyenne reservation. It is difficult to describe the dangers associated with the roads on which these teachers must travel to attend meetings. Sixty miles between towns with no gas stations, no cell phone service, no stores, and deer and animals on the road make driving perilous. This distance is long in daylight and warm weather but in the middle of a Montana winter, the roads can be dangerous, icy and even impassable. Describing her fear of winter driving, one teacher said, “That is a terrible stretch by Busby, to have to drive it when the weather is bad ….there’s been lots of accidents over there – animals [on the road], all kinds of things.” Another teacher said, “I understand why a teacher who lived in a district the greatest distance from others stopped coming because it was too much to ask. She had a little bit more [distance to drive].” And, yet they come – when they can.

Substitutes: (“I Hate to Leave My Students”). The timing of the meetings was another difficult decision for us. If meetings were held during the school day, teachers would be forced to leave their students in the hands of a substitute. Several teachers mentioned that “finding a sub[stitute] teacher for the day long meetings is difficult.”
“Getting a substitute in this area is very difficult” (LF) remarked a reservation school teacher. The unavailability of substitute teachers in these rural districts was not the only problem posed by meeting during the school day. Several teachers mentioned they hated to leave their students in the hands of a mathematically incompetent or untrained substitute in order to attend a meeting. “If I am going to be away, I am leaving the kids in the dust and they have trouble accomplishing things.”

On the other hand, if the meetings are held in the evenings, “I don’t have to ask for time off.” This eliminated the necessity of leaving students with a substitute even though after school meetings involved long drives after dark. Throughout the more than three years of meetings we gradually evolved to meeting after school. The hurdles raised by the substitute issue were ones we could not overcome.

Extended families are a definite priority for teachers in the bounded system and make after school meetings difficult to attend. “For me I have two places to live. My kids are in Billings [75 miles from where the teacher works] so …I have to kind of make time for them too.” Of the 24 teachers interviewed, four lived in Billings. Making the long drive home after attending a meeting until 7:30 PM made a long day for them.

Teachers are starved for social and professional interaction. In spite of all the sacrifices they make to attend meetings, when we presented the possibility of videoconferencing to alleviate the difficulty of long drives, one teacher said she would rather drive an hour each way to attend a meeting to be able to “be with other teachers” than walk down the hall to a videoconference. Other teachers concurred.
Frustration and Disillusions

We addressed many teachers’ needs well but in some cases the very nature of what we attempted to share with the teachers had the unexpected effect of frustrating or disillusioning them. The stories of two teachers who were core MIG members for several semesters and later stopped attending are particularly poignant. One teacher, Brenda, was always a great advocate of the MIG. She participated in all of the other professional development opportunities offered by CLTW. She encouraged other teachers to attend saying, “It’s so great – you don’t know what you’re missing.” So, when she abruptly stopped coming I was confused and concerned. I did not know what had happened that caused this drastic change. When I interviewed her in May 2005, she had not attended a meeting that semester.

Two themes surfaced during the interview to explain her behavior. She was overcommitted. In addition to teaching, she coached and was president of the local teachers’ organization. But the main reason she quit attending was the pain she felt when she returned to school with “new ideas and excitement and there was nobody there to [share with]. You are there by yourself.” She continued, “I find it pretty hard, so rather than having somebody take that enthusiasm away from me, I find I hide in my own hole and share with my own kids.” Leaving her students with a substitute that either didn’t understand math or the learning capabilities of her Title 1 students became a worry. “They just didn’t deal well.” It was “pretty hard to walk out and leave them.” This prompted her to reflect on her motives for attending the MIG. “Was it just myself that needed lifting or do I need to be there with my kids?” She finalized her statements by
saying, “I feel over there by myself” (she lives and teaches in the school that requires the greatest drive to meetings). “I don’t have anybody that will share with me or go with me.”

On the Crow reservation, Eunice, a Northern Cheyenne teacher, was experiencing difficulties she felt were caused by “the old rivalry, old clan. There is always [the feeling] that Crows don’t like the Cheyenne and that is not going to go away.” When she talks to Northern Cheyenne teachers who teach on their home reservation she realizes that “when they are talking about things, I am thinking, they fit in so well.” “It is too discouraging” to go to meetings and then return to teach here. “It is too hard to work like this. And then it makes me feel bad about myself because I can’t do anything about it. The best thing to do is just to get out – save my peace of mind.” “Although the group’s really good – the inquiry group and I really enjoy that – I feel that because I can’t do anything anyway it is a waste of time.” Still another teacher was hopeful that we could convince the administrators to focus on math in her school better than the teachers could. “I was hoping that it would come pretty soon, but we’re dragging.” Her attendance became erratic as she became impatient with waiting for changes to occur.

A Unique Professional Learning Community Emerges

“I feel like I’m a member of a professional learning community,” responded one teacher. Teachers’ unanimously reported they felt like they were members of a professional learning community. Data analysis provides insight into their personal definitions of what it means to be part of a community. They talked about the shared sense of responsibility for teaching students from a common population. Other
characteristics of community they mentioned included the opportunity to collaborate with other teachers, the opportunity for professional learning and once again, the comfortable, safe feelings they have at the meetings. The importance of establishing trust also appears to be a component of teachers’ definition of community. The literature characterizes a professional learning community as a group whose membership has established a shared vision and norms, frequently collaborates, focuses on student learning, engages in reflective thinking and encourages members to deprivatize their practice. (DuFour, 1998; Hord, 1997)

“They’re our kids.” The sense of community teachers feel by accepting joint responsibility for addressing the mathematics learning of their shared students is evident in the following remarks. “We come from similar situations with our cultural population. …When we talk about having to address different issues, it helps develop shared moments,” one teacher gave as a reason for feeling she is a member of a learning community. “You could go all over the country and people talk about their kids, but it is not the same as on the reservations”, said a middle school teacher. “Our kids, meaning our big group of children that live on the Crow and Northern Cheyenne reservations – kids in this little corner of the world. They’re different from other kids,” she explained. “Our focus is on improving student learning, and not student learning in general, but for the population of students that we all have in our classrooms,” remarked another teacher.

Several teachers mentioned the accepted practice of students transferring between schools in the bounded system as a challenge. One teacher said, “Our kids are the same group of kids even though they’re not [the same], because the kids move around so
much.” “We all want our students to do well,” she continued. An experienced Native American teacher said, “We all have the same problems in different schools. Kids transferring – low in reading.” Even though they teach in different districts, it is clear teachers across the bounded system feel a sense of shared responsibility for addressing the needs of their population of students.

“Being able to communicate ....” Teachers also felt having the opportunity to share and collaborate contributed to their sense of belonging to a community. This feeling was apparent as teachers shared responses such as, “The information you get from other teachers is invaluable – to have an opportunity to express it. Being able to collaborate is the biggest part about feeling you are a member of a community.” “It’s more of a community because you know all the faces. I’m very comfortable sharing within that community,” says a high school teacher. Another teacher commented that her growth as a professional contributed to her sense of community. “I felt like I was a member of a professional learning community because I was learning, I was learning more and more ways to teach my profession.”

The sense of community carried over into non MIG settings. “When you see someone [from MIG] outside of that environment, we are not in the classroom or talking about assessment or student learning but we are at the grocery store --- we can have the conversation about what is going on in our personal lives.” When attending another math workshop MIG teachers “seemed to gravitate together. We were very comfortable as a group.”
“It’s not scary.” Comments of feeling safe and comfortable at MIG contributed to many teachers’ sense of belonging to a community. “You can share ideas with other people and it’s not scary,” said one teacher. “You don’t wonder if someone is going to think you’re odd or not want to listen to what you’re going to say because everyone is interested in what you do. You could just go and share math,” she continued. “I like the way that everybody is open and honest. It’s a comfortable, safe environment” is how one teacher stated it. “Everybody was pretty comfortable sharing their thoughts,” added another. The feeling of “respect and safety and encouragement of learning more about teaching math,” from group members helped teachers gain new insights into their teaching practice. They “didn’t make you feel like you had failed but [were interested in] what you learned from the experience.” The sense of community helped build teachers’ professional self confidence. “They would listen to me when I brought up an issue. They would include me in their sharing time,” commented a Native American teacher. This was clearly important to her sense of community.

A Unique Community.

Teachers felt they had a shared vision and norms because they shared the responsibility for the math education of their population of students. They felt they collaborated because they met frequently and shared ideas and materials and received feedback from each other. They commented on the safe environment MIG provided. For these teachers, meeting four times a semester meant they met frequently. Student learning was at the forefront of several teachers’ comments. “We certainly have a focus on student learning otherwise I am not sure why we would be there,” said one teacher.
Of the five characteristics of a professional learning community identified in the literature, deprivatizing their practice produced the most varied responses. A couple of teachers interpreted sharing their practice as “taking our student papers to the meetings and looking at their work” in a Critical Friends Group setting or designing common grade level assessments and rubrics. Most of the teachers however, responded that they had not had the opportunity to “observe” other teachers in the classroom or have other teachers observe them. Although a few “have always wanted to do that”, many were intimidated or did not feel had enough to offer another teacher. Although most teachers felt the experience of observing a colleague teaching a lesson or being observed would contribute to their professional growth as a teacher, they shared several concerns about the process as they perceived it. “I’ve even invited other teachers to my room to see what I am doing. I think teachers need to do that,” shared a Native American teacher. “I think we need to become acquainted with each other. The kids would see that too,” she continued.

Several teachers had previous experience with deprivatizing their practice in other teaching situations. They commented they learned a great deal from the experience and would like to have the opportunity again. “I think we really need to get out there and get into the classrooms with the other teachers. I think we learn a lot from watching other people teach.” “You don’t always get the whole picture, so I think it would be a good way to grow,” she continued. Others said they had always wanted to do it but had never had the opportunity. One teacher said, “I hope we get more comfortable visiting other classrooms and inviting people into our classrooms. I think the students will benefit from that.” As referenced in the literature, teaching is an isolated profession. The comments
of many teachers focused on their own perceived lack of teaching experience and the risk involved in sharing their practice. “It would have to be a teacher that that teacher would feel comfortable with and not threatened by,” was a view shared by several teachers. A certain degree of comfort would need to be established before teachers felt comfortable with sharing their practice.

The range of feelings about sharing their practice is exemplified by the following conversation between an early career teacher and myself. “I’ve never had someone visit my classroom,” she commented. “That would be pretty intimidating.” When I suggested she might work with a more experienced teacher she had a relationship with she answered, “That would be horrible. It would be very scary for me because it’s Sandy.” I asked if she would like to visit Sandy’s classroom. She responded, “Oh definitely – she has a lot of years under her belt and I would learn a lot.” Finally I asked, “Do you think it would be scary to have another teacher observe your class if you had first developed a relationship with that person?” She admitted, “It would still be scary, but I’m not saying I wouldn’t do it. It would be scary but usually those scary things are what makes you grow and become better, right?” This teacher was clearly torn between knowing she would grow from the experience and feeling self conscious about her own limited teaching experience.

**Summary**

All teachers indicated they felt the Math Inquiry Group could generally be characterized as a professional learning community in terms of the characteristics I shared from the literature. All made reference to feeling the meetings provided a safe,
respectful environment for collaboration. They interpreted their need to share common challenges and solutions for teaching the same population of students in a very rural, culturally diverse region as a shared norm. Because the meetings always focused on content and pedagogical knowledge they felt we were focusing on student learning and teaching. For them, meeting four times a semester was “frequent”. After reading the characteristics of a professional learning community on the interview sheet, one teacher said as “I was reading through those, I wondered if that is what she (Karma) started with? Because that is basically what we did.” Even though their interpretations of the characteristics were not as in-depth as those described in the literature, they felt MIG was a professional learning community. In addition, they felt they were members of that community.

**Establishing an Ongoing and Self Sustaining Community**

During the many hours of driving to and from the Crow and Northern Cheyenne reservations, I often pondered how to support local teachers in continuing the work of the professional learning community known as MIG. Many teachers indicated the importance of continuing the current format of meeting with mathematics teachers from districts across the two reservations. “I think those teachers that attend regularly and always want to bring something and take something from each meeting would probably participate. But I think the numbers would be less. Some teachers would be left floating,” said one teacher. Others said they would like to establish professional learning communities in their own buildings and/or districts. “I think it would come down to each
building, especially each district,” commented one reservation school teacher. “It would be easy for us since we’re all in the same place,” she continued.

If it is “really an issue about learning and being able to collaborate and keeping contact open – we need to have a serious conversation about the steps and procedures it would take to get it to happen,” a core MIG participant said. Another long term reservation teacher shared that previously, “When the grants ran out, I didn’t know who to contact. For awhile the effort would continue but people change, retire and there are new people coming in.” Even though forming a professional learning community within schools would have many benefits, “I would miss meeting other teachers from the area,” responded another teacher as we discussed the merits of forming professional learning communities within schools. “I don’t have any contact with teachers from other schools unless I go to MIG meetings,” she continued.

Areas that Need to be Addressed

Teachers identified three areas that need to be addressed for the implementation of either configuration of continued professional learning communities. First, teachers need the support of administrators in continuing the work. They also talked about the importance of strong group leadership, probably a teacher from within the current group. This person(s) would need to accept responsibility for continuing the necessary communication and meeting facilitation. Third, there is the ever present need for funding the group.
**Principals and Administrators.** The literature informs us that the active support of administrators is critical for the efforts of a professional learning community impacts classroom practice and student learning. Administrators in the bounded system have always been supportive of teachers attending MIG meetings held during the school day. Building principals and district superintendents are continuously informed of goals and agendas of MIG and are invited to attend the meetings. For the period of the study none have ever attended a meeting. Only the two largest districts have curriculum directors. Both have participated in MIG and supported their local teachers in carrying the learning back to the classroom.

“Getting building principals and district administrators to talk to each other” is critical commented one teacher. We need to “convince them [administrators] to commit time for collaboration because teachers feel it’s important,” responded another. Administrators decide how teachers’ time is used based on the building or districts’ goals. The agenda for the MIG meetings is set by the facilitator and focuses on the content strand identified for the semester. Supporting teachers in helping students meet mandated accountability standards was the goal of the meetings. We assumed these topics addressed the goals of most administrators and therefore they would become involved. “We have a topic to discuss that’s interesting and relevant to us,” said one teacher. “If MIG wasn’t there I don’t think we would really have that focus,” she continued. If administrators make structured time available for this type of collaboration teachers “don’t have to worry about the kids,” said one teacher. It is a lot of work, takes a lot of time and you worry about how some of your students will get along with the
substitute. If administrators make the time available to the staff, they would need to take responsibility for the substitute issue as well.

A Strong Leader. In addition to administrative support, teachers feel the group would need a strong internal leader to continue the work. The effort would need “some organizational person or some formal organization” to support the continuation said one teacher. “You guys are the ones that pull us all together. …What are we going to do without you?” was one teacher’s response to this challenge. The learning community, whether it includes teachers within a building or across districts, needs “someone that would share and pull the group together and hold them together,” responded another teacher. That person would have to be “really committed.” Some teachers shared the importance of maintaining a positive atmosphere during the meetings as illustrated by the following remark, “Your [Karma’s] facilitating our little group keeps it going. It keeps it positive. Everybody’s comfortable sharing.”

Stipends. Even though one teacher felt, “I’m hoping the pay for time and travel isn’t the only reason that drives people to attend MIG,” there are costs to teachers participating in professional learning communities. One teacher felt “you would have to have a budget which would come from your building or administration,” if there was no grant funding. The cost of substitutes, mileage, food, and stipends are currently covered by CLTW.

A few teachers felt the group could continue its own, “especially if it’s within a building”, while others were more skeptical. “I don’t think it would continue without
funding,” was the response of a dedicated participant. “I don’t think this district would put money into this type of work,” he continued. Another teacher said, “Everyone lives so far away. Gas prices are so high, I don’t know if teachers would be willing to travel if they are not getting reimbursed.” “If the substitute is not paid for no one will be able to go from my district,” responded another. Teachers seem to realize that finding a funding source is important to the continuation of MIG.

Summary (‘Does Anybody Know I’m Here? Anybody Care?’).

The vast emptiness of the landscape is matched only by the loneliness of the teachers in the schools. Teachers spoke of the isolation they felt while teaching in the bounded system. Important outcomes for teachers of participating in MIG are the relationships and trust that have been established between teachers. Over and over teachers commented that it was good to know they were not alone in their efforts to teach.

I was not expecting the strong lack of confidence many teachers expressed about their own understanding of mathematics and how to teach math as well as the lack of validation from others for what they do. Teachers spend their days surrounded by the challenges of attending to the needs of students in difficult environments. Teachers who continued to attend the MIG meetings felt supported and valued as professionals by other members of the Math Inquiry Group. They were comfortable sharing what worked and did not work for them in the classroom. It was safe to share what they knew and do not know and sometimes they discovered that they did not even know what they needed to know. The MIG was a safe environment in which to increase their own content
knowledge and gather new ideas of how to teach that content. Their self confidence increased as teachers of mathematics in a world that seems intent on pointing out that their students are not succeeding and therefore, they are not “highly qualified” to be teaching mathematics. And last but not least, they now know they are not alone.

For the MIG teachers, these are powerful reasons for continuing to attend the MIG meetings. As one teacher explained, “Confidence … it (MIG) has built my confidence up – I have good ideas – I am a good teacher – we can get stuck in that ‘does anybody know I’m here? Anybody care?’ and you guys do.” Without confidence in their teaching, student learning becomes problematic. In an atmosphere of trust and community, participation in MIG combats their feelings of isolation and addresses teachers’ professional, intellectual, emotional and social needs.

In the bounded system, the climate is harsh, the distances are great, the degree of poverty is high, and yet some teachers consistently attend MIG meetings. The collegial support and professional growth made the effort to attend worthwhile. The support was there, the trust was there, and the isolation became more manageable. For others, the sacrifice and pain of becoming involved was too great. Some of the teachers stopped attending for a while and came back – others just quit. The overall factors of complicated lives, distance, time, and family responsibility impacted the consistency with which teachers could attend meetings. For others, the school systems in which they teach and/or the cultures in which they live made the feeling of isolation more acute. It was less painful to stop attending the meetings than to be reminded of what others are doing that is not possible for you.
Factors that Enhance or Limit Collaboration

This section provides a more in-depth description of the factors teachers identified as enhancing or limiting their opportunity to collaborate with other professionals in their schools and districts regarding students learning of mathematics. One factor that both limited and enhanced collaboration was “time”. A second factor that enhanced collaboration was the importance of having a specific goal or purpose for a meeting. The specific goals and purposes for collaboration included: curriculum mapping, the implementation of a new curriculum series, focusing on a school improvement process and attending scheduled grade level meetings. In addition to the lack of time, factors that limit teachers’ opportunities to collaborate included a lack of trust between members of various levels of the school staff, competition between teachers, a district or school focus on other content areas such as reading and the teachers’ union contract.

Time

The need for time and the limited amount of it is a critical factor in teachers’ lives. When time to meet is “officially” scheduled into the teachers’ day it enhances their ability to collaborate. However, when it is not scheduled, collaboration rarely occurs. “The most important factor to enhance collaboration is to be given the opportunity [to collaborate] and the time to do it,” commented one teacher. “Like our inquiry group. It’s set up with a date and time and place. Then it’s easy for us to make it [the meeting].” She went on to say, “We go and we’re there and the collaboration happens.” In contrast, other teachers feel that the lack of time limits their opportunity to collaborate. “We could
collaborate all we wanted if we had the time to do so,” says a middle school teacher. Another teacher agreed “you can’t collaborate with other teachers if you don’t have the time.”

Some teachers did not see mandated collaboration with other teachers within schools and districts as a productive use of their time. The culture of teacher isolation has trained teachers to expect to do everything on their own. This feeling is evidenced in the remark, “If you have the choice to be in your classroom, getting things done, or meeting with someone, most teachers would pick getting stuff done in their classroom.”

Another teacher concurred that when she is asked to meet, “It really cramps the other things that I need to get done during my prep period.” Any time given to collaboration takes time away from what teachers see as their “real work”. As one teacher put it, “We’re burned out… just tired. You need the support of other people, and yet you don’t want the support… You just want to go home.” Yet for others, scheduled time to collaborate was clearly valued when “the administration took away our team prep period.” “That really isolated us this year,” she lamented.

When time is not scheduled into the school day, the busy lives of teachers take over. Many teachers live up to 80 miles from the schools in which they teach requiring more than an hour’s commute each way in mild weather. “A large number of our teachers live in Billings, so they commute. They leave school as soon as it’s over. So we really have no opportunity to meet even on our own time,” commented a teacher in one of the border town schools. The large extended families of many teachers make other demands on their time. Some teachers have multigenerational family responsibilities.
They have young children of their own and at the same time are grandmothers themselves and care givers for their own grandparents. For most Native American teachers, their family commitment extends to a spouse’s extended family and other members of the community as well.

Factors that Enhance Collaboration

   Trust. In a recent article, Roland Barth (2006) commented, “The nature of relationships among the adults within a school has a greater influence on the character and quality of that school and on student accomplishment than anything else” (p 9). Trust is built over time. As commented on previously, the Math Inquiry Group has focused on building trust among it participants. In this regard one teacher said, “I think you have made a real effort to give us an opportunity for sharing. That is a valuable part of what we do [in MIG] and I know that is one of the things that helps me go back. I get to hear what other teachers are doing and what other teachers are facing and how they are working through that challenge.” “The information you get from other teachers is so invaluable, to have an opportunity to express it the biggest part of feeling you are part of a community,” she continued. Another teacher said, “I think people feel comfortable with each other, enough that we can talk about things we’ve done – just knowing you can share ideas with other people and it’s not scary.” The depth of trust that has grown between MIG members is shown in teachers’ statements.

   Specific Purpose or Goals. Teachers mentioned that having a specific purpose or goal for a meeting enhances the possibility of collaboration occurring between teachers.
Having a common goal requires teachers to work together and can help to build trust between them. They “get past the ‘I’m doing it better than you thing’ that is so important,” replied a new teacher. For the most part it is administrators who set the agenda and specify the time for mandated meetings. As one teacher said, “When administrators don’t make the time available, the opportunity for meeting goals or specific purposes doesn’t happen.” In one school, a group of middle school teachers working on a school improvement plan “arrived at a level of professional dialogue that’s very much in the students’ interest.” In his opinion, the informal opportunities for good dialogue between these building teachers that resulted from the school improvement meetings were in contrast to the formal meetings that “have not been very productive”.

**Mapping the Curriculum.** Mapping the curriculum was another purpose that surfaced as a format for positive collaboration in several responses. One teacher commented that when teachers meet to map the mathematics curriculum, “you have to talk about math and what the students are learning - what we’re teaching and what’s good about it and what’s not.” “If anything, it [curriculum mapping] is the basis for conversation, the foundation. I’m hoping that curriculum mapping would be one factor to help enhance those lines of communication.”

**Scheduled Meetings.** Teacher comments regarding administratively mandated meetings as a vehicle for collaboration were mixed. An elementary teacher commented on the required meetings between grade level teachers and curriculum specialists. “I’m not quite sure I like it but it has helped because we’ve gotten together and we do talk a lot
more.” Another teacher in the same building had a conflicting opinion. For her, “We’ve got so much time we have to commit here, commit there. The reason I don’t like them [mandated meetings] is because you have to do it whether or not you want to.”

Factors that Limit Collaboration

Focus on Other Content Areas. Another factor that limits teachers’ opportunity to collaborate is the district’s focus on other content areas. “Reading, reading, reading, reading” was one teacher’s response to the factors that limit collaboration. Several elementary teachers commented on their school’s focus on reading as a limitation for collaborating about teaching students mathematics. Many of the schools in the bounded system received a state Reading First grant that requires students to read 90 minutes a day. Although students are achieving reading success in many of the schools, teachers perceived this emphasis on reading as restricting the time they have to focus on other content areas. “I think right now everybody’s so stressed with just reading going on that if a person added more to their tables, some of them would probably just want to commit themselves,” one teacher shared. She continued “To be truthful, I don’t think anybody in the school has really concentrated on math as a whole.”

Early Release. Many schools have adopted the practice of early student release time, generally on Friday afternoons, to provide scheduled professional development time for teachers to collaborate. This practice enhances the opportunity for collaboration in some schools while it limits it in others. In some schools, administrators use the time for unrelated goals ranging from sharing a math strategy, to classroom management, to
fighting drug and alcohol abuse, etc. For other schools, the plan to use this time for teacher collaboration has failed to materialize. In one district the negotiated union contract allows teacher and students to leave school at 2:30 p.m. on early release days. A teacher in another district commented, “Most teachers felt the students needed the time more than the teachers did” and the practice was curtailed. Teachers from one district commented that some specific activities that took place during early release time were helpful. Requiring teachers to take the state mathematics criterion reference test at their students’ grade level and examining their own results on the assessment “opened our eyes.” This experience opened the door for teachers to discuss cross grade level mathematics expectations for students in the school.

**Summary of Factors that Enhance or Limit Collaboration**

One teacher summarized the factors that enhance or limit teacher opportunities to talk about the students’ mathematical understanding as “Time, time, time, time.” It all takes time, and there is only so much of it. Teachers prioritize how they spend the valuable time they have. Some live miles away from their work place. They feel huge responsibilities for their extended families. They have not experienced collaboration that results in decreased responsibilities.

The participation in meetings or opportunities that focus on a specific goal or purpose enhances the opportunity to build trust and collaborate. Although the focus is usually administrator mandated, teachers feel the time does encourage collaboration and discussion among them. In the case of most schools in the bounded system this means focusing on a “Reading First” grant that consumes “all of our time and energy,” said an
elementary teacher. Without working together and collaborating, teachers live in isolated pockets, creating and recreating learning opportunities for their students by themselves.

Trust continues to surface as a critical need for collaboration. Having the opportunity to interact with teachers over time and share common interests and stories without fear of being criticized greatly enhances teachers’ opportunities for collaboration. Conversely, the lack of trust at all levels of the school community appears to be a huge limitation for collaboration. Once again, finding time for teachers to share and build trust appears to be a critical component of collaboration. “I’m really struck with how education takes place in a classroom and it’s enclosed in four walls. Frequently we don’t get a chance to talk to the teacher next door, let alone a teacher in another grade level – or a person in another building,” summed up a teacher.

**Teachers’ Classroom Practice**

Although the purpose of the study was to document the establishment of a professional learning community of mathematics teachers, the long-range goal of this effort was to increase student achievement in mathematics. There are many factors that influence reaching that goal. One of the factors is a change in teachers’ classroom practice. This section focuses on how teachers perceived their classroom practice to have changed in light of their participation in MIG.

The 24 teachers I interviewed for this project vary a great deal in teaching experience, background in mathematics, opportunities for professional development and culture. Some were early career teachers when they began attending MIG meetings while
others had over twenty years teaching experience in the classroom. The secondary teachers have a major or minor in mathematics while most of the K-8 teachers have elementary certification and little formal mathematics content training. In general, teachers from the two border towns have more opportunities for professional development than teachers from the reservation schools. The one thing that all MIG teachers had in common was the population of students they teach. How they perceived their classroom practice to have changed through their participation in MIG reflects these individual differences.

The first theme that emerged from this analysis focuses on the increased expectations for students’ mathematics achievement teachers have as a result of their participation in MIG. The second theme includes the changes in classroom practice teachers perceive they made. These changes include a heightened awareness of the Montana Mathematics Content Standards, utilization of the backward design process, a change in their assessment practices, the incorporation of various instructional strategies and a stronger emphasis on the Montana Content Standard 1 known as the “process standard”. This standard emphasizes problem solving, reasoning, applications and connections. It is important to remember that most of the teachers attending MIG had little coursework or professional development in standards based mathematics instruction and assessment. The changes they perceive they made in their classroom practice are all the more impressive because of this (Appendix D).
Increased Expectations for Students

There are numerous references in the literature linking increased teacher expectations to improved student achievement. When asked if their participation in MIG had an impact on the goals they had for their students, most teachers answered affirmatively. One high school teacher said, “My overall goals are the same but the tools that I have to get the students there have really improved. I feel so much more prepared and apt to get kids to meet those goals.” An experienced middle school teacher said, “He has changed quite a bit of his focus from remediation to more of an emphasis on what students are going to get in the future – namely a lot more pre-algebra activities. …. I have raised my expectations and expect more of my students.” He continued that he felt “justified in keeping high goals” as a result of MIG discussions. Another teacher commented that her “participation has definitely made my goals [for students] higher. I’ve expressed my concerns about our goals [with other teachers in the school].”

The constant discussions of the types of problems and expectations other MIG teachers have for their students had an impact on the expectation of other teachers in the group. As one teacher said, “I think we’ve shared what works in our classrooms … and we come to the conclusion that we need to have high expectations for our kids.” An early career teacher commented, “Being in a group reminds you of what other teachers do.” Teachers need assurance and encouragement that their students can meet the same standards set by other teachers. “I think some teachers kept coming looking for assistance…somebody to tell them their kids could learn [at a given level]” shared another teacher.
An example of the influence other teachers have on raised expectations for their students follows. The focus of one semester’s MIG meetings was on assessment. Teachers from a grade band; 3-5, 6-8 or high school, were asked to come to consensus on a performance assessment that they agreed their students should be able to do. This proved to be a challenging task for the teachers. There was quite a discussion among 6th grade teachers regarding a fraction problem because two of the three teachers in the group felt students at that grade level should be able to do it. The third teacher felt strongly that his students did not have the necessary background to learn the content at that level. After much dialogue between the three teachers they finally reached consensus. One of them commented that the skeptical teacher “went out so excited saying I know my kids can do this.” This teacher continued that, “I think that’s what kept me coming back… convincing a teacher they can have high expectations for their students and their kids can [meet those expectations]… He looked like he was really defeated before but when he left that day he was kind of bouncing.”

As previously mentioned, many teachers cited their need to increase their confidence in understanding and/or teaching math as a motivation for attending MIG meetings. It was interesting to realize that their lack of confidence often resulted in limited expectations for their students. One teacher said she “was intimidated by math and didn’t want to pass that feeling on to her students.” Another said when she was transferred to the sixth grade classroom, “I was scared to death of teaching math. I only went into the very basic concepts but that changed after I got into MIG and began talking to other teachers… I was so afraid of fractions but after working with MIG facilitators
and other teachers, [I thought] I can do more of that.” Another teacher said that learning
math content in MIG was “tremendously supportive [for her] because you learned
something you did not know that affects the way you teach it.” Modeling the use of
manipulatives helped some teachers gain a deeper understanding of some mathematical
concepts themselves. “When you [Karma] did that [used manipulatives to model fraction
concepts], it was more visual and I understood it. Now I’m trying to teach that way,”
commented an elementary Native American teacher. She continued, “The different little
parts helped in my classroom teaching fractions. The students started to grasp it. Maybe
I didn’t even grasp it myself prior to that.”

Changes in Classroom Practice

Heightened Awareness of Montana Mathematics Content Standards. Several
teachers commented they had little knowledge or awareness of the Montana Mathematics
Content Standards before participating in MIG. One teacher admitted, “Honestly, before
MIG, I didn’t really pay any attention to curriculum or standards. It was just a dusty
document on the shelf. The expertise offered in MIG has changed my mind on that. It
has also cemented the importance of problem solving.” In a similar vein, another teacher
said her participation “Has made me more aware of the standards that are expected in
mathematics and how to help students meet those standards. I think that’s a big plus [of
participation].”

I began every meeting by reviewing a simple “backward design” template using
Wiggins and McTighe’s (2002) “Understanding by Design” model for standards based
instruction. This model proved to have a huge influence on teachers’ classroom practice.
Before designing a unit, the model encouraged teachers to identify the content standard the unit will focus on and the teacher’s expectations of what students should know and be able to do before designing the instructional activities. This model allowed teachers to incorporate the Montana Content Standard 1 known as the process standard into all of their lessons. The standard requires that “Students engage in the mathematical processes of problem solving and reasoning, estimation, communication, connections and applications, and using appropriate technology” (Montana Office of Public Instruction, 1998).

Backward Design Lesson Planning. Teachers commented that using the backward design model, by first identifying the content standard the lesson would address, and then designing an assessment for what they wanted their students to know and be able to do with respect to that standard changed how they planned their instruction. “It shed light on the whole idea of focusing on what the content of the lesson should be. I really have tried to change my practice to do that. I start with the assessment – that is really what I want to be able to explain,” commented a high school math teacher. Instead of just “going through the chapter in the teacher’s edition” another teacher said, “I think about what I want them [students] to learn before I teach the lesson. What do I want them to know at the end of the unit? Then I go from there. I ask myself ‘How am I going to get them to best understand the content’?” An experienced teacher said, “I’ve tried more and more to make my assessment first… I’ve never done that specifically before.” “One thing that’s changed is that a lot of times I think about what I
want them to learn before I teach a lesson … what do I want them to know at the end of class,” agreed another teacher.

When asked if her participation in MIG had changed her classroom practice a teacher responded, “I’ve made big time changes. Before MIG I was a very traditional teacher. I started at the beginning of the book and went through it step by step. I never finished the book. In MIG we talked about the topics that get left out – geometry, proportions, probability – that are always placed at the end of the book.” Now she aligns her lessons with the standards instead of the book.

Assessment Practices. Not only did teachers begin to focus on what they wanted their students to know and be able to do at the end of a unit, but they also changed their view of the types of assessment they used. Many of the MIG teachers work in small districts that have no funding for assessment directors. As a result they had a very limited, traditional understanding of assessment. The MIG focus on backward design allowed us to keep various types of assessment at the forefront of our meetings. Many teachers commented on new or additional methods they used for assessing their students.

The use of performance assessments and rubrics were new concepts for some teachers. An early career teacher commented, since I “didn’t know how I was going to assess my student’s knowledge, MIG supported the direction I was given in college about how to use authentic assessment.” I learned that “assessment is not just grading papers. There are different things you look for … MIG has helped me focus on that,” shared another high school teacher. A teacher who describes herself as being “from an old
school,” “had never heard of using rubrics until a couple of years ago. I still have difficulty using them”, she added, “but they tell me more how kids should be thinking.”

While some teachers had never heard of rubrics, other teachers were familiar with them from other districts. MIG reminded an experienced teacher who had used rubrics in a previous district of their importance. “I have been using them [rubrics] more frequently…I don’t think I would ever have thought about doing that again if I hadn’t been at the MIG meetings when we talked about them.”

The focus on various forms of assessment and rubrics helped a special needs teacher “cement in my mind what I always felt in my heart. We’re not teaching numbers, we’re teaching how to use numbers to assess, analyze and describe patterns. Every step [of the solution] involves both pictures that are representations and language. Those [types of] items enter much more into my assessments now.” A middle school teacher shared that before we focused on using rubrics to assess student understanding “I hated grading because everything was just a percentage grade and it would be so low.” A focus on using rubrics has “definitely helped [me assess my students], rather than just taking a percentage” she added. “Looking at how a student looks at a problem opposed to how a teacher looks at it was huge for me…. Anymore when I give a test or any work I think ‘how is this student going to look at this?’.” He went on to say that his participation in MIG has “totally impacted how I write assessments.” In addition to using various forms of assessments, many teachers commented on the value of examining released items from the state mandated criterion reference test. Released items from previous criterion reference tests were great examples of what students should know and be able to do. A
common comment was “when I’m thinking about teaching a content, I’m also thinking about what questions the kids will get on the state test. I talk to the students about how they would answer those questions.”

**Instructional Strategies.** In addition to increasing the expectations they have for their students and changing how they assess that understanding, teachers report incorporating more research based teaching strategies into their classrooms. They also placed a greater emphasis their students’ ability to use higher level thinking strategies as required by Montana Math Content Standard 1. In this section I will first describe the instructional strategies teachers reported changing or implementing in their classrooms. The strategies included a focus on student-centered instruction, an increased use of hands on materials to teach conceptual understanding and the incorporation of group learning. I will then describe the types of problems teachers began to use emphasizing problem solving, reasoning, and communication.

Teachers are struggling to become more student centered in their teaching. “I would like to get better at student centered instruction,” an early career intermediate teacher commented. “Our kids have been so trained to teacher directed [instruction] that when it comes time for them to do some of their own thinking, they really have a hard time with it…. If you don’t tell them what to do they’re lost.” Incorporating cooperative learning in their classrooms is difficult. “I’m trying to get kids to work cooperatively together and it’s really been hard,” shared a reservation teacher. “There are personality conflicts that have to do with families. This student may not want to cooperate with that student because something happened between their parents. Everybody’s related to
everybody and they all know things.’” “I can arrange them in groups but with a few exceptions, it’s still individual,” commented another. Other teachers felt more successful with incorporating group work. “Just to see them working as a group…pretty soon they were arguing and the girls had to come in and say, well that’s not how you do it.” This experience reminded an elementary teacher of her experience working with groups of teachers in MIG.

Several teachers reported their increased use of manipulatives to help their students understand mathematical concepts. Many teachers did not have much experience with student use of manipulatives before their participation in MIG. In fact, some teachers were not even aware of commonly used manipulatives such as base 10 blocks and pattern blocks. One Native American teacher shared that she did not have any personal experience using manipulatives prior to MIG but felt “teachers need to model what they want students to learn.” She continued, “Native American children are not abstract learners. They need to have things modeled.” Using more concrete methods “seems to be giving them [the students] a lot more.” Participation in MIG has “helped me do more visual things [with my students] like using the floor tiles in the cafeteria to figure out mathematical patterns,” added another teacher.

Another teacher said that before her participation in MIG, “We never used manipulatives. Everything was from a book or a copy, or off the board…. I didn’t know there were manipulatives for different concepts.” I didn’t realize “How important it is to have hands on learning with math instead of always working through the book,” remarked another teacher. “I think I can take some of the ideas I see at MIG meetings
and have the kids do hands on activities instead of pencil and paper ones in the book,” she continued.

A 4th grade teacher used base ten blocks and the area model to illustrate the concept of the traditional two-digit multiplication procedure as an evaluation lesson for her administrator. “I had them work in groups to shade in the areas of the partial products. This activity led to a lot of group interaction [between students] that hadn’t occurred before.” She went on to talk about the classroom dynamics that occurred when a group of boys who understood how to multiply using an accepted symbolic procedure couldn’t understand the relationship between the procedure and the more visual area model. A group of girls who had struggled with the procedural method were able to explain the area model to the boys. The observation lesson resulted in an increased awareness of how students learn mathematics by the administrator and further conversations on how students construct mathematical understanding followed. These conversations carried over into faculty discussions regarding the use of visual representations for teaching mathematics.

Higher Level Thinking. The nature of the mathematics work teachers expected from their students prior to their participation in MIG was primarily procedural in nature. Teachers report incorporating a greater number of higher-level thinking, nonroutine problems, into their lesson plans that require students to apply their mathematical understanding. Commenting on the changes in her thinking one teacher said, “I have incorporated a far greater amount of problem solving and hands on activities [since my participation in MIG]. I spend time writing out verbally what I expect students to do.
Attending MIG made me think about several approaches to one issue versus just giving it my way or the high way.” Another teacher said, “I really pushed applications because that’s what our standards are. MIG stressed that. I wanted to give students more application…not so much number manipulation as much as applying and understanding the concepts.” “I want them to go beyond the rote memorization of math,” another high school teacher concurred. A third grade teacher added that she did not “want them to just learn how to add and subtract. I want them to learn how to use math.”

Incorporating non-routine application type problems into their math classrooms gave teachers the opportunity to use other pedagogical strategies discussed in MIG meetings. During one meeting, a 5th grade teacher shared a problem-solving rubric she used to help her students approach the solution of non-routine problems. Another 5th grade teacher who was in attendance commented on the use of the rubric with her students.

I know teaching the students this process helped them. We would do a problem every morning. I would give them the problem. We would do the problem together…we actually went through the steps together, wrote them together. They told me what to put in and I would write. … They learned the words to use. That was wonderful that Linda shared with us. I enjoyed it – I really did.

An increased emphasis on having students explain their reasoning, both verbally and in written form, was commented on by several teachers. Before her participation in MIG an upper elementary teacher commented

I didn’t really always give them [her students] enough time to explain their thinking. Whether their thinking is right or wrong, their thinking is really unique. The way they think really explains a lot about what they know, where they’re going with a problem. If you stop them and let them explain and not just say you’re right or you’re wrong, they really come up with some neat
ways of getting the solution. MIG has really focused a lot on how do you get there? Not just getting there but how?

“Every time I questioned them they automatically think they are wrong,” a high school teacher commented. As a result of her continued emphasis, “They are starting to learn that whether their answer is right or wrong, they had to explain.” Another teacher said MIG supported her in pushing her students to explain their reasoning. When students complained, “Why are you making us do journals? Why are you making us write in math class?” she was confident in her decision to push forward with her expectations for them to explain their reasoning.

Teachers also reported an increased use of relevant, non-routine application problems. “I wanted more application. Not so much number manipulation as much as application and understanding the concepts, especially in my Algebra II class,” responded a high school teacher. She continued, “That’s what our standards are and that’s what MIG stressed because that’s what math stresses!”

Other teachers encouraged students to apply their mathematics understanding to culturally relevant situations. As discussed in Chapter 3, culture is not just about race. In the bounded system culture includes poverty and ruralness. “I didn’t grow up in rural anywhere,” commented a middle school teacher. “So the water tank problem [shared by another teacher] – I would never think about a water tank… but our kids know about it,” she continued. Teachers also shared Native American activities including the construction of a tipi, the geometric designs used in Star quilts and beadwork, and rules for traditional Native American games.
Summary of Perceived Changes in Classroom Practice

Teachers perceive their classroom practice to have changed in many ways as a result of their participation in MIG. “I’ve made changes in curriculum, and assessment and professional outlook – I mean that’s pretty big. What else could you want?” replied one teacher when asked about the impact of her participation in MIG. Another experienced teacher said she had made “big time changes, because I was very traditional.” “It strengthened my goal that I want my students to be independent thinkers and learners” said yet another. Encouraging my students to “think mathematically and be comfortable with it. To know what they’re doing instead of just memorizing.” was an outcome for another teacher.

These teachers became involved with MIG for a variety of reasons and with a variety of background experience. What they learned and how they applied that learning to their classrooms is just as varied. What stands out are the increased mathematics expectations they have for their students and the sense of belonging that resulted from continued discussions with other teachers who teach the same population of students. For many teachers, participation in MIG is the only mathematics professional development they have accessed. It has affected their practice in meaningful ways and this will eventually have an impact on their students’ mathematical understanding.

Responsibilities as Professional Educators

A major focus of CLTW is to support teachers in assuming various roles attributed to teacher leaders. In this section I will describe the teachers’ perceptions on
how participation in MIG influenced their responsibilities as professional educators. Their responses indicate their participation in MIG has changed how they think about their goals and responsibilities with respect to mathematics education. Some would simply like to become better classroom teachers while others gained the confidence necessary to impact mathematics education outside the classroom. Teachers are willing to assume leadership responsibilities such as coaching, mentoring, facilitating professional development, teaching, advocating for students and participating in wider professional communities. A few would like to continue their formal mathematics education.

Several teachers commented that before their participation in MIG they were somewhat ambivalent in terms of their professional goals. “I am not sure that when I started this profession I really had a clear idea of what my professional goals were,” shared one early career teacher. This response was echoed by another early career teacher who replied, “I don’t know. I don’t really have one right now. [I’m] Just getting out of school.” While some teachers were somewhat unclear about their goals as mathematics educators, others were definitely influenced by their participation in MIG and were beginning to think differently about their roles. For a high school teacher, “Being part of a group like this I have a much stronger sense of what my duties are and what I would like to see happen.” This teacher continued to assume greater responsibilities as a teacher leader and student advocate. An experienced middle school teacher who is now pursuing a doctorate in mathematics education said, “I thought I was just going to be a math teacher all my life. But now I want to teach teachers, I want to
teach teachers math”. For an experienced high school teacher, her goal was “pretty much the same. To take students and hopefully make them into a proficient, knowledgeable user of mathematics with the ability to apply it to their world so they can meet whatever challenges they want to meet.”

Confidence: (“I Never Thought I Would….”)

Teachers’ increased mathematics content and pedagogy knowledge gave them the confidence to teach topics in ways they had not previously tried. For some, participation in MIG gradually gave them a different type of confidence; the confidence to advocate for students with administrators and community members and find their own voice in speaking in front of others with respect to learning and teaching mathematics. Referring to her first Power Point presentation before the group one teacher said, “When you have to present something that you made, that is scary. Now it is not scary to me. Confidence – it has built up my confidence.” “I feel a lot more comfortable speaking in front of adults because of the chances I’ve had to present at the MIG,” she continued. Another high school teacher shared that “MIG gave me more confidence so being a leader in the profession is actually seeable.” An experienced high school teacher shared that approaching her administrator to suggest the faculty needed to work across the K-12 mathematics curriculum was a new role for her. “Oh yes, it was outside of my comfort zone, very definitely, but I think it’s something that we have to do… I think it’s [her participation in MIG] made me more willing. I think this whole process has given me the courage to push my comfort zone.” For still other teachers, participation in MIG reinforces that they’re “doing what I’m supposed to do.” She continued, “I never thought
I would like going out and presenting things to people. No one in my family ever thought I would ever do that because I am always the shy one. … Now I feel good about it. Before [participation in MIG] I don’t think I would have done it. It has been a gradual process.”

Classroom Practice: (“I Would Like to become a Better Mathematics Teacher”)

Some teachers said their professional goal was to become a better math teacher. “I would like to be better at teaching math because I don’t feel that I am very good,” shared an elementary teacher. A Native American teacher shared she would like to “be more relaxed in teaching at this grade level….. to be more challenging in the areas that I think they need to be more challenged.” Another Native American teacher said one of her goals was to “push them [her students] to learn more and more. MIG has really helped me focus on that. Without MIG, I felt I wasn’t doing a very good job.”

Leadership Outside the Classroom

Teachers now see themselves assuming roles as mathematics educators outside the classroom. These roles include peer coaching, mentoring, facilitating professional development opportunities for other teachers, teaching teachers, advocating for students and participating in wider professional communities. “I like the idea of becoming a peer coach,” said one teacher. “I really feel like I am an advocate for students and would like to help other teachers become advocates for student learning,” she continued. “I feel so strongly about the changes we’re making [in MIG],” commented a twenty plus year veteran teacher, “I would like to become a math facilitator.” For a younger inexperienced
teacher, making presentations to a standing room only audience about math games at the state teachers’ conference, made him “feel like I must be doing something right.” This experience has encouraged him to “reach out as a professional educator. I’m trying to help other teachers.”

Their experience with MIG has encouraged several teachers to begin establishing professional learning communities in their home schools and districts. “One thing that I have really tried to work on is collaboration with K-12 teachers. I think that if we collaborate, and if we talk about mathematics education, education of mathematics for all students at our school, then I think things will happen,” commented one teacher. Another teacher from the same district said her goal was to establish “unity and change, to work together.” “I envision my role more as a facilitator than a person who explains it. Try to set them [other teachers] on a course that encourages our kids to learn math.”

**Teaching Teachers**

Several teachers mentioned they would like to teach teachers as a result of their MIG experience. “I would like to be on the other side teaching teachers – whether I am at the university teaching pre-service teachers or going around presenting workshops. I just feel that is where I need to be,” commented one teacher. A young Native American teacher said she would like to teach math “at the college level. I’d like to teach a general math or pre-algebra class to high school students entering the tribal colleges.” A colleague who worked at the tribal college had told her, “The math scores were extremely low for a high school equivalency.” “If they’re in college,” the young teacher continued, “they want to make the grade.”
Still other teachers would like to develop curriculum for teaching Native American students or facilitate communication with the Native American community. “I would like to start looking at math curriculum and see how we can use the tools we have or develop new tools to help with our population of students. I would like to take a look at the big picture vs. the one in our classroom.” A middle school teacher commented that since she “didn’t grow up in a rural anywhere,” she never thought of some of the rural or cultural applications for mathematics she learned from other teachers. “I hear all the stories that are in the Crow culture that I didn’t know. Now I’m asking the Crow language teacher to get some designs for me to incorporate into my math classes…. I never thought about using a tipi,” and elementary teacher excitedly shared.

Reaching Out

“It opens your eyes to the wider professional community. It makes you feel more apart of that and understand better what’s going on,” commented an experienced high school teacher. Prior to MIG “I had never been on a state testing committee or assessment committee. CLTW made me aware of some of those things and so I sent off my application,” she continued. “I now feel I have another responsibility to encourage other teachers to do the same.”

Pursuing Additional Formal Education

A few teachers see themselves pursuing a formal advanced degree in mathematics education. One teacher who describes herself as being very shy is in her first year of her mathematics doctoral education. Another teacher said, “In ten years I’ll be going for my
doctorate…. I really do enjoy all this stuff that you guys got me into so I’m hopefully going to keep doing that.” “I want to teach math at the college level,” she continued. A paraprofessional that attended MIG meetings with her host teacher commented, “When I come to MIG, [I realize] there’s information out there. It makes me want to be a teacher, a fully certified teacher.”

Summary

Teachers feel their participation in MIG has significantly changed how they view their responsibilities as professional teachers and educators both inside and outside of the classroom. They have gained confidence in their ability to improve the mathematics education of their students. Some are speaking out, advocating for their students by encouraging administrators and other teachers to offer a more rigorous, consistent mathematics curriculum. Others are sharing released items from state CRT tests and engaging staff in discussions regarding how to best prepare their students for the types of problems they will be expected to do. “The collaboration between teachers has encouraged me to reflect on the difference between being a professional mathematics educator and what students actually learn,” reflected one teacher. Because of their experiences in MIG teachers are already impacting the mathematics climate in the bounded system.

Chapter Summary

There are two parts to Chapter 4. Part 1 reports the findings from my analysis of my field notes, agendas and minutes used to document the process of building a
professional learning community of mathematics teachers in the bounded system. Part 2 reports the findings from my analysis of the interviews of 24 teachers to help address the four research questions for this study. These findings to address the research questions of this study.

ALRR

The ALRR process appeared to be successful in building trust between MIG teachers that had been eroded through history. It also helped bridge the isolation that is so prevalent in the lives of these teachers. Working together in a spirit of trust, we began to address teacher identified professional, intellectual, emotional and personal needs. Teachers are gaining confidence and knowledge in their understanding of mathematics and how to teach it. This increase in self-confidence and content and pedagogical knowledge influenced teachers’ classroom practice and their professional identities.

Leadership

The facilitation of an effective professional learning community depends on effective leadership at the center of the community and outside of it (Hord, 1997). Jackie and I were responsible for that leadership. Barth (2006) maintains that leadership is the “ability to foster consequential relationships” (p. 10) that grows from “a foundation of trust, openness and affirmation” (Donaldson, 2001, p. 39).

Tasks of Leadership. Knapp et al.(2003) defines three essential tasks for leaders of professional learning communities. They must model, guide and facilitate the participation of others in a manner that focuses on learning and core values. They need
to build trusting relationships among professionals. Building trust among the participants requires leaders to value others, display empathy and deal forthrightly with colleagues. Leaders must set a tone of mutual trust and respect. Finally, they must create structures and schedules that sustain the interaction among participants (p. 25).

Experience and Brokers. In addition to performing the above tasks, leaders must have personal knowledge and connections with the culture in which the professional learning community is embedded. Personal experiences give leaders the understanding they need to model, guide and facilitate the professional learning community as well as empathize with its members. Throughout this project I found myself constantly reflecting on over twenty five years of experience as a secondary math teacher and administrator in Southeast Alaska where towns and villages were only accessible by boat and air. This gave me an understanding of teaching at the classroom, school and district levels. It also gave me some understanding of life in a very rural, isolated environment. There are many similarities between the small villages scattered among the islands known as “Southeast Alaska” and the schools on or near the Crow and Northern Cheyenne reservations. In both cases, the land had been populated for centuries by indigenous people and has only recently been discovered by the white culture. In both localities, it was important for the leaders to understand and value the culture and contextual factors in which the schools are located. It is these similarities that made this study so fascinating to me and formed the foundation for an initial understanding of the contextual factors influencing mathematics education in the bounded system.
Although I felt very competent in the workings of public school systems and comfortable working with the Alaska Native community, this would not transfer to schools in the bounded system. I could not just walk into a school and present the administration with a “plan” for increasing student achievement. I needed a Native American mentor who could guide me in interpreting the Native American culture and the context of living and working on an Indian reservation. Jackie, the Montana Professional Development coordinator for CLTW, proved to be indispensable in this role. For this study, I needed to understand what living in poverty entails, how to function within a non-English speaking environment and the demands of teaching a content you may or may not be prepared to teach. In addition, it was important for me to gain insight into a culture that has been dominated by another culture.

During our long drives, evenings at the local motel, and back in the office at Montana State University, Jackie and I spent numerous hours sharing, mentoring each other, planning and reflecting on the process of establishing a professional learning community in the bounded system. We constantly practiced ALRR in our own conversations. Together we provided the leadership for establishing a professional learning community of mathematics teachers in the bounded system.
LESSONS, IMPLICATIONS AND RECOMMENDATIONS

The purpose of this study was to document the development of a professional learning community of mathematics teachers who teach in small, rural, minority culture schools (i.e. a bounded system) on or near the Crow and Northern Cheyenne Indian reservations in southeast Montana. The teachers who participated in this study were committed to improving student learning but struggled to do so within the context of high student mobility rates and a lack of consistent curricular material.

The professional development literature has identified teacher participation in professional learning communities as a recommended approach for improving student achievement. The literature however, does not provide much guidance for how to establish a professional learning community of teachers who serve the same population of students yet work in geographic and culturally different schools and districts. The results of this study help to address this gap and provide insight for future efforts to build professional learning communities with teachers who work in the bounded system.

At the annual meeting of the National Centers for Learning and Teaching, Dr. Elisabeth Swanson, Principal Investigator for CLTW reported that, “Perhaps the most important learning from reading the numerous research articles and policy reports on achievement gaps, or conducting fieldwork in schools serving high needs students, is that achievement gaps arise in complex systems and must be addressed in their complexity, not one aspect at a time,” (Washington, D.C., February, 2006, p. 16). This statement
echoes Eaker ‘s (2002) comment on reculturing schools toward becoming professional learning communities.

The structural and cultural changes needed to advance a traditional school along the continuum of becoming a professional learning community are inherently non-linear and complex. Progress is typically incremental, characterized more by starts and stops, messiness and redundancy than sequential efficiency (p. 2).

If the process of establishing a professional learning community is ‘inherently non-linear and complex’ in traditional schools, the challenges of establishing a professional learning community in a bounded system of schools embedded in the complex contextual factors can be seen as overwhelming. The results of this study demonstrate that the key to establishing a professional learning community in this context is to continually and consistently employ the ALRR approach to respond to the contextual factors of culture, poverty, and rurality. This chapter also sets forth the critical lessons learned as we moved through this process together and offers recommendations for those who would adapt this approach to their unique situations. The chapter concludes with identification of questions that still need to be answered and recommendations for future research.

The Importance of the ALRR Approach

The importance of the ALRR (Ask, Listen, Respond, and Reflect) approach is a pivotal finding of this study. The four elements of the ALRR approach are highly interconnected and are the keys to building a successful professional learning community in a bounded system (Figure 10). The ALRR approach is not a linear list of steps for
building a professional learning community because the “process” is far more complex. The process (Figure 10) is about the ever growing, ever changing relationships that address teachers’ needs in a spirit of trust and respond to important contextual factors influencing classroom practice and teachers’ professional identity. The double-ended arrows in the figure indicate the constant application of ALRR throughout the process. The components of the ALRR approach are similar to the characteristics of relational trust (trust, respect, personal regard, integrity and role competence) (Bryk & Schneider, 2002) that became the basis of the environment of the MIG meetings.

As indicated by the double arrows in Figure 10, the ALRR components were continually revisited and reinforced – not in any specific order but intertwined throughout all interactions. Each of the components of the model were themselves also non-linear and multifaceted. For example, it was not enough to initially identify the contextual factors and address them once. Rather, using the ALRR approach allowed us to effectively meet teacher needs and as the teachers increased their content and pedagogical knowledge and self-confidence, this influenced their classroom practice and sense of professional identity. As teachers grew in confidence and expanded their professional identities, their needs changed and they pushed back on the system as a whole. The ALRR approach allowed us to identify and respond to these changed teacher needs and adjust the MIG accordingly.
Figure 10. Professional Learning Communities Influence Classroom Practice and Teacher Professional Identity.
Critical Factors in Building a Professional Learning Community

The findings from this study indicate that there are four critical factors in building a professional learning community: identifying leaders and brokers, identifying and addressing contextual factors, building trusting relationships with teachers, and identifying and addressing teacher needs. The following sections pinpoint the lessons we learned concerning these critical factors and recommendations for future efforts.

Working with Leaders and Brokers

The process of building a professional learning community among mathematics teachers who work in a bounded system requires competent leaders familiar with school systems at all levels and brokers with personal knowledge of the communities in the bounded system and who help to bridge various cultural gaps.

Lessons Learned. We learned the following three key lessons regarding leaders and brokers:

- Reading and studying about another culture cannot substitute for a mentor who is personally knowledgeable of the culture and has the trust of key people in the school and town community. Jackie’s personal knowledge of the history and culture of the Crow and Northern Cheyenne tribes and the interaction between the two tribes and the white community enhanced my experience working with Alaska Native tribes. This knowledge was indispensable to increasing my understanding of the culture and area in which we would be working.
Understanding the communication norms of another culture is critical in establishing a spirit of trust. Conversations with Jackie helped polish my listening skills enabling me to gain a deeper understanding of the cultural contextual factors. She was gentle with me when I overstepped accepted cultural conversational boundaries. The story I have attempted to tell would not have been possible without her mentorship, guidance and friendship.

The creation of structures and schedules that sustain and support professional learning community participants must take the organizational contextual factors of schools and districts in the bounded system into account. We needed to understand both the culture of teaching and how the relationships between administration, faculty and schools boards impact class schedules, student placement and curriculum.

**Leader Actions and Recommendations.** The evidence from the study leads to the following recommendations for future work in systems similar to the bounded system.

- Thorough knowledge of the system is prerequisite to changing the system.
  Facilitators need to be experienced as mathematics teachers and knowledgeable of the schools’ organizational structure. If the facilitator is an outside entity, it is critical to work with a broker or mentor who has the trust of the local community and understands the cultural norms.

- Build on the rich perspectives of the Native American culture rather than looking at the system from a deficit perspective that needs fixing. Trust in the past has been broken by those who view life on the reservation through the
lenses of a deficit model. The importance of asking, listening, and responding to the voices of those who live and teach in the system cannot be overlooked in the process of building communities in small, rural, isolated communities.

Identifying and Addressing Contextual Factors

In this study, I focused on the three major contextual categories, organizational, family and community, and policy, identified by Knapp et al. (2002). As indicated by the double arrows in figure 10, the contextual factors are constantly changing as the components of the bounded system change; thus, identifying and addressing contextual factors is an ongoing process.

In the bounded system of schools on and near the reservation teachers faced high rates of student mobility, a lack of consistency of mathematics curriculum and curriculum materials between schools, and no structure for providing professional development for all teachers.

Lessons Learned. Throughout the project, we learned about the contextual factors in which the bounded system is situated. In terms of organizational factors, we learned:

- It is not enough for administrators to “support” the involvement of their teachers by signing off on a grant. Administrators need to participate in discussions with teachers to establish a shared vision for the outcomes of the professional learning community collaboration.
- Administrators do not consider collaborating with their fellow administrators across the bounded system a priority. The findings from this study will
hopefully alert them to the positive outcomes on student achievement of such collaboration.

- Administrators need to be kept informed of goals, plans and the rationale for MIG agendas. It was important for leaders to serve as a liaison between teachers and administrators.

- Administrators need increased awareness of pedagogical strategies used in standards based mathematics classrooms and the research on which those strategies are based.

- Teachers need updated information of state and federal assessment requirements. The MIG agendas needed to focus on state standards. Research based teaching and assessment practices helped teachers align their instruction with district goals and empowered teachers by giving them knowledge to share with their colleagues.

- We learned that multiple forms of communication with teachers and administrators must be utilized multiple times, all the time. Communication needs to be a constant priority for MIG professional development leaders.

- We learned to schedule meeting times around school and athletic schedules. We learned to call the school early on the day of the meeting to remind school personnel of the meeting and arrived early to help prepare the meeting place.

The community and family contextual factors centered on three aspects of culture in the bounded system; Native American, poverty and rurality. We learned that these three cultures interacted to form a unique fourth culture--that of the teachers and students
who attended school in the bounded system. Addressing any of the three in isolation would result in missing an important piece of the puzzle. We also learned:

- The priority of family, community and tribal relationships with the Native American communities in the bounded system cannot be overemphasized. Responsibilities to an extended family structure are a priority for Native American teachers.

- When living in poverty, time spent with family and tribal members is the one asset people can control. Prioritizing the use of time often conflicts with a traditional school system’s assumed schedules. Calendars and schedules designed by others are not the basis for many Native American families’ decisions on the best use of time for their families.

- Facilitators need to respond to the implications of living in poverty when planning MIG meetings. When possible, we arranged for advanced travel money. We arranged for hotel rooms to accommodate family members. We learned not to assume teachers or the schools had computers, printers or access to reliable email.

- We learned not to assume schools had working computer labs, graphing calculators or other electronic learning devices. We learned to take into consideration the educational materials teachers had at their disposal to implement suggested reform activities that require manipulatives, computers or calculators when planning activities.
Districts in the bounded system are targeted by external entities to engage in professional development designed to increase student achievement. These efforts are not coordinated and at times are counterproductive in terms of teachers’ use of time and district goals.

**Leader Actions and Recommendations.** From the lessons learned in this project, I make the following recommendations for the development of future professional learning communities situated in the complex contexts of the bounded system.

- Do not tell others what they “need”. Use the ALRR approach for teachers and administrators to identify their goals for students and the challenges they face in achieving them. “Telling” teachers and administrators what they need or promising to “fix” their problems does not build a trusting atmosphere for collaboration.

- System administrators should be involved at all levels of a professional learning community. Teachers and administrators need time to collaborate and develop a shared vision for the mathematics curriculum for all students in the bounded system. Time is a precious commodity in school organizations and meetings should be planned judiciously.

- Teachers and administrators need an understanding of the importance of a coherent mathematics curriculum within and across the bounded system. If necessary, they should seek assistance in designing that curriculum and follow through on classroom implementation. This is critical for schools in the bounded system where students frequently move or transfer between schools.
• Encourage administrators across the bounded system to form their own inquiry group addressing the education of their shared population of students.

Administrative needs should be identified and addressed just as teacher needs are identified and addressed in MIG.

• Show respect for the Native American culture. One way this can be done is to ask a Native American teacher to open a large meeting with a prayer or a traditional greeting. Jackie would often open a meeting with a traditional greeting in her native language.

• Address the implications of living in poverty when asking for parent and community participation. This might include supplying meals, stipends and day care.

• Form a learning community of Native American and white families to build a vision for the mathematics education of their children. Family nights, career nights, informational nights on postsecondary opportunities and financial aid processes are topics to bring the communities together.

• External entities (universities, OPI, content organizations) designing grants should coordinate efforts with each other to address district goals in a consistent manner.

Building Trusting Relationships

Knapp (2003) identified building trusting relationships as one of the three essential tasks of leaders of professional learning communities. “Trust is established by leaders who are trustworthy themselves,” remarked Kanold (2006, p. 36). Leaders
demonstrate they are trustworthy by making and keeping commitments and cultivating integrity that occurs when the beliefs and behaviors of leaders are in alignment (Kanold, 2006).

**Lessons Learned.** We learned five key lessons about the importance of building trusting relationships in the bounded system.

- Creating trust must start at the beginning of the project. Prior to participating in MIG, the lack of trust between some administrators within and between schools, between some teachers and administrators, between cultures and between members of the communities and the schools prevented the type of collaboration needed to develop a shared vision for the mathematics achievement of all students.

- Providing an emotionally safe environment for teachers’ collaboration is critical. Teachers felt comfortable interacting with their colleagues about learning and teaching mathematics. Through their participation in MIG, teachers found they were not alone in the challenges they faced in teaching mathematics to the same population of struggling students.

- Creating a professional learning community must begin with basic team building. Teachers work in isolation. They do not have experience sharing their practice and learning from one another. Their work environment is often fraught with stress resulting in low morale and high teacher turnover. Providing safety and order through communication, advanced agendas, minutes, face-to-face contact and humor are initial building blocks.
• Internal struggles within the bounded system might challenge the formation of a professional learning community. Tension between the tribes, as well as between the white and Native American cultures, challenges the formation of a professional learning community built in a spirit of trust. The lack of trust between various administrators, teachers, tribal and community members at large may set up power situations that make it difficult to create structures for teachers’ ongoing collaboration.

• The overarching lesson learned in this project was the importance of establishing relational trust. It cannot be overlooked and the process of building trust cannot be shortcut. Building trust was a constant focus and it occurred slowly, consistently and over time. The ALRR approach was instrumental in providing a safe atmosphere in which teachers could share and learn from each other and from us.

Leader Actions and Recommendations. Based on the findings from this study and the lessons learned, I make the following recommendations for those who want to build trusting relationships in a professional learning community.

• Use the ALRR approach to identify and address teacher needs and to create a feeling of safety, comfort and respect for Native American norms of communication.

• Facilitators need to plan the agendas for each meeting carefully – building on previous meetings and the identified needs of the participants.
• Facilitators need to plan for meetings to take place at different locations – respectful of the long distances teachers drive to attend meetings. Teachers are proud of their schools and want to share where they live and work with their colleagues.
• Facilitators need to provide multiple entry points to encourage all teachers to participate in MIG and avoid creating levels of opportunity, power or expertise.
• Facilitators need to recognize and celebrate teacher and school successes, even the little ones. Students in the majority of schools in the bounded system have not met AYP. This can be discouraging for teachers who have taught in the system for many years. Recognizing little successes helps them feel they are making progress.

Identifying and Addressing Teacher Needs

Teacher participation in MIG is voluntary and for the most part occurs during after school hours. Identifying and meeting teacher needs was all the more important in encouraging teachers’ continued MIG participation. Kanold (2006) believes, “A strong, learning focused community offers professional support, renewed commitment, a setting for managing conflicts and help with problems of practice” (p. 18). This appeared to be the case for MIG participants.

Lessons Learned. The critical lessons we learned about identifying and addressing teacher needs are as follows:
• Teachers need to know their work is valued and important. We needed to communicate this fact as often as possible. We asked them to share their work with colleagues, supported them in assuming professional roles outside the classroom and showed respect for them as professionals.

• Teachers wanted to learn math content and instructional strategies to help them more effectively teach their students. They did not want to transfer their lack of self-confidence in mathematics to their students.

• Teachers craved interaction with their colleagues. Most teachers commented that a supportive environment where teachers could express their opinions, risk sharing their work and that of their students and receive feedback from their colleagues was important to them.

• Teachers needed to have fun. MIG provided a social forum for teachers where they could meet new friends and celebrate small successes.

Leadership Actions and Recommendations. Based on the findings of this study, I make the following recommendations for identifying and addressing teacher needs:

• Use multiple measures based on the ALRR approach to determine the needs of teachers. These measures include an analysis of field notes, questionnaires, surveys and evaluations, assessment of mathematics understanding, conversations and interviews. Facilitators need to build learning opportunities for teachers based on their identified needs.

• Engage teachers in consensus building. Teachers have ideas of how their students learn best and ways in which they could be more successful.
Teachers rarely have the opportunity to share successes they experience in their classrooms or risk talking about their failures.

- Inform teachers of expectations for themselves and their students mandated by state and federal policies. Keeping them up to date with state standards and accountability requirements empowers teachers to request the support they need.

- Model mathematics content at MIG meetings using standards based teaching strategies and materials. Many teachers have not had the opportunity to explore various research based instructional strategies. Engaging them in activities using manipulatives, cooperative learning and technology often increases their own understanding of the content and how to teach it.

- Build in a social aspect to meetings including food. Meetings help teachers combat the isolated environments in which they live and work.

Benefits of Building a Professional Learning Community

The development of the MIG in this study reveals that it became a professional learning community both similar and different from those described in the literature. The teachers in this study taught in numerous schools throughout the bounded system and yet their singular focus was on improving the learning is of their shared population of students. Through participation in the MIG, teachers reported increases in content knowledge, pedagogical knowledge and self-confidence. These improvements led to positive changes in classroom practice and sense of professional identity.
Increase in Teachers’ Content Knowledge, Pedagogical Knowledge and Self Confidence

One of the indicators identified in the CLTW proposal for assigning a ‘high needs’ designation to a student population is their teachers’ lack of access to quality professional development. Research indicates that effective, professional development must include more than collegial support; it needs to have a clear focus on mathematics, how children learn mathematics and the curriculum (Gearhart, M., Saxe, G.B., Seltzer, M., Schlackman, J., Ching, C.C. et al., 1999). Many on-reservation schools do not have funds or timely information to provide these opportunities in mathematics for teachers. Based on this research, the CLTW professional development staff responded to teacher needs through setting out to a professional learning community.

Lessons Learned. We learned the following three lessons about teachers’ content and pedagogical knowledge.

- Many teachers have a limited understanding of mathematics and how to teach it. This impacts their professional self-confidence. In a small, rural community where there are few available jobs, teachers are hesitant to expose their lack of content knowledge. It is important to identify their content knowledge and provide means to address the deficiencies.

- Teachers learn through social interaction, not in a vacuum (Bransford, 2000). Adults do not learn mathematics when they feel intimidated or threatened. Without a safe environment where they can learn, share and feel supported teachers have no way to increase their mathematical knowledge or confidence.
• Teachers are often unaware of professional development opportunities. If they are aware of the opportunity but it requires a long drive or overnight stay, teachers have a difficult time leaving their families and other responsibilities. This is further complicated by the fact that teachers may feel they lack the requisite understanding of mathematics to attend such opportunities.

**Leadership Actions and Recommendations.** Based on the findings of this study I make the following recommendations for increasing teachers’ content and pedagogical knowledge while increasing their self-confidence.

• To teach mathematics, you must know the content. Find a non-threatening way to determine teachers’ content knowledge and provide learning opportunities to address areas of weakness.

• Meet the teachers at their level of mathematics and build on that understanding.

• Give teachers the necessary knowledge and facilitation skills to establish mathematics professional learning communities in their own schools.

**Changes in Teachers’ Classroom Practice**

Research clearly indicates teacher methods and curricula have a significant impact on student achievement levels (NCTM, 2000; ACE, 1999). To close the achievement gap, mathematics leaders need to help teachers change the way they teach mathematics (NCSM Newsletter, 2006). When individual teachers try to change their classroom practice, the support of other teachers is important to their success (Romagnano, 1994).
Teachers need to have a safe place to discuss successful as well as frustrating or failed experiences with colleagues is essential to teachers’ development (Silver, Smith & Nelson, 1995; Stein, Silver & Smith 1998).

Throughout our MIG meetings we modeled research based teaching and assessment strategies and discussed the related research on instructional strategies and questioning techniques. As teachers began to reflect and collaborate on what would work with their shared population of students in the bounded system, they began to change their classroom practice.

Lessons Learned. I learned four critical lessons about how teachers perceived their classroom practice to have changed as a result of their participation in MIG.

• The greatest change teachers experienced was the increased expectation they gained for their students’ learning in mathematics. Collaboration with other MIG teachers made them aware of what similar grade level students were achieving in other classrooms in the bounded system.

• The backward design model for lesson planning helped teachers focus on standards and assessments rather than turning the pages in a book. By focusing on the standards, teachers’ discussions shifted to the content strands and how to incorporate them into their lessons. Exploring the design of problems and rubrics helped teachers clarify their expectations for student understanding.

• Modeling various instructional strategies gives teachers personal experience with learning mathematics that increases their own understanding. Prior to
their participation in MIG, few teachers used manipulatives in their mathematics classrooms. Experiencing a growth in their own understanding as a result of the activities we engaged them in opened discussions of the importance of using hands on learning with their students.

- Encouraging teachers to engage their students in group work had its own set of challenges. Most teachers taught in very traditional classrooms with students working independently. The lack of trust that existed between the adults in the community played out in the classroom. One teacher commented that it was difficult for students whose families had a negative history to work together. This was a problem of working with students in small rural schools I had not foreseen.

**Leader Actions and Recommendations.** My recommendations for changing teachers’ classroom practice echo that found in the literature.

- Model standards based strategies for teaching mathematics focused on the content and performance standards.
- Encourage teachers to build consensus for what they believe students should be able to do at each grade level and design appropriate assessments and rubrics to assess that knowledge.

**Change in Teachers’ Professional Identity**

Teachers’ increased content and pedagogical knowledge combined with the opportunity to collaborate with colleagues increased their professional self-confidence
and led to a change in their professional identity. Lambert (2003) made the following observation on building leadership capacity:

Networks [professional learning communities] provide teachers with an extended learning community in which to develop their professional self-concepts.… Teachers see themselves as part of a broader profession and are listened to with an intensity and respect that may not exist in their schools; hearing and thinking how other teachers think and interact allow them to fine-tune their perceptions of their roles as teachers (p. 36).

As facilitators, we chose to establish a professional learning community of teachers rather than to develop a group of teacher leaders. I was hesitant about setting up a hierarchical situation between teachers in the bounded system because my own experience has taught me that teaching is a very egalitarian profession and colleagues often ostracize a teacher who ‘steps out of the box’. Although this aspect of the teaching culture has definitely begun to change as districts engage teachers in mentoring, peer coaching, study groups, teachers on special assignment etc., these practices were not in place in many of the schools in the bounded system where the culture of teaching remains very traditional. I was also hesitant to pursue a teacher leader model because my experience has shown me that the Native American community is basically communal in nature. Historically, every member of a tribe worked for the good of the community as a whole. Thus, I believed developing a non-hierarchical learning community would be most successful.

**Lessons Learned.** As teachers gained confidence and began to change their classroom practice, they also began to change their sense of professional identity. These are the lessons we learned:
Teachers need support to become advocates for changing student learning opportunities in mathematics in their home schools and districts.

Understanding the importance of a coherent mathematics curriculum for all students gave teachers the confidence and information to speak to their administrators requesting time for K-12 or grade level collaboration.

Due to the isolation of their communities, many teachers are not aware of professional opportunities in mathematics education. Teachers need to be encouraged and supported to apply for a seat on state and local committees or to make a presentation. Once selected, they need support and encouragement in preparing presentations.

Participation in MIG gave several teachers the confidence to explore other professional possibilities and accept responsibility for advocating for change in mathematics education that would impact student achievement. They need ongoing support in their efforts.

**Leadership Actions and Recommendations.** Based on our experience with MIG and the lessons we learned, I would like to make the following recommendations for districts interested in changing teachers’ professional identity.

- Encourage teachers to engage in roles outside of the classroom such as participating on local and state mathematics education committees then support them in their attendance.
- Support teachers in making presentations at local and state conferences. Assist them in filling out proposal forms, designing and practicing their
presentations. The MIG teachers who took this step found new confidence in their own teaching.

- Encourage teachers to engage other teachers and administrators in their school and district to participate in professional learning communities. Model and explain facilitation techniques. Empower teachers by giving them tools to engage other teachers in safe, ordered collaboration.

Recommendations for Further Research

As a professional community we have many lessons to learn about building professional learning communities in the bounded system. My recommendations for research that would aide future efforts in similar systems follow.

- What is the actual transfer rate for students in the bounded system? How many individual students actually transfer between schools during grades K-5, 6-8 or 9-12? How many times do individual students transfer between schools in a given year?

- What structure would encourage administrators across districts in the bounded system to participate in a professional learning community focused on providing a coherent mathematics curriculum for their shared population of students?

- Several districts are beginning to hire teachers to become math coaches. What are the job descriptions for “math coaches”? What experiences do coaches need for the job? What professional development do they receive? How do
other teachers perceive a math coach? What is the impact of a math coach on the classroom practice of teachers and mathematics achievement of their students?

- What is a process for involving the community at large in developing a shared vision for what mathematics students in the bounded system should know and be able to do?
- What should a culturally based mathematics curriculum include for students in the bounded system?
- What is the mathematics content knowledge of practicing teachers? How do you address deficiencies when trust is so tenuous and jobs are scarce?
- Teachers from some schools and districts were more engaged in MIG over the long term than those from other schools. What are the characteristics of the schools that encouraged these teachers to participate?

**Conclusion**

Establishing a professional learning community of mathematics teachers in the bounded system located on or near the Crow and Northern Cheyenne reservations in southeast Montana provides clear evidence that participating in a *professional learning community that addresses teacher needs in a spirit of trust and responds to important contextual factors does influence classroom practice and teachers’ professional identity*. These changes, if supported by all members of the educational community in the bounded
system will provide opportunities for the highly mobile population of students in the bounded system to increase their achievement in mathematics.

I believe the most important outcome of MIG has been the support, validation, and increase in the self-confidence teachers developed through their participation in MIG. This increased confidence is carrying over to their classrooms where both teachers and their students are learning more in-depth mathematics. During this project, we learned that a professional learning community is, by its very nature, always learning and therefore changing. In establishing a professional learning community where teachers can collaborate in a safe environment, more teacher needs will surface and more difficulties will be encountered. As these needs are identified and addressed, the influence of teacher participation will push back on the bounded system requiring it to change. The ALRR approach is a dynamic process for addressing these evolving needs.

Knapp (2003) reminds us that, “professional learning communities that both value and promote learning improvement are harder to realize than current rhetoric would imply” (p. 25). The tendency of a closed organizational system is to wear down, to give off energy that can never be retrieved “while open systems engage with their environment and continue to grow and evolve” (Wheatley, 1994, pp. 76-77). While reaching equilibrium can be viewed as a healthy state from a scientist’s perspective, the search for organizational equilibrium is a sure path to institutional death (Wheatley, 1994). As teachers change their classroom practice, increase their self-confidence, and change their professional identity, they introduce disequilibrium into the bounded system. The system has no alternative but to change. Regardless of the complexity of the effort,
we owe it to the students in the bounded system to use methods that have been found to be effective in improving students’ learning.


A precondition for doing anything to strengthen our practice and improve a school is the existence of a collegial culture in which professionals talk about practice, share their craft knowledge, and observe and root for the success of one another. Without these in place, no meaningful improvement - no staff or curriculum development, no teacher leadership, no student appraisal, no team teaching, no parent involvement, and no sustained change - is possible. ... Empowerment, recognition, satisfaction, and success come only from being an active participant within a masterful group -- a group of colleagues (p. 13).

The teachers who have participated in MIG are a ‘masterful group’ as voiced by the teacher who said, “Confidence…it (MIG) has built my confidence up. I have good ideas. I am a good teacher. We can get stuck in that ‘does anybody know I’m here? Anybody care? – You guys do”. This type of teacher confidence can only result in improved opportunities for all students. I believe student achievement in mathematics in the bounded system will increase when all members of the community are given the opportunity to collaborate in a spirit of trust to establish a shared vision for those students.

Epilogue

Sixteen months after the “conclusion” of the study, we are still holding MIG meetings in the bounded system. Thirteen of the teachers I interviewed have continued their participation in MIG. Six other teachers including the paraprofessional are still
teaching in the system but no longer attend MIG meetings for various reasons. One is now teaching history, his major. Five teachers who were core members of MIG have either retired or are teaching in districts outside of the bounded system.

Of the thirteen interviewed teachers who have continued participating in MIG, many are pushing their practice to the next level by participating in the CLTW pilot Sharing Your Practice. During the interviews, teachers commented they did not have the opportunity to share their practice with colleagues – a characteristic of professional learning communities identified in the literature. We offered core MIG teachers the opportunity to participate in a pilot project involving collaborative teams. The teams worked together to design a lesson using a simple Understanding by Design template. They observed and video taped each other teaching the lesson and reflected on their own and each others’ practice. They also designed performance assessments and used rubrics to determine their students’ understanding of the mathematics in the lesson. The group will continue working on this project during the 2006-07 school year focusing on the art of reflection and questioning techniques.

There has been an increase in the administrators’ interaction with MIG teachers and facilitators. Some are attempting to provide a consistency of curriculum materials for students who transfer between schools. A couple of districts use MIG teachers to facilitate mathematics professional development for their district grade level teachers with the support of CLTW staff. In one district, three teachers prepared and designed a three-day summer math workshop for 24 other teachers in the district. This effort was a joint venture between CLTW staff and the district. From my perspective, the workshop
was extremely well done and the teachers received a lot of support from their colleagues in workshop evaluations. These teachers are continuing to provide mathematics support for district teachers during early release days. I have been included in conversations with administrators about the importance of providing access to a coherent mathematics curriculum for all students as a result of these conversations. This gives me the opportunity to promote the idea of collaboration with other bounded system administrators.

Several teachers participated in a three-week residential mathematics content workshop over the last two summers. These teachers are beginning to assume leadership roles in their districts as a result. Other teachers have served on state assessment committees including bias review, determining cut scores and providing guidance for state coordinators. Two high school teachers facilitated a state grant designed to teach content to teachers in the lower grades in the bounded system. Another teacher has become a district mathematics leader and is working on her doctorate in mathematics education. I believe that as teachers 1) grow in their own understanding of mathematics content and pedagogy and 2) facilitate opportunities for their colleagues and the community to participate in discussions of a vision for their shared population of students, students in the bounded system will be the beneficiaries.
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APPENDIX A

PARTICIPANT INFORMATION AND CONSENT FORM
Participant Information and Consent Form
Montana State University

Researcher: Karma G. Nelson, CLTW Teacher Leader
Phone: 570-4055 email: karmanelson@montana.edu

Title of Study: **Process of Building a Professional Learning Community Among Mathematics Teachers on Two Montana Indian Reservations**

Over the past two years, a number of us have been involved in a collaborative effort to improve student learning in mathematics and classroom practice. The teachers in our group work in various schools and districts on or near the Crow and Northern Cheyenne Indian reservations in rural Southeast Montana.

During my conversations with teachers and administrators during the fall of 2001 and winter of 2002, the difficulty of providing access to a consistent mathematics experience for students who frequently transfer between schools was a common theme. The districts in which the schools are located are public, parochial or tribal and are separated by up to forty or fifty miles. Responding to this voiced need for collaboration, the CLTW professional development staff embarked on the process of establishing a collaborative group of math teachers committed to the above goals. All math teachers in grades 5-12 were invited to attend the Math Inquiry Group meetings every semester. Some of the teachers were consistent in their attendance at meetings while others chose to attend sporadically. This group with flexible attendance became known as the Math Inquiry Group.

With your participation, I would like to document the process of establishing the Math Inquiry Group. If you agree to participate in the study I may ask you to engage in an interview with me. The interview will be audiotaped. The tapes will be stored in a locked cabinet throughout the duration of the study. I will also ask you to complete a survey regarding your participation in the Math Inquiry Group and other CLTW activities. The data I collect from your interviews and surveys will help to describe a process of building a professional learning community of teachers in rural, culturally diverse areas. There will be no stipend for participation in the study other than the stipend, mileage and CEU credits you received for your participation in the Math Inquiry Group. A possible benefit of your participation may be that your opinions will help teachers and administrators design programs for teachers in similar situations.

Risks related to participation in this study are minimal. Your participation is always voluntary, and at any time, you may decline to participate. The results of your participation will remain confidential. No names or other specific identifiers will be reported from interviews. No names will be collected on surveys. All participant responses will be combined in a final paper. If I use some of your ideas in the final paper, your name will not be attached to them. The final report will be available in the Renne Library at Montana State University - Bozeman.

If you have additional questions about the study, please contact Karma Nelson, karmanelson@montana.edu or Billie Jo Brown, CLTW Director of Professional Development in Montana, bjbrown@montana.edu. If you have specific questions about the rights of participants in this study, please contact the Chairman of the Institutional Review Board at Montana State University, Mark Quinn, (406) 994-5721.

**AUTHORIZATION:** I have read the above and understand the nature of my involvement in the program evaluation of the Center for Learning and Teaching in the West.

I, ____________________________ (name of subject), agree to participate in this evaluation. I understand that I may later refuse to participate, and that I may withdraw from the study at any time. I have received a copy of this consent form for my own records.

Signed: __________________________ Date: _______________
APPENDIX B

TEACHER INTERVIEW QUESTIONS
Process of Building a Professional Learning Community Among Mathematics Teachers on Two Montana Indian Reservations

What is a process for establishing a self-sustaining professional learning community of mathematics teachers who teach in small, rural, minority culture districts and who teach students from the same population?

Interview Questions

b. How long have you been in your current teaching position (Grade and Content)? (Other relevant history).
   How long have you been in the teaching profession?

c. Before participating in CLTW activities, describe the types of discussions you had on the topics of teaching, learning and assessment with other math teachers
   1. In your building?
   2. In your district?
   3. In other districts?

d. What motivated you to attend your first Math Inquiry Meeting? Why have you continued to attend the Math Inquiry Meetings?

e. What kinds of things made it difficult for you to attend Math Inquiry Meetings?

f. Describe what you like about the Math Inquiry meetings.

g. Describe what you don’t like, or would like to change, about the Math Inquiry Group.

h. Have you or would you encourage other teachers to participate in the Math Inquiry Group meetings? Why or why not?

i. Why did you stop attending the Math Inquiry Groups? (If appropriate)

j. How do you see this group sustained if CLTW funding was discontinued?

k. How has participation in the Math Inquiry Group supported you as a classroom teacher?

l. How could further participation support you as a classroom teacher?
In education articles and courses authors refer to a professional learning community as a group of teachers who:

1) meet frequently to talk about teaching and learning
2) develop shared norms and values
3) have a group focus on improving student learning
4) are comfortable sharing their thoughts about their own teaching practice
5) are comfortable having other teachers from the professional learning community visit their classrooms or help with student learning challenges.

a. So - do you think our Math Inquiry Group would qualify as a professional learning community? Why?
b. Which characteristics listed above do you feel the group has?
c. Which characteristics do you think need to be improved on?
d. I'm interested in hearing what you think were the important turning points in the process that helped the MIG grow.

What are the factors that enhance or limit collaboration between mathematics teachers in schools on or near the two reservations? (Strang & von Glatz, 2001).

a. What factors enhance your collaboration with teachers or other educational professionals regarding student learning in mathematics
   1. In your school?
   2. In your district?

b. What factors limit your collaboration with teachers or other educational professionals regarding student learning in mathematics
   i. In your school?
   ii. In your district?
How do teachers perceive their classroom practice to have changed in light of their participation in a professional learning community?

a. What changes in your teaching practice have occurred as a result of your participation in the Math Inquiry Group?

b. How has participation in the Math Inquiry Group influenced your goals for your students in mathematics?

c. How has participation in the Math Inquiry Group changed how you assess your students’ knowledge?

How has participation in a professional learning community changed teachers’ perspectives on their responsibilities as professional educators?

a. Do you see yourself as a member of a professional learning community as a result of your participation in the Math Inquiry Group and other CLTW activities?

b. What elements of the Math Inquiry Group helped you feel you are a member of a professional learning community?

c. How has your participation in the Math Inquiry group changed how you perceive yourself as a professional mathematics educator in your region/state?

d. How has your collaboration with teachers from other schools and districts influenced what you do as a professional mathematics educator?

e. How has participation in the Math Inquiry Group helped you to clarify or change your own professional goals as a mathematics educator?
f. How has the implementation of school or district curricula been changed or effected (if it has been) as a result of your participation in the Math Inquiry Group?

g. What changes and/or effects in school and district assessment have occurred because of your participation in the Math Inquiry Group?

h. When you make decisions about math instruction in the classroom, what influences you?
   If people influenced the decisions you make about math instruction in the classroom, who are they and how do they influence you?

i. What do you envision your role as a math educator to be in the future?
   Explore how you’ve come to this conclusion.
APPENDIX C

NEEDS OF TEACHERS BY THEME
### Professional:

<table>
<thead>
<tr>
<th>Code</th>
<th>Definition/Characteristics</th>
</tr>
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| • Collaboration (PC) | • Professional dialogue about teaching and learning mathematics  
                          • Discussions of common challenges of teaching in the bounded system  
                          • Characterized by in-depth rather than surface dialogue.              |
| • Sharing (PS)  | • Sharing ideas, activities, what works and what doesn’t work with students in the mathematics classroom with other teachers. |
| • Professional Growth (PG) | • A change or acceptance of taking personal responsibility for improving mathematics education outside the classroom.  
                          • A change in how teacher assesses mathematics.  
                          • Encourages reflective thinking                                        |
| • Student Response (PSR) | • Saw increased understanding/enthusiasm of mathematics by students as a result of implementing MIG ideas/activities in the classroom. |

### Intellectual (Increased “knowledge – having to do with the mind”)

<table>
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<tr>
<th>Code</th>
<th>Definition/Characteristics</th>
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<tbody>
<tr>
<td>• Increase in content knowledge (IC)</td>
<td>• Improved teacher’s personal understanding of mathematics.</td>
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</table>
| • New/relevant information learned from MIG facilitators (IR) | • Information regarding state/national accountability  
                          • Research on teaching and learning mathematics                                    |
| • Increased pedagogical/assessment knowledge (IPA) | • Increased understanding of how to teach mathematics  
                          • Increased understanding of how/when to use various forms of assessment  
                          • Increased understanding of how children learn mathematics.                      |
Emotional

• Support of other teachers and/or facilitators (ES)

• Compliments, reinforcements made that indicate support for each other as educators.

• Valued as a professional (EP)
  • Felt valued as a professional
  • Personal affirmation of worth as a professional
  • Increased confidence in teaching mathematics

• Atmosphere (A)
  • Feeling of comfort or safety when attending meetings
  • Positive atmosphere of meetings

• Isolation (I)
  • Combatted feelings of isolation (professional, emotional, geographic)

Personal

• Social interaction (PS)
  • Importance of socializing, making friends, eating.

• Money/credits (PEC)
  • The importance of receiving a stipend, mileage and/or credits for attending MIG meetings.
APPENDIX D

CLASSROOM PRACTICE DESCRIPTIONS
<table>
<thead>
<tr>
<th>Code</th>
<th>Definition/Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beliefs</td>
<td></td>
</tr>
<tr>
<td>• Increased expectations (SE)</td>
<td>• Indications of teachers’ increased expectations for their students’ mathematical understanding</td>
</tr>
<tr>
<td>• Increased understanding of mathematics (MU)</td>
<td>• Impact of teacher understanding of mathematics on their classroom practice</td>
</tr>
<tr>
<td>Changes in classroom practice</td>
<td></td>
</tr>
<tr>
<td>• Implementation of Montana content standards (CS)</td>
<td>• Indications of a heightened awareness of content standards</td>
</tr>
<tr>
<td></td>
<td>• Use of backward design model for planning instruction.</td>
</tr>
<tr>
<td>• Assessment (A)</td>
<td>• Types of assessment teachers used in the classroom.</td>
</tr>
<tr>
<td></td>
<td>• Teacher incorporation of rubrics</td>
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<tr>
<td>• Instructional strategies (IS)</td>
<td>• Implementation of student centered strategies</td>
</tr>
<tr>
<td></td>
<td>• An awareness of the importance of questioning techniques</td>
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<tr>
<td></td>
<td>• Use of hands on materials</td>
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<tr>
<td></td>
<td>• Use of groups</td>
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<tr>
<td>• Implementation of process standard (PS)</td>
<td>• Emphasis on problems requiring problem solving and reasoning.</td>
</tr>
<tr>
<td></td>
<td>• Inclusion of culturally relevant and/or problems requiring application of mathematics.</td>
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<tr>
<td></td>
<td>• Emphasis on having students explain their understanding through written or verbal communication</td>
</tr>
</tbody>
</table>
STANDARDS-BASED INSTRUCTIONAL PLANNING MODEL

BACKWARD DESIGN TEMPLATE

1. Identify relevant standards.
2. Design/select an assessment through which students have opportunities to demonstrate what they know and can do.
3. Decide what learning experiences will enable students to learn what they need to know and to do.
4. Plan/implement instruction to assure that each student has adequate opportunities to learn.
5. Conduct the assessment and use data to provide feedback; re-plan and re-teach, or repeat process with next set of relevant standards.