

12-5-2008

The relationship between the maturity level of professional learning communities (PLCs) and student achievement

Eric Brett Arbetter

University of Missouri-St. Louis

Follow this and additional works at: <https://irl.umsl.edu/dissertation>



Part of the [Education Commons](#)

Recommended Citation

Arbetter, Eric Brett, "The relationship between the maturity level of professional learning communities (PLCs) and student achievement" (2008). *Dissertations*. 529.

<https://irl.umsl.edu/dissertation/529>

This Dissertation is brought to you for free and open access by the UMSL Graduate Works at IRL @ UMSL. It has been accepted for inclusion in Dissertations by an authorized administrator of IRL @ UMSL. For more information, please contact marvinh@umsl.edu.

THE RELATIONSHIP BETWEEN THE MATURITY LEVEL OF PROFESSIONAL
LEARNING COMMUNITIES (PLCs) AND STUDENT ACHIEVEMENT

by

ERIC BRETT ARBETTER
A.B., Washington University, 1995
M.A. Ed., Washington University, 1996

A Dissertation Submitted to the Graduate School of the University of Missouri – St.
Louis in partial fulfillment of the requirements for the degree

DOCTOR OF EDUCATION

in

EDUCATIONAL ADMINISTRATION

October 2008

Advisory Committee

Matthew Davis, Ph.D.
Chairperson

Margaret Dolan, Ph.D.
Committee Member

Kenneth Owen, Ed.D.
Committee Member

Lloyd Richardson, Ph.D.
Committee Member

Abstract

The purpose of this study was to determine if a relationship exists between schools' maturity as professional learning communities (PLC) and student achievement in mathematics and communication arts. Teachers from all 333 public elementary schools in Missouri serving students in kindergarten through fifth grade were invited to participate by completing Hord's *School Professional Staff as Learning Community Questionnaire*. Each question was directly related to one of Hord's five critical dimensions of PLCs: "...supportive and shared leadership; a shared vision and values; collective learning and application of learning; shared personal practice; and supportive conditions" (Hord, 1997a, p. 6, *passim*). Multiple linear regression analyses were used to test the hypothesis: as the maturity level of schools as PLCs increases, according to scores on the *School Professional Staff as Learning Community Questionnaire*, student scores on standardized tests in communication arts and mathematics, specifically the *Missouri Assessment Program* Index Score, will also increase. The findings for this study suggest that as the maturity level of schools as PLCs increases, student scores on standardized tests in third grade communication arts and mathematics also increase significantly. There was no significant relationship between schools' maturity levels as PLCs and student achievement in fourth or fifth grade for communication arts or mathematics.

TABLE OF CONTENTS

| | |
|---|----|
| CHAPTER 1: INTRODUCTION..... | 1 |
| Theoretical Framework..... | 2 |
| Statement of the Problem..... | 4 |
| Purpose of the Study..... | 7 |
| Hypothesis..... | 7 |
| Significance of the Study..... | 7 |
| Delimitations..... | 8 |
| Operational Definitions..... | 8 |
| Organization of the Study..... | 9 |
| CHAPTER 2: REVIEW OF RELATED LITERATURE..... | 11 |
| Introduction..... | 11 |
| Learning Organizations..... | 11 |
| Characteristics of Professional Learning Communities..... | 15 |
| Exemplars of Professional Learning Communities..... | 19 |
| Interrelatedness of shared leadership, shared vision, and supportive conditions.. | 20 |
| Antecedents to Student Achievement..... | 21 |
| Leadership Strategies within Professional Learning Communities..... | 21 |
| Collaboration in Professional Learning Communities..... | 23 |
| Critical Friends Group..... | 27 |
| Collective Efficacy and Student Achievement..... | 27 |
| CHAPTER 3: METHODOLOGY..... | 29 |

| | |
|---|----|
| Purpose of the Study..... | 29 |
| Research Question..... | 29 |
| Research Design..... | 29 |
| Population and Sample..... | 30 |
| Instrumentation..... | 30 |
| Data Collection Procedures..... | 31 |
| Data Analysis..... | 33 |
| Limitations..... | 33 |
| Summary..... | 34 |
| CHAPTER 4: ANALYSIS OF DATA..... | 35 |
| Preliminary Analysis..... | 35 |
| Relationship between PLC Maturity and 3 rd Grade Communication Arts..... | 37 |
| Relationship between PLC Maturity and 3 rd Grade Mathematics..... | 41 |
| Relationship between PLC Maturity and 4 th Grade Communication Arts..... | 44 |
| Relationship between PLC Maturity and 4 th Grade Mathematics..... | 48 |
| Relationship between PLC Maturity and 5 th Grade Communication Arts..... | 52 |
| Relationship between PLC Maturity and 5 th Grade Mathematics..... | 56 |
| Summary..... | 60 |
| CHAPTER 5: SUMMARY AND DISCUSSION..... | 61 |
| Statement of the Problem..... | 61 |
| Review of Methodology..... | 63 |
| Summary of the Results..... | 64 |
| Discussion of the Results..... | 65 |

| | |
|--|----|
| Recommendations for Further Research..... | 68 |
| Concluding Remarks..... | 69 |
| REFERENCES..... | 70 |
| APPENDIX A: Letter to Professional Development Representative..... | 75 |
| APPENDIX B: Letter to Teacher..... | 76 |
| APPENDIX C: Institutional Review Board Approval..... | 77 |

CHAPTER 1

INTRODUCTION

The No Child Left Behind Act of 2001 (NCLB), based on President George W. Bush's framework for education reform, has increased state, school district, and school accountability. NCLB requires states to hold schools accountable for meeting challenging statewide standards in reading and mathematics by annually testing all students in grades three through eight and setting annual student proficiency goals so that by 2014, 100 percent of all students are proficient as measured by state assessments (No Child Left Behind Act of 2001).

The state of Missouri set its annual proficiency rate for communication arts at 42.9 percent in 2007. Districts with schools with less than 42.9 percent or more of its students scoring proficient or higher in communication arts faced possible punitive measures from Missouri's Department of Elementary and Secondary Education (DESE). Schools or districts that do not meet their state's proficiency goals for two years in a row are put in School Improvement or District Improvement status by DESE and face possible state takeover if improvements are not made (Department of Elementary & Secondary Education, 2007). In August, 2007, 167 out of 524 school districts in Missouri were placed on the state's improvement list due to not meeting state proficiency goals (Giegerich & Bock, 2007). As a result of NCLB, many school districts and schools are looking at educational reform methods to positively affect student achievement and to avoid possible state takeover.

Theoretical Framework

In the late 1960's, educational reform was based on an input-output design; it was believed that by giving schools extra money, technology, or new educational programs, student performance would increase (Berman & McLaughlin, 1978). By 1973, researchers began to doubt the effectiveness of these reforms because the expected results had not materialized. The United States Office of Education contracted the Rand Corporation to conduct a mixed-methods study on the effectiveness of federally funded programs to bring innovative change to public education. The study spanned from July, 1973 to April, 1977. In the first phase, researchers identified which strategies and conditions were more likely to increase student performance, accomplish the program goals, and change teachers' teaching. The second phase studied what happened to the programs after the funding stopped. It was concluded that the type of project and amount of federal funds were not important factors in whether the programs were effective or not. Local concerns and traditions of a particular school district and how the district implemented the program had the biggest influences on the outcome of the program.

Berman and McLaughlin's (1978) framework divided innovations into three stages: mobilization; implementation; and institutionalization. During the mobilization, or adoption, stage, they concluded that broad-based support was needed for the program to continue after federal funding ceased. Also, a crucial component was that all stakeholders were supportive of the program and involved in the planning events. The implementation stage occurred when the program was put into practice. For lasting success, mutual adaptation should take place; "...*mutual adaptation* occurred when *both* project and setting were changed" (p. 16, emphasis in original). The local school or

district should adapt the project to fit the needs of the school's present situation. In addition, teachers' behaviors and attitudes would have to change in order to implement the new program. In other words, the staff would work "...to make the project work for them" (p. 16). The final stage, institutionalization, would take place when the program continued even after federal funding stopped.

Common factors were present during the implementation stage that positively affected the institutionalization of new programs. According to Berman and McLaughlin, "Clarity of project goals and precepts was important in the implementation of all projects" (1978, p. 35). Similarly, Berman and McLaughlin noted that implementation strategies were adapted at the local level, teachers were provided with feedback in a timely manner, and teachers were able to choose ways to correct the program for their needs, which encouraged commitment from the teachers. Likewise, active support of the program by principals was crucial to the effectiveness and institutionalization of programs; principals provided moral support to the teachers and created positive organizational climates for the program. Finally, teachers' sense of efficacy had strong positive effects on the institutionalization of programs.

An educational reform method which helps schools effectively implement and institutionalize other programs is to restructure schools into professional learning communities (PLCs). In the past decade, a number of researchers have studied PLCs, its components, how schools have created PLCs, and successes of PLCs (Childs-Bowen, Moller, & Scrivner, 2000; Hipp & Huffman, 2002; Hord, 1998; Huffman & Jacobson, 2003; Ponder, Webb, & Trawick, 2003; Stein, 1998; Strahan, Carlone, Horn, Dallas, & Ware, 2003). Hord (1997a) refers to five common characteristics of PLCs:

- *Supportive and shared leadership* - the collegial and facilitative participation of the principal who shares leadership...through inviting staff input in decision making
- *A shared vision and values* - a shared vision that is developed from an unswerving commitment on the part of staff to students' learning and that is consistently articulated and referenced for the staff's work
- *Collective learning and application of learning* - collective learning among staff and application of the learning to solutions that address students' needs
- *Shared personal practice* - the visitation and review of each teacher's classroom behavior by peers as a feedback and assistance activity to support individual and community improvement
- *Supportive conditions* - physical conditions and human capacities that support such an operation (*passim*, esp. p. 18).

PLCs, when working optimally, are a reform method where the school community can work together to carry on programs with or without continuous funding; at the highest maturity level, school community members are working together to increase student achievement and basing all educational decisions on their effects on student achievement. A high frequency of occurrences of the above five characteristics of PLCs is important for a strong PLC.

Statement of the Problem

Hord (1997a) concludes that the principal's influence on the school community is crucial in determining whether a school can change into a community of learners. This

influence is achieved principally by enabling the teachers and staff to collaborate regularly around student learning and sharing with all of the school community the responsibility of decision-making. The critical dimensions of a PLC, as noted by Hord, are "...supportive and shared leadership, a shared vision and values, collective learning and application of learning, supportive conditions, and shared personal practice" (1997a, p. 6, *passim*). In order for PLCs to succeed, schools must be organized so that all of these components are geared toward increasing student achievement (Hipp & Huffman, 2002). Lambert (1998) maintains that school leadership should work hand-in-hand with the other school community members so that there is "...shared responsibility for a shared purpose of community" and that "...leadership is about learning together, and constructing meaning and knowledge collectively and collaboratively" (p. 5). Therefore, in order to learn together in a goal-oriented manner, teachers and staff must work toward a common purpose, another name for a shared vision, and should tie everything they do to their purpose.

Several studies have been conducted on individual schools that act as professional learning communities. DuFour (1999) concluded that a shared vision, mission, values, and goals are essential to the success of a PLC. Adlai Stevenson High School, in Lincolnshire, Illinois, centered its vision, mission, values, and goals around student learning, along with using data to guide its teachers in developing common assessments. Schmoker (2001) reports how the PLC at Stevenson High School resulted in great success:

When DuFour began as principal in 1983, Stevenson didn't even rank in the top 50 schools in the Midwest. By 1995, they were ranked by the College Board as

the top high school in the Midwest and the sixth in the world, based on student success on Advance Placement (AP) exams. They raised achievement in every measurable category.... (p. 9).

Weekly meetings were scheduled for teams of teachers to collaborate. At these collaborative meetings, teams "...focused on improving teaching strategies that promote[d] better results on the common end-of-course assessments [which each team of teachers created]" (p. 11-12).

During a case study at Hunter Elementary School, Ponder, Webb, and Trawick (2003) discovered that teacher collaboration during common planning time, in addition to "...shared values and vision..." (Hord, 1997a, p. 12), were important antecedents to the school's ability to continuously increase student achievement over a period of years. Like Stevenson High School, Hunter Elementary School used common planning time to analyze student achievement on common assessments and learn teaching strategies to help increase student achievement on these assessments. Stein (1998) conducted a case study of three elementary schools acting as PLCs to study leadership styles. At each of the schools, student achievement was high. While leadership styles differed, all three principals helped their staff adopt a common mission focusing on student learning. In a case study at Cottonwood Creek School, Hord studied how PLC characteristics were expressed and the process the school went through to become a PLC (Hord, 1998). She discovered that teachers were more effective in teaching and increasing student learning when they learned together and that teachers and administrators trusted one another. Also, teacher efficacy was high when the school became a PLC.

While a number of researchers have looked at individual schools or a number of schools in one school district that act as PLCs and the characteristics that make them a PLC, this researcher found no extant research on the relationship between student achievement and the maturity levels of PLCs across several schools in more than one school district. This study investigated this relationship across elementary schools in one Midwestern state.

Purpose of the Study

With NCLB placing more and more pressure on schools to raise student achievement, schools across Missouri are focusing on effective student learning practices. One accepted approach is to create a PLC among a school's staff to focus on increasing student achievement. The purpose of this study was to determine if a relationship exists between schools' maturity as professional learning communities and student achievement.

Hypothesis

As the maturity level of schools as professional learning communities increases, according to scores on the *School Professional Staff as Learning Community Questionnaire*, student scores on standardized tests in communication arts and mathematics, specifically the *Missouri Assessment Program Index Score*, will also increase.

Significance of the Study

NCLB is placing increasing amounts of pressure on schools to increase student achievement scores with stiff penalties for those schools that do not succeed (No Child Left Behind Act of 2001). It was hoped that this study would determine whether the

maturity level of schools' work as PLCs improves student achievement. If so, principals would be justified in pushing their teachers out of isolation and creating structures for them to collaborate regularly to focus on student achievement. Case studies suggest that schools that have become PLCs have more success with the implementation and institutionalization of other educational programs designed to increase student achievement. This correlational study should add to the literature base on PLCs and their effect on student achievement.

Delimitations

This study included elementary schools in the state of Missouri for the 2007-2008 school year serving students in kindergarten through fifth grade. Teachers answered a questionnaire in Spring, 2008, about their perception of how their school functioned as a PLC which was then correlated with each school's MAP Index score for communication arts and mathematics from Spring, 2008.

Operational Definitions

Professional Learning Community (PLC): A school in which all stakeholders (administrators, teachers, parents, and community members) share a common vision, mission, values, and goals, all of which focused on student learning. In a PLC, teachers collaborate regularly to analyze student achievement data and use its analysis to guide instruction. All stakeholders have a sense of ownership in the school and the operating decisions, since they are all based on whether they will positively affect student achievement or not. Administrators provide support by sharing decision-making and providing structures to make collaboration possible. Hord (1997a) uses the following dimensions to describe the parts of a PLC: "...supportive and shared leadership, a shared

vision and values, collective learning and application of learning, supportive conditions, and shared personal practice” (p. 6, *passim*).

Collaboration: Teachers working together, with a shared mission and vision, focusing on student achievement, continuously reflecting on their own professional practices to try new strategies to increase student learning

Community: a group of individuals working together

Maturity: the level of commitment to the PLC model and, as a result, the implementation of the PLC model; the average score for all items on the *School Professional Staff as Learning Community Questionnaire*, with a 17.0 being the lowest level of maturity and an 85.0 being the highest level of maturity (Hord, 1996; Meehan, Orletsky, & Sattes, 1997).

Missouri Assessment Program (MAP): state assessment given each spring to all students in grades 3 through 8 in mathematics and communication arts in Missouri; measures student learning of grade level expectations in each content area; achievement levels are, from lowest to highest: Below Basic; Basic; Proficient; and Advanced

Missouri Assessment Program Index Score (MAP Index): $(\% \text{ Below Basic} * 600) + (\% \text{ Basic} * 700) + (\% \text{ Proficient} * 800) + (\% \text{ Advanced} * 900)$, with 600 being the lowest possible score and 900 being the highest possible score

Student Achievement: MAP Index score of communication arts and mathematics

Organization of the Study

The remainder of the study is organized into four chapters, a bibliography, and appendixes in the following manner. Chapter Two presents a review of literature dealing with PLCs. Chapter Three outlines the methodology and research design of the study.

Population and sample, instrumentation, and data collection and analysis are also discussed. An analysis of the data is presented in Chapter Four. Chapter Five includes a summary, conclusions, and recommendations of the study. A bibliography and appendixes are at the conclusion of the study.

Chapter 2

Review of Related Literature

Introduction

The body of literature on restructuring schools into professional learning communities (PLC) to increase student achievement provides the basis for this study. This chapter will examine the theoretical frameworks for professional learning communities, also referred to as learning organizations, and the empirical research in the field.

Learning Organizations

The concept of learning organizations is founded on the concept that humans are, by nature, learners. From birth on, humans learn in order to survive; babies learn to crawl, infants learn to walk and talk, etc. In the business world, there are numerous industries with many companies learning from one another (Senge, 1990). Rather than learning in isolation, learning organizations are "...organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together" (p. 3). Learning organizations, according to Senge, are comprised of five components that work together: systems thinking; personal mastery; mental models; building shared vision; and team learning.

Systems thinking helps individuals see how an entire process works together rather than examining individual components. By analyzing the entire process, one can affect change better. Senge offers the United States-Union of Soviet Socialist Republics

(US-USSR) arms race as an example of how systems thinking works. By habit, society looks at problems as a direct relationship; an event causes a reaction. In systems thinking, problems are looked at as a cyclical relationship with the ultimate goal of sustaining positive outcomes and changing cycles leading to negative outcomes. In the arms race, the USSR's increase in nuclear weapons was seen as a threat to the US. As a result, the US built more nuclear weapons. At the same time, the USSR saw the US's increase in nuclear weapons as a threat and built more weapons themselves. In systems thinking, the arms race is seen as "...a perceptual cycle of aggression" (p. 71) rather than two linear chain reactions. Both the US and the USSR responded to the threats. However, the outcome – continuous increases in weapons – was not the desirable outcome for either party. Senge states that by looking at the interrelationships behind a problem, one can find a successful intervention. In the arms race scenario, rather than responding to more arms on one side by increasing the number of arms on the other side, each side began to start initiatives to reduce the numbers of arms causing the cycle to reverse. Another way to regard systems thinking is to look at every action as both a cause and an effect (1990).

Personal mastery, another component of learning organizations, is what Senge refers to as "...the discipline of personal growth and learning" (1990, p. 141). A person works at increasing his/her personal mastery because he/she loves to learn and apply new concepts to one's life and work to gain deeper insights and better results. Another term for personal mastery would be lifelong learning. Bill O'Brien, CEO of Hanover Insurance, states "...that practicing the virtues of life and business success are not only compatible but enrich one another" (Senge, 1990, p. 144). In other words, individuals

who make lifelong learning a part of their life benefit in both their personal lives and in their places of work. In order to maintain order and direction for a business to be successful, it is important for businesses to build a shared vision and mental models so that individuals practicing personal mastery do so toward the same goal rather than conflicting goals (p. 146).

A lot of good ideas or new programs or initiatives are seldom successful because of interfering assumptions, generalizations, or personal beliefs of the people involved. Senge refers to these assumptions, generalizations, and personal beliefs as mental models (1990). People often act and react based on their perceptions and generalizations of others, even though these perceptions and generalizations may not be founded in fact. One's ability to learn is lessened when he/she treats these generalizations as fact without testing or questioning them; for learning to occur, one must acknowledge the gap between perceptions and reality. The goal of using mental models to aid in learning and creating successful learning organizations is for everyone to develop a mental model and regularly examine it, question it, and revise it "...so that conversations can produce genuine learning, rather than merely reinforcing prior views" (Senge, p. 186).

Shared vision is necessary for the constituents in a learning organization to learn and collaborate together because it provides focus and a sense of energy (Senge, 1990). People learn better when they are learning about something that they feel is important. While everyone has personal visions, shared vision is created with everyone's input and commitment to a common goal. For an organization's vision to become a reality, a commitment to the vision is needed. Committed people will do whatever is necessary to

make the vision a reality. “The committed person brings an energy, passion, and excitement that cannot be generated if you are only compliant, even genuinely compliant” (Senge, p. 221). Senge also states that building a shared vision leads to developing a purpose or mission and establishing core values. An organization’s mission answers the question, “Why do we exist?” (p. 223) and core values answers the question, “How do we want to act, consistent with our mission, along the path toward achieving our vision?” (p. 224). Shared vision, mission, and core values are all interrelated.

Team learning refers to how the members of an organization work together with its talent and toward its shared vision. Senge breaks team learning into 3 parts: learning how to work in a way to be more productive as a team than as individuals; acting in ways to complement one another’s strengths and weaknesses; and fostering other groups within the organization by “...inculcating the practices and skills of team learning more broadly” (1990, pp. 236-237). Team learning also involves learning the difference between dialogue and discussion and being able to implement both effectively. Dialogue leads to discourse about a topic where individuals listen to each other to learn more. Discussion, on the other hand, is when individuals present their different views with the purpose of convincing others that their view is the right one (Senge).

In summary, learning organizations consist of the following:

- Systems thinking teaches individuals how to analyze an entire process in order to implement an intervention to get positive outcomes.
- Personal mastery is the practice of lifelong learning.

- One's mental models determine how he/she acts. To hone one's mental models, he/she needs to practice being consciously aware of his/her perceptions and reality and work on not allowing perceptions to shape how he/she acts.
- Shared vision leads individuals to work toward a common purpose with a sense of urgency. In creating a shared vision, individuals in an organization naturally create a mission and agree upon values as well.
- When individuals work together toward their shared vision, they are practicing team learning. To be successful in team learning, individuals must know how to differentiate between dialogue and discussion and know when to use each.

Learning organizations, according to Senge, are effective when all five components work in conjunction with each other (1990).

Characteristics of Professional Learning Communities

After conducting a case study of a school which collaborated with Hilltop University to create a community of learners among teachers around a new curriculum, Hord (1998) concluded that learning together was more effective than learning in isolation. She had set out to answer how PLC characteristics, "supportive and shared leadership, a shared vision and values, collective learning and application of learning, supportive conditions, and shared personal practice" (Hord, 1997a, p. 6, *passim*), were expressed at Cottonwood Creek School and how the school became a PLC. Cottonwood Creek School had 500 students, in grades pre-kindergarten through fifth, and 36 faculty members. In addition, there was a principal, an assistant principal, an instructional guide, and 12 teacher aides.

Hord (1998, 1997a) reported that teachers felt empowered by the school's "supportive and shared leadership" (1997a, p. 6). Teachers attended meetings at Hilltop University to learn leadership and decision-making skills. In 1987, Cottonwood's principal encouraged innovative practices and change as well as encouraging the school's partnership with Hilltop University. When a new principal hired in 1988 did not subscribe to the partnership with the university, relations among staff members and their commitment to positively affecting student achievement declined. In 1991, yet another new principal was hired. The learning community continued to succeed under this principal because he believed in shared leadership and decision-making. Staff members were invited to share concerns and discuss issues with him at regularly scheduled meetings. All staff members had a say in decisions affecting them. In 1987 and after 1991, the principal had "...a collegial relationship with teachers, shares power and decision making, and promotes and nurtures leadership development among the staff" (p. 4).

"Collective learning and application of learning..." (Hord, 1997a, p. 18) was seen when the staff collaboratively worked together to make their newly adopted curriculum work for their students. Teachers decided that they would achieve more by working together rather than in isolation; teachers worked in grade level teams as well as in vertical teams. Teachers met in these teams to map out a pacing guide for the new curriculum. Throughout the year, the staff met to share new knowledge and plan additional units. In this way, and with the principal's encouragement, the staff learned from each other (Hord, 1998).

DuFour and Eaker (1998) emphasize the importance of collective inquiry, collaborative teams, and action orientation and experimentation in PLCs. Teams of teachers collaborate, or work together, to increase student achievement. They do this by refusing to be satisfied with the status quo; they continuously ask what is it that they want students to learn, how will teachers know that students have learned it, what will they do when students have not mastered the concept, and what will they do for students who already have reached mastery. By collective inquiry into these questions on a routine basis, teachers create common assessments and use student data to refine and experiment with new teaching practices to affect student achievement. The focus is always on student learning and is centered around action; teachers in a PLC will not tolerate complacency with the status quo. In a reflection on his experiences as a building principal and the use of collaboration for school improvement, DuFour (1999) states that principals must lead by empowering teachers to make decisions and must give teachers the support to collaborate on student achievement. He further mentions the importance of all stakeholders coming to consensus on a shared vision, mission, values, and goals.

Cottonwood's staff and faculty had "shared values and vision" (Hord, 1997a, p. 12) with an "...unwavering focus on student learning" (Hord, 1998, p. 5). DuFour and Eaker (1998) echo Hord's findings by stating that an important part of the foundation of learning communities is "...shared understandings and common values" (p. 25). Furthermore, they declare that schools' mission and vision statements should be centered on the purpose of helping all students learn and reach their utmost potential.

Physical elements and personal and professional characteristics make up "supportive conditions" (Hord, 1997a, p. 13) for PLCs. Physical elements include the

arrangement of classrooms so that teachers are close to one another, regularly scheduled meeting times, and the school's size and structures for communication. Communication structures at Cottonwood included the printing and distribution of meeting minutes to all teachers as well as administrator announcements to the entire school each morning and notes to individual teachers. A full-time parent coordinator helps plan family events and brings parents into the school to help with student learning. The staff at Cottonwood Creek School were able to work together across grade levels regularly due to 90-minute planning periods during the day when students were in special area classes. Personal and professional characteristics include respect and trust among faculty and staff, collegial relationships, willingness to work toward critical inquiry and improvement and accepting feedback, and positive, caring relationships among one another (Hord, 1998).

As Cottonwood staff members worked with and learned more about its newly adopted curriculum, they visited one another's classrooms to learn more. In this way, they shared their personal practice. To help its faculty share, the principal set up regular meetings for open discussions of issues and concerns of teachers. Grade levels exchanged information with other grade levels. The principal also regularly visited classrooms, praised teachers, and shared teacher practices with other teachers. Teachers were asked to share successful practices with other teachers at faculty meetings. Hord (1998) concluded that teachers need the same supports as students do to grow and develop as learners.

In summary, characteristics of professional learning communities include:

- There is a "supportive and shared leadership" (Hord, 1997a, p. 6) between the school's administration and teachers, which includes teacher input in decisions

and regularly scheduled times for teachers to share concerns and discuss issues with the administration;

- Teachers are engaged in "...collective learning and application of learning..." (Hord, 1997a, p. 18), where the staff and faculty learns from each other and designs pacing guides, assessments, and scoring guides;
- Teachers collaborate together to increase student achievement;
- Teachers collectively inquire into how they can improve the status quo;
- Teachers answer the questions what is it they want students to learn, how will they know that students have learned it, and what will they do when students have not mastered it;
- Teachers focus all their actions on improving the student learning;
- Teachers and administrators work toward the same shared vision and with the same values;
- Teacher's rooms are located close to one another on the same team or grade level;
- Teachers have regularly scheduled meeting times;
- There is respect and trust among faculty and staff; and
- Teachers regularly share teacher practices with one another.

Exemplars of Professional Learning Communities

Hipp and Huffman (2002) interviewed 58 faculty and staff members at six K-12 schools to identify exemplars and non-exemplars of each of Hord's 5 dimensions of PLCs: "...shared and supportive leadership; shared vision and values; collective learning and application of learning; supportive conditions; and shared personal practice" (Hord, 1997a, p. 6, *passim*). While exemplars were found for each of the dimensions (and

common themes were found within each dimension), the dimension of “supportive conditions” (Hord, 1997a, p. 13) was found to be most crucial in holding the other dimensions together. Childs-Bowens, Moller, and Scrivner (2000) also emphasize the importance of “supportive conditions” (Hord, 1997a, p. 13) in concluding that principals should provide teachers with the supports necessary to make instructional decisions and decisions about professional development. In building a PLC, they state the importance of creating leadership opportunities for teachers, providing results-driven professional development, and celebrating teacher successes.

In summary, “supportive conditions” (Hord, 1997a, p. 13) are most important for holding all the other components of PLCs together. Teachers should be involved in making instructional decisions and designing results-driven professional development opportunities. Also, teachers should be exposed to leadership opportunities.

Interrelatedness of Shared Leadership, Shared Vision, and Supportive Conditions

Huffman and Hipp (2002) examined results of a five year national study of 20 schools showing the strong interrelatedness of “shared leadership, shared vision, and supportive conditions” (Hord, 1997a, p. 6, *passim*) (3 of Hord’s 5 dimensions) in schools exhibiting high-readiness toward forming a PLC. Researchers used a semi-structured interview protocol to analyze the characteristics. Shared leadership was determined to be present when principals were proactive, teachers worked with colleagues constantly to share knowledge, and all committee work was found to be productive by teachers. A shared vision was evident in the high-readiness schools with all staff focused on student learning and teachers initiating ideas and activities to result in positive changes in student learning. “Supportive conditions” (Hord, 1997a, p. 13) were also present so that the

vision was a reality, yet always served as motivation to challenge the staff and students, faculties felt respected by principals and were involved in all decision-making, and principals monitored and rewarded teachers regularly.

Antecedents to Student Achievement

In a case study of an elementary school in North Carolina, Ponder, Webb, and Trawick (2003) examined the ways that the faculty supported student achievement. They found that professional development and teacher collaboration during the school day was an important antecedent to the school being able to increase student achievement. Hord (1997b) states that PLCs are very powerful for professional development and a great strategy for school change and improvement. Other common themes that emerged from the study were “shared values and vision” (Hord, 1997a, p. 12) among the faculty, regular celebrations of student successes, and teaching to the whole child (Ponder et al., 2003).

Leadership Strategies within Professional Learning Communities

Stein (1998) conducted a case study of three elementary schools to examine the leadership strategies used to create and maintain PLCs. While each school’s mission was clearly focused on student learning, each principal exhibited a different leadership style. Leadership styles ranged from assertive and persistent leadership in a very visible way to a facilitator who acted more in the background and under the pretense of shared leadership. Yet, all three schools still developed into a PLC with high student achievement due to the implementation of common leadership strategies. In addition to a common mission, each school focused on literacy and a commitment to making sure that every child would learn to read and write. Professional development was driven by this focus on student literacy; all professional development had to relate to literacy

instruction. With the focus on literacy, the schools set their annual goal on increasing student achievement in literacy as measured by citywide tests of reading. Principals also de-privatized teaching; they insisted that teachers work together and share their practices with one another. As a result, work across grade levels, in vertical teams, increased. One school's art teacher worked with all teachers to find common themes in each grade's curriculum. Another school created multi-age classrooms, which necessitated teachers working together. The third principal created structures for teachers to observe one another. In these various ways, teachers opened up to sharing their practices. The district leaders instilled the expectation in teachers that everyone, including the adults, should assume the role of learners. Through the principals' and district's expectations, teachers de-privatized their practices and collectively worked collaboratively more and more. These principals' leadership strategies helped all three of these schools develop into PLCs.

Huffman and Jacobson (2003) conducted a quantitative study on perceptions of teachers and administrators on the level of organizational development of their schools as PLCs. Analyzing data from surveys of 83 educators enrolled in graduate classes in educational administration in Texas, they concluded that leaders exhibiting collaborative leadership styles, "...where the leader and the teachers jointly take responsibility for decisions and negotiate a course of action" (p. 244) had more success than others in developing PLCs. Furthermore, participants in the study believed that the presence of characteristics of PLCs had a positive impact on student achievement. It is important to note that Huffman and Jacobson were analyzing teacher and administrator perceptions based on answers to their survey using a Likert scale. Huffman and Jacobson concur

with other researchers when they conclude that in developing PLCs, it is important to build a community within the culture of schools.

In summary, one leadership style was not found to be more conducive to PLCs than others. However, common leadership strategies were present among all the principals of PLCs with high student achievement. These strategies include:

- Common mission
- A focus on literacy
- A commitment to learning for all children
- All professional development for staff focusing on literacy
- Insisting that teachers work together and share practices
- Collaborative leadership strategies

Collaboration in Professional Learning Communities

Clark and Astuto (1994) refer to three communities as they relate to schools: the professional community; learning communities; and the stakeholder community.

Professional communities allow for dialogue among teachers and among common stakeholders. Learning communities refer to collaboration in learning activities as well as the interaction between teachers and students. The stakeholder community creates structures for collaboration to improve communication among parents and community members. Organizational structures should be built around the principles of a community, where the sharing of ideas is encouraged and nurtured, innovation and change is fostered, and multiple perspectives on problems are sought, to foster cooperation and growth and lead to school improvement.

Campo (1993) studied the extent of collaboration in schools as perceived by teachers and administrators in addition to leadership strategies used to develop a collaborative culture. Teachers looked at collaboration as important, and they enjoyed it more as they became more comfortable with it. To encourage collaboration, many principals used bureaucratic mechanisms and shared decision-making; teachers were involved, whenever possible, in decision-making. Collaborative cultures were noted to contain teacher talk, joint planning, and teacher observation; “teacher observation and teaching not only enhance collaboration among teachers, but help to ensure that professional growth and implementation of innovations are actually occurring” (p. 125). A relationship was found to exist between the level of teacher motivation and commitment, the principal’s use of strategies, and outcomes of school improvement. When teachers were highly motivated and/or committed, the principal used more indirect strategies. When teachers were less motivated and/or committed, the principal used more direct strategies.

Working relationships among teachers are important in PLCs; all relationships within a school are defined by the relationship among the school’s educators. There are four types of teacher relationships: parallel play where there is no interaction; adversarial relationships where there is a negative relationship between principals and teachers; congenial relationships where teachers interact and are positive; and collegial relationships, the hardest to establish and a prerequisite of PLCs. Collegial relationships exist when teachers talk with one another about practice, share professional practices and experiences with one another, observe one another while they are engaged in their professional practice, and encourage each other to succeed (Barth, 2006). The de-

privatization of practice that Stein (1998) refers to leads to these kinds of collegial relationships.

“Collegial experimentation was a way of life...” Little (1982, p. 332) noted in the successful schools in her ethnography of six schools in an urban setting. Little classified the schools according to levels of success and staff development. She found that continuous staff development was more effective when teachers collaborated frequently about specific teaching practices, teachers were frequently observed and given constructive feedback, teachers planned units of study together and evaluated student work together, and teachers taught each other about teaching practices. Teachers would talk about practices with each other in a multitude of settings.

Astuto and Clark (1995) focus on learner centered schools, where students are “...exposed to a wide range of learning opportunities that capture their imagination, expand their intellectual lives, and increase their access to society’s benefits” (p. 243). These schools strive to help all students succeed, regardless of socioeconomic status. By adjusting school and teacher practices to focus on learning for all students, learner centered schools aim to increase student achievement. These schools are characterized by collaboration among teachers where all school personnel are dedicated to helping each other reach their full potential. In this way, both the children and the adults are viewed as learners. In addition, assessment is continuous and criticism is used to improve the performance of students and staff. As a result, learner centered schools take on similar characteristics as do PLCs.

Strahan, Carlonne, Horn, Dallas, and Ware (2003) found that student achievement increased as a result of shared norms and teaching practices. In a case study of Archer

Elementary School, a kindergarten through fifth grade school of over 600 students in a mid-sized city, Strahan et al. (2003) set out to describe how the school developed a supportive school culture. Teacher and administrator interviews and observations revealed a shared responsibility toward student learning; teachers and administrators were dedicated to helping students succeed beyond what the state assessments measured by teaching to the whole child. While teacher collaboration is an important part of PLCs, student collaboration was an important part of learning at Archer Elementary School; cooperation among students was stressed more than competition between students. Teachers collaborated to increase student engagement in learning by actively involving them in higher level thinking. In addition, teachers collaborated to find a variety of ways to give students extra help and to individualize instruction. DuFour, DuFour, Eaker, and Karhanek (2004) explain that PLCs develop interventions for all students when they first experience difficulty and promote systematic, timely, and required interventions rather than remediation.

In summary, collaboration is an important part of communities, and therefore learning communities, in various ways:

- The sharing of ideas is encouraged and nurtured.
- Different views on problems are sought.
- Teachers enjoy it once they become comfortable with collaboration.
- Teachers become involved in decision-making.
- Collaboration leads to collegial relationships, which is a prerequisite of PLCs.
- Collaboration leads to shared norms and teaching practices, which increase student achievement.

Critical Friends Group

The National School Reform Faculty program created a Critical Friends Group (CFG) in schools to help foster the creation of groups of teachers into reflecting on their practices to improve student learning. Regardless of the school, CFGs went through three common developmental stages. In the first stage, teachers talked about student problems and external factors that disrupted their teaching. During the second stage, participants began to examine their teaching practices and how to improve student learning. High trust levels among teachers and administrative support were needed for the third stage, where deeper teaching issues were examined. Though CFGs took time to fully develop, teachers reported that it provided them with the best professional development experience and was a major influence on their teaching. CFGs, like PLCs, take time to develop, require patience, and require a shared vision, mission, values, and goals directed at student learning (Dunne and Honts, 1998).

Collective Efficacy and Student Achievement

Berman and McLaughlin (1978) found that for federal programs to have lasting impact on student achievement, the program had to be institutionalized, and teachers' sense of efficacy had strong positive effects on programs' institutionalization. Goddard, Hoy, and Hoy (2000) studied the relationship between teachers' collective efficacy in a school and student achievement. Collective teacher efficacy is the shared belief among all the teachers that they, as a group, are capable to do whatever is necessary to produce higher levels of student achievement. After surveying the perceptions of teachers in multiple elementary schools in a large urban Midwestern school district and comparing the results to individual schools' student achievement scores in reading and mathematics,

Goddard et al. concluded that collective teacher efficacy was an antecedent to increased student achievement in both reading and mathematics. Furthermore, they saw a greater effect on student achievement from collective efficacy than they did from students' socioeconomic status.

Chapter 3

Methodology

This chapter describes the design and procedures followed in this study. The research design, population and sample, instrumentation, data collection procedures, data analysis, and limitations are discussed.

Purpose of the study

With the No Child Left Behind Act (NCLB) placing more and more pressure on schools to raise student achievement levels, schools across Missouri are focusing on effective student learning practices. One approach to achieving effective practices is to create a professional learning community (PLC) among a school's staff to focus on increasing student achievement. The purpose of this study was to determine if a relationship existed between schools' maturity as PLCs, as measured by the *School Professional Staff as Learning Community Questionnaire*, and student achievement.

Research question

Is there a relationship between the maturity level of public elementary schools as PLCs and student achievement as indicated by MAP Index scores?

Research design

This study utilized a correlational design. The purpose of this study was to determine whether, and to what degree, a statistical relationship existed between the maturity level of professional learning communities and student achievement. In this study, elementary school teachers were surveyed to collect data on their perceptions of how their schools acted as PLCs. This information was then correlated with student achievement data, specifically their schools' Missouri Assessment Program (MAP) data

in communication arts and mathematics. Since there may be other school factors that may be associated with both the extent to which a school is a PLC and with student achievement, including prior student achievement, student enrollment, student composition, free and reduced lunch rate, attendance rates, student-staff ratios, and faculty demographics, these other factors were included in the analysis as covariates in order to control them as much as possible when examining the relationship between PLC scores and student achievement.

Population and sample

The population for this study consisted of certified teachers at all 333 public elementary schools in Missouri serving students in kindergarten through fifth grade. All teachers at each school were invited to participate.

Instrumentation

Certified teachers in each of the sample schools were asked to complete Hord's (1996) *School Professional Staff as Learning Community Questionnaire*. The questionnaire asked participants to choose a number on a Likert scale that "...best represents the degree to which..." (Hord, 1996) the participant perceived his/her school to have developed as a PLC; a score of 1 represented a low level of community and a score of 5 represented a high level of community. There were 17 items upon which to rate the school, all of which were based on the five characteristics of a PLC: "...supportive and shared leadership; a shared vision and values; collective learning and application of learning; supportive conditions; and shared personal practice" (Hord, 1997a, p. 6, *passim*). Each rating was added together to compute a total score for each questionnaire. When the instrument was field tested, some participants marked the scale

between the whole numbers. When this happened, the scorers chose the whole number which the mark was closest to (Meehan, Orletsky, & Sattes, 1997). Questionnaire scores from each school were averaged to determine an overall PLC maturity score for each school. These average scores were correlated with the student achievement data for each school.

Meehan, Orletsky, and Sattes, researchers for the Appalachia Educational Laboratory (AEL), piloted and field tested Hord's instrument. To make it more user-friendly, they reformatted it with Hord's approval. They found that the reformatted instrument was valid and reliable in measuring a school's maturity as a PLC. However, the data showed that the instrument is most reliable when using the total instrument score rather than the independent scores of each of Hord's 5 dimensions; using a test-retest of the total instrument, the stability coefficient was .6147. The researchers found a significant correlation of .7489 between the PLC questionnaire and a school climate instrument from Manning, Curtis, and McMillen, titled *School Climate Questionnaire*, at the .001 level (1997).

NCLB mandates that all students, third grade through eighth grade in public schools, take state achievement tests in mathematics and reading. Public school districts in the state of Missouri administer the MAP tests to students in grades three through eight in communication arts and mathematics to comply with NCLB. Student achievement data consisting of the third, fourth, and fifth grade communication arts and mathematics tests administered in the Spring of 2008 were used in this study.

Data collection procedures

Data collection began in January, 2008 and was completed by August, 2008.

On January 15, 2008, a letter was sent to the professional development (PD) chair at each of the 333 elementary schools to inform them of the purpose of the study and solicit their help in disseminating, collecting, and returning completed questionnaires from the certified teachers at his/her school (Appendix A). PD chairs and teachers received a letter assuring them that their personal identity would not be identifiable (Appendix B). PD chairs were provided with a pre-addressed and stamped envelope to return teachers' completed questionnaires. PD chairs that had not responded were emailed in February, 2008, to please return completed questionnaires. Reminder phone calls were made to PD chairs in March, 2008, for those chairs that still had not returned their questionnaires. In June, 2008, questionnaires from schools that had a 20% return rate of certified teachers were scored; questionnaires from each qualifying school were added together and averaged for a school average rating. In August, 2008, MAP Index Scores for third, fourth, and fifth grade communication arts and mathematics were collected from Missouri's Department of Elementary and Secondary Education's (DESE) website for each school that had a 20% return rate of completed questionnaires. Student achievement data was obtained from DESE's homepage (<http://www.dese.mo.gov>) by clicking on School Statistics and School Data and Statistics and then looking up each school according to the district name. At this time, confounding variable data was also collected, including prior student achievement, student enrollment, student composition, free and reduced lunch rate, attendance rates, student-staff ratios, and faculty demographics.

Data analysis

The perceptions of certified staff were measured on a Likert scale from 5 to 1. Each question was directly related to one of Hord's five critical dimensions of PLCs. Ratings for each question were summed to get a total questionnaire score. All of the respondents' questionnaire scores from each school were then averaged to calculate an average questionnaire score for each school with a 20% or higher questionnaire return rate; only those schools with a 20% or higher completion rate were used in order to assure a representative sample of staff from the school.

Current Missouri Assessment Program Index scores (MAP Index) were gathered from DESE's website for third, fourth, and fifth grade communication arts and mathematics from those schools with a 20% or higher questionnaire return rate. In addition to MAP Index scores, other aggregate data from those schools with a 20% or higher questionnaire return rate was collected from DESE's website, including prior student achievement, student enrollment, student composition, free and reduced lunch rate, attendance rates, student-staff ratios, and faculty demographics.

Multiple linear regression was used to examine the hypothesis. For this study, the researcher used a statistical significance level of 95% ($p = .05$). A high coefficient of determination between PLC maturity and student achievement meant that when schools acted as mature PLCs, their students scored higher on standardized tests in communication arts and mathematics in K-5 schools (Gay & Airasian, p. 322).

Limitations

A limitation of this study was the make-up of elementary schools in the state of Missouri. Some elementary schools serve students in pre-kindergarten. Others start at

kindergarten (K) or first grade. Three common grade configurations of elementary schools in Missouri are K-5, K-6, and K-8. Several school districts also have different schools serving only a couple of grade levels at a time. For this study, the researcher chose to only look at K-5 schools. Since the highest and lowest grade levels can affect the climate in a school, the researcher chose to look at schools with the exact same grade level configurations and the results of this study can only be generalized to K-5 schools.

Summary

Research design, population and sample, instrumentation, data collection procedures, data analysis, and limitations were described in this chapter. Chapter Four presents an analysis of the data from the *School Professional Staff as Learning Community Questionnaire* (Hord, 1996) and MAP tests for the elementary schools in the sample.

Chapter 4

Analysis of the Data

With the No Child Left Behind Act (NCLB) placing more and more pressure on schools to raise student achievement levels, schools across Missouri are focusing on effective student learning practices. One approach to achieving effective practices is to create a professional learning community (PLC) among a school's staff to focus on increasing student achievement. The purpose of this study was to determine if a relationship existed between schools' maturity as PLCs, as measured by the *School Professional Staff as Learning Community Questionnaire*, and student achievement.

The hypothesis was that as the maturity level of schools as professional learning communities increases, according to scores on the *School Professional Staff as Learning Community Questionnaire*, student scores on standardized tests in communication arts and mathematics, specifically the *Missouri Assessment Program Index Score* (MAP Index), will also increase. The chapter is organized in terms of grade level and content area; third, fourth, and fifth grades were examined in this study. Before examining the correlation between PLCs and each grade level and content area, the researcher conducted a preliminary analysis to ensure that the necessary assumptions of multiple linear regression were met.

Preliminary Analysis

Descriptive statistics were used to ensure normality and constancy of error variance for each of the possible covariates. Table 1 shows that initially average daily attendance (ADA) was significantly negatively skewed and the enrollment percentage of

Asians, African Americans, Hispanics, and Native Americans were significantly positively skewed.

Table 1

Variance of Errors (N=76)

| Covariate | Mean | Skewness |
|-------------------|--------|----------|
| ADA | 95.482 | -1.536 |
| Asians | 1.780 | 4.012 |
| African Americans | 24.971 | 1.293 |
| Hispanics | 3.857 | 1.587 |
| Native Americans | 0.401 | 2.920 |

Chatterjee, Hadi, and Price state that corrective action needs to be taken to the raw data when it is skewed or regression analysis "...will result in estimated coefficients which lack precision in a theoretical sense" (2000, p. 161). The researcher performed a square root transformation on Asians, African Americans, Hispanics, and Native Americans to lower the skewness. To lower the skewness on ADA, the raw data had to be reflected and then a square root transformation was conducted. The resulting distribution of error variance is shown in Table 2.

Table 2

Transformed Variance of Errors (N=76)

| Covariate | Mean | Skewness |
|-------------------|-------|----------|
| ADA | 1.968 | 0.441 |
| Asians | 1.018 | 1.385 |
| African Americans | 4.007 | 0.597 |
| Hispanics | 1.673 | 0.377 |
| Native Americans | 0.380 | 1.323 |

Relationship between PLC Maturity and Third Grade Communication Arts

Since it is important that the covariates are not strongly related in order for multiple regression analysis to be accurate, correlations were studied to determine multicollinearity. Table 3 shows that achievement data was highly correlated across years. As a result, the researcher discarded prior achievement data from the full model. It can also be seen that the percentage of African Americans and the percentage of whites were highly correlated and the virtual inverse of one another. In order for the regression model to be valid, the researcher had to choose either the percentage of African Americans or the percentage of whites as a covariate; the researcher selected the percentage of African Americans for this model instead of the percentage of whites.

Table 3

Intercorrelations between Prior Achievement Data, Present Achievement Data, African Americans, and Whites (N=76)

| Subscale | 1 | 2 | 3 | 4 | 5 |
|----------------------|-------|-------|-------|-------|-------|
| 1. 2008 MAP | 1.000 | .815 | .580 | -.366 | .429 |
| 2. 2007 MAP | .815 | 1.000 | .713 | -.412 | .463 |
| 3. 2006 MAP | .580 | .713 | 1.000 | -.503 | .547 |
| 4. African Americans | -.366 | -.412 | -.503 | 1.000 | -.977 |
| 5. Whites | .429 | .463 | .547 | -.977 | 1.000 |

Stepwise selection of the variables was conducted to determine the best model (see Table 4). Free and reduced lunch rate, the percentage of African Americans, and the PLC maturity score for each school were the only variables that had a significant relationship to MAP Index scores on the third grade communication arts MAP test in 2008. This led to the selection of the model:

$$\text{Third Grade Communication Arts MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch} + \beta_2 * \text{Percent of African Americans} + \beta_3 * \text{PLC Maturity} + \epsilon \quad (1)$$

The standardized betas showed that the percentage of African Americans and rate of free and reduced lunch was negatively correlated to 2008 communication arts scores in third grade while the PLC maturity level of schools was positively correlated to student achievement in third grade communication arts. A residual plot showed that the pattern of residuals was approximately normally distributed and homoscedastic (i.e., the standard deviations for the errors of prediction were comparable across predicted scores), without evidence of significant outliers. The R-square change showed that free and reduced lunch rate, percent of African American students, and PLC Maturity explained 33.2% of the student achievement variance (see Table 5).

Table 4

Summary of Stepwise Regression Analysis for Variables Related to MAP Achievement in Third Grade Communication Arts (N=76)

| Variable | B | β | t | Sig. |
|--------------------|---------|---------|---------|------|
| Step 1 | | | | |
| (Constant) | 782.579 | | 103.370 | .000 |
| Free/Reduced Lunch | -.672 | -.453 | -4.367 | .000 |
| Step 2 | | | | |
| (Constant) | 786.233 | | 104.126 | .000 |
| Free/Reduced Lunch | -.551 | -.371 | -3.462 | .001 |
| African Americans | -2.278 | -.240 | -2.242 | .028 |

Step 3

| | | | | |
|--------------------|---------|-------|--------|------|
| (Constant) | 701.922 | | 23.212 | .000 |
| Free/Reduced Lunch | -.508 | -.342 | -3.329 | .001 |
| African Americans | -2.266 | -.239 | -2.338 | .022 |
| PLC Maturity | 1.244 | .278 | 2.871 | .005 |

Table 5

*Summary of Change Statistics for Variables Related to MAP Achievement
in Third Grade Communication Arts (N=76)*

| Model | R Square Change | F Change | df1 | df2 | Sig. F Change |
|-------|-----------------|----------|-----|-----|---------------|
| 1 | .205 | 19.068 | 1 | 74 | .000 |
| 2 | .051 | 5.025 | 1 | 73 | .028 |
| 3 | .076 | 8.241 | 1 | 72 | .005 |

Note.

| Model | Formula |
|-------|--|
| 1 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch} + \epsilon$ |
| 2 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch} + \beta_2 * \text{African Americans} + \epsilon$ |
| 3 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch Rate} + \beta_2 * \text{African Americans} + \beta_3 * \text{PLC Maturity} + \epsilon$ |

Relationship between PLC Maturity and Third Grade Mathematics

Analyzing correlations for variables relevant to showing a relationship between PLC maturity and student achievement in third grade mathematics showed multicollinearity among the student achievement scores. Therefore, prior achievement data was taken out of the regression analysis. Also, the percentage of African American students was inversely correlated to a very high degree with the percentage of white students. Since the percentage of white students had a higher correlation with the third grade mathematics MAP Index score than did the percentage of African American students, the researcher chose to apply the percentage of white students to the model (see Table 6).

Table 6

Intercorrelations between Prior Achievement Data, Present Achievement Data, African Americans, and Whites for Third Grade Math (N=76)

| Subscale | 1 | 2 | 3 | 4 | 5 |
|----------------------|-------|-------|-------|-------|-------|
| 1. 2008 MAP | 1.000 | .776 | .630 | -.445 | .487 |
| 2. 2007 MAP | .776 | 1.000 | .739 | -.461 | .517 |
| 3. 2006 MAP | .630 | .739 | 1.000 | -.537 | .589 |
| 4. African Americans | -.445 | -.461 | -.537 | 1.000 | -.977 |
| 5. Whites | .487 | .517 | .589 | -.977 | 1.000 |

Stepwise regression analysis was conducted to determine the best model to show the relationship between 2008 MAP Index scores for third grade mathematics and average PLC maturity scores (see Table 7). The percentage of white students, rate of free and reduced lunch, and PLC Maturity score were the only variables that had a significant relationship to MAP Index scores on the third grade mathematics MAP test in 2008. This led to the selection of the model:

$$\text{Math MAP Index} = \beta_0 + \beta_1 * \text{Whites} + \beta_2 * \text{Free \& Reduced Lunch Rate} + \beta_3 * \text{PLC Maturity} + \epsilon. \quad (2)$$

The standardized betas showed that the free and reduced lunch rate was negatively correlated with student achievement on the mathematics MAP test while the percent of whites and PLC Maturity was positively correlated to student achievement. A residual plot showed that the pattern of residuals was approximately normally distributed and homoscedastic, without evidence of significant outliers. The R-square change showed that the percent of white students, free and reduced lunch rate, and PLC Maturity explained 38.5 percent of the student achievement variance in third grade mathematics (see Table 8).

Table 7

Summary of Stepwise Regression Analysis for Variables Related to Student Achievement in Third Grade Mathematics (N=76)

| Variable | B | β | t | Sig. |
|--------------------|---------|---------|---------|------|
| Step 1 | | | | |
| (Constant) | 722.609 | | 101.420 | .000 |
| Whites | .454 | .487 | 4.797 | .000 |
| Step 2 | | | | |
| (Constant) | 746.161 | | 61.529 | .000 |
| Whites | .359 | .386 | 3.589 | .001 |
| Free/Reduced Lunch | -.375 | -.254 | -2.364 | .021 |
| Step 3 | | | | |
| (Constant) | 653.958 | | 21.833 | .000 |
| Whites | .347 | .372 | 3.691 | .000 |
| Free/Reduced Lunch | -.335 | -.227 | -2.242 | .028 |
| PLC Maturity | 1.378 | .309 | 3.327 | .001 |

Table 8

*Summary of Change Statistics for Variables Related to MAP Achievement
in Third Grade Mathematics (N=76)*

| Model | R Square Change | F Change | df1 | df2 | Sig. F Change |
|-------|-----------------|----------|-----|-----|---------------|
| 1 | .237 | 23.008 | 1 | 74 | .000 |

| | | | | | |
|---|------|--------|---|----|------|
| 2 | .054 | 5.588 | 1 | 73 | .021 |
| 3 | .094 | 11.071 | 1 | 72 | .001 |

Note.

| Model | Formula |
|-------|---|
| 1 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Whites} + \epsilon$ |
| 2 | $\text{Index} = \beta_0 + \beta_1 * \text{Whites} + \beta_2 * \text{Free \& Reduced Lunch Rate} + \epsilon$ |
| 3 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Whites} + \beta_2 * \text{Free \& Reduced Lunch Rate} + \beta_3 * \text{PLC Maturity} + \epsilon$ |

Relationship between PLC Maturity and Fourth Grade Communication Arts

As in the previous analyses, analyzing correlations for variables relevant to showing a relationship between PLC maturity and student achievement in fourth grade communication arts showed high multicollinearity among student achievement scores from year to year. Therefore, prior student achievement data was taken out of the regression analysis. The percentage of African American students was negatively correlated to a very high degree with the percentage of white students. Since the percentage of white students had a higher correlation with the fourth grade communication arts MAP Index score than did the percentage of African American students, the researcher chose to apply the percentage of white students to the model (see Table 9).

Table 9

Intercorrelations between Prior Achievement Data, Present Achievement Data, African Americans, and Whites for Fourth Grade Communication Arts (N=76)

| Subscale | 1 | 2 | 3 | 4 | 5 |
|----------------------|-------|-------|-------|-------|-------|
| 1. 2008 MAP | 1.000 | .730 | .619 | -.433 | .491 |
| 2. 2007 MAP | .730 | 1.000 | .629 | -.434 | .459 |
| 3. 2006 MAP | .619 | .629 | 1.000 | -.537 | .566 |
| 4. African Americans | -.433 | -.434 | -.537 | 1.000 | -.977 |
| 5. Whites | .491 | .459 | .566 | -.977 | 1.000 |

Stepwise regression analysis was conducted to determine the best model to show the relationship between 2008 MAP Index scores for fourth grade communication arts and average PLC maturity scores (see Table 10). PLC maturity was not significantly related to student achievement scores in fourth grade communication arts. Exploring the relationships further, the percentage of Asians and average daily attendance also predicted achievement and further reduced the already non-significant association for PLC maturity. Therefore, the best model resulted in:

$$\text{Fourth Grade Communication Arts MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch Rate} + \beta_2 * \text{Whites} + \varepsilon \quad (3)$$

In this model, the standardized betas showed that the free and reduced lunch rate was negatively correlated with student achievement data while the percent of white students was positively correlated with student achievement. A residual plot showed that the pattern of residuals was approximately normally distributed and homoscedastic, without evidence of significant outliers. The R-square change showed that free and reduced lunch rate and percent of white students explained 45.7% of the student achievement variance in fourth grade communication arts (see Table 11).

Table 10

Summary of Stepwise Regression Analysis for Variables Related to Student Achievement in Fourth Grade Communication Arts (N=76)

| Variable | B | β | t | Sig. |
|--------------------|---------|---------|---------|------|
| Step 1 | | | | |
| (Constant) | 792.602 | | 131.281 | .000 |
| Free/Reduced Lunch | -.838 | -.622 | -6.832 | .000 |
| Step 2 | | | | |
| (Constant) | 768.613 | | 79.438 | .000 |
| Free/Reduced Lunch | -.683 | -.507 | -5.386 | .000 |
| Whites | .245 | .289 | 3.074 | .003 |
| Step 3 | | | | |

| | | | | |
|--------------------|---------|-------|--------|------|
| (Constant) | 727.755 | | 28.952 | .000 |
| Free/Reduced Lunch | -.665 | -.493 | -5.301 | .000 |
| Whites | .240 | .283 | 3.044 | .033 |
| PLC Maturity | .611 | .150 | 1.757 | .083 |
| Step 4 | | | | |
| (Constant) | 735.926 | | 29.308 | .000 |
| Free/Reduced Lunch | -.408 | -.303 | -2.944 | .004 |
| Whites | .351 | .413 | 4.361 | .000 |
| PLC Maturity | .403 | .099 | 1.216 | .228 |
| Asians | 9.177 | .308 | 3.221 | .002 |
| ADA | -11.709 | -.175 | -2.076 | .042 |

Table 11

*Summary of Change Statistics for Variables Related to MAP Achievement
in Fourth Grade Communication Arts (N=76)*

| Model | R Square Change | F Change | df1 | df2 | Sig. F Change |
|-------|-----------------|----------|-----|-----|---------------|
| 1 | .387 | 46.679 | 1 | 74 | .000 |
| 2 | .070 | 9.449 | 1 | 73 | .003 |
| 3 | .022 | 3.087 | 1 | 72 | .083 |
| 4 | .079 | 6.227 | 2 | 70 | .003 |

Note.

| Model | Formula |
|-------|---|
| 1 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch Rate} + \varepsilon$ |
| 2 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch Rate} + \beta_2 * \text{Whites} + \varepsilon$ |
| 3 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch Rate} + \beta_2 * \text{Whites} + \beta_3 * \text{PLC Maturity} + \varepsilon$ |
| 4 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch Rate} + \beta_2 * \text{Whites} + \beta_3 * \text{PLC Maturity} + \beta_4 * \text{ADA} + \beta_5 * \text{Asians} + \varepsilon$ |

Relationship between PLC Maturity and Fourth Grade Mathematics

Analyzing correlations for variables relevant to showing a relationship between PLC maturity and student achievement in fourth grade mathematics showed multicollinearity between student achievement from year to year. Therefore, prior student achievement data was removed from the regression analysis. Also, the percentage of African American students was inversely correlated to a very high degree with the percentage of white students. Using both ethnic groups in the analysis would violate the assumptions of the analysis. Since the percentage of white students had a higher correlation with the fourth grade mathematics MAP Index score, the researcher chose to remove the percentage of African American students from the analysis and used percentage of white students instead (see Table 12).

Table 12

Intercorrelations between Prior Achievement Data, Present Achievement Data, African Americans, and Whites for Fourth Grade Mathematics (N=76)

| Subscale | 1 | 2 | 3 | 4 | 5 |
|----------------------|-------|-------|-------|-------|-------|
| 1. 2008 MAP | 1.000 | .790 | .686 | -.556 | .597 |
| 2. 2007 MAP | .790 | 1.000 | .778 | -.488 | .536 |
| 3. 2006 MAP | .686 | .778 | 1.000 | -.528 | .573 |
| 4. African Americans | -.556 | -.488 | -.528 | 1.000 | -.977 |
| 5. Whites | .597 | .536 | .573 | -.977 | 1.000 |

Stepwise regression analysis was conducted to determine the best model to show the relationship between 2008 MAP Index scores for fourth grade mathematics and average PLC maturity scores (see Table 13). PLC maturity was not significantly related to student achievement scores in fourth grade mathematics. The best fitting model resulted in:

$$\text{Fourth Grade Mathematics MAP Index} = \beta_0 + \beta_1 * \text{Whites} + \beta_2 * \text{Asians} + \beta_3 * \text{Free \& Reduced Lunch Rate} + \epsilon \quad (4)$$

The standardized betas showed that the percentage of white students and Asian students were positively correlated with fourth grade student achievement in mathematics while the free and reduced lunch rate was negatively correlated. A residual plot showed that the pattern of residuals was approximately normally distributed and homoscedastic, without evidence of significant outliers. The R-square change showed that the percent of white students, percent of Asian students, and free and reduced lunch rate explained 50.8% of the student achievement variance in fourth grade mathematics (see Table 14).

Table 13

Summary of Stepwise Regression Analysis for Variables Related to Student Achievement in Fourth Grade Mathematics (N=76)

| Variable | B | β | t | Sig. |
|---------------|---------|---------|---------|------|
| Step 1 | | | | |
| (Constant) | 709.300 | | 101.693 | .000 |
| Whites | .592 | .597 | 6.397 | .000 |
| Step 2 | | | | |
| (Constant) | 696.043 | | 98.120 | .000 |
| Whites | .605 | .610 | 7.203 | .000 |
| Asians | 12.157 | .349 | 4.125 | .000 |
| Step 3 | | | | |

| | | | | |
|--------------------|---------|-------|--------|------|
| (Constant) | 721.473 | | 51.688 | .000 |
| Whites | .515 | .519 | 5.553 | .000 |
| Asians | 8.654 | .249 | 2.599 | .011 |
| Free/Reduced Lunch | -.345 | -.219 | -2.099 | .039 |
| Step 4 | | | | |
| (Constant) | 683.056 | | 23.919 | .000 |
| Whites | .502 | .506 | 5.445 | .000 |
| Asians | 7.676 | .220 | 2.285 | .025 |
| Free/Reduced Lunch | -.351 | -.223 | -2.156 | .034 |
| PLC Maturity | .613 | .129 | 1.538 | .129 |

Table 14

*Summary of Change Statistics for Variables Related to MAP Achievement
in Fourth Grade Mathematics (N=76)*

| Model | R Square Change | F Change | df1 | df2 | Sig. F Change |
|-------|-----------------|----------|-----|-----|---------------|
| 1 | .356 | 40.924 | 1 | 74 | .000 |
| 2 | .122 | 17.016 | 1 | 73 | .000 |
| 3 | .030 | 4.407 | 1 | 72 | .039 |
| 4 | .016 | 2.364 | 1 | 71 | .129 |

Note.

| Model | Formula |
|-------|--|
| 1 | $MAP\ Index = \beta_0 + \beta_1 * Whites + \varepsilon$ |
| 2 | $MAP\ Index = \beta_0 + \beta_1 * Whites + \beta_2 * Asians + \varepsilon$ |
| 3 | $MAP\ Index = \beta_0 + \beta_1 * Whites + \beta_2 * Asians + \beta_3 * Free \ \& \ Reduced \ Lunch \ Rate + \varepsilon$ |
| 4 | $MAP\ Index = \beta_0 + \beta_1 * Whites + \beta_2 * Asians + \beta_3 * Free \ \& \ Reduced \ Lunch \ Rate + \beta_4 * PLC \ Maturity + \varepsilon$ |

Relationship between PLC Maturity and Fifth Grade Communication Arts

Analyzing correlations for variables relevant to showing a relationship between PLC maturity and student achievement data in fifth grade communication arts showed multicollinearity between student achievement from year to year. Therefore, prior student achievement data was removed from the regression analysis. Also, the percentage of African American students was inversely correlated to a very high degree with the percentage of white students. Using both ethnic groups in the analysis would not be appropriate. The researcher chose to use the percentage of African American students in the regression analysis (see Table 15).

Table 15

Intercorrelations between Prior Achievement Data, Present Achievement Data, African Americans, and Whites for Fifth Grade Communication Arts (N=76)

| | | | | | |
|----------|---|---|---|---|---|
| Subscale | 1 | 2 | 3 | 4 | 5 |
|----------|---|---|---|---|---|

| | | | | | |
|----------------------|-------|-------|-------|-------|-------|
| 1. 2008 MAP | 1.000 | .722 | .657 | -.540 | .553 |
| 2. 2007 MAP | .722 | 1.000 | .710 | -.409 | .450 |
| 3. 2006 MAP | .657 | .710 | 1.000 | -.486 | .527 |
| 4. African Americans | -.540 | -.409 | -.486 | 1.000 | -.977 |
| 5. Whites | .553 | .450 | .527 | -.977 | 1.000 |

Stepwise regression analysis was conducted to determine the best model to show the relationship between 2008 MAP Index scores for fifth grade communication arts and PLC maturity scores (see Table 16). PLC maturity was not significantly related to student achievement scores in fifth grade communication arts. The best model resulted in:

$$\text{Fifth Grade Communication Arts MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced} \quad (5)$$

$$\text{Lunch Rate} + \beta_2 * \text{School Enrollment} + \beta_3 * \text{African Americans} + \beta_4 * \text{Asians} + \epsilon.$$

The standardized betas showed that the free and reduced lunch rate, school enrollment, and percent of African American students were negatively correlated with student achievement in fifth grade communication arts while the percent of Asian students was positively correlated. A residual plot showed that the pattern of residuals was approximately normally distributed and homoscedastic, without evidence of significant outliers. The R-square change showed that free and reduced lunch rate, school

enrollment, percent of African American students, and percent of Asian students explained 57.7% of the student achievement variance (see Table 17).

Table 16

Summary of Stepwise Regression Analysis for Variables Related to Student Achievement in Fifth Grade Communication Arts (N=76)

| Variable | B | β | t | Sig. |
|--------------------|---------|---------|---------|------|
| Step 1 | | | | |
| (Constant) | 794.693 | | 134.031 | .000 |
| Free/Reduced Lunch | -.730 | -.576 | -6.058 | .000 |
| Step 2 | | | | |
| (Constant) | 828.192 | | 96.598 | .000 |
| Free/Reduced Lunch | -.817 | -.645 | -7.661 | .000 |
| School Enrollment | -.081 | -.413 | -4.902 | .000 |
| Step 3 | | | | |
| (Constant) | 822.694 | | 96.096 | .000 |
| Free/Reduced Lunch | -.691 | -.546 | -6.036 | .000 |
| School Enrollment | -.060 | -.306 | -3.344 | .001 |
| African Americans | -1.953 | -.241 | -2.514 | .014 |
| Step 4 | | | | |
| (Constant) | 811.258 | | 85.995 | .000 |

| | | | | |
|--------------------|---------|-------|--------|------|
| Free/Reduced Lunch | -.540 | -.426 | -4.286 | .000 |
| School Enrollment | -.060 | -.306 | -3.464 | .001 |
| African Americans | -2.420 | -.299 | -3.133 | .003 |
| Asians | 6.308 | .225 | 2.512 | .014 |
| Step 5 | | | | |
| (Constant) | 806.422 | | 32.587 | .000 |
| Free/Reduced Lunch | -.538 | -.424 | -4.222 | .000 |
| School Enrollment | -.059 | -.300 | -3.218 | .002 |
| African Americans | -2.435 | -.301 | -3.118 | .003 |
| Asians | 6.206 | .221 | 2.410 | .019 |
| PLC Maturity | .067 | .018 | .212 | .833 |

Table 17

*Summary of Change Statistics for Variables Related to MAP Achievement
in Fifth Grade Communication Arts (N=76)*

| Model | R Square Change | F Change | df1 | df2 | Sig. F Change |
|-------|-----------------|----------|-----|-----|---------------|
| 1 | .332 | 36.705 | 1 | 74 | .000 |
| 2 | .166 | 24.031 | 1 | 73 | .000 |
| 3 | .041 | 6.321 | 1 | 72 | .014 |
| 4 | .038 | 6.308 | 1 | 71 | .014 |
| 5 | .000 | .045 | 1 | 70 | .833 |

Note.

| Model | Formula |
|-------|---|
| 1 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch Rate} + \epsilon$ |
| 2 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch Rate} + \beta_2 * \text{School Enrollment} + \epsilon$ |
| 3 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch Rate} + \beta_2 * \text{School Enrollment} + \beta_3 * \text{African Americans} + \epsilon$ |
| 4 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch Rate} + \beta_2 * \text{School Enrollment} + \beta_3 * \text{African Americans} + \beta_4 * \text{Asians} + \epsilon$ |
| 5 | $\text{MAP Index} = \beta_0 + \beta_1 * \text{Free \& Reduced Lunch Rate} + \beta_2 * \text{School Enrollment} + \beta_3 * \text{African Americans} + \beta_4 * \text{Asians} + \beta_5 * \text{PLC Maturity} + \epsilon$ |

Relationship between PLC Maturity and Fifth Grade Mathematics

Analyzing correlations for variables relevant to showing a relationship between PLC maturity and student achievement in fifth grade mathematics showed multicollinearity between student achievement from year to year (see Table 18). Therefore, prior student achievement data was removed from the regression analysis. Also, the percentage of African American students was inversely correlated to a very high degree with the percentage of white students. Using both ethnic groups in the regression model would therefore prove futile. The researcher chose to use the percentage of African American students for the analysis.

Table 18

Intercorrelations between Prior Achievement Data, Present Achievement Data, African Americans, and Whites for Fifth Grade Mathematics (N=76)

| Subscale | 1 | 2 | 3 | 4 | 5 |
|----------------------|-------|-------|-------|-------|-------|
| 1. 2008 MAP | 1.000 | .690 | .725 | -.571 | .595 |
| 2. 2007 MAP | .690 | 1.000 | .779 | -.550 | .575 |
| 3. 2006 MAP | .725 | .779 | 1.000 | -.548 | .583 |
| 4. African Americans | -.571 | -.550 | -.548 | 1.000 | -.977 |
| 5. Whites | .595 | .575 | .583 | -.977 | 1.000 |

Stepwise regression analysis was conducted to determine the best model to show the relationship between 2008 MAP Index scores for fifth grade mathematics and average PLC maturity scores (see Table 19). PLC maturity was not significantly related to student achievement scores in fifth grade mathematics; the only significant variables related to student achievement were percent of African American students, free and reduced lunch rate, and school enrollment. The best fitting model resulted in:

$$\text{Fifth Grade Mathematics MAP Index} = \beta_0 + \beta_1 * \text{African Americans} + \quad (6)$$

$$\beta_2 * \text{Free \& Reduced Lunch Rate} + \beta_3 * \text{School Enrollment} + \varepsilon.$$

The standardized betas showed that the percentage of African American students, free and reduced lunch rate, and school enrollment were negatively correlated with student achievement in fifth grade mathematics. A residual plot showed that the pattern of residuals was approximately normally distributed and homoscedastic, without evidence of significant outliers. The R-square change showed that these variables explain 51.5% of the student achievement variance (see Table 20).

Table 19

Summary of Stepwise Regression Analysis for Variables Related to Student Achievement in Fifth Grade Mathematics (N=76)

| Variable | B | β | t | Sig. |
|--------------------|---------|---------|---------|------|
| Step 1 | | | | |
| (Constant) | 779.413 | | 174.015 | .000 |
| African Americans | -5.359 | -.571 | -5.979 | .000 |
| Step 2 | | | | |
| (Constant) | 798.473 | | 122.528 | .000 |
| African Americans | -4.239 | -.451 | -4.834 | .000 |
| Free/Reduced Lunch | -.519 | -.353 | -3.778 | .000 |
| Step 3 | | | | |
| (Constant) | 826.041 | | 81.217 | .000 |
| African Americans | -2.780 | -.296 | -3.012 | .004 |

| | | | | |
|--------------------|---------|-------|--------|------|
| Free/Reduced Lunch | -.675 | -.459 | -4.960 | .000 |
| School Enrollment | -.073 | -.321 | -3.425 | .001 |
| Step 4 | | | | |
| (Constant) | 773.397 | | 26.003 | .000 |
| African Americans | -3.019 | -.322 | -3.297 | .002 |
| Free/Reduced Lunch | -.624 | -.424 | -4.574 | .000 |
| School Enrollment | -.061 | -.267 | -2.768 | .007 |
| PLC Maturity | .712 | .161 | 1.892 | .063 |

Table 20

*Summary of Change Statistics for Variables Related to MAP Achievement
in Fifth Grade Mathematics (N=76)*

| Model | R Square Change | F Change | df1 | df2 | Sig. F Change |
|-------|-----------------|----------|-----|-----|---------------|
| 1 | .326 | 35.746 | 1 | 74 | .000 |
| 2 | .110 | 14.271 | 1 | 73 | .000 |
| 3 | .079 | 11.728 | 1 | 72 | .001 |
| 4 | .023 | 3.580 | 1 | 71 | .063 |

Note.

| Model | Formula |
|-------|--|
| 1 | $MAP\ Index = \beta_0 + \beta_1 * African\ Americans + \epsilon$ |

2 $\text{MAP Index} = \beta_0 + \beta_1 * \text{African Americans} + \beta_2 * \text{Free \& Reduced Lunch Rate} + \varepsilon$

3 $\text{MAP Index} = \beta_0 + \beta_1 * \text{African Americans} + \beta_2 * \text{Free \& Reduced Lunch Rate} +$
 $\beta_3 * \text{School Enrollment} + \varepsilon$

4 $\text{MAP Index} = \beta_0 + \beta_1 * \text{African Americans} + \beta_2 * \text{Free \& Reduced Lunch Rate} +$
 $\beta_3 * \text{School Enrollment} + \beta_4 * \text{PLC Maturity} + \varepsilon$

Summary

The analyses of the data presented above indicated that PLC maturity was significantly related to third grade student achievement in communication arts and mathematics. There was no significant relationship between PLC maturity and student achievement in fourth or fifth grade. A more detailed summary and discussion of the findings are presented in the next chapter, in addition to recommendations for further study.

Chapter 5

Summary and Discussion

This chapter of the dissertation restates the problem statement and reviews the methodology used in the study. The remaining sections of the chapter summarize the results and discuss the implications for action and recommendations for further research.

Statement of the Problem

Hord (1997a) concludes that the principal's influence on the school community is crucial in determining whether a school can change into a community of learners. This influence is achieved principally by enabling the teachers and staff to collaborate regularly around student learning and sharing with all of the school community the responsibility of decision-making. The critical dimensions of a professional learning community (PLC), as noted by Hord, are "...supportive and shared leadership, a shared vision and values, collective learning and application of learning, supportive conditions, and shared personal practice" (1997a, p. 6, *passim*). In order for PLCs to succeed, schools must be organized so that all of these components are geared toward increasing student achievement (Hipp & Huffman, 2002). Lambert (1998) maintains that school leadership should work hand-in-hand with the other school community members so that there is "...shared responsibility for a shared purpose of community" and that "...leadership is about learning together, and constructing meaning and knowledge collectively and collaboratively" (p. 5). Therefore, in order to learn together in a goal-oriented manner, teachers and staff must work toward a common purpose, another name for a shared vision, and should tie everything they do to their purpose.

Several studies have been conducted on individual schools that act as professional learning communities. DuFour (1999) concluded that a shared vision, mission, values, and goals are essential to the success of a PLC. Adlai Stevenson High School, in Lincolnshire, Illinois, centered its vision, mission, values, and goals around student learning, along with using data to guide its teachers in developing common assessments. Schmoker (2001) reports how the PLC at Stevenson High School resulted in great success:

When DuFour began as principal in 1983, Stevenson didn't even rank in the top 50 schools in the Midwest. By 1995, they were ranked by the College Board as the top high school in the Midwest and the sixth in the world, based on student success on Advance Placement (AP) exams. They raised achievement in every measurable category.... (p. 9).

Weekly meetings were scheduled for teams of teachers to collaborate. At these collaborative meetings, teams "...focused on improving teaching strategies that promote[d] better results on the common end-of-course assessments [which each team of teachers created]" (p. 11-12).

During a case study at Hunter Elementary School, Ponder, Webb, and Trawick (2003) discovered that teacher collaboration during common planning time, in addition to "...shared values and vision..." (Hord, 1997a, p. 12), were important antecedents to the school's ability to continuously increase student achievement over a period of years. Like Stevenson High School, Hunter Elementary School used common planning time to analyze student achievement on common assessments and learn teaching strategies to help increase student achievement on these assessments. Stein (1998) conducted a case

study of three elementary schools acting as PLCs to study leadership styles. At each of the schools, student achievement was high. While leadership styles differed, all three principals helped their staff adopt a common mission focusing on student learning. In a case study at Cottonwood Creek School, Hord studied how PLC characteristics were expressed and the process the school went through to become a PLC (Hord, 1998). She discovered that teachers were more effective in teaching and increasing student learning when they learned together and that teachers and administrators trusted one another. Also, teacher efficacy was high when the school became a PLC.

While a number of researchers have looked at individual schools or a number of schools in one school district that act as PLCs and the characteristics that make them a PLC, this researcher found no extant research on the relationship between student achievement and the maturity levels of PLCs across several schools in more than one school district. This study investigated this relationship across elementary schools in one Midwestern state.

Review of Methodology

As explained in Chapter 3, this study utilized a correlational design to determine whether, and to what degree, a statistical relationship existed between the maturity level of PLCs and student achievement. In January, 2008, letters (Appendix A) were sent out to teachers in all 333 public elementary schools in Missouri serving kindergarten through fifth grade inviting them to fill out Hord's (1996) *School Professional Staff as Learning Community Questionnaire*. The questionnaire consisted of 17 questions asking certified staff to rate their answers on a Likert scale from 5 to 1. Each question was directly related to one of Hord's five critical dimensions of PLCs: "...supportive and shared

leadership; a shared vision and values; collective learning and application of learning; supportive conditions; and shared personal practice” (Hord, 1997a, p. 6, *passim*). Ratings for each question were summed to get a total questionnaire score, and then the total questionnaire scores for each school with a 20% or higher rate of return from its faculty were averaged; 76 schools met this response rate criterion. In August, 2008, MAP Index scores were recorded for third, fourth, and fifth grades in communication arts and mathematics for each of the participating schools. For each school, confounding variable data was also collected, consisting of prior student achievement, school enrollment, student-to-teacher ratio, percent of free and reduced lunch students, average daily attendance (ADA), average years of experience for teachers, percent of teachers with master’s degrees, percent of Asian students, percent of African American students, percent of Hispanic students, percent of Native American students, and percent of white students.

Multiple linear regressions were used to examine the hypothesis. Due to the large number of covariates, the researcher used stepwise selection to select those variables significantly related to student achievement when determining the best model, or equation (Chatterjee, Hadi, & Price, 2000, p. 292-294). For this study, the researcher used a statistical significance level of 95% ($p < .05$).

Summary of the Results

This study was conducted to test the hypothesis: as the maturity level of schools as PLCs increases, according to scores on the *School Professional Staff as Learning Community Questionnaire*, student scores on standardized tests in communication arts and mathematics, specifically the MAP Index Score, will also increase. The hypothesis

was supported at third grade, but not at fourth or fifth grade. More specifically, the findings for this study suggest:

- As the maturity level of schools as PLCs increases, student scores on standardized tests in third grade communication arts also increase significantly.
- As the maturity level of schools as PLCs increases, student scores on standardized tests in third grade mathematics also increase significantly.
- There is no significant relationship between a school's maturity level as a PLC and student scores on standardized tests in fourth grade communication arts or mathematics.
- There is no significant relationship between a school's maturity level as a PLC and student scores on standardized tests in fifth grade communication arts or mathematics.

Discussion of the Results

On the basis of this study alone, it is difficult to state conclusively whether the maturity level of PLCs is related to all students' learning in any particular school. MAP Index Scores limited the researcher to examining grade levels and contents independently of one another. An analysis of the third grade communication arts data resulted in equation 1 in Chapter 4, showing that free and reduced lunch rate, percent of African American students, and PLC maturity were significantly related to student achievement. While free and reduced lunch rate and percent of African American students were negatively correlated with student achievement, PLC maturity was positively correlated. Upon examining the standardized beta coefficients, it can be seen that PLC maturity ($\beta = .278$) is correlated to a larger positive degree while the percent of African American students ($\beta = -.239$) is negatively correlated with student achievement (Table 4). In other

words, the percent of African American students affects student achievement at a rate of -.239 while PLC maturity affects students achievement at a rate of .278, which means that PLC maturity can more than make up the difference for the negative weight of African American students; it is important to note that while African American student achievement appears to work negatively against a school's overall student achievement, there are many other factors, including institutionalized racism in the United States, that have contributed to lower educational outcomes for these students that are not explained for when race is used as a variable in isolation (O'Connor, Lewis, & Mueller, 2007). Furthermore, when PLC maturity is added to the equation, an additional 7.6% of the student achievement variance can be explained in third grade communication arts scores (Table 5). Equation 2 showed that the percent of white students, percent of students on free and reduced lunch, and PLC maturity were significantly related to student achievement in third grade mathematics. Schools' PLC maturity level ($\beta = .309$) was positively correlated to student achievement to a higher degree while the rate of free and reduced lunch ($\beta = -.227$) was negatively correlated. In other words, the percent of students on free and reduced lunch affects student achievement at a rate of -.227 while PLC maturity affects students achievement at a rate of .309, which means that PLC maturity can more than make up the difference for the negative weight of students on free and reduced lunch; research on student performance has historically shown that students with higher socioeconomic status perform higher than students with lower socioeconomic status (Tajalli & Opheim, 2005). It can be further stated that PLC maturity explained 9.4% of the variance in student achievement in third grade mathematics. Both of these analyses suggest that at the third grade level, the level of a school's PLC maturity can

help counter the negative relationships of its percent of African American students with student achievement in communication arts and its percent of free and reduced lunch students with student achievement in mathematics.

The hypothesis was not supported at the significant level in fourth or fifth grade communication arts or mathematics. While PLC maturity was not significantly related at the 95% significance level in fifth grade mathematics, there was a slight positive relationship at the 93.7% significance level. At this level of significance, an additional 2.3% of the variance in student achievement in fifth grade mathematics can be explained. In other words, while PLC maturity was not significantly related to student achievement in fifth grade mathematics, when added to Equation 6, it can explain a little over two percent of the variance in student achievement.

Past case studies suggest that schools that researchers judge to have become PLCs have more success with the implementation and institutionalization of other educational programs designed to increase student achievement. While a number of researchers have looked at individual schools or a number of schools in one school district that act as PLCs and the characteristics that make them a PLC, there was no readily identifiable research on the relationship between student achievement and the maturity levels of PLCs across several schools in more than one school district. The present study investigated this relationship across 76 elementary schools in 40 different districts in one Midwestern state.

The results of this study suggest that PLCs have a significant relationship to student achievement in communication arts and mathematics at the third grade level and can further explain some student achievement variance in fifth grade mathematics,

though not at a significant level. With the federal government placing increasing amounts of pressure on schools to increase student achievement scores through the No Child Left Behind Act of 2001, this study would suggest that elementary school principals should feel justified in pushing their teachers out of isolation and into creating structures for them to collaborate regularly to focus on student achievement.

The fact that the study found a significant relationship between PLC maturity in third grade but not in fourth or fifth grade may have resulted from a non-representative sampling of questionnaires from appropriate certified staff. While there was a space on the questionnaire for participants to write in their grade level or specialty area, a majority of the participants left this section blank. As a result, questionnaire scores could not be further analyzed by grade level or special area. Instead, the study made the assumption that the total questionnaires from each school were a good sampling of the various assignments of the certified staff, including third, fourth, and fifth grade teachers. Another factor that may have affected the results was whether fourth and fifth grades were departmentalized or not; this study had no way of differentiating between schools that departmentalized and those that did not. Future research should consider inclusion of this variable. Also, developmental differences among fourth and fifth graders may be a factor in overall student achievement.

Recommendations for Further Research

This study focused on the relationship of PLCs and student achievement in third, fourth, and fifth grades. The results of this study led to the following recommendations:

1. Conduct this study at the middle school and high school levels.

2. Replicate the study using percent of total students proficient and percent of disaggregate groups proficient as measures for student achievement.
3. Replicate the study using questionnaire responses from third grade teachers and correlating the questionnaire scores to third grade student achievement scores.
4. Replicate the study using questionnaire responses from fourth grade teachers and correlating the questionnaire responses to fourth grade student achievement scores.
5. Replicate the study using questionnaire responses from fifth grade teachers and correlating the questionnaire responses to fifth grade student achievement scores.
6. Replicate the study with departmentalized schools and non-departmentalized schools in two separate groups. Research could examine whether departmentalization affects the existence and/or strength of the relationship between PLCs and student achievement.

Concluding Remarks

Professional learning communities (PLCs) have been a passion of this researcher. Interest grew in this area from Schmoker's account of how PLCs helped raise student achievement at Adlai Stevenson High School (2001). Attending a Professional Learning Communities Institute led this researcher to begin implementing PLCs with the staff at his own elementary school. The trials and tribulations of developing a PLC led the researcher to this meaningful study that produced the above data. The study has validated the researcher's interest in the power of PLCs and the effect PLCs can have on student achievement.

References

- Astuto, T.A. & Clark, D.L. (1995). Activators and impediments to learner centered schools. *Theory into Practice*, 34(4), 243-249.
- Barth, R.S. (2006). Improving relationships within the schoolhouse. *Educational Leadership*, 63(6), 8-13.
- Berman, P. & McLaughlin, M.W. (1978). *Federal programs supporting educational change, vol. VIII: Implementing and sustaining innovations* No. R15898HEW. U.S.; California: December 3, 2006, from ERIC database.
- Callahan, R.E. (1962). *Education and the cult of efficiency*. Chicago, IL: The University of Chicago Press.
- Campo, C.A. (1993). Collaborative school cultures: How principals make a difference. *School Organization*, 13(2), 119-127.
- Chatterjee, S., Hadi, A.S., & Price, B. (2000). *Regression analysis by example (3rd ed.)*. New York: John Wiley & Sons.
- Childs-Bowen, D., Moller, G., & Scrivner, J. (2000). Principals: Leaders of leaders. *NASSP Bulletin*, 84(616), 27-34.
- Clark, D. & Astuto, T. (1994). Redirecting form. *Phi Delta Kappan*, 75(7), 512.
Retrieved Friday, October 20, 2006 from Academic Search Premier database.
- Department of Elementary & Secondary Education. (2007, August 21). *Understanding your adequate yearly progress (AYP) report 2007-2008*. Retrieved October 14, 2007, from <http://dese.mo.gov/divimprove/sia/dar/UnderstandingYourAYP20072008.pdf>
- DuFour, R.P. (1999). Help wanted: Principals who lead professional learning

communities. *NASSP Bulletin*, 83(604), 12-17.

DuFour, R., DuFour, R., Eaker, R., & Karhanek, G. (2004). *Whatever it takes: How professional learning communities respond when kids don't learn*. Bloomington, IN: National Educational Service.

DuFour, R. & Eaker, R. (1998). *Professional learning communities at work: Best practices for enhancing student achievement*. Bloomington, IN: National Educational Service.

Dunne, F., & Honts, F. (1998). "That group really makes me think!" *Critical friends groups and the development of reflective practitioners*. U.S.; Rhode Island: October 8, 2006, from ERIC database.

Eaker, R., DuFour, R., & DuFour, R. (2002). *Getting started: Reculturing schools to become professional learning communities*. Bloomington, IN: National Educational Service.

Furlong, N., Lovelace, E., & Lovelace, K. (2000). *Research methods and statistics: An integrated approach*. Fort Worth, TX: Harcourt Brace and Company.

Gay, L.R. & Airasian, P. (2003). *Educational research: Competencies for analysis and Applications*. Upper Saddle River, NJ: Merrill Prentice Hall.

Giegerich, S. & Bock, J. (2007, August 14). 167 districts in state discover they haven't met federal academic goals. *St. Louis Post Dispatch*, p. D1.

Goddard, R.D., Hoy, W.K., & Hoy, A.W. (Summer, 2000). Collective teacher efficacy: Its meaning, measure, and impact on student achievement. *American Educational Research Journal*, 37(2), 479-507.

Hipp, K.A. & Huffman, J.B. (2002, April 1-5). *Documenting and examining practices in*

creating learning communities: exemplars and non-exemplars. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Hord, S.M. (1996). *School professional staff as learning community questionnaire*. Austin, TX: Southwest Educational Development Laboratory.

Hord, S.M. (1997a). *Professional learning communities: Communities of continuous inquiry and improvement*. U.S.; Texas: Southwest Educational Development Laboratory. October 30, 2006, from ERIC database.

Hord, S.M. (1997b). Professional learning communities: What are they and why are they important?. *Issues about Change*, 6(1), 42-49.

Hord, S.M. (1998). Creating a professional learning community: Cottonwood Creek School. *Issues about Change*, 6(2), 1-8.

Hord, S.M., Meehan, M.L., Orletsky, S., & Sattes, B. (1999). Assessing a school staff as a community of professional learners. *Issues about Change*, 7(1), 1-8.

Huffman, J.B., & Hipp, K.A. (2000, April). *Creating communities of learners: The interaction of shared leadership, shared vision, and supportive conditions*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA.

Huffman, J.B., Hipp, K.A., Pankake, A.M., & Moller, G. (2001, September). Professional learning communities: Leadership, purposeful decision making, and job-embedded staff development. *Journal of School Leadership*, 11(5), 448-463.

Huffman, J.B., & Jacobson, A.L. (2003). Perceptions of professional learning communities. *International Journal of Leadership in Education*, 6(3), 239-250.

- Lambert, L. (1998). *Building leadership capacity in schools*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Little, J.W. (Fall, 1982). Norms of collegiality and experimentation: Workplace conditions of school success. *American Educational Research Journal*, 19(3), 325-340.
- Meehan, M.L., Orletsky, S.R., & Sattes, B. (1997). *Field test of an instrument measuring the concept of professional learning communities in schools*. Charleston, WV: Appalachia Educational Laboratory.
- No Child Left Behind Act of 2001, Pub. L. No. 107-110, § 1001 *et seq.*, 115 Stat. 1439 (2002).
- O'Connor, C., Lewis, A., & Mueller, J. (December, 2007). Researching "black" educational experiences and outcomes: Theoretical and methodological considerations. *Educational Researcher*, 36(9), 541-552.
- Ponder, G., Webb, S.M., & Trawick, A.R. (Spring, 2003). The success cycle at Hunter Elementary. *Journal of Curriculum and Supervision*, 18(3), 222-239.
- Schmoker, M.J. (2001). *The results fieldbook: Practical strategies from dramatically improved schools*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Senge, P.M. (1990). *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday.
- Stein, M.K. (1998). *High performance learning communities district 2. Report on year one implementation of school learning communities. High performance training communities project*. U.S.; Pennsylvania: October 8, 2006, from ERIC database.

Strahan, D., Carlone, H., Horn, S., Dallas, F., & Ware, A. (2003). Beating the odds at Archer Elementary School: Developing a shared stance toward learning. *Journal of Curriculum and Supervision, 18*(3), 204-221.

Tajalli, H., & Opheim, C. (June, 2005). Strategies for closing the gap: Predicting student performance in economically disadvantaged schools. *Educational Research Quarterly, 28*(4), 44-54.



Appendix A

College of Education

Division of Educational Leadership
and Policy Studies

One University Boulevard
St. Louis, Missouri 63121-4400
Telephone: 314-516-5944
Fax: 314-516-5942

January, 2008

Dear Professional Development Representative:

My name is Eric Arbetter and I am the principal at Walker Elementary School, which is in the Hazelwood School District, Hazelwood, Missouri. I am also a doctoral student in the process of completing my dissertation research at the University of Missouri-St. Louis. My Doctoral Committee chair is Dr. Matthew Davis. If you would like to speak with him before participating in this project, he may be reached at 314-516-5953.

The title of my dissertation is "The Relationship between The Maturity Level of Professional Learning Communities (PLCs) and Student Achievement." Your school has been chosen to participate in this study, but in order to do this, I need your assistance.

Enclosed in this packet is a questionnaire to be completed by your teachers. Thirty copies have been sent. If more are needed, may I impose on you to make additional copies so that each teacher in your building will have an opportunity to participate in this project? When the questionnaires are completed, please collect and place them in the enclosed self-addressed, stamped envelope and mail back to me. I realize that time is always a precious commodity for teachers and administrators. Therefore, this questionnaire has been designed to gather the necessary data for the study, while requiring the least amount of time to respond to the questions.

Limited research has been done on this topic and your school's participation will contribute to the knowledge base needed for good schools to become better. Be assured that neither your teachers nor your school will be identified in any way in any written or verbal reports on the study. In fact, the data received from participating schools will be utilized to arrive at general correlations between schools that involve practices normally associated with PLCs and the achievement of students as determined by school-level MAP scores.

I want to thank you in advance for assisting me with this important project. Your help in getting the questionnaires to the teachers, collecting them within a couple of days and sending them back to me is vital to the completion of my work. Through your cooperation, your school will be contributing to the knowledge available to other districts as they enhance teaching and learning in their schools.

If you have questions, please contact me at the phone number or email address listed below.

Sincerely,

Eric Arbetter
109 Fleurie Drive
Florissant, MO 63031
(314)953-4901
earbettr@hazelwoodschoools.org



Appendix B

Division of Educational Leadership
and Policy Studies

One University Boulevard
St. Louis, Missouri 63121-4400
Telephone: 314-516-5944
Fax: 314-516-5942

January, 2008

Dear Teacher:

My name is Eric Arbetter and I am the principal at Walker Elementary School, which is in the Hazelwood School District, Florissant, Missouri. I am also a doctoral student in the process of completing my dissertation research at the University of Missouri-St. Louis. The title of my dissertation is "The Relationship Between the Maturity Level of Professional Learning Communities (PLCs) and Student Achievement." Your school has been chosen to participate in this study, but in order to do this, I need your assistance.

Your school's Professional Development Representative has a brief questionnaire for you to complete. The questionnaire is anonymous, and completing it will only take 5-10 minutes. I realize that time is always a precious commodity for teachers. Therefore, this questionnaire has been designed to gather the necessary data for the study, while requiring the least amount of time to respond to the questions. Naturally, your participation is completely voluntary. If you decide to participate in this study, please complete the questionnaire and return it to your Professional Development Representative, who has agreed to send all of your school's completed questionnaires back to me. You do not have to answer any questions you choose not to, although it would be helpful if you would try to answer all of the questions.

Limited research has been done on this topic and your participation will contribute to the knowledge base needed for good schools to become better. The questionnaire is to be completed anonymously, and all information will be kept confidential. Be assured that neither you nor your school will be identified in any way in any written or verbal reports on the study. The data received from participating schools will only be utilized to examine general relationships between school practices associated with PLCs and the achievement of students as determined by school-level MAP scores.

I want to thank you in advance for assisting me with this important project. Your help in completing the questionnaire is vital to the completion of my doctoral work. Through your cooperation, your school will be contributing to the knowledge available to other districts as they enhance teaching and learning in their schools.

If you have questions, please contact me at the phone number or email address listed below. My Doctoral Committee chair is Dr. Matthew Davis. If you would like to speak with him before participating in this project, he may be reached at 314-516-5953.

Sincerely,

Eric Arbetter
109 Fleurie Drive
Florissant, MO 63031
314-953-4901
earbettr@hazelwoodschoools.org



Appendix C

OFFICE OF RESEARCH ADMINISTRATION

Interdepartmental Correspondence

Name: Eric Arbetter

Title: The Relationship between the Maturity Level of Professional Learning Communities (PLCs) and Student Achievement

The chairperson of the Human Subjects Committee for UM-St. Louis has reviewed the above mentioned protocol for research involving human subjects and determined that the project qualifies for exemption from full committee review under Title 45 Code of Federal Regulations Part 46.101b. The time period for this approval expires one year from the date listed below. You must notify the Human Subjects Committee in advance of any proposed major changes in your approved protocol, e.g., addition of research sites or research instruments.

You must file an annual report with the committee. This report must indicate the starting date of the project and the number of subjects to date from start of project, or since last annual report, whichever is more recent.

Any consent or assent forms must be signed in duplicate and a copy provided to the subject. The principal investigator must retain the other copy of the signed consent form for at least three years following the completion of the research activity and they must be available for inspection if there is an official review of the UM-St. Louis human subjects research proceedings by the U.S. Department of Health and Human Services Office for Protection from Research Risks.

This action is officially recorded in the minutes of the committee.

| Protocol Number | Date | Signature - Chair |
|-----------------|----------|-------------------|
| 071119A | 11-27-07 | |