Professional learning communities: An analysis of teacher participation in a PLC and the relationship with student academic achievement

Anthony James Aylsworth
Iowa State University

Follow this and additional works at: http://lib.dr.iastate.edu/etd
Part of the Educational Administration and Supervision Commons

Recommended Citation
Aylsworth, Anthony James, "Professional learning communities: An analysis of teacher participation in a PLC and the relationship with student academic achievement" (2012). Graduate Theses and Dissertations. 12264.
http://lib.dr.iastate.edu/etd/12264

This Dissertation is brought to you for free and open access by the Graduate College at Iowa State University Digital Repository. It has been accepted for inclusion in Graduate Theses and Dissertations by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.
Professional learning communities: An analysis of teacher participation in a PLC and the relationship with student academic achievement

by

Anthony James Aylsworth

A dissertation submitted to the graduate faculty in partial fulfillment of the requirements of the degree of DOCTOR OF PHILOSOPHY

Major: Education (Educational Leadership)

Program of Study Committee

Joanne Marshall, Major Professor
   Mike Book
   Patricia Carlson
   Gary Ratigan
   Jan Westerman-Beatty

Iowa State University

Ames, Iowa

2012

Copyright © Anthony James Aylsworth, 2012. All rights reserved.
# TABLE OF CONTENTS

**LIST OF FIGURES** ........................................................................................................ iv

**LIST OF TABLES** ........................................................................................................... v

**ACKNOWLEDGMENTS** ................................................................................................. vi

**ABSTRACT** ................................................................................................................... viii

**CHAPTER 1: INTRODUCTION** .................................................................................... 1

- Background ................................................................................................................. 1
- Professional Learning Communities .............................................................................. 3
- Problem ........................................................................................................................ 4

- Purpose ......................................................................................................................... 5
- Research Questions ....................................................................................................... 5
- Hypotheses ...................................................................................................................... 6

- Significance of the Study ............................................................................................... 7
- Definition of Terms ......................................................................................................... 8
- Summary ......................................................................................................................... 9

**CHAPTER 2: LITERATURE REVIEW** .......................................................................... 10

- History of School Reform and Accountability .............................................................. 10
- Accountability and Reform in the State of Iowa ............................................................. 15

- Conceptual Frameworks .................................................................................................. 16
- Schools and Businesses as Learning Organizations ....................................................... 16

- Use of Assessment .......................................................................................................... 20
- Summative and Formative Assessment .......................................................................... 21
- Collaboration and Teamwork .......................................................................................... 28

- Collaborative Learning Theory ...................................................................................... 35
- Defining PLCs .................................................................................................................. 36

- Professional Learning Community Frameworks ............................................................ 39

- Summary ......................................................................................................................... 44

**CHAPTER 3: METHODOLOGY** .................................................................................. 46

- Introduction ...................................................................................................................... 46

- Research Questions ........................................................................................................ 46
- Methods ............................................................................................................................ 47

- Data Sources ................................................................................................................... 47

  - Pre-/Post- Student Achievement Data Analysis ......................................................... 48

  - The Aylsworth PLC Survey ......................................................................................... 50

- Ethical Considerations .................................................................................................... 55
- Limitations ...................................................................................................................... 55

- Delimitations of the Study ............................................................................................. 58
# CHAPTER 4: RESULTS

- Introduction ........................................................................................................ 59
- Research Questions ............................................................................................. 59
- Selection Criteria ................................................................................................. 60
- Pre-/Post- Student Achievement Data Analysis .................................................. 60
  - Research Question 1 .......................................................................................... 61
  - Research Question 2 ........................................................................................ 64
- The Aylsworth PLC Survey .................................................................................. 67
  - Research Question 3 ........................................................................................ 67
- Summary .............................................................................................................. 73
- Discussion of Results ........................................................................................... 73
- Conclusion ........................................................................................................... 74

# CHAPTER 5: DISCUSSION AND IMPLICATIONS FOR EDUCATIONAL PRACTICE

- Introduction ......................................................................................................... 75
- Research Questions ............................................................................................. 75
- Research Findings ................................................................................................ 76
- Implications and Recommendations for Educational Practice ......................... 81
- Research Summary and Limitations .................................................................... 86
- Suggestions for Future Research .......................................................................... 86
- Conclusion ........................................................................................................... 89

# REFERENCES ....................................................................................................... 91

# APPENDIX A: AYLSWORTH PLC SURVEY .......................................................... 101

# APPENDIX B: STUDENT LETTER GRADE COUNTS PRE-/POST- BY PLC ............ 112
LIST OF FIGURES

Figure 2.1: NCLB-Mandated Student Proficiency Trajectory (Reading)...........................13
Figure 2.2: NCLB-Mandated Student Proficiency Trajectory (Math)..............................13
Figure 2.3: DuFour et al. PLC Framework......................................................................42
Figure 4.1: Welch t-test for Unequal Sample Sizes and Unequal Variance .....................61
LIST OF TABLES

Table 2.1: Comparison of PLCs and Traditional Schools (Non-PLCs).................................43
Table 3.1: Aylsworth PLC Survey Connection to the Hord PLC Survey ...............................51
Table 3.2: PLC Research and Aylsworth PLC Research..........................................................54
Table 4.1: Numerical Value Assignments to Passing Student Scores (for Calculation
            in Welch t-test)........................................................................................................62
Table 4.2: Welch t-test Analysis of the Relationship Between PLCs and Passing
            Student Scores...........................................................................................................63
Table 4.3: Research Site Letter Grade Scale ...........................................................................64
Table 4.4: Analysis of the Relationship Between PLCs and Student Failure Scores ..........66
Table 4.5: Aylsworth PLC Survey Results: Survey Components Reported by PLC .........71
Table 4.6: Data Comparison of Effective PLCs and Student Learning...............................72
Table 4.7: Data Comparison by PLC of All Three Sources of Data....................................73
ACKNOWLEDGMENTS

Although my name appears on the cover of this dissertation, I would be remiss in not thanking the many professors, mentors, family, and friends who contributed to the production of this dissertation. All of you have made this process possible, and it is one that I will always cherish. I owe you my most sincere gratitude.

I cannot overstate my gratitude to my Committee Chair, Dr. Joanne Marshall. Your guidance, insight, and inspiration made what once seemed like an impossible task very “doable.” I will always be grateful for and remember your kindness and patience in helping me through this dissertation process.

I would like to thank Dr. Jan Beatty, Dr. Mike Book, and Dr. Gary Ratigan for the many years of mentorship, guidance, encouragement, and sage advice. Your insightful leadership, constructive feedback, and support have influenced and shaped my beliefs about educational leadership. I’ve learned so much from all of you, and vow to “pay it forward” with the same support and encouragement you have all shown me.

I am grateful to Dr. Patricia Carlson for agreeing to serve on my committee on such short notice, and for immediately bringing an informed and supportive voice to the table. Your insight from a Curriculum and Instruction lens added significant value to our discussions and, ultimately, to my dissertation.

I am grateful to the Ankeny Community School District for providing me with the opportunity to conduct this research, and for allowing me the time to write this dissertation. The level of commitment you have shown in helping me to accomplish my goals is one I will always remember and will aspire to in my support of future colleagues who pursue advanced degrees.
Many great friends also supported me through this process. Your support and patience in putting up with my frequent dissertation updates helped me to overcome difficulties and stay focused on my progress. I greatly appreciate your friendship and your support.

Most importantly, this journey was made possible through the love and support of my family. I must first acknowledge and thank my wife, Cari, and my daughter, Hayden. Along the way, they made considerable sacrifices to facilitate my commitment to my coursework and this research. The extended time at night and on weekends spent away from home was difficult, but you were persistent in reminding me of my desire to complete this process and steadfast in motivating me every step of the way. I will be forever grateful, indebted, and inspired by your love. I want to thank my parents, Dave and Becky Aylsworth, for raising me to understand the value of education, hard work, and persistence. This would not have been possible without all of you, and I love you all very much.
This study sought to compare teacher participation in a Professional Learning Community with the performance of their students. Student achievement data from multiple subject-alike groups were compared in a pre- and post-PLC format, using an independent, two-sample t-test. Overall, 10 PLCs from one high school in a suburban, Iowa setting were compared. Mean scores from the 3 research questions that guided this study found that (1) 7 of the 10 PLCs improved student learning after functioning as a PLC, (2) no consistent relationship existed between teacher participation in a PLC and student failure rates, and (3) no consistent correlation existed between the student learning results from effective PLCs (as measured by the Aylsworth PLC Survey) and those that did not meet the criteria of an effective PLC.

Based on the findings of this study, implications for educational practice and suggestions for future research include (1) collaboratively setting the vision for PLCs, (2) researching and understanding the implementation and structures of PLCs, (3) providing appropriate resources and ongoing support for PLCs, and (4) developing supportive leadership for PLCs.
CHAPTER 1: INTRODUCTION

The PLC movement is probably the most influential movement with regard to actually changing practices in schools I have ever seen.

Robert Marzano (2011, p.x)

Background

At the time of this writing, it is ten years after the 2001 No Child Left Behind Act, and schools across the US continue to scramble to respond to the federal demands placed on schools and districts. As high stakes school assessment and improvement reform efforts have become mainstream, school districts have turned to a multitude of professional development and collaboration models and strategies to turn around their schools, so that all students might learn at high levels. One such model for improved student achievement is the Professional Learning Community (PLC) model. It has gained popularity in the past decade as a model for improving teacher collaboration, morale, and ultimately student academic performance.

In response to NCLB, the state of Iowa requires all K-12 schools to adhere to a state curriculum guideline that calls for all students to earn a “proficient” score on state tests. This guideline focuses on conformance to the 2001 Iowa Test of Basic Skills (ITBS) for grades K-8, and the Iowa Test of Educational Development (ITED) for grades 9–12, both of which will be assessed in 2014. “Proficiency” in the state of Iowa has been measured as achieving at the 41st percentile or above in the curricular areas of math and reading. Students who score at or below the 40th percentile in either math or reading would not meet the state benchmark, and would be deemed as non-proficient. Each year, the state asks districts to set goals for improvement and, ultimately, to elevate all students to proficiency. Entire school districts, as individual schools within a district, that fail the meet the state expectations
(termed, “Adequate Yearly Progress”) run the risk of incurring a variety of state and federal sanctions, including replacement of staff and/or administration and, in the event of long-term inadequate progress, closure.

Increased focus on student achievement has caused educational reformers to challenge schools, their staff, and leadership, to think differently about their fundamental philosophies regarding teaching and learning. Through the increased focus on school reform, there have been enormous shifts in many assumptions about effective teaching and its connection to improving teacher collaboration and combating teacher isolation, as well as the relationships between teacher isolation and teacher moral and student performance.

Teacher isolation, of course, is nothing new. Researchers have been discussing it for at least thirty years. Davis (1986), for example, argued against teacher isolation by arguing, “although teaching is of a highly interpersonal nature, teachers are isolated from their colleagues for most of the working day, and professional interaction among teachers is often limited” (1986, p. 1). Lieberman (1985) took teacher isolation a step further by focusing not only on the potential for teachers to learn with and from one another, but also on the potential impact on school culture, when she suggested, “teacher isolation is incredibly important, because if people are isolated from each other, they not only don’t know what everybody else is doing, there is [also] not very much trust” (p. 10). One of the great ironies of our schools is that our systems are supposed to embrace a school culture of learning for all. However, as Fullan (2007) argues, “schools are in the business of teaching and learning, yet they are terrible at learning from each other” (p. 92). Although the research is clear that teacher isolation is linked with higher levels of stress, increased burnout, and higher teacher attrition
rates, the phenomenon is still widespread in many public schools throughout the US (Murphy, 1982; Chang, 2009; Dworkin, 2009).

PLC experts (DuFour et al., 2011, 2010, 2008; Eaker, 2006; Karhanek, 2004; Barth, 2004, 2001, 1991; Reeves et al., 2010; Lezotte, 2010) argue that traditional educational systems are not designed to accomplish the mission of learning for all. They argue that educational leaders must rethink their system of values, and reconsider current philosophical beliefs about the purpose of schools. Although educational leaders have tackled the demands of NCLB, including high-stakes standardized testing, through a variety of solutions and approaches, the PLC model of collaboration and school improvement continues to gain traction throughout the world. The popularity of the PLC model may be attributed to several factors, including the wealth of research on adult learning, teacher modeling, and peer collaboration. Additionally, in a time of ongoing budget cuts and reductions in state and federal funding for public schools, another factor in the popularity of the PLC movement may be the relatively low cost associated with implementation of PLCs, which require little to no outside trainers, expensive travel, nor materials to purchase. Instead, the “costs” come in the form of providing time, typically during the school day, for professionals to collaborate and work together in accordance with the PLC model.

Professional Learning Communities

Although the term, *Professional Learning Community*, is relatively new itself, the philosophical underpinnings of the method of working together for improving practice or knowledge are centuries old. In his research on communities of practice, Wenger (1998) summarizes the concept of professional collaboration as a process where people “engage in collective learning in a shared domain of human endeavor” (p. 4). Wenger suggested that this
type of collaboration goes back centuries, when tribes learned to survive by working together, but that it also has modern applications, such as with groups of like-minded professionals who collaborate to solve problems.

This research is based upon the theories of organizational collaboration, constructivist learning theory, and collaborative learning theory. As a whole, researchers agree that collaboration is a process “by which organizations or people exchange information, alter activities, share resources, and enhance each other’s capacity for mutual benefit and common purpose, by sharing risks, responsibilities, and rewards” (Himmelman, 1992). Specifically, this study examines the relationship between the PLC model of teacher collaboration and student learning. PLCs also offer professional development opportunities that potentially enable schools and teachers to respond to state and federal education policies soundly and effectively. In addition to the demands placed on schools by NCLB, many states (including Iowa) have been issued the ultimatum of high learning achievement levels for all students, and a small timeframe in which to accomplish them. The issue that remains, and which this study seeks to answer, is the degree to which PLCs merit legislators’ and educators’ requests for increased time and funding for additional teacher professional development to meet the multitude of education policy demands.

Problem

K-12 schools across the country are adopting the Professional Learning Communities model for teacher collaboration, with the expectation of increased student learning and achievement. As a part of NCLB requirements, professional development structures and training opportunities are required to have a research or evidence base for improving learning prior to implementation. However, little research or evidence exists regarding the
relationship between Professional Learning Communities (PLCs) on student academic performance. Although PLCs are generally viewed as a helpful structure by educators, the lack of a credible research base connecting PLCs to improved student learning may jeopardize the PLC movement’s long-term sustainability, and force it to become another educational fad that passes with time.

**Purpose**

Federal and state legislators, local boards of control, educators, and parents alike want an education system that prepares all children for success. Due to the popularity of the PLC model in K-12 schools, a more comprehensive research base is needed to understand better PLCs and their effectiveness in improving student learning. Consequently, this study intended to gain insight into the relationship between teacher collaboration in a PLC and student academic achievement. Student achievement was examined and compared prior to and after the implementation of course-specific PLCs. Participating teachers were also surveyed regarding their perceived impact of their PLC. Student learning results were then compared with teacher survey data for connections between teacher perception about their PLC team and the learning of their students.

**Research Questions**

In order to find out whether PLC involvement and collaboration improved teacher effectiveness and student learning, this study sought to understand the relationship between teacher participation in a Professional Learning Community and student learning in one Midwestern suburban 10th–12th grade high school. The following research questions therefore guided this study:
(1) What statistical relationship exists between teacher participation in a PLC and student learning (as measured by students’ end of term letter grades)?

(2) Is there any difference in the percentage of students that fail a class when their teacher participates in a PLC?

(3) Is there any difference in student learning (as measured by students’ end of term letter grades) in PLCs that demonstrate strong evidence of operating as a PLC, as measured by the Aylsworth PLC Survey?

**Hypotheses**

Given the nature of this study and the literature on PLCs, multiple independent two-sample t-tests were used to compare student achievement before and after teacher involvement in PLCs. Online teacher survey data was collected on a 4-point Likert-scale using the Aylsworth PLC Survey (Aylsworth, 2011) (Appendix A). The Aylsworth PLC Survey instrument was developed in previous research, and designed to evaluate each individual PLCs by asking participants to respond to multiple PLC-related statements, which were then scored by response count. Survey data was then compared with student learning statistical data to draw conclusions about teacher perception of their PLC work. Three hypotheses structured the research of this study:

$H_{01}$: Students whose teacher participated in a PLC will show higher levels of academic performance.

$H_{02}$: Students whose teacher participated in a PLC will show lower levels of student failure rate.

$H_{03}$: Teachers who participated in an effective PLC, as measured by the Aylsworth PLC Survey, will show higher levels student of academic performance.
For Hypotheses 1–3, final letter grades were used to measure the comparison.

**Significance of the Study**

This study focused on the relationships between PLCs and student learning. Because federal and state legislation have increased accountability for schools to perform and students to achieve at higher rates, many districts have responded by offering more time for teacher collaboration, time to learn together, and for professional development in general. Although there is no “one-size-fits-all” approach to teacher collaboration and professional development, the PLC is a framework that many schools have embraced as a primary model for improvement, due to the potential for teachers to learn from one another and the relatively low costs associated with providing teachers time to work together. Although some educators feel improving teaching and learning is directly at odds with the accountability measures of NCLB, education researcher Richard Elmore (2000) supports schools’ and teachers’ intent to improve curriculum, instruction, and assessment, with the qualification that accountability is not necessarily a bad thing:

[S]chools and school systems should be held accountable for their contributions to student learning. Society should communicate its expectations for what students should know and be able to do in the form of standards both for what should be taught and for what students should be able to demonstrate about their learning. (p. 5).

This imperative truly is the heart of the PLC framework, in that students should know how best to demonstrate their learning, and that we should encourage them to do so.

Education literature is rife with strategies for improving student learning. At the time of this writing, little data exist to offer an evaluation of whether PLCs positively influence
learning outcomes. A common assumption by supporters of PLCs is that more time for teachers to collaborate results in higher levels of learning for their students. This study looked at a small amount of data from one setting to determine the relationship between teacher participation in a PLC and the achievement of their students. This study, therefore, adds an initial piece to an emerging body of research that investigates such relationships. Because PLCs evolve as a common model of teacher collaboration and professional development in K-12 education, this study’s findings potentially offer school districts further knowledge with which they may make curriculum and professional development (for teachers) decisions.

**Definition of Terms**

**Collaboration:** “A systemic approach in which educators work together interdependently to analyze and impact their professional practice in order to achieve better results for their students, their teams, and for their schools” (DuFour et al., 2006, p. 98).

**Criterion-Referenced Assessment:** Assessment that provides for translating test scores into a statement about the behavior to be expected of a person with that score or their relationship to a specified subject matter.

**Formative Assessment:** “Assessment designed to provide direction for improvement and/or adjustment to a program for individual students or for a whole class” (O’Connor, 2009, p. 117).

**Norm-Referenced Assessment:** Assessment that yields an estimate of the position of the tested individual in a predefined population, with respect to the trait(s) being measured.

**Professional Learning Community:** “A group of teachers who meet regularly as a team to identify essential and valued student learning, develop common formative
assessments, analyze current levels of student achievement, set achievement goals, share strategies, and then create lessons to improve upon those levels” (DuFour et al., 2005, p. xxi).

*School Culture:* “A complex pattern of norms, attitudes, beliefs, behaviors, values, ceremonies, traditions, and myths that are deeply ingrained in the very core of the organization (Barth, 2001, p. 8).

*Summative Assessment:* “Assessment/evaluation designed to provide information to be used in making judgments about a student’s achievement at the end of a period of instruction” (O’Connor, 2009, p. 117).

**Summary**

This research is organized into five chapters, a references section, and two appendices. Chapter 2 includes a review of the literature of school reform, accountability and standards movement, No Child Left Behind, and the ways they have shaped the current state of PLCs and collaboration in schools today. Chapter 3 describes the research methods used for the study, the research site selected, instruments, procedures, and overall design of the study. The data yielded as a result of this research can be found in Chapter 4, while Chapter 5 includes the summary, findings, policy and action implications, recommendations for further research, and conclusions.
CHAPTER 2: LITERATURE REVIEW

Why professional learning communities? Because they fit into changing philosophy of knowledge, they fit with what research tells us about learning, and because they work!

K. Patricia Cross (1998, p.4)

An overwhelming amount of literature addresses school development and improvement (including PLCs), school reform, the No Child Left Behind Act, and other accountability measures for school improvement, professional development, and student achievement. This chapter reviews the literature of school reform and accountability, as well as the relevant literature on learning theory, professional learning communities, collaboration, and assessment. It includes references from educational journals, research briefs, dissertations, online databases and websites, including the dates 1947–2011, with the majority from 2000 through 2011. This research was heavily influenced by DuFour et al.’s work on implementing and assessing PLCs.

History of School Reform and Accountability

Since the release of the National Commission on Excellence in Education’s (NCEE) 1983 report, “A Nation at Risk,” public education leaders have rushed to identify solutions to student performance problems with our nation’s schools. Although a history of governmental involvement in school accountability existed prior to 1983, many educators agree that the, “A Nation at Risk”, report proved to be the tipping point for an era both of reform and increased accountability at the student level for U.S. public education systems. Although “A Nation at Risk” prompted calls for a more rigorous curriculum, including higher expectations for students, the report offered little in terms of best practices or solutions to the issues behind
the data. As a response to “A Nation at Risk”—and later to the *No Child Left Behind Act*—many state and local schools adopted higher learning goals for all students.

Within three years of the release of “A Nation at Risk,” the Carnegie Forum on Education (1986) published a similar report, ironically entitled, “A Nation Prepared: Teachers for the 21st Century.” While differing from its predecessor in many ways, the Carnegie Report shared its fundamental conclusions—most notably, the call for a more rigorous curriculum and improved learning for all students. The report offered five recommendations, in the form of core statements, intended to improve greatly teachers’ ability to improve student learning. This original list, or what is known as, “the Carnegie Framework” (which loosely resembles the now-prevalent PLC frameworks), currently forms the basis of the National Board Certification for Teachers’ standards and criteria:

1. Teachers are committed to students and their learning.
2. Teachers have knowledge of subject matter for which they are responsible and know how to share this knowledge with students.
3. Teachers are able to plan, monitor, and assess student learning.
4. Teachers think systematically about their teaching, reflect upon their practice, and make adjustments based upon their reflection.
5. Teachers are members of learning communities.

Fifteen years later, President George W. Bush signed into law the *No Child Left Behind Act* (NCLB) (2001) on January 8, 2002. The Act served as President Bush’s education reform plan, and contained updates to previous education legislation, some of which dated as far back as 1965. NCLB changed the federal government’s role in K-12 education, in that it measured a school’s success based on individual schools’ student
achievement on standardized tests. The Act contained President Bush’s four basic education reform principles:

1. Increased accountability for results.
2. Increased flexibility and local control.
3. Expanded school choice and options for parents.
4. Reliance on research-based teaching methods and strategies.

Additionally, NCLB legislation forced schools to assess annually all students in the 3rd through 11th grades in the subjects of reading and math. States were told to set and define a proficiency standard on the assessment of their choice—essentially, a target achievement level for every student to reach, by the year 2014.

As shown in Figures 2.1 and 2.2, NCLB requires districts and schools to have all students reach proficiency on state-wide assessment in both math and reading. The year-by-year NCLB-Mandated Student Proficiency Trajectories for reading and math (Figures 2.1 and 2.2 below) chart proficiency trajectories (known as, “Adequate Yearly Progress”) that demonstrate the state expectations for annual improvement benchmarks. Schools that fail to make adequate progress toward the goals set forth in NCLB legislation will be identified. Furthermore, if target goals are not met, schools will face increasing degrees of state and federal sanctions for each year they fail to meet the standards. Schools that fail to show progress over multiple years face the possibility of closure and/or state takeover.
These trajectories shed some light on not only the demands placed on schools by federal legislation, but also the pressure school leaders face in improving achievement at their schools. One of the unintended results of these reform efforts is the now prevalent “quick-fix mentality” (Hord, 1997) of U.S. schools which—as Hord suggests—“... has
resulted in many schools being poorly prepared for their plans for change and therefore implementing change in superficial and substandard ways”. Brown and Spangler (2006) agreed with the notion of the quick-fix mentality, and noted, “When reforms fail, it is often because the school district has not established adequate systems that ensure sustainability” (p. 1).

On the topic of school reform and leadership, author Michael Fullan (1998) argues that, “Not only are the demands (of leadership and school reform) fragmented and incoherent, but even good ideas have a short shelf life as initiatives are dropped in favor of the latest new policy” (p. 1). Hord, Brown and Spangler, and Fullan all point to a critical issue with school reform efforts: among educational policy makers, reformers, and leaders, there is a track record of adopting the “next best thing”. The “next best thing” culture that exists with K-12 professional development has led to a sense of skepticism and a “this too shall pass” mentality among educators, many of whom have experienced first-hand a school or district’s failure to commit to and sustain school improvement initiatives over time. There is overwhelming evidence that well-designed staff development, fully integrated with effective school improvement practices, can increase student learning (Cohen & Hill, 2001; Consortium for Policy Research in Education, 2000; Elmore & Burney, 1999; Joyce & Allen, 1996; Joyce & Showers, 2002; Loucks-Horsley et al., 1998; Schmoker, 1996; Supovitz, Mayer, & Kahle, 2000; NSDC, 2006). To that end, the PLC movement offers districts a potentially financial-friendly improvement initiative that, in turn, offers teachers to learn and work with one another, which may minimize the urge to abandon PLCs and move on to a new initiative.
Accountability and Reform in the State of Iowa

Schools in the state of Iowa are required (in accordance with federal and state mandates) to test all students in grades 4, 8, and 11 in both reading comprehension and math. To measure elementary and middle school student performance in these subject areas, Iowa uses the Iowa Test of Basic Skills (ITBS). The state uses The Iowa Test of Educational Development (ITED) to assess secondary school students’ performance levels.

Despite the history of local control with no statewide articulated learning standards and benchmarks in the state of Iowa, the ITBS and ITED were selected nearly 75 years ago by the Iowa Department of Education, both of which now serve as the NCLB-required statewide exam. Assessments such as the ITBS and ITED are commonly referred to as, “norm-referenced tests”. Norm-referenced tests are designed to highlight student achievement differences between and among students to produce a dependable rank order of students across a continuum of achievement, from high achievers to low achievers (Stiggins, 1994). Often, schools use norm-referenced tests to identify and classify students appropriately, typically by the most appropriate grade level, according to the normed test results, as well as to extend appropriate services to students (such as acceleration programs and remedial programming). According to the Iowa Testing Programs (2011) website at the University of Iowa, “the main purpose for using a standardized achievement battery is to gather information that can be used to improve the instruction” (“Iowa Testing Programs—College of Education—The University of Iowa,” 2010).

At the time of this research, the lack of established statewide standards and benchmarks for student learning had earned the state of Iowa a unique position among public schools in the United States as the only state in the country without consistent and agreed-
upon statewide standards. Iowa elementary, middle, and secondary students typically experienced a locally-developed curriculum, which may or may not have had any connection to the ITBS or ITED. The lack of state standards and assessment that connected to them made it difficult for Iowa schools to fulfill the required norm-referenced testing components of NCLB with fidelity. Consequently, the ITBS and ITED have been looked upon from educators within the state of Iowa with a sense of skepticism, specifically as they relate to the NCLB requirement for all students to reach proficiency by the year 2014.

**Conceptual Frameworks**

Within the PLC model, there exist multiple conceptual frameworks. These frameworks are significant to the foundations of the larger PLC framework, and influence the success or failure of a PLC. Such frameworks include (1) learning organizations, (2) assessment, and (3) collaboration and teamwork. These frameworks will be discussed and explained in greater detail in the subsequent sections as they relate to the PLC model.

**Schools and Businesses as Learning Organizations**

In the decades following, “A Nation at Risk,” educators adopted the idea of implementing “learning organizations”—a term that was, at the time, *en vogue* in the business world—to respond to the new emphasis on sustainable reform. Peter Senge (2006) defined learning organizations as, “organization[s] where people continually expand the capacity to create 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). Citibank CEO Walter Wriston (as cited in Senge, 1990) claimed that, “The person who figures out how to harness the collective genius of the people in his or her organization is going to blow the competition away” (p. 2). In the article, “The
Leader’s New Work: Building Learning Organizations,” Senge quotes Ray Stata, Chairman of the Board of Analog Devices, Inc.: “The rate at which organizations learn may become the only sustainable source of competitive advantage” (2006, p. 1). As is often the case when compared to education, the business world was in front of the curve with the idea of employees working together as a learning community (or, “learning organization”, in Senge’s terms). The adult collaboration ideas described by Senge and Stata, although not directly connected to schools (student learning, curriculum, instruction, or assessment), relate to PLCs because of the focus on adults working together to achieve common goals and improve practice. The basic rationale for Senge’s learning organizations (as is also the case with PLCs) was that modern-day, successful organizations would be flexible and adaptive in their approaches to solving problems. For this to happen, Senge argued, the organization must tap into their employees’ motivation and capacity to learn across all levels of the organization.

Similar to the PLC core principles, Senge (2006) identified “five disciplines” necessary for learning organizations to be effective:

1. Personal Mastery.
4. Team Learning.
5. Systems Thinking.

For Senge, these five disciplines represented the intersection of theory and practice to develop the core capacity of learning within an organization. Comprising this core capacity were the goals of fostering both aspiration and reflective conversation, and understanding
complexity. Senge described personal mastery as individual team members’ inner drive to continually learn, but pointed to balancing personal mastery and team learning as essential practice for any learning organization. This reminder also holds true with the PLC framework, where individual and group learning are key components, with neither individual nor group learning being more important than the other.

In simplistic terms, systems thinking can be summarized as focusing on the goal(s) of the organization as a whole, instead of focusing on individual parts of the organization. Shared vision is essentially an agreed-upon picture of the desired future for the organization. In this model, systems thinking and shared vision have a close connection within a learning organization, with the vision clearly defining the end result for the organization, and a systems thinking approach aligning the multitude of “parts” of the organization to the greater vision. The vision-setting and systems-thinking literature from Senge has become a staple for federal, state, and local educational Boards of Control that have crafted vision and mission statements with the intention ensuring that schools clearly define the end result, which typically connects back to NCLB in some manner, given that it speaks to high levels of learning and proficiency for all students.

Even though these ideas were developed for business-oriented organizations, Senge’s idea was that employees possess an intrinsic motivation, curiosity, as well as joy in discovery, problem solving, and learning—key components to promoting an organization’s success through individual performance and collaboration. When compared with the multitude of PLC definitions that emphasize a focus on shared vision and commitment, learning, collaboration, and results—for example, from DuFour (2006), Hord (1999), Eaker & Many (as cited in DuFour et al., 2006)—the subsequent connections and influence
between Senge’s learning organizations and the PLC model of collaboration and adult learning are evident.

For the past three decades, school leaders have taken note of the concept of learning organizations, and have embraced the belief that the capacity to improve an organization (school and/or district) lies from within. Researchers who come from business-related disciplines, like Senge (2006), and educational-related authors, like DuFour et al. (2006), Rosenholtz (1989), Hord (1999), Warren-Little (1993), Eaker (as cited in DuFour et al., 2006), and Many (2006) agree that, regardless of whether the model is called a “learning organization” or a “PLC,” the concept and ideas hold potential for organizations to attain sustainable, long-term improvement. Schools began to embrace the notion that they could no longer operate when the thinking and leadership in the organization took place at the top and employees carried out their mission on the ground. Instead, a culture of collaboration and shared responsibility arose, specifically from the work of Senge (2006), DuFour et al. (2006), Rosenholtz (1989), Hord (1999), Warren-Little (1993), Eaker (as cited in DuFour et al., 2006), and Many (2006) and others, in response to the demands of the changing expectations for their organizations. Respected educational authors and researchers, such as Barth (2001), DuFour et al. (2005), Eaker et al. (2002), Fullan (2011), Lezotte (2010), Reeves (2010), Schmoker (1996), and Stiggins (as cited in DuFour et al., 2005) agreed that, “a school must transcend its dependence on a single leader and develop a collective culture that sustains improvement” (Stiggins, 2005, p. 24). In other words, PLCs offer a format that not only provides teachers with a structure to collaborate, but also offer the potential to facilitate teacher leadership.
Through the emergence and inclusion of effective business-realm problem solving techniques, many Iowa schools in the last decade have begun a transformation away from working in isolation to a focus on collaboration, away from a focus on individual and school-specific needs to a focus on systems thinking aligned with a shared vision. They have thus embraced learning for all members of the system. Although much work still remains before PLCs are viewed as a proven, go-to method for teacher professional collaboration that improves student learning, educators who work in innovative educational systems that embrace PLCs can take heart in Malcolm Gladwell’s (2002) conclusion that, “challenges that would be daunting and impossible if faced alone are suddenly possible when tackled in a close-knit group” (p. 264). Much like a PLC faced with improving student learning for all students in the face of federal mandates, Gladwell suggested that a small close-knit group could champion an idea or proposal until it reaches a tipping point that spreads throughout the organization. Gladwell’s notion that a small group of like-minded adults focused on the right “things” is the big idea behind what makes a PLC work.

**Use of Assessment**

Attention to student learning and assessment data is a key component of the PLC framework. Over the past two decades, many schools connected their focus on student learning to an emphasis on greater focus on classroom assessment. Some educators have suggested that the push for assessment has come from within our educational systems, as teachers and leaders have sought to become more “data driven” in their decision making; others have suggested the driving force behind the push on student assessment to be from the legislature. Regarding state standards and assessments, Reeves (as cited in Du Four et al., 2005) argues that, “standards must be accompanied by frequent common assessments in the
classroom. While the nation may be, according to the charges of many critics, over-tested, our students are actually under assessed” (p. 46). Reeves’ comments point both to state and federal legislature’s over-reliance on standardized testing as a measurement of school success in meeting mandates, as well as the under-reliance of formative assessment to inform instruction at the local level. The transition from reliance on summative assessment (‘‘assessments of learning” in PLC vernacular) toward the appropriate use of formative assessment (‘‘assessment for learning” in PLC vernacular) is another foundation of the PLC framework.

**Summative and Formative Assessment**

The use of ongoing assessment to inform and gauge student learning is one of the foundations of PLCs. Experts in the use of assessment agree that there are two types of assessment common to schools today: assessment of learning and assessment for learning, referred to as formative and summative assessments, respectively. On behalf of the National Middle School Association, Garrison and Ehringhaus (2007) suggest, “In a balanced educational system, both formative and summative assessments are part of information gathering” (p. 1). Balancing the assessment strategies used in K-12 schools today in lieu of over-relying on strictly summative assessment is one of the chief strategies PLCs offer, and which holds potential to make the goal of learning for all students increasingly easy.

Summative assessments tend to be cumulative in nature, and are implemented periodically to determine, at a specific point in time, what students do and do not know. Although summative assessments are often associated with high-stakes standardized tests (e.g., the type of assessments mandated in NCLB), summative assessments are used at the federal, state, and local levels of education. Common examples of summative-style
assessments include state assessments, district benchmark or interim assessments, end of chapter (end of unit) tests, and end of semester (term) tests.

Summative assessments can provide important information about student learning, as well as indicate the quality of classroom instruction; however, summative assessments are frequently criticized by educators on a number of grounds: (1) the lack of connection between summative assessments and standards/benchmarks; (2) the information they provide about a student’s performance comes too late to act upon; (3) summative assessments are typically only written for core-area subjects (math, science, social studies, language arts) and other content areas that are only easily assessed; and (4) their results are often used and interpreted in inappropriate ways, such as for rewards, mandates, and sanctions (Popham, 1999; Popham, 2008; Wainer, Braun, & Service, 1988; Baker & Linn, 2004).

Although NCLB and the accountability constructs built into the legislation connect to summative-style assessments, PLC supporters DuFour et al. (2006), Hord (1999), Eaker (as cited in DuFour et al., 2006), and Many (2006) believe that the interactive nature of formative assessment can lead to truly significant learning gains that summative assessments have failed to yield. Reeves (2010) used a medical analogy for comparing formative assessments to a physical examination, and comparing summative assessments with an autopsy: although useful, autopsies tend not to improve the health of their patients (p. 11). This assessment can be connected to the student and teacher-level, where summative assessments provide educators information about students, but often come too late to act upon to improve individual student learning.

Assessment expert Rick Stiggins (as cited in DuFour et al., 2005) explains that success is possible when evidence of student achievement is collected specifically to inform
instructional decisions and used to motivate students to learn (p. 65). Stiggins narrates prior failure with the more traditional models of education:

Our assessment legacy has been to use [summative] assessment to check achievement status. Traditionally, we have used assessments to discover how much our students have learned [at one] particular point in time. Our habit of mind has been to feed those results to adults in the system so they can make informed instructional decisions to help students . . . This in itself has been insufficient. (p. 74)

The type of assessment to which Stiggins refers is the use of norm-referenced tests (NRTs) and/or criterion-referenced tests (CRTs). Both NRTs and CRTs are considered assessments of learning (summative) in the PLC framework. Schools across the US are required by law to implement, monitor, and address multiple standardized measures of student performance. The federal legislature has greatly emphasized the use of NRTs because they allow for comparing valid and reliable results across larger populations of students. In this case, such assessments are essentially used as accountability assessments for schools. Examples of commonly utilized NRTs and CRTs include the ACT, ITED/ITBS, SAT, NAEP, and so on.

Although there is value in the use of standardized assessment in education, many researchers (Stiggins, 2002; Popham, 1999; Wainer et al., 1988; Fuhrman & Elmore, 2004) would argue that schools are being forced to overemphasize their value. Stiggins (2002) suggests that one of the main flaws in our school systems comes from over-focusing on standardized tests, and failing to include the use of “moment-to-moment” and “day-to-day” (formative) locally-developed assessments, the types of assessments emphasized in the PLC framework: “the problem [is] that such [summative] tests, ostensibly developed to ‘leave no student behind,’ are in fact causing major segments of our student population to be left
behind, because the tests cause many to give up in hopelessness” (p. 2). Stiggins’ sentiments resonate with educators, many of whom are fed up with being judged publically on a summative assessment that does not align with their curriculum or their teaching. Teachers and students instead might better be served through Stiggins’ suggestion for maximizing student achievement in the US by “. . . paying greater attention to the improvement of [formative] classroom assessment” (p. 1). Within the structure of teacher collaboration, effective PLCs implement frequent, ongoing formative assessment, and use student data to improve not only the students learning, but also the teaching as well.

Assessment expert James Popham’s (2008) widely-accepted definition of formative assessment maintains that, “formative assessment is a planned process[,] in which assessment-elicited evidence of students’ status is used by teachers to adjust their ongoing instructional procedures[,] or by students to adjust their current learning tactics” (p. 6). The key to Popham’s definition is that teachers use student data to adjust instruction. This step, although simple, differentiates PLCs from a group of teachers who simply meet and plan lessons together.

Within the PLC framework, the foundations for the use of formative assessment for learning stem from multiple theories on self-regulated learning and metacognition. According to Dweck and Leggett (1988), self-regulated learners are cognizant of their academic strengths and weaknesses, and have a repertoire of strategies they appropriately apply to tackle the day-to-day challenges of academic. Dweck and Legget’s work in self-regulated learning suggests that learners who are aware of and involved in the collection and analysis of their learning in a timely and understandable manner have greater confidence in their ability to take on challenging tasks. Self-regulated learning theory argues that greater
confidence ultimately yields a deeper understanding of subject matter, as well as increases the likelihood of learners giving their full effort in rising to academic challenges. This premise is perhaps the most important student-focused component of the PLC framework: involving students in their learning, and creating a sense of confidence in their abilities, results in increased student achievement.

The foundational changes within the PLC model versus traditional models of school improvement are that both formative and summative assessments should be utilized, and that assessment data be used intentionally and in various ways. The PLC model uses formative and summative assessment to improve student learning and teacher effectiveness. Through frequent and ongoing analysis of student learning, teachers are able to respond appropriately to gaps or misunderstandings in students’ skills. Formative assessments are used as a guide to adjust learning instead of as a reporting tool. Summative assessments are then used to evaluate wholesale results all the way from the individual student and teacher-level to entire departments (math, science, language arts, and so on) and schools. PLC researchers (DuFour, 2006; Hord, 2009; Eaker, 2006; Many, 2006) agree that the use of student data to inform teaching and instruction is often what separates the successful from the unsuccessful PLCs.

The PLC model combines the focus on standardized tests associated with NCLB with a heavy emphasis on formative assessment, or assessments for learning, at the classroom level. Sadler (1998) argued that instead of summative assessment of students for reporting purposes, “by formatively gauging student learning, offering immediate feedback, and instantaneously providing appropriate interventions, modifications, and accommodations, increased student learning for all will result” (p. 8). A professional collaboration model that can merge strategies intended to improve student learning on standardized tests, as well as
locally-developed criteria, offers school leaders a solution to improve learning that satisfies internal (local) and external (state and federal) demands.

It is apparent in both PLC-specific and non-PLC literature that a number of best practices exist (in the use of formative assessment) as a tool for feedback and improvement. Nicol and MacFarlane (2006), for example, identified seven principles of good feedback in facilitating self-regulation (formative assessment):

1. Helps to define good performance (goals, criteria, expected standards).
3. Delivers timely and appropriate information to students about their learning.
4. Encourages teacher and peer dialogue about learning.
5. Encourages positive motivational beliefs and self-esteem.
6. Provides opportunities to close the gap between current and desired performance.
7. Provides information to teachers that could be used to help shape teaching.

These rigorous principles offer teachers and PLCs a roadmap of best practices in working with formative student data, a skill that many individual teachers and PLCs do not possess. With the main goal of NCLB being that all students achieve academic proficiency by 2014, the seven principles of quality formative assessment offer teachers/PLCs easy-to-implement strategies that shift the purpose of feedback from what now stands as a largely reactive role to a more proactive role that promotes student confidence and control of their learning.
Within the constructs of a PLC, Stiggins (as cited in DuFour et al., 2005) identified five roles of a teacher’s progression in a PLC when using formative assessments for student learning:

1. Start by clearly understanding the standard to be mastered.
2. [Translate] the standard into understandable and enabling classroom achievement targets.
3. Create a student-friendly version of those targets to share with students throughout their classroom experience.
4. Create rigorous assessments of those classroom targets.
5. Use those assessments in collaboration with students to track improvement over time. (p. 76)

Stiggins’ progression ties into the work of Nichol and MacFarlane in four main ways:

1. Learning outcomes must be clearly defined;
2. Environment, motivation, and self-esteem are acknowledged as factors that influence learning;
3. Assessment results are used to inform student learning and teaching;
4. Dialogue is encouraged from teacher to student, and teacher to teacher. The work of these experts is significant in terms of the structural formation and benefits of PLCs as it relates to the use of student learning data to guide instructional decision-making.

Six years prior to this dissertation, PLC experts agreed that to influence practice and improve student learning effectively, a combination of effective assessment practices must be combined with professional collaboration and cooperation among teachers. DuFour, DuFour, and Eaker (2005) argued that the end result of collaborative best practices meeting effective assessment practices was the creation of a, “community of confidence through assessment”
(p. 81), and concluded that such a community held the potential to improve student learning in ways not commonly seen in the country.

For many years, and presently, school leaders have embraced the assessment philosophies of Stiggins, Dweck and Legget, Popham, and DuFour and Eaker. Schools across the country are also beginning to embrace the PLC framework and the use of student learning data as means for fulfilling their mission and vision of learning for all students. School leaders now also count on the combination of collaboration, effective use of assessment, and the focus on learning as means for meeting the increased legislative demands placed upon them. Although many schools and districts find success with the PLC model, one element currently emerging as a significant part of the framework—and which is often overlooked—is the importance of the PLC team and teamwork itself.

**Collaboration and Teamwork**

Despite an overwhelming body of evidence that suggests collaboration and collegial relationships represent best practice in the recruitment, retention, and professional improvement of teachers, a culture of teacher isolation is deeply entrenched, and even embraced, in many school systems. Guarino, Santibanez, and Daley’s (2006) research on teacher retention overwhelmingly indicates lower turnover rates among teachers in school districts where collaboration is emphasized (p. 2). Futernick (2007) argued that over 2,000 teachers felt greater personal satisfaction when strong collegial relationships had been established in their districts, compared with districts where collegial relationships were not emphasized (p. 3). Goddard, Goddard, and Taschannen-Moran (2007) surveyed 452 teachers in 47 elementary schools to determine the extent to which they worked collectively to influence decisions related to school improvement, curriculum and instruction, and
professional development. They found a positive relationship between teacher collaboration and differences among schools in mathematics and reading achievement (p. 880). Despite the body of evidence in support of collaboration, there are many difficulties associated with implementing collaborative models of teacher and program development—most notably, the deep entrenchment of teacher isolation that exists in many schools.

DuFour et al. (2009) have indicated that collaboration and teamwork is often the missing element that separates effective PLCs from those that struggle. Many schools have been intentional about modifying schedules and creating opportunities that allow teachers to collaborate, but have failed to assist and support teachers in learning to work together, collaborate, and function within a true PLC framework. Darling-Hammond (1999) clarified this discrepancy, specifically by contrasting situations where a team of teachers “meet” with the specific ways that PLCs ensure collaboration: “when schools are strategic in creating time and [emphasis in original] productive working relationships within academic departments or grade levels, across them, or among teachers school wide, the benefits can include better instruction and more success in solving problems of practice” (p. 11). Michael Fullan (2011) further added to this argument by emphasizing the benefits of teacher collaboration under a PLC model—not only to teachers themselves, but also to the school system in which they work. He found that, since the late 1970s, research has proven consistently that collaborative cultures, “result in better learning for students, [specifically when] teachers focus on improving their teaching practice, learn from each other, and are well led and supported by school principals” (p. 2). Like DuFour et al. and Darling-Hammond, Fullan clearly shows that, when teachers are supported and collaborative cultures are established, the likelihood of improving student learning greatly increases.
Although collaborative models for schools and educators are gaining momentum across the country, and in various forms, researchers like Jackson and Bruegmann (2009) agree that educators are still not taking advantage of collegial learning (a component of PLCs) to the fullest extent. Their 2009 research on the importance of peer learning for teachers documented that students have larger test score gains when their teachers have more effective collegial relationships (p. 1). Darling-Hammond et al. (2009) suggested that, “overall, the kind of high-intensity, job-embedded collaborative learning that is most effective is not a common feature of professional development across most states, districts, and schools in the United States” (p. 4). Furthermore, Fullan (2011), Darling-Hammond et al. (2009), and Jackson and Bruegmann (2009) all expound the benefits of teachers working collaboratively and learning from one another. The PLC holds the potential to serve as a mechanism for this type of job-embedded, collaborative learning opportunity in lieu of isolation, and benefits students, teachers, schools, and districts.

Teacher collaboration is one of the foundations of the PLC model and, therefore, one of the most important components of the PLC framework. Louis and Marks (2011) have described collaboration within the PLC model as the de-privatization of educational expertise and sharing of practices among teachers. Judith Warren-Little (1990) described PLC collaboration as the exchange of expertise, and suggested that not only is collaboration, “a natural outgrowth of reflective dialogue and de-privatized practice,” but also that, “collaborative efforts enhance shared understandings[,] and reinforce the mosaic of relationships within the school that enhance teacher resiliency” (p. 510). The act of working together and sharing professional practice serves as the foundation of a PLC, as the other
components of the framework (inclusion of common formative student data and response to intervention) are not possible until teachers are able to work together.

Collaboration by itself, however, is not enough to improve student learning. As Darling-Hammond et al. (200) have correctly pointed out, simply having teachers “meet” without a guiding framework does not reflect the rigor of PLC collaboration—at best, such unguided “meetings” may produce uncertain outcomes; at worst, they may result in superficial pedagogy decisions that are more harmful than helpful. PLC conversations must focus on meeting the guidelines of the PLC framework and integrate curriculum, instruction, and assessment criteria.

Thus, far from focusing simply on rules, teachers’ collaborative discussions and actions within a PLC should center on opportunities for students to learn (Darling-Hammond et al., 2009; DuFour et al., 2008; DuFour et al., 2006; DuFour et al., 2005). As Louis and Marks (1998) have argued, schools that foster an environment of teacher collaboration promote for students an increased sense of belonging, engagement, and connection to their schools. The PLC offers these benefits for students (engagement, motivation, connection to schools), while at the same time fosters a sense of belonging and self-fulfillment for teachers.

The discussion thus far is not simply to say that PLCs are, intrinsically, free from error or difficulty simply by virtue of their methodology. Lencioni (2002), for example, studied the qualities of successful and unsuccessful teams, and identified a framework of five dysfunctions that prove to be insurmountable barriers for unsuccessful teams. Although Lencioni’s work generally takes on the perspective of unsuccessful business teams, his findings connect logically to the broader literature on the role of teamwork within effective groups, as well as with the PLC framework. The most significant dysfunction of a team is the
absence of trust. Trusting teams operate with the best intentions, which eliminates the need for members to be protective or careful around the group. Sergiovanni (1992) explained that an effective learning community as one in which there exists, “... a connectedness among members that resembles what is found in a family, a neighborhood, or some other closely knit group, where bonds tend to be familial or even sacred” (p. 47). Lencioni’s and Sergiovanni’s statements on the importance of trust and collegial relations highlight that which research from Wiseman and Arroyo (2011), Wiseman (2008), West (2004), Gruenfeld (2004), and Cohen and Bailey (1997) have identified as perhaps the most important implication in operating as an effective PLC: laying the groundwork as an effective team before moving into the subsequent components of the PLC framework, such as focusing on curriculum, instruction, and assessment work.

The second dysfunction Lencioni (2002) lists is fear of conflict, such as when effective teams understand that some conflict can aid in production of the best solution, often in the most efficient manner. The third type of dysfunction is lack of commitment. Lencioni defines lack of commitment simply as a lack of clarity and/or buy-in from team members. The fourth dysfunction is avoidance of accountability, which Lencioni characterizes as unwillingness to tolerate discomfort associated with calling out a peer on his or her behavior. Another way of looking at the fourth dysfunction is the tendency to avoid difficult or tough conversations. The fifth and final type of dysfunction is inattention to results, which Lencioni suggests, “is the tendency of members to care about something other than the collective goals of the group” (p. 216). Lencioni’s work touches on many of the same characteristics as effective PLCs. That is, in positive terms, a strong level of trust, commitment, accountability, and a focus on results lays the groundwork for any effective group of people, including
effective PLCs. Wiseman (2008) supports Lencioni’s findings in concluding that schools with strong evidence of PLCs had substantially higher degrees of “teamness” (as measured in Harvey & Drolet, 2003) that connect all five of Lencioni’s teamwork attributes as strong evidence within a PLC. All of Lencioni’s findings are salient to the ultimate success or failure of a team (or PLC). Research from Wiseman (2008), West (2004), and Cohen and Bailey (1997) overwhelmingly suggest that teams that fail to lay the groundwork for effective practice, regardless of their field (business, education, and so on), ultimately have a significantly diminished chance of achieving their intended outcomes.

While Lencioni and Sergiovanni stress the sanctity of the bonds between members of a learning community, Hord (1997) first provided the structure by which that bond is reinforced and put to productive use within the educational realm. She identified five equally important attributes of a PLC (which emerged from her exhaustive review of effective learning communities):

1. Supportive shared leadership.
2. Collective creativity.
3. Shared values and vision.
4. Supportive conditions.
5. Shared personal practice. (p. 21)

Hall and Hord (2006) further explained that in addition to collegial relationships and collaboration, frequent team assessment of practices and the impact on student learning was a necessary component of an effective learning community. She argued that, ultimately, assessment of practice and agreed-upon response to ineffective results were practices that separated a traditional teacher team from a learning community. Hord’s (2004) work also
identified the importance of the role of school administrators in a PLC. She concluded that,
in an effective learning community, “administrators, along with teachers, must be learners:
questioning, investigating, and seeking solutions for school improvement and increased
student learning. The traditional pattern that teachers teach, students learn, and administrators
manage is completely altered” (p. 8). Hord’s suggestions on the inclusion of administrators
as a vital component changed the dynamics of principals’ and administrators’ role from being
supervisory, and which emphasizes compliance, to actually being important and
contributing members of the PLC.

The final component of Hord’s (2004) model includes shared vision and values. Her
research qualified the fact that there is no “one size fits all” method for arriving at a
collective, shared vision with staff; however, “although the process for the development of
each school’s vision varied from site to site, the principal at each school, without exception,
supported teacher involvement in the development of the vision” (p. 46). The struggle in
education between “one size fits all” and complete differentiation of professional needs still
exists today; however, Hord’s remarks laid the ground work for PLCs to operate in a way
that not only meets their needs as a team, but also aids in accomplishing the larger, systemic
goals of the district (including the requirements/sanctions imposed by state and federal
government).

Hord’s research on PLCs was the earliest findings specifically related to the term,
“PLC”. Although her work began in the early 1980s, many of the trends and themes she
identified still hold true for effective PLCs today, not to mention having served as the basis
for subsequent PLC research (Rosenholtz, 1989; Warren-Little, 1993; DuFour et al., 2002;
DuFour et al., 2004; DuFour et al., 2005; DuFour et al., 2006; DuFour et al., 2008; and
DuFour et al., 2011). Collectively, the work of Hord and subsequent researchers has shaped our understanding of PLC best practices, specifically regarding the significance of teamwork within the PLC structure.

**Collaborative Learning Theory**

The conceptual underpinnings of the PLC model are directly connected to collaborative learning theory. Collaborative learning theory itself is based on the conceptual assumption that groups of people who learn together can capitalize on one another’s resources and skills. As it relates to PLCs, collaborative learning refers to the methodology and environment in which teachers engage in a common task, and where teachers depend on and are accountable to each other in the name of improved student learning.

Yoon, Matsui, Yamada, and Nof (2009) have shown that adult collaboration and group work can create many beneficial outcomes, compared to traditional forms of working in isolation. Furthermore, Chiu’s (2000) findings on group problem-solving and social interactions revealed that collaboration can yield many beneficial outcomes for group members, specifically in the forms of increased learning, decreased tension, and improved attitudes (p. 27).

In many ways, PLCs (and collaboration theory) are heavily rooted in psychologist Lev Vygotsky’s (1986) work with the theory of zone of proximal development (ZPD). Vygotsky defined ZPD as the difference between what a learner can do and is capable of without help, versus what the learner is capable of with help. The essence of a PLC is collaborating and improving learning; Vygotsky’s ZPD and collaborative learning theory would support this model, and suggest that the range of skills that can be developed with peer collaboration (PLC) exceeds that which could be attained alone.
Vygotsky’s theory of ZPD was later expanded upon and further developed by more researchers (Brown & Campione, 1994), specifically as it relates to student interventions—such as reciprocal teaching and dynamic assessments. Both Vygotsky’s and Brown’s work suggest that learners (both adults and children) are often capable of achieving greater success with help, as opposed to working in isolation. Today, collaborative learning still manifests itself in a variety of approaches that have redefined traditional relationships between students, families, teachers, and administrators, where groups are required to work collectively to achieve a solution to a problem and/or demonstrate their understanding and learning of a particular concept.

**Defining PLCs**

Despite their relatively short history, Professional Learning Communities have been conceived of in different ways. For this purpose of this study, understanding the ways their identity has changed allows for a deeper understanding of their applicability to education environments. Educational expert Mike Schmoker (as cited in DuFour et al., 2005) defined a PLC as, “a group of teachers who meet regularly as a team to identify essential and valued student learning, develop common formative assessments, analyze current levels of student achievement, set achievement goals, share strategies, and then create lessons to improve upon those levels” (p. xii). For the purposes of this dissertation, Schmoker’s definition of a PLC is appropriate, with its focus on teams that share common goals, decision-making and collaboration, and that utilize student data to guide their work.

The administrative benefits of PLCs do not extend only to methods and criteria, however. The emerging trends and philosophies in PLC research, according to DuFour et al. (2006), perceive of schools and districts that function as learning communities as thinking
differently from those that do not. That is, PLCs operate within a collaborative framework where teamwork, learning, and collective wisdom are emphasized.

The shift from the traditional model of education, where teachers work in isolation, to a collaborative culture is not a simple transition. Although researchers like Chenoweth (2009), Matier (2007), Schlichte, Yssel, and Merbler (2005), Drago-Severson and Pinto (2006), and Ackerman and Mackenzie (2006) agree that successful schools reduce teacher isolation by providing time for teachers to work and learn together, isolation is still the norm in many K-12 institutions, including those in the state of Iowa. PLCs offer a concrete way to combat this problem, in that implementing them would give school leaders an evidence-based strategy for reducing teacher isolation and the opportunity to provide a structure wherein teachers could work together and improve practice. Chenoweth (2009) took this point further by arguing that PLC involvement enables teachers to improve the quality and consistency of their teaching, and across all grade levels. In Chenoweth’s own words, “teachers in those schools assume responsibility for teaching what they want students to know” (p. 41).

Although numerous definitions of a PLC exist, the core principles of the models remain consistent throughout the literature: (1) a focus on ensuring that students learn, (2) a culture of collaboration, and (3) a focus on student results (DuFour et al., 2008; DuFour & Marzano, 2011; Graham & Ferriter, 2009; Hord, 1997; Rosenholz, 1989). Eaker et al. (2002), further argue that

Schools that function as professional learning communities are always characterized by a collaborative culture. Teacher isolation is replaced with collaborative processes that are deeply embedded into the daily life of the school. Members of a PLC are not
invited [simply] to work with colleagues: they are called upon to be contributing
members of a collective effort to improve the school’s capacity to help all students
learn at high levels. (p. 5)

These remarks recall those of Senge, not only regarding team collaboration, but also the
significance that the PLC model gives to shared vision and systems thinking. True PLCs not
only collaborate and implement effective team practices that help guide their work as a PLC,
but also connect that work to the larger mission of their school building, not to mention the
school district.

The literature on school improvement overwhelmingly shows that schools that fail to
transform their focus on teaching to a focus on learning, and from a culture of isolation to a
culture of collaboration, continue to fail in their school improvement efforts and initiatives.
The traditional style of infrequent and disconnected professional development is losing steam
to more frequent, in-house efforts focused on improvement from within. For example,
Darling-Hammond et al. (2009) have defended the PLC model over some traditional
professional development models for teachers, stating that, “rigorous research illustrates the
shortcomings of the occasional, one-shot workshops that many school systems tend to
provide, [and] which generations of teachers have deride[d]” (p. 9). Reeves (2010) further
defined criteria for a transformed educational system, or high-impact professional learning,
in contrast to traditional teacher development models, by identifying three characteristics
essential to such models: (1) a focus on student learning, (2) rigorous measurement of adult
decisions, and (3) a focus on people and practices, not programs (p. 21). These three
characteristics have a strong connection to PLC work with (1) its focus on learning (student
learning and adult learning), (2) the inclusion of data (measurement) to inform future
decision-making, and (3) the ongoing examination of the work of teachers through their curriculum, instruction, and assessment practices.

Whether called professional learning networks, data teams, communities of practice, teacher teams, grade-level teams, study teams, or PLCs, teacher collaboration and its potential to improve student learning is the hottest trend in educational reform circles. Experts at the publishing company Solution Tree are widely considered the leading authority in PLCs. Authors published by Solution Tree, including DuFour et al., have refined and developed PLC resources for teachers and administrators for nearly 20 years. At the time of this research, one hundred and fifty-eight schools across the United States, and six schools in four different provinces in Canada had met the rigorous Solution Tree criteria for selection as a PLC model school (DuFour, 2011). As a specific example of the prevalence of PLCs in central Iowa, eighteen out of eighteen schools in the Central Iowa Metropolitan League (athletic and activities conference for this research site) were involved with differing levels of PLC work at the time of this research.

**Professional Learning Community Frameworks**

This research focuses on two prevalent PLC-specific frameworks: DuFour and Eaker’s (1998) model and Hord’s (1997) model. Hord’s model was the original PLC model that identified and operationalized the importance of teacher collaboration, with topics centered on the improvement and development of consistent curriculum, instruction, and assessment. Hord’s list of PLC criteria emerged through exhaustive synthesizing of case studies, eventually identifying five attributes of a PLC:

1. Supportive and shared leadership.
2. Collective creativity.
(3) Shared values and vision.

(4) Supportive physical and human conditions.

(5) Shared personal practice. (p. 6)

Hord’s (1997) findings are the foundation of the emergence of the PLC model, in that she merged five separate, but equally important influencers of school improvement—professional development, collaboration, curriculum, instruction and assessment, and school culture—into a clear and concise model for improvement. Hord’s original PLC research and PLC attributes are still observable in more recent and updated PLC models that are based on her work.

One example of the Hord framework being condensed and updated is by DuFour et al. and their staff at Adlai Stevenson High School (1998; 2005; 2006) (referred to hereafter interchangeably as “the DuFour et al. framework” or “the DuFour et al. model”) into what is now a widely accepted and understood model for PLC work (I created a visual representation of this model specifically for this dissertation, see Figure 2.3). The DuFour et al. model organizes the work of a PLC with four guiding ideas, or “critical questions”. Its major assumption is that if teachers participate in frequent, ongoing opportunities to collaborate and work together to answer the four critical questions, then student learning will improve as a result. DuFour et al.’s critical PLC questions include

(1) What do we want students to know and be able to do?

(2) How will we know if students have learned what we intended?

(3) How will we respond if students do not learn what we intended?

(4) How will we respond if students already know what we intended to teach them?

(p. 183)
Therefore, the guiding principles essentially focus on student learning, frequent and ongoing opportunities for teachers to collaborate, the inclusion of student learning results in the form of formative assessment, and the opportunity to adjust instruction to fit the needs of students. DuFour et al. (2005) suggested that one of the key differences between a true PLC and one that provides only lip service to the work is the focus on the third question of the model (p. 33), which focuses on teacher response to student academic struggles. Historically, K-12 educational institutions have adopted and embraced the philosophy that, “it’s the teachers responsibility to teach and the student’s responsibility to learn”; however, the PLC work of DuFour et al. challenges this philosophy, and asks teachers to respond with academic interventions with students who fail to grasp essential curricular standards.
DuFour et al. (2005) have also identified philosophical differences between schools that operate under traditional models of schooling, and those that function and operate as PLCs (Table 2.1). A compilation of the literature on PLCs outlines the following comparisons between schools that operate as a PLC, and those that do not:
Table 2.1  
*Comparison of PLCs and Traditional Schools (Non-PLCs)*

<table>
<thead>
<tr>
<th>PLCs</th>
<th>Traditional Schools (Non-PLCs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on learning</td>
<td>Focus on teaching</td>
</tr>
<tr>
<td>Fixation on what students</td>
<td>Emphasis of what was taught</td>
</tr>
<tr>
<td>learned</td>
<td></td>
</tr>
<tr>
<td>Demonstration of student</td>
<td>Coverage of content</td>
</tr>
<tr>
<td>proficiency</td>
<td></td>
</tr>
<tr>
<td>Working collaboratively</td>
<td>Working in isolation</td>
</tr>
<tr>
<td>Internal experts and job</td>
<td>External experts and training</td>
</tr>
<tr>
<td>embedded learning</td>
<td></td>
</tr>
<tr>
<td>Focus on results</td>
<td>Focus on inputs</td>
</tr>
<tr>
<td>Collective vision</td>
<td>Vision developed by a few</td>
</tr>
</tbody>
</table>

Within the DuFour et al. framework, the conclusion can be drawn that the third and fourth PLC critical questions separate a “group” of teachers (non-PLC in Table 2.1) versus a PLC. The shift in thinking to include not only responses to students’ academic difficulty, but also acceleration of gifted and advanced students, can only be accomplished by an effective team focusing on a shared vision, using consistent curricular materials, and collaboratively designing systemic responses. In other words, such work could only be accomplished by a true PLC.

The research for this dissertation was conducted in a school district that has embraced the DuFour et al. model of PLCs; accordingly, DuFour et al.’s model is the primary framework for this study. The teacher survey instruments for this study were developed using both DuFour et al.’s and Hord’s frameworks, with the inclusion of multiple collaboration and best practice frameworks from a variety of resources. More specifically, the teacher survey instrument developed through this dissertation was created by merging the work of previous researchers (Hord, 1997; Huffman & Hipp, 2003; Solution Tree, 2010; Kruse, Louis, & Bryk, 2010), and adapting it to fit the needs of the school district, so that all questions related
thematically directly to either a teamwork best practice and/or the DuFour et al. PLC framework. Hord’s Likert scale survey (using her five attributes of a successful PLC) was used as a guide in the development of the survey, along with scholarship and survey samples from the North Cascades and Olympic Science Partnership PLC Observation Protocol (2008), the Appalachia Educational Laboratory Teaching Questionnaire, the Leaders Edge Network Leadership and PLC Survey, and several team practice and protocols from the National Staff Development Council’s (2008) book, Team to Teach (See Chapter 3, “Methodology”, for specific details regarding this study’s survey development, validity, and reliability).

**Summary**

An overwhelming collection of research and literature exists on school improvement, professional development, collegial collaboration, and PLCs. This review focused on a historical perspective of all four areas, as well as the emerging themes and trends in current research. A general understanding of professional development and school improvement best practices is necessary to grasp the complexities of the PLC framework and the potential value it holds for improving teacher effectiveness and student learning.

Additionally, this chapter discussed the following considerations and talking points to create a comprehensive understanding of PLCs:

- Educational Consequences of the No Child Left Behind Act of 2001.
  - Increase in student accountability for schools.
- Shift from focusing on teaching to focusing on learning.
- Focus on assessment (formative and summative).
- Inclusion of data in decision-making.
• Shift from isolation to collaboration.
• Increased belief in the power of teacher professional development.

The existing literature on PLC frameworks offers a concrete and innovative approach for structuring teacher collaboration and improving student learning. However, and perhaps because of the relatively recent adoption of PLC models in education, the relationship between teachers’ participation in a PLC and their students’ learning is still largely unknown. This unknown relationship constitutes a gap in justifying the effectiveness of PLCs, and is the focal point for this dissertation research.

Nearly fifteen years ago, Hord (1997) cautioned that knowledge of learning communities was still in its infancy (p. 56). While many strides have been made in developing learning communities, Hord’s comments still hold true today. Thus, this dissertation follows up on Hord’s words of caution by offering an initial examination of the relationship between PLC implementation and student learning. A triangulated approach to quantitative data collection (local student achievement results comparison data, failure rate comparison data, and teacher survey data) was used to examine student learning in light of the PLC framework. The overall goal of this research was to build on and add to an emerging body of evidence that validates the investment in teacher collaboration through PLCs as a method both for improving teaching and student learning.
CHAPTER 3: METHODOLOGY

Research is finding out what you don’t already know. No one knows everything, but everybody knows something. However, to complicate matters, often what you know, or think you know, is incorrect.

Richard F. Taflinger (1996)

Introduction

The purpose of this research was to investigate the relationship between the independent variable (having a teacher who participated in a PLC) and the dependent variable (student achievement) using a quasi-experimental research design. The quasi-experimental design of this research compared nonequivalent groups, which allowed for the most similar context to compare the participants and variables in this case. For this research, two years’ worth of student data (compiled by their participating teacher within a PLC) prior to implementing PLCs served as the comparison/control group, while two years’ worth of student data (again, compiled by participating teacher within a PLC) after the implementation of PLCs served as the program/treatment group. Teacher-participants in this study were also surveyed on their perceptions of the effectiveness of their PLC, using a locally-developed, non-probability survey, with the purpose of comparing teacher perception of their PLC work with the actual performance of their students before and after the participating teacher had taken part of a PLC.

Research Questions

The overarching research question guiding this research study was: What is the relationship between teacher participation in a Professional Learning Community and student learning in one Midwestern suburban 10th–12th grade high school?

Three sub-questions guided this study:
(1) What statistical relationship exists between teacher participation in a PLC and student learning (as measured by students’ end of term letter grades)?

(2) Is there any difference in the percentage of students that fail a class when their teacher participates in a PLC?

(3) Is there any difference in student learning (as measured by students’ end of term letter grades) in PLCs that demonstrate strong evidence of operating as a PLC, as measured by the Aylsworth PLC Survey?

**Methods**

Creswell (2009) describes quantitative approaches to research as research that tends to utilize a Postpositivist worldview, experimental strategy of inquiry, and pre-/post-test measures of attitudes (p. 16). The three methods of data collection included in this research are quantitative in nature, and include: (1) statistical analysis of student achievement data pre-/post-PLCs, (2) comparison of student failure rate data pre-/post-PLCs, and (3) teacher survey data.

**Data Sources**

In general, educational research can be difficult to conduct for a variety of reasons. One of the main assumptions of the methodology for this study is that student learning can be quantified. Although there are concerns about the reliability of letter grades as a valid measure of academic performance, the dependent variable (student learning pre-/post-PLCs) was selected because secondary schools often view student letter grades as the most significant data collection point. End-of-course letter grades (the dependent variable in this study) were used as a permanent data point on student transcripts and in post-secondary institutions when examining such data as admissions requirements, class rankings, and grade
point averages. Additionally, a focus on student results (grades) commonly forms a main tenet of PLC implementation. Thus, in the absence of articulated state standards and assessments at the time of this research, student letter grades constituted the most appropriate measure of student learning.

Generally, PLC literature has spoken less about a connection to results on norm-referenced assessment than it has on performance and adjustment within a PLC, based on local formative and summative assessments. Therefore, locally established criteria (student letter grades) served as the main dependent variable in this study. Data for this study were accessed from one high school (within one district) in the state of Iowa during the 2007–08, 2008–09, 2009–10, and 2010–11 school years. Local student achievement data (compiled by teachers) were accessed via Infinite Campus, the participating district’s district-wide student management database.

**Pre-/Post- Student Achievement Data Analysis**

Descriptive quantitative research methods were used for this component of the research design to examine the relationship between the dependent and independent variables. The dependent variables in this research were students’ end-of-course letter grade results (compiled by their corresponding teacher and PLC). Also, a pre-/post- model was utilized to compare student results before and after the implementation of PLCs (independent variable).

Non-equivalent group design allowed for analysis of multiple groups of student data in this study with a program group (students whose teacher had participated in a course-specific PLC, or “post-PLCs”) and a comparison group (students whose teacher had not yet participated in a PLC of any kind, or “pre-PLCs”). The rationale for selecting a pre-/post-
PLC comparative model seemed the most appropriate in quantifying the relationship between PLCs and student performance for the program group. Because the PLC was intended to help teachers and students improve, selecting targeted groups of students who had taken a class with a teacher who was not in a PLC (pre-) and comparing their achievement levels with a different group of students (with the same teacher now participating in a PLC) allowed for the most similar comparison between two different, yet comparable groups. In this case, the teacher having participated in the PLC served as the independent variable, with student achievement serving as the dependent variable.

Using purposive sampling—and comparing student letter grades, by teacher, before and after the teacher had participated in a PLC—Welch’s t-test (1947) was selected as the most appropriate statistical model, due to the unequal sample sizes and unequal variances of the two sample groups of students. Welch’s t-test is a modification of the t-test for independent samples, because it does not assume equal population variances. In the Welch t-test, degrees of freedom are modified to account for unequal sample sizes and unequal variances. Additionally, the standard of error in the Welch t-test does not pool the sample variances to estimate a common population variance, which is an important qualifier, because this study compares two different samples. In this research, the variance may be different from one class or year to another class or year. To pool the variance would assume that an incorrect equivalence existed between every class and every semester within a school year, since four different samples of student grades were compared. The Welch t-test operates under the assumption that the observations in the test are independent from one another, and that samples were drawn from normal populations.
The Aylsworth PLC Survey

The Aylsworth PLC Survey was originally created as a component of an unpublished capstone research project (Aylsworth, 2011), and presented a comprehensive review of PLC surveys and research instruments. The intended purpose of the Aylsworth PLC Survey component in this study was to survey teachers’ perceptions of the effectiveness of their PLC, and to connect that survey data back to their students’ results. By assessing student data and assessing teachers, this study sought to address a noticeable gap in PLC research, specifically by attempting to understand the relationship between the teachers’ perceptions of their work with their actual student achievement results. This survey was cross-sectional, with data collected online at only one point in time. Survey data was only collected at one point in time because the survey instrument had not yet been created at the beginning of the PLC initiative at this research site. Babbie (as cited in Creswell, 2009) has noted that survey research provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population (p. 12). The survey research conducted for this study met this definition, and was intended to solicit feedback from teacher-participants who met the criteria for this study. The online format was beneficial in collecting, analyzing, and organizing a large number of data points, as well as in soliciting feedback from multiple participants in a cost-effective manner. Thirty-nine teachers who met the criteria for this study (See “Abstract”) were targeted for participation, and all thirty-nine responded.

The survey instrument utilized for this study was based mainly on the work of researcher Shirley Hord (1997). Her survey identified five attributes of a PLC—attributes that were interwoven into the Aylsworth PLC survey (Table 3.1). Hord’s work differs from
most other PLC surveys, and served as the basis for the Aylsworth PLC survey, because it allows for understanding the degree to which a school performs as a PLC. It has been rigorously tested for validity and reliability (Hord, 1997). Although not completed for the Aylsworth PLC survey, Psychometric testing of the Hord survey instrument was established using Cronbach’s (1951) alpha test for internal consistency and a test-retest format for stability. The Cronbach’s alpha rating of Hord’s survey was .92 (where a score of .75 or above indicates appropriate instrument internal consistency). The test-retest measure for reliability was .94 (again, .75 or above indicates appropriate instrument internal consistency). A validity analysis of Hord’s survey was conducted using content, concurrent, and construct validity. The usability, reliability, and validity tests conducted on Hord’s survey all met or exceeded established criteria for use in academic research (Hord, 1999, p. 7), which made them appropriate for use in this dissertation research.

Due to the validity and reliability of Hord’s (1997) PLC survey instrument, the following table was created to show connections between Hord’s design and the Aylsworth PLC Survey:

Table 3.1
Aylsworth PLC Survey Connection to the Hord PLC Survey

<table>
<thead>
<tr>
<th>Hord Survey PLC Attributes</th>
<th>Descriptors within Hord Survey</th>
<th>Connection to Aylsworth PLC Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supportive &amp; Shared Leadership</td>
<td>• Administrative support &amp; active participation</td>
<td>Q6, Q7, Q8, Q9, Q13, Q15, Q17</td>
</tr>
<tr>
<td></td>
<td>• Collective wisdom</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Sense of team</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Goal setting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Everybody learns</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Shared decision-making &amp; authority</td>
<td></td>
</tr>
</tbody>
</table>
As in Hord’s survey, the locally developed Aylsworth PLC Survey asked participants to reflect on closed-ended questions related to their perceptions on the effectiveness of their PLC. The survey was administered online, with questions written using a four-point Likert scale (Likert, 1930), with “strongly disagree, disagree, agree, and strongly agree” as options for responses. For meeting the goal of measuring participants’ true perceptions of PLCs, a

<table>
<thead>
<tr>
<th>Table 3.1 Continued</th>
</tr>
</thead>
</table>
| **Shared Values & Vision** | • Common language  
• Strategic roadmap  
• Developed collectively  
• Norms of behavior  
• Trust  
• Open Communication  
• Focus on quality | Q7, Q9, Q11, Q13, Q17 |
| **Collective Creativity** | • School as a learning organization  
• Continuous improvement  
• Staff collectively identifies and solves problems  
• Discussions about learning, priorities | Q7, Q9, Q11, Q13, Q15, Q17 |
| **Shared Personal Practice** | • Peer help & review  
• Mutual respect and trust  
• Collaborative celebrations | Q7, Q11, Q17 |
| **Supportive Conditions** | • Logistics (when, where, how) PLCs work & meet  
• Processes & protocols for discussion, communication, and feedback  
• Group norms  
• Empowerment in decision making  
• Systemic trust | Q5, Q6, Q8, Q9, Q11, Q13, Q15, Q16, Q17 |
The four-point scale was deemed most appropriate in this case. The four-point Likert scale is widely accepted as an appropriate method for measuring the attitude and beliefs of participants, and was selected over a similar five-point scale (with one additional mid-point response option “neutral”), based on Garland’s (1991) findings on social desirability bias—bias that may arise from participants’ desire to please the interviewer, and the strong tendency for participants to indicate their disagreement with survey items by selecting the mid-point, neutral option, instead of “disagree” or “strongly disagree” (p. 2).

The Aylsworth PLC Survey instrument includes, in addition to Hord’s categories, research survey components created by the North Cascades and Olympic Science Partnership, the Appalachia Educational Laboratory, the Leaders Edge Network, and National Staff Development Council. In addition to Hord’s (1997) survey, Olivier, Hipp, and Litke’s (2010) “PLC Assessment—Revised” was used to add further elements. It asked participants to reflect on the degree to which their PLC’s implementation worked within the DuFour et al. model. As in the Oliver, Hipp, and Litke survey, Aylsworth PLC Survey questions 10, 12, 14 and 16 address the degree or stage of implementation of the PLC. Both of the teamwork-specific sections (questions 7 & 8) on the Aylsworth PLC Survey are drawn from the Solution Tree (2006) survey. The inclusion of specific teamwork-based best practices into a PLC framework is largely what separates the Aylsworth PLC Survey from those previously created by Hord and DuFour et al. The Leaders Edge Network (2007) survey was utilized mainly for its electronic-design features, including question format and response structure. Table 3.2 presents the Aylsworth PLC Survey’s inclusion of current and credible PLC research.
Table 3.2
PLC Research and Aylsworth PLC Research

<table>
<thead>
<tr>
<th>PLC Research</th>
<th>Research Components in the Aylsworth PLC Survey:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hord (1999).</td>
<td>Hord’s 5 components and 17 PLC descriptors appear throughout the Aylsworth survey. In addition to Hord’s work, the Aylsworth PLC Survey uses the language of DuFour et al. 4 PLC Questions*.</td>
</tr>
<tr>
<td>PLC Assessment—Revised. Olivier, Hipp, &amp; Litke (2010). Southwest Educational Development Laboratory (SEDL).</td>
<td>This survey is based on the work of Hord, but this instrument assesses a PLC’s degree of effectiveness (or stage) within the Hord components of a PLC. Questions directly relate to Hord’s dimensions and components, which tie into Aylsworth survey as mentioned above.</td>
</tr>
<tr>
<td>Solution Tree (2006).</td>
<td>This survey is a team-based, best practice self-assessment. Many of the sub-questions on teamwork on the Aylsworth PLC Survey were generated from this assessment. The inclusion of these questions is the main difference between the Aylsworth PLC Survey and previous models, including Hord’s.</td>
</tr>
<tr>
<td>Leaders Edge Network (LEN) (2007).</td>
<td>This survey is the best example of an electronic survey that utilized all components of the PLC framework, as described by DuFour’s work. The Aylsworth PLC Survey uses LEN’s components of teamwork and PLC practice, but modified the original terminology (e.g., power standards, DuFour’s questions, and so on) to be more appropriate to the culture of the research site.</td>
</tr>
</tbody>
</table>

To add validity and reliability to the instruments and design of this research, two levels of pilot study groups were conducted with teachers both from within and outside of the research site (n=20 teachers piloted within research site and n=5 teachers piloted outside research site) and school administrators (n=5) from within the research site to provide the
researcher with feedback and advance warning about potential misunderstandings of survey questions and/or directions, poorly worded questions, order of questions, and participants’ impressions of the survey. Pilot groups were conducted during the 2010–2011 school year. The pilot study allowed for clear assessment of the feasibility of the survey and study, identification of potential logistical problems in the research design, and assurance that the study was worth conducting.

**Ethical Considerations**

This study is in compliance with institutional ethical standards in conducting research. All collected data have been reported in the aggregate, and stripped of any information or labels that could be used to identify individual teachers or students. The Iowa State University Institutional Review Board (IRB) provided consent for the study, and declared it exempt from the human subject protection regulations. This researcher, in conjunction with a university advisor, reviewed all methods applied in this study to ensure that applicable measures were taken to ensure ethical implementation. Measures to ensure the strictest ethical standards included voluntary participation from subjects with the option to opt out of the study at any time, as well as strict confidentiality measures, including that all data be stripped of any specific teacher or student identifiers. Data were stored on a password-protected computer, and participants were able to skip any survey questions without penalty.

**Limitations**

This study has five identified limiting factors: (1) non-equivalent comparison groups, (2) end of course student letter grades as source of student achievement, (3) relatively low sample size, (4) relatively short data collection and comparison timeframe (four years), and
The most significant limitations of this study were the first and second: (1) the use of a non-equivalent group comparison of student achievement at only one research site, which neither takes into consideration external validity, nor allows for generalizability of the study, and (2) the use of student letter grades as the main indicator of academic performance.

The rationale for conducting research from only one site with a limited number of participants was related to the concept of quality control. This site was purposefully selected due to the researcher’s knowledge and certainty of the institution’s adherence to the PLC model. As DuFour (2006) reminded educators, “the term PLC has been used so ambiguously to describe virtually any loose coupling of individuals who share a common interest in education that it is in danger of losing all meaning” (p. 2). The ambiguity of the term “PLC” is the reason that the concept of quality control comes into play for this study. To that end, the study design required keeping the sample sizes and data collection samples low, and focusing on only one research site, where adherence to the DuFour et al. PLC framework could be monitored closely.

The use of student letter grades as a measure of reporting academic achievement constitutes the second limitation. Although student letter grades are generally viewed by the literature as being unreliable in terms of their validity in measuring learning outcomes, this study used them to compare and contrast results from staff members who taught prior to, and after, the implementation of PLCs. In her 1995 article, grading and homework expert Lynn Olson stated that, “although grades have acquired an almost cult-like importance in American Schools, letter grades will be the norm in reporting student academic progress in most schools for some time to come” (p. 24). Because the literature widely views end-of-
course letter grades as a normative category in reporting local student academic progress in American schools, these grades were selected as the dependent variable in this study. However, due to the design of this study, the validity of the actual student grade itself is not of concern, due to the consistency of the independent variable (teacher) across the four-year timeframe of this study. In other words, the methods behind the dependent variable (student achievement) remained consistent in nature across the four years of this study, allowing the most accurate comparison of student achievement as possible.

It is important to consider the fact that, in addition to PLCs, many factors likely influenced student achievement at this research site. The quality of curriculum, classroom instruction, assessment, and other professional development influences were not included as variables for the statistical values in this model. It is conceivable that these additional initiatives influenced teacher and/or student performance at the time that this research was conducted, since these initiatives, in addition to PLCs, were intended to impact student learning and teacher improvement in a manner similar manner to PLCs.

Data for this research study was triangulated to identify clearly the influence of teacher participation in a PLC on student learning. Expert sampling (teachers with a minimum of two years’ experience prior to implementing PLCs, and with two years’ experience with PLC implementation) was chosen for this research as a part of the pre-/post-model. By using a proximal similarity sampling model (Campbell & Stanley, 1963) and targeting a specific population sample (teachers who fit the research criteria), the researcher was better able to select, monitor, and evaluate the effectiveness of the participants, as well as improve the external validity of the research. In terms of drawing generalizations, the design and results of this study could be generalized to other schools with similar PLC models and
similar demographics to this school, but not beyond. There were no dropouts from the original group of participants selected for this research.

**Delimitations of the Study**

This study was conducted with the following delimitations:

1. Non-equivalent student groups were used to compare PLC results.
2. End-of-course letter grades were the only source of student achievement data compared.
3. Data were used from only one public high school within the state of Iowa. No additional public or private schools were included in this study.
4. The analysis of student achievement data covered the 2007–08 through 2010–2011 school years. Student data were collected in the following formats:
   a. Student final letter grade data (Pre-/Post-PLCs).
   b. Student failure rates (Pre-/Post-PLCs).
5. Teacher survey data was collected once during the 2011–2012 school year. The Aylsworth PLC Survey did not exist prior to the implementation of the PLC initiative and, therefore, could not be used in a Pre-/Post-PLC format.
CHAPTER 4: RESULTS

*Insanity is doing the same thing over and over again and expecting different results.*

Rita Mae Brown (1983, p. 68)

**Introduction**

This chapter describes the criteria used to select the study’s participants, and discusses the findings from the study’s collected data. This discussion includes participation data and the reorganization required to prepare student achievement data for statistical analysis.

The purpose of this study is to investigate the relationship between teacher participation in a Professional Learning Community and the learning results of their students at one Midwestern suburban high school, measured by (1) student academic letter grades, (2) failure rates, and (3) results from the Aylsworth PLC Survey. Student achievement data utilized for statistical analysis was obtained from the research site’s data information system, *Infinite Campus*, and imported into Microsoft Excel for Windows (2003) for a pre-/post-comparison. Participating teachers completed the electronic Aylsworth PLC Survey during the fall of the 2011–2012 school year.

**Research Questions**

This study intended to answer three research questions:

(1) What statistical relationship exists between teacher participation in a PLC and student learning (as measured by students’ end of term letter grades)?

(2) Is there any difference in the percentage of students that fail a class when their teacher participates in a PLC?
(3) Is there any difference in student learning (as measured by students’ end of term letter grades) in PLCs that demonstrate strong evidence of operating as a PLC, as measured by the Aylsworth PLC Survey?

Selection Criteria

To create the sample population, this study targeted all teachers who participated in 10th–12th grade classes that functioned as PLCs during the 2009–2010 and 2010–2011 school years at one high school in a suburban, Iowa setting. To have been eligible for this study, participants must have (1) taught at the research site (school) for a minimum of four full school years (two years prior and two years after implementation of PLCs), and (2) participated in a PLC at the selected school during the two years of this study (2009 through 2011). These criteria yielded 39 eligible teacher participants for this study. The participation rate for this study was 100%. Within the eligible teacher population, 27,493 student letter grades over a four-year period were collected from the research site’s online student database. “Appendix B: Student Letter Grade Counts Pre-/Post- by PLC” shows that 13,151 student scores were collected from this research site prior to the implementation of PLCs, compared with 14,342 student scores at the same research site after the implementation of PLCs. Also, each participating teacher completed the Aylsworth PLC Survey to determine teachers’ perceptions of the effectiveness of their PLC.

Pre-/Post- Student Achievement Data Analysis

This section provides a review of the First and Second research questions and the hypotheses that directed this study. Also included is a description and explanation of the statistical models and data analysis protocols utilized in this research.
Research Question 1

(1) What statistical relationship exists between teacher participation in a PLC and student learning (as measured by students’ end of term letter grades)?

\( H_0: \) Students whose teacher participated in a PLC will show higher levels academic performance.

A Pre-/Post- comparison model was used to study the relationship between student academic performance (final letter grades) and teacher participation in a PLC. For the first model, all passing student letter grades (ranging from “A” to “D-”) were compared according to Pre-PLC (2007–08 and 2008–09 school years) with Post-PLC (2009–10 and 2010–11 school years) involvement, using the Welch t-test (Figure 4.1). This construct was used to compare unequal populations of students’ passing letter grades before implementation of PLCs with students’ passing letter grades after PLC implementation.

Figure 4.1

**Welch t-test for Unequal Sample Sizes and Unequal Variance**

\[
t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_{X_1}^2}{n_1} + \frac{s_{X_2}^2}{n_2}}}
\]

The Welch t-test required that the distribution of student scores be grouped into raw numerical values comprising four categories, each corresponding with a letter grade range. Because student scores collected at this site lacked a numerical value and were only assigned a letter grade, all passing student scores were grouped and organized by letter grade range with a highly interpretable and recognized numerical value. For example, the letter grade range for a student score of “A” was given a numerical value of “95,” which coincides with the nearly universal GPA and letter grade scales used by educational institutions, including
this research site. Table 4.1 shows the numerical values assigned to each corresponding letter grade value for the purposes of the Welch t-test.

Table 4.1
Numerical Value Assignments to Passing Student Scores (for Calculation in Welch t-test)

<table>
<thead>
<tr>
<th>Student Letter Grade</th>
<th>Assigned Numerical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>95</td>
</tr>
<tr>
<td>B</td>
<td>85</td>
</tr>
<tr>
<td>C</td>
<td>75</td>
</tr>
<tr>
<td>D</td>
<td>65</td>
</tr>
</tbody>
</table>

As an example, prior to functioning as a PLC, the U.S. History teachers at this school showed a mean student letter grade score of 81.154465, with a variance of 105.3287784. These numbers represent two years’ worth of the final letter grades students earned in U.S. History. In the two years of working together and functioning as a PLC, the U.S. History teachers at this school showed a mean student letter grade score of 84.12033195, and a variance of 103.5444783. Every student grade earned in U.S. History during this timeframe (pre-/post-) is included and factored. A comparison of student performance prior to and after PLCs for U.S. History shows an improvement in mean student score of +2.965866946. The improvement in the mean student score in this example indicates that the mean student score (final letter grade) in U.S. History at this school improved by nearly three percentage points after the teacher had participated in a PLC. The pre-/post- variance statistical calculation is necessary in determining variability of the observations (student grades in this study). For this study, variance is worth noting because it is a required component of the Welch t-test that impacts the statistical significance of the findings.

The Welch t-test was applied to student data results from all ten participating PLCs in this study. In each case, varying statistical correlations were found between teacher
participation in a PLC and improvement in student learning. Table 4.2 highlights the findings for all ten PLCs, with student learning serving as the analytic variable.

Overall, the test yielded consistent results. Of the ten individual PLCs included in this comparison, seven demonstrated an improvement in mean student letter grade score after PLC participation. Of the seven PLCs that showed a mean improvement in student learning, three were deemed statically significant at \( p \leq .05 \). The aggregate comparison of all ten PLCs at this school in a pre-/post- comparison demonstrated a slight improvement in the mean student letter grade score (+0.329886662) after teachers had participated in a PLC.

Table 4.2

*Welch t-test Analysis of the Relationship Between PLCs and Passing Student Scores*

<table>
<thead>
<tr>
<th>PLC</th>
<th>Pre-PLCs</th>
<th>Post-PLCs</th>
<th>Pre-/Post-Difference in Means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Variance</td>
<td>Mean</td>
</tr>
<tr>
<td>* History</td>
<td>81.154465</td>
<td>105.3287784</td>
<td>84.12033195</td>
</tr>
<tr>
<td>Western Civilization</td>
<td>83.2677761</td>
<td>107.1409593</td>
<td>83.57249626</td>
</tr>
<tr>
<td>* Chemistry</td>
<td>84.53328233</td>
<td>98.17404458</td>
<td>83.28303152</td>
</tr>
<tr>
<td>Biology</td>
<td>81.44016837</td>
<td>104.6484938</td>
<td>81.53252481</td>
</tr>
<tr>
<td>English 10</td>
<td>84.20930233</td>
<td>104.0951262</td>
<td>84.1107078</td>
</tr>
<tr>
<td>* Writing</td>
<td>86.74055829</td>
<td>75.35744981</td>
<td>85.77108434</td>
</tr>
<tr>
<td>* Algebra II</td>
<td>81.32231405</td>
<td>112.171714</td>
<td>82.20983419</td>
</tr>
<tr>
<td>* Geometry</td>
<td>80.87431694</td>
<td>100.5337487</td>
<td>81.75316456</td>
</tr>
<tr>
<td>Spanish III</td>
<td>85.28181818</td>
<td>85.54380015</td>
<td>85.63078217</td>
</tr>
<tr>
<td>French IV</td>
<td>87.79569892</td>
<td>66.25667208</td>
<td>87.79596977</td>
</tr>
<tr>
<td>* Combined Samples</td>
<td>83.17095515</td>
<td>103.4261576</td>
<td>83.50084181</td>
</tr>
</tbody>
</table>

* denotes statistically significant findings at \( p \leq .05 \)

For Research Question 1, although seven of the ten PLCs in this study improved the mean student score after functioning as a PLC, the statistical findings indicate inconsistent
results. Additionally, the combined samples of all PLC data also indicated a statistically significant improvement post-PLCs. Although the data for Research Question 1 do not fully support the original hypothesis, outright rejection of the hypothesis in this case does not take into consideration that the majority of students whose teacher participated in a PLC did demonstrate improvement in their scores. Chapter 5 offers larger discussion of the significance of the findings.

**Research Question 2**

(2) Is there any difference in the percentage of students that fail a class when their teacher participates in a PLC?

*H₀₂*: Students whose teacher participated in a PLC will show lower levels of student failure rate.

The second model applied to student failure data featured a two-sample t-test that compared the failure rate of students before the implementation of PLCs to the failure rate of students after the implementation of PLCs. Failing student scores were calculated separately from passing student scores in this research, due to of the large range of scores that commonly signify a failing score. The range of student scores that encompasses a failing score is zero to 59.4 (Table 4.3). Because of the large range of the letter grade “F,” and the relatively low sample sizes, failures were calculated separately from passing scores.
Table 4.3
Research Site Letter Grade Scale

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Minimum Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>92.5</td>
</tr>
<tr>
<td>A-</td>
<td>89.5</td>
</tr>
<tr>
<td>B+</td>
<td>86.5</td>
</tr>
<tr>
<td>B</td>
<td>82.5</td>
</tr>
<tr>
<td>B-</td>
<td>79.5</td>
</tr>
<tr>
<td>C+</td>
<td>76.5</td>
</tr>
<tr>
<td>C</td>
<td>72.5</td>
</tr>
<tr>
<td>C-</td>
<td>69.5</td>
</tr>
<tr>
<td>D+</td>
<td>66.5</td>
</tr>
<tr>
<td>D</td>
<td>62.5</td>
</tr>
<tr>
<td>D-</td>
<td>59.5</td>
</tr>
<tr>
<td>F</td>
<td>0</td>
</tr>
</tbody>
</table>

As an example, the U.S. History teachers at this school had a total of 111 students (8.24% of the total student population who took U.S. History) who earned a final letter grade of “F” (fail) in the two school years prior to the implementation of PLCs. In the two years while functioning as a PLC, the U.S. History teachers had a total of 47 students (4.76% of the total student population that took U.S. History) earn a final letter grade of “F.” This example demonstrates that the failure rate for students taking U.S. History was reduced by 3.73%. The total percentage of student population was calculated and factored to take into account the fact that the pre-/post- sample sizes were unequal.

Independent two-sample t-tests were applied to all ten participating PLCs in this study. In each case, varying conclusions were found between teacher participation in a PLC and reduction in student failure rates. Table 4.4 highlights the findings for all ten PLCs. Student failure data served as the variable used in analysis and, again, mixed results occurred. Of the ten individual PLCs included in this comparison, six demonstrated a reduction in the percentage of students who failed their classes after participating in a PLC. The aggregate comparison of all ten PLCs in a pre-/post- comparison of failure rates
demonstrated a slight increase in the percentage of students who failed a course (+0.20%) after teachers had participated in a PLC.

Table 4.4
Analysis of the Relationship Between PLCs and Student Failure Scores

<table>
<thead>
<tr>
<th>PLC</th>
<th>Pre-PLCs</th>
<th>Post-PLCs</th>
<th>Pre-/Post-Difference in Failure Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of Student Failures</td>
<td>Total Percentage of Student Population</td>
<td>Number of Student Failures</td>
</tr>
<tr>
<td>U.S. History</td>
<td>111</td>
<td>8.24%</td>
<td>57</td>
</tr>
<tr>
<td>Western Civilization</td>
<td>79</td>
<td>5.65%</td>
<td>70</td>
</tr>
<tr>
<td>Chemistry</td>
<td>21</td>
<td>1.59%</td>
<td>59</td>
</tr>
<tr>
<td>Biology</td>
<td>79</td>
<td>4.49%</td>
<td>142</td>
</tr>
<tr>
<td>English 10</td>
<td>86</td>
<td>5.40%</td>
<td>93</td>
</tr>
<tr>
<td>Writing</td>
<td>30</td>
<td>2.65%</td>
<td>21</td>
</tr>
<tr>
<td>Algebra II</td>
<td>98</td>
<td>6.43%</td>
<td>120</td>
</tr>
<tr>
<td>Geometry</td>
<td>78</td>
<td>5.05%</td>
<td>105</td>
</tr>
<tr>
<td>Spanish III</td>
<td>13</td>
<td>1.17%</td>
<td>12</td>
</tr>
<tr>
<td>French IV</td>
<td>3</td>
<td>1.05%</td>
<td>2</td>
</tr>
<tr>
<td>Combined Samples</td>
<td>598</td>
<td>4.55%</td>
<td>681</td>
</tr>
</tbody>
</table>

For Research Question 2, six of the ten PLCs in this study reduced the rate of student failure after functioning as a PLC. The findings of the failure data are again indicative of inconsistent results. Although the data for Research Question 2 do not support the original hypothesis, outright rejection the hypothesis in this case would not take into consideration that the majority of students whose teacher participated in a PLC did demonstrate lower percentages of student failure rates. Chapter 5 offers larger discussion of the significance of the findings.
The Aylsworth PLC Survey

This section provides a review of the Research Question 3, and the hypothesis for this study. Also included is a description and explanation of the survey instrument and data analysis protocols utilized in this research.

Research Question 3

(3) Is there any difference in student learning (as measured by students’ end of term letter grades) in PLCs that demonstrate strong evidence of operating as a PLC, as measured by the Aylsworth PLC Survey?

H₀₃: Teachers who participated in an effective PLC, as measured by the Aylsworth PLC Survey, will show higher levels student of academic performance.

The Aylsworth PLC Survey contains 45 PLC-related statements. This study grouped those statements into six components. The first component is participant consent, and demographic and PLC logistical information (such as the format, frequency, and structure of their specific PLC model). The first component was included as a part of the survey so that the survey could later be utilized outside of this research site by districts that utilize different PLC structures. Such application would be valuable for future research seeking to compare different PLC structures. Since the Aylsworth PLC Survey was administered at only one site, where all the PLCs followed the same format, the information from Component 1 was not reported as a part this study’s scope.

The next component of the Aylsworth PLC Survey corresponds to the work of authors and experts in teamwork best practices (Chapter 2). Component 2 is referred to as, “teamwork,” for the purpose of this research. The final four components correspond to the
DuFour et al. “critical PLC question” framework, with each critical question serving as a separate component:

Q1: What do we want students to know and be able to do?
Q2: How will we know if students have learned what we intended?
Q3: How will we respond if students do not learn what we intended?
Q4: How will we respond if students already know what we intended to teach them?

(p. 183)

The Aylsworth PLC Survey is an electronic survey, and asks participants to respond with their perception to statements that pertain to the DuFour et al. framework for teamwork best practices. Each statement connects to evidence-based practices of effective PLCs from researchers such as Hord (1999), Huffman and Hipp (2003), and DuFour et al. (2006). The Aylsworth PLC Survey used a four-point Likert scale with the following selection options: (4) Strongly Agree, (3) Agree, (2) Disagree, and (1) Strongly Disagree. Each teacher-participant’s response to the Aylsworth PLC Survey was tallied and scored (by PLC) to determine evidence of the team’s effectiveness as a PLC, and to capture accurately each individual PLC teacher’s perception of his or her work as it relates to established PLC best practices. Responses were reported and disaggregated by component.

The Aylsworth PLC Survey offered participants a Likert scale range from 1 to 4, with a total of 45 statements. The overall scores for the Aylsworth PLC Survey ranged from 45 to 180. For this study, a cut-off score of 135 and above was used to indicate strong evidence of an effective PLC. A cut-off score of 135 and above was established because 135 correlates to a mean at, or above, the Likert 3.0 mark (indicative of agreement with the statement) on the Aylsworth PLC Survey. Within the six components of the survey, the breakdown of survey
items includes seventeen statements related to teamwork, six statements related to DuFour et al.’s question of what we want students to know and to be able to do, ten statements related to DuFour et al.’s question of how we will know if students learn what we intended, seven statements related to DuFour et al.’s question of how we will respond if students do not learn what we intended, and five statements related to DuFour et al.’s question of how we will respond if students already know what we intended to teach them.

As an example, the composite score for the U.S. History PLC (which was represented by all U.S. History teachers at this school) on the Aylsworth PLC Survey was 110.0 out of a possible 180. The Aylsworth PLC consists of 5 components of effective PLCs. Specific to U.S. History, the PLC indicated a component score of 44.75 out of a possible 68 for the first component, which was teamwork. They indicated a component score of 14.25 out of 24 on the second component, which was the first DuFour et al. PLC question. The next component was the next DuFour et al. PLC question, for which this PLC indicated a combined score of 23.5 out of 40. The following component (DuFour et al. question 3) scored 18 out of 28, and the score for the last component (DuFour et al. question 4) was 10.5 out of 20. Using the cutoff score of 135 or greater as an effective PLC, the U.S. History PLC at this school self-identified on the Aylsworth Survey that it did not yet operate as a highly effective PLC.

One of the unique features of this survey is that it allows school leaders or even PLCs to easily interpret and indentify growth targets to improve as an effective PLC. For example, the U.S. History PLC identified component 6 (DuFour et al. question 4) as its lowest-ranking component. This result could be interpreted by a school principal, instructional coach, or the PLC itself as an area in which they could improve. Resources, time, and energy could then be devoted to helping that PLC improve its practice.
The combined sample mean shown in Table 4.5 is the average score of all of the combined PLC results at this school. The combined sample component average is a ratio of combined sample means out of the possible component total. For example, the combined sample mean (of all PLCs at this school) for Component 2 was 52.3583327. The combined sample component average for Component 2 is the ratio of 52.3583327 out of the possible of 68 total in that specific component (.769975). The combined samples component average can be interpreted as a percent-ranking within a specific component, with a higher percentage indicating a higher sense of agreement with survey questions. These numbers are helpful in demonstrating the overall culture of PLCs within a school building or even a school district.

With a cut-off score of 135 or greater on the Aylsworth PLC Survey representing strong evidence of an effective PLC, 5 of the 10 participating PLCs (Table 4.5) met this criterion, and demonstrated evidence in alignment with established best practices of functioning as an effective PLC.
To answer Research Question 3, student learning data from Research Question 1 were compared with the results of the Aylsworth PLC survey (Table 4.6). This question sought to

**Table 4.5**
Aylsworth PLC Survey Results: Survey Components Reported by PLC

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. History</td>
<td>44.75</td>
<td>14.25</td>
<td>23.5</td>
<td>18.0</td>
<td>10.5</td>
<td>111.0</td>
</tr>
<tr>
<td>Western Civilization</td>
<td>51.0</td>
<td>15.75</td>
<td>22.75</td>
<td>15.75</td>
<td>10.5</td>
<td>115.75</td>
</tr>
<tr>
<td>Chemistry</td>
<td>59.0</td>
<td>20.8</td>
<td>35.2</td>
<td>23.4</td>
<td>14.2</td>
<td>**152.6</td>
</tr>
<tr>
<td>Biology</td>
<td>53.3333333</td>
<td>22.3333333</td>
<td>32.0</td>
<td>21.66667</td>
<td>10.33333</td>
<td>**139.667</td>
</tr>
<tr>
<td>Writing</td>
<td>52.8333333</td>
<td>18.3333333</td>
<td>32.0</td>
<td>20.0</td>
<td>13.166666667</td>
<td>**136.3333267</td>
</tr>
<tr>
<td>Algebra II</td>
<td>50.0</td>
<td>21.0</td>
<td>33.8</td>
<td>26.8</td>
<td>14.3</td>
<td>**145.9</td>
</tr>
<tr>
<td>Geometry</td>
<td>61.0</td>
<td>21.5</td>
<td>35.5</td>
<td>25.5</td>
<td>12.0</td>
<td>**155.5</td>
</tr>
<tr>
<td>Spanish III</td>
<td>51.0</td>
<td>19.0</td>
<td>28.75</td>
<td>18.5</td>
<td>13.25</td>
<td>130.5</td>
</tr>
<tr>
<td>French IV</td>
<td>51.0</td>
<td>17.5</td>
<td>31.5</td>
<td>17.0</td>
<td>12.5</td>
<td>129.5</td>
</tr>
<tr>
<td>Combined Sample Mean</td>
<td>52.35833327</td>
<td>18.9133327</td>
<td>30.333333333</td>
<td>20.795</td>
<td>12.4083327</td>
<td>134.808335</td>
</tr>
<tr>
<td>Combined Samples Component Average</td>
<td>0.769975</td>
<td>0.788056</td>
<td>0.758333</td>
<td>0.742679</td>
<td>0.620417</td>
<td>0.748935</td>
</tr>
</tbody>
</table>

** denotes survey composite score ≥ 135 (indicative of effective PLC)
investigate the potential relationship between PLCs that demonstrated strong evidence of functioning as a PLC and the learning of their students. Of the ten PLCs surveyed in this study, five met the Aylsworth PLC Survey cut-off score for an effective PLC of 135 or higher. Of those five PLCs, three demonstrated an improvement in student learning (as measured by students’ end of term letter grades) after functioning as a PLC.

Table 4.6
Data Comparison of Effective PLCs and Student Learning

<table>
<thead>
<tr>
<th>PLC</th>
<th>Aylsworth PLC Survey Composite Score</th>
<th>Pre-/Post- Passing Score Difference in Means</th>
<th>Improvement in Passing Score Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>** 152.6</td>
<td>* -1.250250803</td>
<td>N</td>
</tr>
<tr>
<td>Biology</td>
<td>** 139.6667</td>
<td>+0.092356437</td>
<td>Y</td>
</tr>
<tr>
<td>Writing</td>
<td>** 136.3333267</td>
<td>* -0.969473955</td>
<td>N</td>
</tr>
<tr>
<td>Algebra II</td>
<td>** 145.9</td>
<td>+0.887520141</td>
<td>Y</td>
</tr>
<tr>
<td>Geometry</td>
<td>** 155.5</td>
<td>* +0.878847617</td>
<td>Y</td>
</tr>
</tbody>
</table>

* denotes statistically significant findings at p ≤ .05 on Welch t-test (passing scores)
** denotes survey composite score ≥ 135 (indicates effective PLC)

The findings from Research Question 3 are again indicative of inconsistent results. Although the two data sets for Research Question 3 do not support the original hypothesis as stated, outright rejection of the hypothesis in this case because does not take into consideration that the majority of PLCs that met the survey cut-off score did demonstrate increased student learning after functioning as a PLC. Chapter 5 offers larger discussion of the significance of the findings.
Summary

Three sources of data—passing letter grade scores, failing letter grade scores, and teacher survey data—were collected and compared to assess the relationship between student learning and PLCs at this school. Table 4.7 demonstrates that all three sources of data demonstrated inconsistent relationships between the independent variable (having a teacher who participated in a PLC) and dependent variables (student learning).

Table 4.7
Data Comparison by PLC of All Three Sources of Data

<table>
<thead>
<tr>
<th>PLC</th>
<th>Pre-/Post- Passing Score Difference in Means</th>
<th>Pre-/Post- Failure Rate Difference in Means</th>
<th>Aylsworth PLC Survey Composite Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. History</td>
<td>* +2.965866946</td>
<td>-3.73%</td>
<td>111.0</td>
</tr>
<tr>
<td>Western Civilization</td>
<td>+0.304720166</td>
<td>-0.67%</td>
<td>115.75</td>
</tr>
<tr>
<td>Chemistry</td>
<td>* -1.250250803</td>
<td>+2.20%</td>
<td>** 152.6</td>
</tr>
<tr>
<td>Biology</td>
<td>+0.092356437</td>
<td>+2.78%</td>
<td>** 139.6667</td>
</tr>
<tr>
<td>English 10</td>
<td>-0.098594522</td>
<td>-0.08%</td>
<td>131.3333267</td>
</tr>
<tr>
<td>Writing</td>
<td>* -0.969473955</td>
<td>-0.57%</td>
<td>** 136.3333267</td>
</tr>
<tr>
<td>Algebra II</td>
<td>* +0.887520141</td>
<td>+0.02%</td>
<td>** 145.9</td>
</tr>
<tr>
<td>Geometry</td>
<td>* +0.878847617</td>
<td>+1.13%</td>
<td>** 155.5</td>
</tr>
<tr>
<td>Spanish III</td>
<td>+0.348963988</td>
<td>-0.14%</td>
<td>130.5</td>
</tr>
<tr>
<td>French IV</td>
<td>+0.000270849</td>
<td>-0.55%</td>
<td>129.5</td>
</tr>
<tr>
<td>Combined Samples</td>
<td>* +0.329886662</td>
<td>+0.20%</td>
<td>134.808335</td>
</tr>
</tbody>
</table>

* denotes statistically significant findings at p ≤ .05 on Welch t-test (passing scores)
** denotes survey composite score ≥ 135 (indicates effective PLC)

Discussion of Results

The findings of this research appear to echo the findings of DuFour et al. (2011, 2010, 2008), Eaker (as cited in DuFour et al., 2006), Karhanek (2004), Barth (2001), Reeves (2010), and most importantly Hord (2004), in that there is no “one size fits all” approach to improving schools, improving student learning, or even working as an effective PLC. While improvements were made from pre-/post- in this study, the results were inconsistent.
Conclusion

Chapter 4 outlined the criteria used to select participants and described the data collected for this study. An analysis of two different statistical models comparing student achievement data in a pre-/post- format followed. The final component of research for this study included the Aylsworth PLC Survey, which was administered to participants to evaluate the effectiveness of PLCs.

Chapter 5 reviews the implications of the findings of this research. Recommendations for future research and implications for future PLC practice are based on findings as presented in this chapter.
CHAPTER 5: DISCUSSION AND IMPLICATIONS FOR EDUCATIONAL PRACTICE

Not everything that counts can be counted, and not everything that can be counted counts.

William Bruce Cameron (1963, p.13)

Introduction

This study sought to understand the ways teacher collaboration in a PLC affected high school students’ academic achievement at a suburban, Midwestern 10th–12th grade high school. Student achievement was examined and compared prior to and after the implementation of course-specific PLCs at this site. Participating teachers were surveyed regarding their perceptions of their PLC as an effective team. Whereas the previous chapter compared and analyzed student learning results and teacher survey data, this chapter discusses the need for policy makers and school leaders to emphasize, fund, and create structures that support PLCs as a fundamental part of their professional development repertoire and plans. This chapter also summarizes the findings of the research, discusses the meaning of the results, shares implications for educational practice, offers suggestions for future research regarding PLCs, and presents the overall conclusions of this research.

Research Questions

To understand the relationship between teacher participation in a Professional Learning Community and student learning at one Midwestern suburban 10th–12th grade high school, this study sought to answer three research questions:

(1) What statistical relationship exists between teacher participation in a PLC and student learning (as measured by students’ end of term letter grades)?

(2) Is there any difference in the percentage of students that fail a class when their teacher participates in a PLC?
(3) Is there any difference in student learning (as measured by students’ end of term letter grades) in PLCs that demonstrate strong evidence of operating as a PLC, as measured by the Aylsworth PLC Survey?

**Research Findings**

The findings and discussion from Chapters 3 and 4, as they pertain to the results from Research Question 1, support the majority of current PLC literature. The findings from Research Questions 2 and 3, however, lack consistent alignment with the majority of current PLC literature.

The first guiding research question resulted in answers that support a positive relationship between teachers’ involvement in a PLC and student learning. The statistical analysis of students’ passing scores, using the Welch t-test in a pre-/post- format, demonstrated that seven out of the ten PLCs in this study showed in improvement in the mean of passing student letter grades after functioning as a PLC. Of the ten PLCs in this study, five yielded statistically significant data. The mean student letter grade for all combined samples (PLCs) showed a statistically significant improvement of 0.329886662 after operating as PLCs (Table 4.2).

The Second and Third guiding Research Questions resulted in definitive answers—contrary to the bulk of PLC literature—about the lack of relationship between teachers’ PLC involvement and student performance: (1) no consistent relationship existed between teacher participation in a PLC and the failure rate of their students, and (2) no consistent correlation existed between student learning results in effective PLCs (as measured by the Aylsworth PLC Survey) and those that did not meet the criteria of an effective PLC.
The second comparison of student failure rate data using a two-sample t-test also yielded an inconclusive relationship between student failures and teacher participation in a PLC. Six of the ten PLCs in this study demonstrated a reduction in student failure rates after participating in a PLC. The mean difference in failure rate for all of the PLCs in this study increased by 20%. These findings suggest that teacher participation in a PLC does not reduce student failure rates in their classes. Contrary to current findings in PLC research, these findings suggest that teacher participation in a PLC does not guarantee improvement in student achievement.

The third data component, which came from the Aylsworth PLC Survey, demonstrated composite scores for individual PLCs meeting the standard of an effective PLC for five of the ten PLC groups surveyed. Collective analysis and comparison of all three components of this research indicated that no relationship existed between effective PLCs (measured as a composite score of 135 or higher on the Aylsworth PLC Survey) and the achievement of students (as measured by letter grades and failure rate). Of the five groups that met the “135” cut-off score for effective PLCs, three demonstrated an improvement in student learning, while two showed a decrease (Table 4.6). Analysis of failure rate data indicated that four out of the five PLCs that met the survey cut-off score demonstrated an increase in failure rate after operating as a PLC. Of the five groups that did not meet the composite survey score for effective PLCs, four showed an improvement in student learning after meeting as a PLC. Analysis of failure rate data for the five groups that did not meet the composite score on the survey indicates a reduction in student failure rate for all five groups. Overall, based on the findings of the Aylsworth PLC Survey, no clear relationship existed
between teacher perception of their PLC as an effective structure for improving student learning and their students’ actual learning results.

In addition to the conclusions that can be drawn from Research Question 3, questions for further research also surfaced. For example, the student achievement data sets and survey results for groups that did not meet the effective PLC cut-off score demonstrated consistent increases in student learning, as well as consistent decreases in student failure. Although beyond the scope of this research, the gains demonstrated by these PLCs may be attributed to the fact that (1) teachers in PLCs at this site answered survey questions with unrealistic perceptions of their PLC and student learning, and that (2) effective PLCs spent more time discussing, designing, and implementing a rigorous curriculum that influenced student achievement.

Conceptually, the Second and Third Questions of this study failed to yield results that directly connected teacher participation in a PLC with decreased failure rates, and offered no relationship between higher student learning and effective PLCs. While the main known benefit of PLCs is that they provide time for teachers to collaborate, this study’s findings offer data-informed solutions on how PLC time is spent. The findings of the Aylsworth PLC Survey show that PLCs at this school self-reported their highest component of the survey as DuFour et al.’s first question, which relates to curriculum planning. The second lowest combined sample average on the Aylsworth PLC Survey was Component 5 (DuFour et al., question 3), which relates to how PLCs respond when students struggle. As it relates to response to student intervention, survey Component 5 has strong connections to student failure, and offers school leaders potential points of emphasis for PLC growth targets and suggested areas for improvement.
This research demonstrated that PLCs at this site were all at very different places in their PLC journey. Although the literature from DuFour et al. clearly indicates that PLCs should focus on topics related to their 4-question framework, what is not always clear to school leaders or PLCs is the best way to determine PLC-specific deficiencies systemically. Through the findings of this research, the development of the Aylsworth PLC Survey offers a solution to differentiating and personalizing PLC goals. From a practical standpoint, one may conclude from this research that simply providing teachers more time outside of the classroom in a structure to meet together and collaborate without PLC-specific goals for improvement in student learning would fail to yield improvements in student learning.

However, it is important to consider the fact that, in addition to PLCs, many factors likely influenced student achievement at this research site. The quality of curriculum, classroom instruction, assessment, and other professional development influences were not included as variables for the statistical values in this model. However, the student achievement findings in this research do provide some understanding of the relationships between student achievement and teacher participation in a PLC, which indicate that PLCs at this site tended to rank themselves highest on survey Component 3, which relates to curriculum planning. It is reasonable to conclude that PLCs that focus more and rank themselves higher in Component 3 may have better odds of improving student achievement (Research Question 1). Although this research is difficult to generalize to the larger field, this research model could be implemented on a larger scale by comparing results to determine consistency of results, which would offer more insight and knowledge of PLC benefits and strengths.
A summary of PLC research during 2008 to 2010 (Wiseman & Arroyo, 2011) found that 69% of PLCs achieved a statistically significant relationship between implementation of PLCs and increased student achievement. Wiseman and Arroyo’s samples were comprised of populations representing public elementary and high schools across the United States, with diverse socioeconomic, academic, and ethnic backgrounds. Although Wiseman and Arroyo noted that the majority of research indicated that PLCs had a positive relationship with student achievement, their results demonstrated the presence of extremely wide-ranging variations of PLC structures, philosophies, and degrees of implementation (see “Implications and Recommendations for Educational Practice” and “Suggestions for Future Research” for further discussion of these PLC variations) within wide-ranging data sets. Although the combined sample size of Wiseman and Arroyo’s meta-evaluation of nine PLC studies offers a high combined sample size, it does not account for bias or quality-control in adherence to the PLC framework—factors for which this study does account, and which constitute part of the strength of this research.

This research sought to examine the potential connection between PLCs and student learning, which points to one of the most important (and frequently overlooked) components of effective professional development evaluation—a strong focus on results. Darling-Hammond et al. (2009) identified ongoing and frequent evaluation of professional development from multiple sources of information (data) to guide improvement and to demonstrate the impact of the initiative as one of the chief standards for quality of staff development. Although some educators have already identified the PLC movement as the “next best thing” in improving achievement in K-12 schools, this research sought to add to an emerging research base that, in accordance with professional development evaluation best
practices, connected PLCs to student learning. Based on the improvements observed from pre- to post-PLCs in student data from Research Question 1, it is apparent that PLCs offer potential in improving student learning. Based on the lack of results connecting PLCs to reductions in student failure rate (Research Question 2) and clear evidence differentiating highly effective PLCs that improve student learning from those that struggle (Research Question 3), further study on variations of PLC structures, philosophies, and degrees of implementation (see “Implications and Recommendations for Educational Practice” and “Suggestions for Future Research” for further discussion of these PLC variations) is needed.

Implications and Recommendations for Educational Practice

Four overarching recommendations for implementation of PLCs emerged from this research, and are intended to aid design and implementation of PLCs.

(1) Collaboratively setting the vision for PLCs.

(2) Researching and understanding the implementation and structures of PLCs.

(3) Providing appropriate resources and ongoing support for PLCs.

(4) Developing supportive leadership for PLCs.

These recommendations are also intended to aid PLCs best to meet the increased requirements for learning as established by federal and state government, as well as best to fulfill the mission and vision of individual schools and districts. Researchers (e.g., Barth, 2006; Schmoker, 1996; DuFour et al., 1998) have shown that the PLC approach offers great promise as a mechanism for school improvement; however, the suggestions from this research may increase the likelihood of success of site-specific PLC initiatives.

The first recommendation, deciding on a structure for providing teachers time to collaborate, is important for determining the overall impact of the initiative, because it should
be done prior to the first time a PLC meets and, once a decision has been made, impacts the teachers in the PLC each and every time they meet. Examples of PLC structure-related decisions to be taken into consideration should include decisions regarding the PLC meeting date, time, frequency, and location. This process would ideally be done collaboratively with teachers to increase ownership and buy-in of the PLC movement.

The second recommendation, study and implementation of PLCs, requires school leadership (teachers, principals, school leaders) to answer questions, such as how PLCs would be grouped, how often, and when PLCs would collaborate. As in recommendation one, these are all important factors to consider ahead of time, so that schedules and structures could be constructed according to the collective vision for PLCs at that school. In addition to deciding a structure of the PLC model, PLC research and teacher training for the most appropriate framework to structure PLC conversations is essential. As Servage (2007) suggested, it is not enough for PLCs to focus solely on student learning: teachers need opportunity to reflect, explore, and debate the meaning of what they are doing as educators. Collectively, teachers and administrators should determine an appropriate PLC framework, such as DuFour et al.’s, that teachers may use as a guide to structure their PLC conversations.

In addition to structure, availability of appropriate resources, the third recommendation is essential for classes to function effectively as PLCs. Resources should include a viable curriculum with clearly defined standards and assessment measures, as well as the teamwork foundations needed to function effectively. As the teamwork section of the Aylsworth PLC Survey results indicate, no two PLCs are exactly alike, and various PLCs rank their progress as effective teams so disparately as to seem arbitrary. Teachers and administrators must remember that fostering the types of collaboration that characterize
effective PLCs is a major shift that takes some teachers out of their comfort zone. This is a vital element for educational leaders to remember when considering the adoption of a PLC initiative. Leaders should consider formally allocating time and resources to support the ongoing and evolving needs of the various PLCs they support. If leaders fail to take the necessary pre-PLC steps of working with and coaching their teachers to function as an effective team, then that PLC will likely fail to experience the improved curriculum, assessment, and instruction that come with operating as a true PLC.

Leaders should also consider reviewing and adopting formalized practices that align with the PLC framework of their choice—which may require additional time for researching appropriate practices. Within DuFour et al.’s (1998) framework, for example, Questions 2–4 (See “Professional Learning Community Frameworks”, in Chapter 2) address common assessments and responses to intervention practices for struggling and advanced students. Once teachers become accustomed to agreeing upon curriculum topics, methods, and instructional pacing decisions, they could be tasked with collaboratively writing and then administering common assessments to their students. A structure or process for data analysis (such as the Leadership and Learning Center’s Data Team’s, 2010, process) formalizes the inclusion and use of data within the PLC to inform instructional practices. Again, the inclusion and nature of a formalized data process should be determined during the initial considerations of implementing a PLC structure, and approved collectively. Of course, administrators and teacher-leaders may refine this process as the PLC evolves, to ensure an accurate match between goals, curriculum, and outcomes.

As part of the recommendation to provide appropriate resources and support, teachers and administrators should consider agreeing upon the roles that administrators should fill in
PLCs, and form consensus as to the ways PLCs would be observed and evaluated. Answering the following types of questions could create such a consensus: Is the collective vision for administrators to attend all PLC meetings? Who creates PLC agendas? Can administrators add topics to PLC agendas? Are PLCs evaluated or assessed formally? If so, how? By collectively researching and discussing these topics prior to PLC implementation, all stakeholders would understand and be aware of not only the roles each PLC member should play, but also the methods and criteria for evaluation and accountability to the school and district. Additionally, such systematic consensus-building could enable districts and schools preparing for the implementation of PLCs to formalize their PLC data collection processes. Such processes (e.g., the instructional rounds format from Elmore & City et al., 2009) would allow for rich PLC conversations at the district level between leaders of any size or grade-level school.

In agreement with Hord’s (1997) and Wiseman and Arroyo’s (2011) visions for leadership in effective PLCs, the final recommendation is for schools and districts to foster supportive leadership for PLC members. This recommendation includes administrator and teacher-leadership. Administrators preparing to implement PLCs should consider a supportive, collaborative leadership style (recommendation 4) that involves staff in the decision-making process. As with any implementation of a new initiative, bringing stakeholders to the table, providing open lines of communication, and enabling staff to have input in decision-making would set the tone and the culture of the entire initiative. Due to the inherent collaborative nature of PLCs, developing supportive leadership is especially important when adopting the professional learning community model of teacher collaboration.
The recommendations from this study find their precedent in previous PLC research. In 1997, for example, Shirley Hord outlined five fundamental dimensions of PLCs: (1) supportive leadership, (2) shared values and vision, (3) collective learning and application of learning, (4) supportive conditions, and (5) shared personal practice. The findings of this research align with Hord’s dimensions of effective PLCs, as well as with Wiseman and Arroyo’s (2011) suggestions for successful implementation of PLCs. Although worded and grouped differently, the conclusions from Hord, Wiseman and Arroyo, and this study focus on strategically implementing PLCs that operate with a tight framework. This framework recommends that discussion occur according to four dimensions: curriculum, instruction, assessment, and teamwork.

Fullan (2007) reminds educators that successful implementation of a program (including PLCs) consists of a simple formula: 25% having the vision and 75% implementing the right process. Fullan’s suggestions connect with the first and second recommendations from this research, which should both be viewed as steps to be taken (with careful planning) prior to the decision to embrace PLC philosophies and introduce them to teachers. After a collective vision for PLCs has been established and embraced by all stakeholders, researching and studying well-established PLC structures that have yielded positive results would then, importantly, lay the groundwork for the PLC initiative to have the highest possible chance for success. Collective study of the initiative would also increase the likelihood of stakeholder buy-in to the initiative.
Research Summary and Limitations

Because findings in two of the three research questions for this study contradicted the bulk of research that expounds the positive learning effects resulting from PLCs, it is important to note key differences between this research and the larger body of PLC literature. First, this study’s sample was significantly less expansive in size, and examined a less generalizable representation. The rationale for conducting research at only one site with a limited number of participants was due primarily to the researcher’s knowledge and certainty of the institution’s adherence to the PLC model. As DuFour (2006) reminded educators, “the term PLC has been used so ambiguously to describe virtually any loose coupling of individuals who share a common interest in education that it is in danger of losing all meaning” (p. 2). Due not only to general ambiguity and overuse of the term “PLC,” but also to the concern over the reliability of data that such ambiguity could cause, this study ensured that the research site and the resulting data truly reflected the activities of a well-defined PLC. As such, it was necessary to confirm that the research site and the teacher-participants clearly adhered to DuFour et al.’s PLC framework. Focusing on a single research site also made it possible to monitor that adherence throughout the course of the study. Finally, this study’s design required maintaining low sample sizes and data collection samples—focusing on a single site thus enabled tight control over the data.

Suggestions for Future Research

The lack of consistent results in this research suggests that further study is necessary in the areas of Professional Learning Communities and student learning. Although the literature shows that the PLC model offers great potential for improving teacher effectiveness—and, consequently, student learning—further empirical evidence is required
before that potential could be said to apply to this study’s research site. The recommendations, thus, stem from this study’s findings, and focus on methods and actions to improve teaching and learning, and to evaluate and implement effective PLC models. While these recommendations are intended to serve as site-specific recommendations, they also apply generally to schools across the nation.

As an extension of this research—specifically as a way to address the contrasts between this study and the general PLC literature—examining and analyzing a larger population of teacher survey results on the Aylsworth PLC Survey would define comprehensively the ways PLCs do benefit, and operate at, the study site. Furthermore, the school should compare individual survey statements, and determine whether connections exist between survey elements consistently marked by a higher level of teacher satisfaction with results that suggest higher levels of student learning. A regression analysis of survey variables connected to improved student achievement would provide leaders with specific components of the PLC framework that would likely influence student learning in a positive way.

Like most available PLC research, this study employed a quantitative research design. Although the current abundance of quantitative research reveals trends and insight into PLCs, a qualitative research approach using teacher interviews to gather more insight into PLCs would strengthen our understanding of the dynamics within PLCs. A qualitative approach would allow researchers to take subjective information from PLC members and begin to identify emergent themes as they relate to effective PLCs. Currently this is a component commonly missing from the research base. For example, interviewing school leaders about the implementation of PLCs at the school/district would also be beneficial—not only because
such research currently does not exist, but also because it offers potentially more in-depth, comprehensive information that better describes context, variables, and PLC interactions.

Beyond this study’s findings, PLC-specific research on the various formats and structures of PLCs that yield results in student learning on state/federal assessments or on teacher retention and morale would benefit educators and policy-makers considering the implementation of PLCs. This is a hole in the PLC research as it exists today, and could potentially add more credibility to PLCs as a solution in addressing federal and state demands. An examination of the impact of PLCs from a variety of educational levels (elementary, middle, and high school), systems (public and private schools), enrollment sizes, and demographic backgrounds would benefit educators trying to decide whether the PLC model would be the most appropriate fit for their school’s/district’s needs.

Additionally, research examining the relationship between PLCs and student performance on standardized assessments like the ACT, SAT, and NAEP would offer assessment-based results using valid and reliable instruments. Currently, little or no relationship currently exists in the research between implementation of PLCs and student performance on standardized assessments. If such an analysis were to find a positive relationship between PLC implementation and students performance on standardized tests, education policy and practice could be informed by (1) advocating for the recommendation of PLCs as an effective way to meet federal and state mandates, and (2) providing educators with evidence-based rationale in advocating at the federal, state, and local levels for increased time for staff to function as PLCs.

Finally, schools and districts should consider examining the ways they might benefit from implementing the Professional Learning Network (PLN) model. Warlick (2007) defined
PLNs as an individual’s topic-oriented goal, a set of practices and techniques aimed at attracting and organizing a variety of relevant content sources, selected for their value, to help the owner accomplish a professional goal or personal interest. In other words, a PLN is like a PLC, but with technology utilized to conduct conversations with like-minded professionals who are not bound by proximity or timeframe. As federal and state standards movements tighten the similarities of school curriculum from state to state, and from school to school, PLNs offer an increasingly beneficial outlet to conduct PLC-type conversations. Although many PLN supporters believe that the PLN movement offers professional benefits, little to no research-based evidence currently exists that connects PLNs to school or district implementation.

**Conclusion**

Professional Learning Communities hold the potential to assist educational leaders in addressing and solving many of the challenges they face from the federal, state, and local levels. This study focused on a small sample size, which operated with strict adherence to established PLC practices (per DuFour et al.’s 2006 framework), and attempted to support the emerging base of research that connects PLCs directly to student achievement.

Unfortunately, this study did not confirm the hypothesis that a school operating as a PLC would result in higher levels of student achievement. However, it is worth noting that in addition to the meta-analysis of PLC research from Wiseman and Arroyo, this study confirmed that some teams of teachers at this school were able to improve learning and reduce failures in their classrooms after operating as a PLC. At a time when school leaders face increasing scrutiny and pressure in improving learning and leading academics, strategic allocation of professional development resources is essential. The time and resources
required for teacher improvement through PLCs has shown the potential to improve teacher professional practice as well as student achievement. Educational research is in clear agreement that teachers are overwhelmingly identified as the most important factor influencing student learning (Darling-Hammond, 1999). Consequently, schools should continue to implement professional development and growth opportunities that support, meet the needs of, and inspire teachers in their work. Additionally, this study adds new information for PLCs regarding the foundations of an effective PLC initiative, the importance of teamwork (Aylsworth PLC Survey) in the PLC framework, and informs educational theory and practice as they relate to PLCs. These distinctions are worth noting, since Professional Learning Communities may hold the potential to promote professional growth for teachers while concurrently improving student learning.
REFERENCES


http://www.education.com/reference/article/Ref_Creating_Sustainable/


Chenoweth, K. (2009). It can be done, it’s being done, and here’s how. *Phi Delta Kappan, 91*(1), 38–44.


*Professional learning in the learning profession: A status report on teacher development in the United States and abroad.* Dallas, TX: National Staff Development Council.


http://risal.cite.hku.hk/resources/leadership%20for%20the%2021st%20century_Fullan%201998.pdf


www.michaelfullan.ca/.../11_july_fullan_learning_is_the_work.pdf


Reeves, D. B., Rose, A., Peery, A., Pitchford, B., Doubek, B., Kamm, C., Allison, E., Cordova, J., Besser, L., Campsen, L., Gregg, L., Nielsen, K., Ventura, S., & White,


Welch, B. L. (1947). The generalization of ‘student’s’ problem when several different population variances are involved. *Biometrika, 34*(2), 28–35.


## APPENDIX A: AYLSWORTH PLC SURVEY

<table>
<thead>
<tr>
<th>Aylsworth PLC Survey (2011): Consent To Participate</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>1. Consent to participate</em></td>
</tr>
<tr>
<td>You are being asked to participate in a dissertation research study of Professional Learning Communities (PLCs). You have been asked to participate because you are a teacher in the Ankeny Community Schools who participates in a PLC.</td>
</tr>
<tr>
<td>The PLC process is a major focus for improving student performance. It is important to evaluate how the process is working. This research will provide feedback that helps us understand the impact of PLCs.</td>
</tr>
<tr>
<td>There are three main data collection components to consider for participation in this study:</td>
</tr>
<tr>
<td>1) Participating teachers will be surveyed on a variety of questions related to their perceptions of their PLC.</td>
</tr>
<tr>
<td>2) Participating teachers will have two years worth of their student's final letter grade data collected and analyzed prior to their participation in a PLC with two years worth of student letter grade data during their participation in a PLC.</td>
</tr>
<tr>
<td>3) Participating teachers will have two years worth of their student's failure rate data collected and analyzed prior to their participation in a PLC with two years worth of student failure data during their participation in a PLC.</td>
</tr>
<tr>
<td>Your participation in this research may benefit the understanding and development of PLCs in the Ankeny Community Schools as well as those in other K12 schools.</td>
</tr>
<tr>
<td>Your participation is completely voluntary. You do not have to answer any question that you do not want to answer.</td>
</tr>
<tr>
<td>If at any time during your participation you change your mind, you may end your participation without penalty by contacting the Principal Investigator (Tony Aylsworth) and asking that your survey data be removed from the study.</td>
</tr>
<tr>
<td>All student data will be stripped of identifiers and teacher &amp; class grades and results will be reported without any identifiers. All of your responses to the survey will be kept confidential with the Principal Investigator (Tony Aylsworth). Data from this study will be stored on a password protected computer and web based survey software.</td>
</tr>
<tr>
<td>The findings of this research study may be shared, used and presented for professional purposes. The identity of all participants and students will be kept confidential at all times.</td>
</tr>
<tr>
<td>There are no risks to you in this study.</td>
</tr>
<tr>
<td>The findings of this research study may be shared, used and presented for professional...</td>
</tr>
</tbody>
</table>
purposes. The identity of all participants and students will be kept confidential at all times.

There are no risks to you in this study.

Most people should be able to complete this survey in approximately 10-15 minutes. Completing and submitting the survey implies that you have read the information contained on this page and consent to participate in the research. You may print this page for your records and future reference. You must be 18 years of age or older to participate in this study.

You may obtain copies of the manuscripts that report the findings of the study from the researcher at your request.

You may ask any questions about the research at any time by contacting the Principal Investigator: Mr. Tony Aylsworth, Assistant Principal, Ankeny High School at (tony.aylsworth@ankenyschools.org) or phone (515) 965-9630.

If you are not satisfied with the response of the research team, have more questions, or have questions regarding your rights as a participant in this study, contact the Iowa State University Institutional Review Board, 5152944566. Iowa State University IRB ID # 10302.

Clicking on the agreement check-box below and then the “Next” button at the bottom of the page to complete the survey indicates that you have read this consent form and voluntarily consent to participate in this dissertation research study.

I willingly agree to participate in this PLC survey and dissertation research study.
<table>
<thead>
<tr>
<th><strong>Aylsworth (2011) PLC Survey: Participant Information</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2. Name:</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>3. Please indicate your department area of instruction</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>4. Please indicate your primary PLC (PLC where you spend the most time).</strong></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
## Aylsworth (2011) PLC Survey: PLC Structure

When responding to questions in this survey please respond with your primary PLC (the PLC where you spend the most time) in mind.

### 5. How often does your PLC...

<table>
<thead>
<tr>
<th>Question</th>
<th>Monthly</th>
<th>Bi-monthly</th>
<th>Weekly</th>
<th>More than Weekly</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>... meet?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>... analyze student learning to guide instruction?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>... give common assessments?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>... discuss common assessment results?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>... discuss interventions for students?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>... discuss teaching practices based on shared assessment results?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>... spend time with non-instructional / management issues?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 6. The structure of my PLC is effective in meeting my needs.

- [ ] Strongly Agree
- [ ] Agree
- [ ] Disagree
- [ ] Strongly Disagree
### Aylsworth (2011) PLC Survey: Teamwork

7. Please indicate your level of agreement with the following statements about your PLC related to effective teamwork.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My PLC has articulated shared norms.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC has articulated a shared vision / beliefs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC uses articulated processes and protocols to guide our meetings.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC evaluates our adherence to team norms.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC has articulated roles and responsibilities within our team.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC has created strategies for exploring each others' thinking.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC discusses how our efforts align with the district / school goals.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC work causes me to reflect upon my own practices.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC establishes goals to monitor its progress.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC collects evidence to assess the success of our goals.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC holds individual members accountable.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC is committed to working together to improve our practice.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC makes an effort to understand our team members as well as to be understood.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC operates in a shared leadership model.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am a member of a collaborative PLC.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am a member of a trusting PLC.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Aylsworth (2011) PLC Survey: Teamwork

8. Please indicate your PLC’s overall progress as an effective team.

- [ ] Not yet begun
- [ ] Just beginning
- [ ] Partially in place
- [ ] In place and improving
Aylsworth (2011) PLC Survey: DuFour et al. Question #1

9. Please indicate your level of agreement with the following statements related to the 1st DuFour PLC Question: "What do we want students to know and be able to do?"

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My PLC addresses the question of what students must know and be able to do.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My PLC has identified power standards.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My PLC shares and/or models examples of quality work with students.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My PLC considers state test results when developing power standards.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>I focus my own instruction on the power standards agreed upon by the PLC &amp; the curriculum review process.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

10. Please indicate your PLC’s overall progress in implementing the 1st DuFour PLC Question.

- [ ] Not yet begun
- [ ] Just beginning
- [ ] Partially in place
- [ ] In place and improving
### Aylsworth (2011) PLC Survey: DuFour et al. Question #2

11. Please indicate your level of agreement with the following statements related to the 2nd DuFour PLC Question: “How will we know when students have learned it?”

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My PLC uses ongoing formative assessments to adjust our teaching.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My PLC uses ongoing formative assessments to help students monitor their own progress.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My PLC has developed formative assessments aligned with our power standards.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My PLC uses formative assessment results to identify students who need additional support for learning.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My PLC monitors the achievement of students frequently in order to intervene promptly.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My PLC has agreed upon criteria we use to judge student work.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My PLC shares with students the criteria that will be used in judging their work.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My PLC uses an agreed upon summative assessment.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>My PLC regards on-going analysis of student results as a critical part of improving teaching and learning.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

12. Please indicate your PLC’s overall progress in implementing the 2nd DuFour PLC Question.

- [ ] Not yet begun
- [ ] Just beginning
- [ ] Partially in place
- [ ] In place and improving
### Aylsworth (2011) PLC Survey: DuFour et al. Question #3

#### 13. Please indicate your level of agreement with the following statements related to the 3rd DuFour PLC Question: "How will we respond when students do not learn it?"

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My PLC has students who require additional support to learn the material.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC provides extra support for students who experience difficulty.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC expects that students who experience difficulty are required to put in extra time for support.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC develops interventions proactively to ensure that students receive the assistance when needed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC provides interventions systematically for all students when needed.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My PLC uses the available resources (Instructional Coaches, Academic Resource Center, etc.) for students who are struggling to learn what we intend.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 14. Please indicate your PLC’s overall progress in implementing the 3rd DuFour PLC Question.

- [ ] Not yet begun
- [ ] Just beginning
- [ ] Partially in place
- [ ] In place and improving
### Aylsworth (2011) PLC Survey: DuFour et al. Question #4

15. Please indicate your level of agreement with the following statements related to the 4th DuFour PLC Question: "How will we respond when students already know it?"

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My PLC has students who already know what we intend to teach.</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>My PLC develops interventions proactively to ensure that advanced students receive assistance.</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>My PLC provides extra support for advanced students in our classrooms.</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>My PLC uses the available resources (Instructional Coaches, AELP Staff, etc.) for students who already know what we intend to teach.</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
</tbody>
</table>

16. Please indicate your PLC's overall progress in implementing the 4th DuFour PLC Question.

- O Not yet begun
- O Just beginning
- O Partially in place
- O In place and improving
Thank you for completing this survey and for participating in this dissertation research. Your participation will provide valuable feedback on how our PLC processes are working.
### APPENDIX B: STUDENT LETTER GRADE COUNTS PRE-/POST- BY PLC

#### 2 years (4 semesters) Pre-PLCs

<table>
<thead>
<tr>
<th>US History</th>
<th>S1 2007-08</th>
<th>S2 2007-08</th>
<th>S1 2008-09</th>
<th>S2 2008-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td>50</td>
<td>69</td>
<td>72</td>
<td>87</td>
</tr>
<tr>
<td>Bs</td>
<td>108</td>
<td>110</td>
<td>107</td>
<td>113</td>
</tr>
<tr>
<td>Cs</td>
<td>62</td>
<td>74</td>
<td>86</td>
<td>76</td>
</tr>
<tr>
<td>Ds</td>
<td>70</td>
<td>52</td>
<td>59</td>
<td>48</td>
</tr>
<tr>
<td>Fs</td>
<td>38</td>
<td>31</td>
<td>23</td>
<td>19</td>
</tr>
</tbody>
</table>

#### 2 years (4 semesters) Post-PLCs

<table>
<thead>
<tr>
<th>US History</th>
<th>S1 2009-10</th>
<th>S2 2009-10</th>
<th>S1 2010-11</th>
<th>S2 2010-11</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td>100</td>
<td>100</td>
<td>131</td>
<td>104</td>
</tr>
<tr>
<td>Bs</td>
<td>103</td>
<td>93</td>
<td>99</td>
<td>74</td>
</tr>
<tr>
<td>Cs</td>
<td>63</td>
<td>71</td>
<td>75</td>
<td>52</td>
</tr>
<tr>
<td>Ds</td>
<td>36</td>
<td>35</td>
<td>37</td>
<td>32</td>
</tr>
<tr>
<td>Fs</td>
<td>19</td>
<td>11</td>
<td>15</td>
<td>12</td>
</tr>
</tbody>
</table>

#### Algebra II

<table>
<thead>
<tr>
<th></th>
<th>S1 2007-08</th>
<th>S2 2007-08</th>
<th>S1 2008-09</th>
<th>S2 2008-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td>83</td>
<td>62</td>
<td>129</td>
<td>108</td>
</tr>
<tr>
<td>Bs</td>
<td>100</td>
<td>92</td>
<td>114</td>
<td>111</td>
</tr>
<tr>
<td>Cs</td>
<td>90</td>
<td>82</td>
<td>107</td>
<td>111</td>
</tr>
<tr>
<td>Ds</td>
<td>61</td>
<td>76</td>
<td>62</td>
<td>64</td>
</tr>
<tr>
<td>Fs</td>
<td>28</td>
<td>24</td>
<td>18</td>
<td>28</td>
</tr>
</tbody>
</table>

#### Geometry

<table>
<thead>
<tr>
<th></th>
<th>S1 2007-08</th>
<th>S2 2007-08</th>
<th>S1 2008-09</th>
<th>S2 2008-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td>72</td>
<td>61</td>
<td>91</td>
<td>81</td>
</tr>
<tr>
<td>Bs</td>
<td>121</td>
<td>122</td>
<td>134</td>
<td>126</td>
</tr>
<tr>
<td>Cs</td>
<td>97</td>
<td>98</td>
<td>106</td>
<td>102</td>
</tr>
<tr>
<td>Ds</td>
<td>61</td>
<td>55</td>
<td>64</td>
<td>73</td>
</tr>
<tr>
<td>Fs</td>
<td>22</td>
<td>15</td>
<td>22</td>
<td>19</td>
</tr>
</tbody>
</table>

#### Spanish III

<table>
<thead>
<tr>
<th></th>
<th>S1 2007-08</th>
<th>S2 2007-08</th>
<th>S1 2008-09</th>
<th>S2 2008-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td>92</td>
<td>104</td>
<td>100</td>
<td>114</td>
</tr>
<tr>
<td>Bs</td>
<td>107</td>
<td>108</td>
<td>83</td>
<td>89</td>
</tr>
<tr>
<td>Cs</td>
<td>67</td>
<td>44</td>
<td>67</td>
<td>49</td>
</tr>
<tr>
<td>Ds</td>
<td>23</td>
<td>16</td>
<td>22</td>
<td>15</td>
</tr>
<tr>
<td>Fs</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Biology

<table>
<thead>
<tr>
<th></th>
<th>S1 2007-08</th>
<th>S2 2007-08</th>
<th>S1 2008-09</th>
<th>S2 2008-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>As</td>
<td>97</td>
<td>97</td>
<td>104</td>
<td>111</td>
</tr>
<tr>
<td>Bs</td>
<td>138</td>
<td>126</td>
<td>123</td>
<td>136</td>
</tr>
<tr>
<td>Cs</td>
<td>122</td>
<td>112</td>
<td>113</td>
<td>114</td>
</tr>
<tr>
<td>Ds</td>
<td>59</td>
<td>65</td>
<td>83</td>
<td>63</td>
</tr>
<tr>
<td>Fs</td>
<td>13</td>
<td>14</td>
<td>31</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>2 years Pre-PLCs</td>
<td>2 years Post-PLCs</td>
<td>2 years Pre-PLCs</td>
<td>2 years Post-PLCs</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------</td>
<td>-------------------</td>
<td>------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Chemistry</td>
<td></td>
<td></td>
<td>Chemistry</td>
<td></td>
</tr>
<tr>
<td>As</td>
<td>121</td>
<td>131</td>
<td>127</td>
<td>139</td>
</tr>
<tr>
<td>Bs</td>
<td>117</td>
<td>100</td>
<td>143</td>
<td>98</td>
</tr>
<tr>
<td>Cs</td>
<td>74</td>
<td>63</td>
<td>91</td>
<td>99</td>
</tr>
<tr>
<td>Ds</td>
<td>26</td>
<td>38</td>
<td>31</td>
<td>57</td>
</tr>
<tr>
<td>Fs</td>
<td>6</td>
<td>7</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>As</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ds</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>As</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ds</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fs</td>
<td></td>
</tr>
<tr>
<td>Western Civ</td>
<td></td>
<td></td>
<td>Western Civ</td>
<td></td>
</tr>
<tr>
<td>As</td>
<td>90</td>
<td>121</td>
<td>127</td>
<td>139</td>
</tr>
<tr>
<td>Bs</td>
<td>114</td>
<td>92</td>
<td>115</td>
<td>102</td>
</tr>
<tr>
<td>Cs</td>
<td>83</td>
<td>86</td>
<td>62</td>
<td>68</td>
</tr>
<tr>
<td>Ds</td>
<td>45</td>
<td>36</td>
<td>49</td>
<td>34</td>
</tr>
<tr>
<td>Fs</td>
<td>22</td>
<td>20</td>
<td>21</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>As</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ds</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fs</td>
<td></td>
</tr>
<tr>
<td>English 10</td>
<td></td>
<td></td>
<td>English 10</td>
<td></td>
</tr>
<tr>
<td>As</td>
<td>127</td>
<td>138</td>
<td>158</td>
<td>176</td>
</tr>
<tr>
<td>Bs</td>
<td>118</td>
<td>119</td>
<td>115</td>
<td>102</td>
</tr>
<tr>
<td>Cs</td>
<td>75</td>
<td>78</td>
<td>68</td>
<td>76</td>
</tr>
<tr>
<td>Ds</td>
<td>48</td>
<td>40</td>
<td>68</td>
<td>50</td>
</tr>
<tr>
<td>Fs</td>
<td>25</td>
<td>18</td>
<td>33</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>As</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ds</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fs</td>
<td></td>
</tr>
<tr>
<td>Writing</td>
<td></td>
<td></td>
<td>Writing</td>
<td></td>
</tr>
<tr>
<td>As</td>
<td>110</td>
<td>137</td>
<td>50</td>
<td>220</td>
</tr>
<tr>
<td>Bs</td>
<td>129</td>
<td>108</td>
<td>85</td>
<td>148</td>
</tr>
<tr>
<td>Cs</td>
<td>58</td>
<td>45</td>
<td>49</td>
<td>46</td>
</tr>
<tr>
<td>Ds</td>
<td>18</td>
<td>20</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>Fs</td>
<td>8</td>
<td>2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>French 4</td>
<td></td>
</tr>
<tr>
<td>As</td>
<td>38</td>
<td>44</td>
<td>35</td>
<td>40</td>
</tr>
<tr>
<td>Bs</td>
<td>29</td>
<td>18</td>
<td>34</td>
<td>25</td>
</tr>
<tr>
<td>Cs</td>
<td>9</td>
<td>8</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>Ds</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Fs</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>French 4</td>
<td></td>
<td></td>
<td>As</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Bs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Cs</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ds</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fs</td>
<td></td>
</tr>
<tr>
<td>Combined Samples</td>
<td></td>
<td></td>
<td>Combined Samples</td>
<td></td>
</tr>
<tr>
<td>As</td>
<td>880</td>
<td>964</td>
<td>1008</td>
<td>1268</td>
</tr>
<tr>
<td>Bs</td>
<td>1081</td>
<td>995</td>
<td>1071</td>
<td>1004</td>
</tr>
<tr>
<td>Cs</td>
<td>737</td>
<td>690</td>
<td>722</td>
<td>695</td>
</tr>
<tr>
<td>Ds</td>
<td>411</td>
<td>399</td>
<td>493</td>
<td>442</td>
</tr>
<tr>
<td>Fs</td>
<td>164</td>
<td>139</td>
<td>197</td>
<td>140</td>
</tr>
</tbody>
</table>